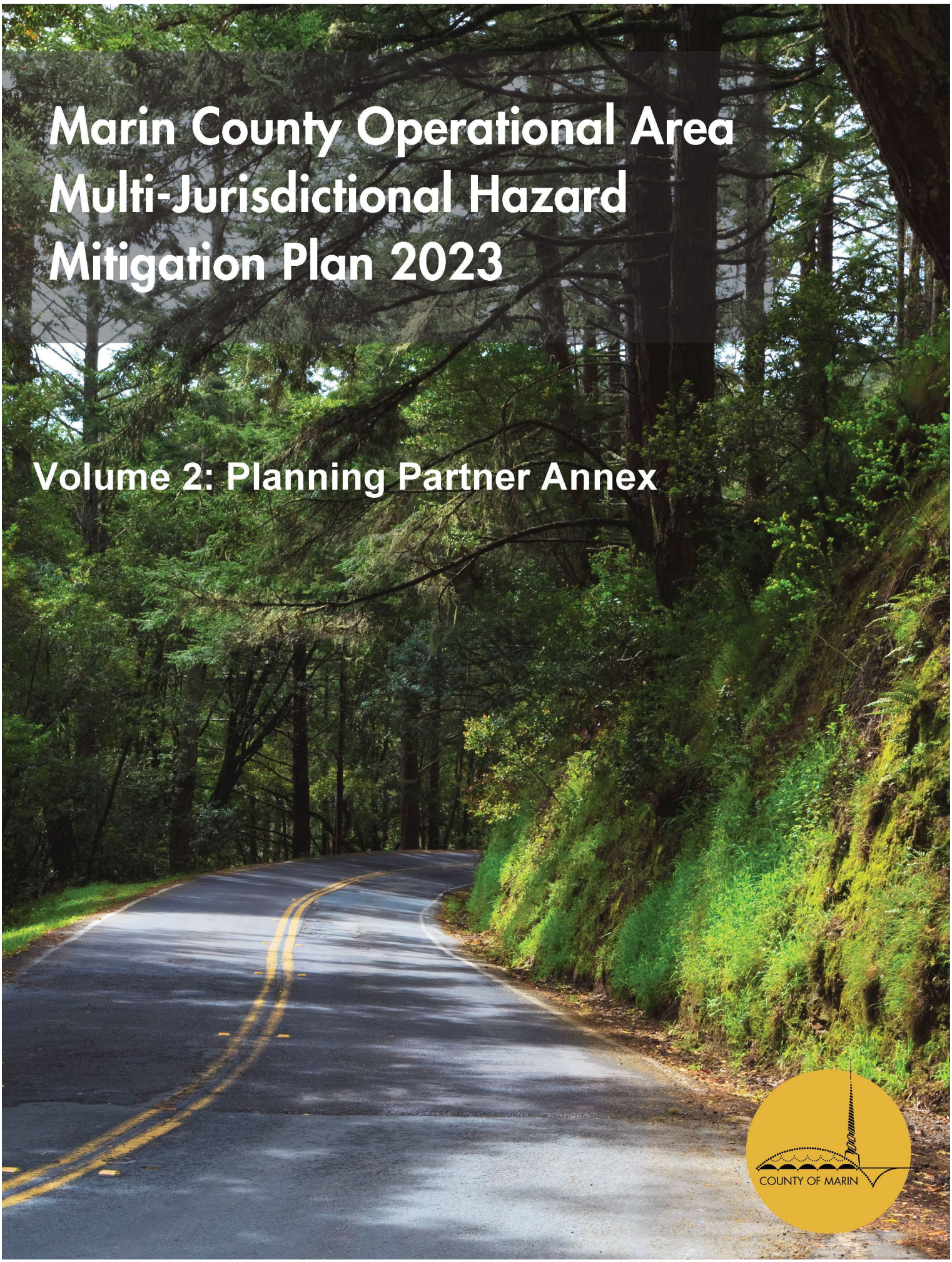
Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan 2023

Volume 2: Planning Partner Annex



Cover Photo: The image provided by the Marin County Office of Emergency Management, illustrates the precarious balance of mitigating potential wildfire fuels to ensure a safe evacuation corridor while preserving the exquisite natural beauty unique to Marin County.

ACKNOWLEDGEMENTS

The Marin County Office of Emergency Management and Preparative Consulting would like to thank those collaborators and planning partners who participated in the planning and development of this Volume 2: Planning Partner Annex to the Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan.

The official Marin County Operational Area Hazard Mitigation Steering Committee provided the oversight and dedication to this project that was required and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the planning partner jurisdictions and special districts of the Marin County Operational Area more disaster resistant and sustainable.

2023 Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan

Prepared For:

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TABLE OF CONTENTS

1. CITY OF BELVEDERE COMMUNITY PROFILE 1-1
2. BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT PROFILE 2-1
3. TOWN OF CORTE MADERA AND SANITARY DISTRICT NUMBER 2 PROFILE 3-1
4. TOWN OF FAIRFAX COMMUNITY PROFILE 4-1
5. CITY OF LARKSPUR COMMUNITY PROFILE 5-1
6. LAS GALLINAS VALLEY SANITARY DISTRICT PROFILE 6-1
7. CITY OF MILL VALLEY COMMUNITY PROFILE 7-1
8. NORTH MARIN WATER DISTRICT PROFILE 8-1
9. CITY OF NOVATO COMMUNITY PROFILE 9-1
10. TOWN OF ROSS COMMUNITY PROFILE 10-1
11. TOWN OF SAN ANSELMO COMMUNITY PROFILE 11-1
12. CITY OF SAN RAFAEL COMMUNITY PROFILE 12-1
13. CITY OF SAUSALITO COMMUNITY PROFILE 13-1
14. SOUTHERN MARIN FIRE PROTECTION DISTRICT PROFILE 14-1
15. TOWN OF TIBURON COMMUNITY PROFILE 15-1

INTRODUCTION

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (44 CFR):

"Multi-jurisdictional plans (e.g. watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan." (Section 201.6(a)(4)).

For the 2023 Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan Update, a unified effort between the planning partners was formed to leverage resources and to meet requirements of the federal Disaster Mitigation Act for as many eligible local governments and special districts as possible. The Disaster Mitigation Act defines a local government as follows:

"Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity."

Two types of planning partners participated in this process for the 2023 Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan Update, with distinct needs and capabilities:

- Incorporated municipalities
- Special districts

Each participating planning partner prepared a jurisdictional or district profile which are contained in this volume.

THE PLANNING PARTNERSHIP

Initial Solicitation and Letters of Intent

A planning team made up of Marin County OEM and consultant staff solicited the participation of all eligible municipalities and special districts at the outset of this project. A kickoff meeting was held on October 26, 2022, to identify potential stakeholders and planning partners for this process. The purpose of the meeting was to introduce the planning process to jurisdictions and districts in the County that could have a stake in the outcome of the planning effort.

All eligible local governments in the planning area were invited to attend. The goals of the meeting were as follows:

- Provide an overview of the Disaster Mitigation Act.
- Review the 2023 Marin County Operational Area Multi-Jurisdictional Hazard Mitigation Plan Update and planning partnership
- Outline the work plan for this hazard mitigation plan.
- Describe the benefits of multi-jurisdictional planning.

- Outline planning partner expectations.
- Solicit planning partners.
- Solicit volunteers/recommendations for the steering committee.

Local governments wishing to join the planning effort were asked to provide the planning team with a "letter of intent to participate" that agreed to the planning partner expectations (see Appendix A) and designated a point of contact for their jurisdiction. In all, the planning team received formal commitment from 13 planning partners in addition to the County. A map showing the location of participating special purpose districts is provided at the end of this introduction. Maps showing risk assessment results for participating cities are provided in the individual annexes for each city. Risk assessment maps for all planning areas countywide are provided in Volume 1 of this hazard mitigation plan.

Planning Partner Expectations

The planning team developed the following list of planning partner expectations, which were provided and discussed at the kickoff meeting:

- Complete a "letter of intent to participate."
- Designate a lead point of contact for this effort.
- Support and participate in the selection and function of the Steering Committee.
- Provide support required to implement the public involvement strategy.
- Participate in the process through opportunities such as:
  - Steering Committee meetings
  - Public meetings or Town Hall Meetings
  - Workshops and planning partner specific training sessions
  - Public review and comment periods prior to adoption.
- Complete the tasks required to develop the jurisdictional or district profiles and Annex.
- Perform a "consistency review" of all technical studies, plans and ordinances specific to hazards.
- Review the risk assessment and identify hazards and vulnerabilities specific to the jurisdiction or district.
- Review and determine if the mitigation recommendations chosen in Volume 1 will meet the needs of the jurisdiction.
- Create hazard mitigation actions that identifies each project or program, who will oversee the task, how it will be financed, and when it is estimated to occur.
- Formally adopt the hazard mitigation plan.

By adopting this plan, each planning partner also agrees to the plan implementation and maintenance protocol established in Volume 1. Failure to meet these criteria may result in a partner being dropped from the partnership by the Steering Committee, and thus losing eligibility under the scope of this plan.

1. City of Belvedere Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan

2023

CITY OF BELVEDERE

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ACKNOWLEDGEMENTS

The City of Belvedere and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of Belvedere more disaster resistant and sustainable.

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TABLE OF CONTENTS

CITY OF BELVEDERE COMMUNITY PROFILE 1-1
ACKNOWLEDGEMENTS 1-3
TABLE OF CONTENTS 1-5
SECTION 1.0: INTRODUCTION 1-7
1.1 Introduction 1-7
1.2 Planning Process 1-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 1-8
1.2.2 Steering Committee Planning Process 1-9
1.2.3 Coordination with Stakeholders and Agencies 1-9
1.2.4 Public Engagement 1-16
1.3 Overview and History 1-23
1.4 Government 1-26
1.5 Weather and Climate 1-26
1.6 Demographics 1-27
1.7 Social Vulnerability and Risk 1-31
1.8 Economy and Tax Base 1-34
1.9 Critical Facilities 1-36
1.10 Historical Properties 1-38
SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT 1-39
2.1 Climate Change 1-41
2.2 Hazards 1-47
2.2.1 Debris Flows 1-49
2.2.2 Drought 1-55
2.2.3 Earthquake 1-56
2.2.4 Flooding 1-63
2.2.5 Land Subsidence 1-69
2.2.6 Levee Failure 1-72
2.2.7 Sea Level Rise 1-75
2.2.8 Severe Weather – Extreme Heat 1-80
2.2.9 Severe Weather – High Wind & Tornado 1-81
2.2.10 Tsunami 1-84
2.2.11 Wildfire 1-86
SECTION 3.0: MITIGATION STRATEGY 1-97

3.1 Changes in Development 1-97
3.2 Capability Assessment 1-98
3.2.1 Regulatory Capabilities 1-99
3.2.2 Administrative and Technical Capabilities 1-102
3.2.3 Fiscal Capabilities 1-104
3.2.4 Community Outreach 1-105
3.2.5 Participation in the National Flood Insurance Program 1-105
3.3 Mitigation Goals 1-108
3.4 Status of Previous Mitigation Actions 1-110
3.5 Hazard Mitigation Actions 1-111
3.6 Progress in Local Mitigation Efforts 1-117
3.7 Plan Integration 1-117
3.8 Future Development Trends 1-118
SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION 1-120
4.1 Plan Adoption 1-120
4.2 Plan Monitoring 1-120
4.3 Plan Evaluation 1-121
4.4 Plan Update 1-121
FIGURES AND TABLES 1-123
ACRONYMS/ABBREVIATIONS 1-125

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of Belvedere, Community Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of Belvedere.

1.2 PLANNING PROCESS

The majority of Marin County is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Marin County and City of Belvedere Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small participating jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County, the City of Belvedere and the other participating planning areas to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving the City of Belvedere and all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County is very different from most California Counties in that the populated portion of the County where the participating jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Marin County and City of Belvedere Steering Committee to establish a more robust Planning Team representing local Belvedere, countywide, regional, state, and federal stakeholders servicing the Marin County and City of Belvedere planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County and City of Belvedere Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the City of Belvedere involved additional internal planning team members to support the broader planning process. The City of Belvedere jurisdictional representatives for the coordinated Marin County Multi-Jurisdictional

Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Robert Zadnik, City Manager
Telephone: 415-435-8906
E-mail: rzadnik@cityofbelvedere.org

Alternate Point of Contact
Laurie Nilsen, Emergency Svs, Coord.
Telephone: 415-789-2805
E-mail: lnilsen@tiburonpd.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Belvedere	Robert Zadnik	City Manager	415-435-8906	rzadnik@cityofbelvedere.org
Belvedere	Laurie Nilsen	Emergency Svs, Coord.	415-789-2805	lnilsen@tiburonpd.org
Belvedere	Rebecca Markwick	Planning Director	415-435-8907	rmarkwick@cityofbelvedere.org
Belvedere	Samie Malakiman	Associate Planner	415-435-8931	smalakiman@cityofbelvedere.org

Table 1: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the City of Belvedere. All participating jurisdictions are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Marin County and City of Belvedere Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Marin County and City of Belvedere Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.

- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Marin County and City of Belvedere Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Marin County and City of Belvedere Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Marin County and City of Belvedere Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County and City websites. The County and City website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of Belvedere Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of Belvedere communities and could provide subject matter expertise and relevant information to the planning process

regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of Belvedere Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of Belvedere and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Svcs	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 2: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Belvedere's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained

on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their City of Belvedere website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of Belvedere & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview

Table 3: City of Belvedere & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects

Table 3: City of Belvedere & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan	• Individual phone or conference calls with planning jurisdictions and districts to answer specific

Table 3: City of Belvedere & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Development Sessions	questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 3: City of Belvedere & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM and the City of Belvedere, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release from Marin County and the City of Belvedere informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by Marin County, the City of Belvedere, and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the Marin County and City of Belvedere website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Marin County and City of Belvedere Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual

broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Marin County and City of Belvedere Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan

development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 1: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting

on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

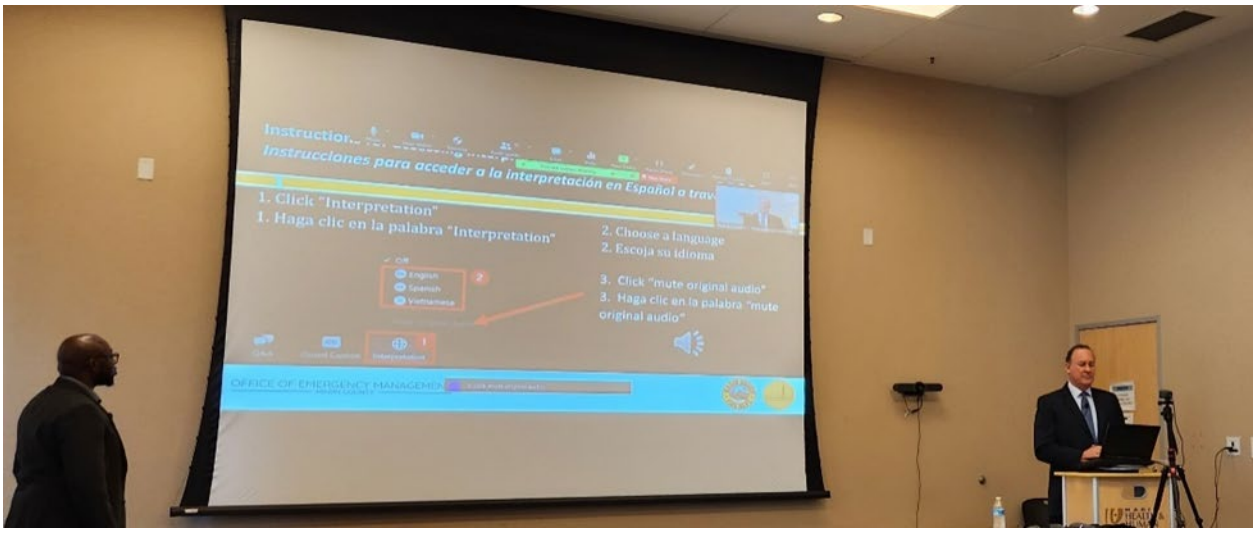


Figure 2: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

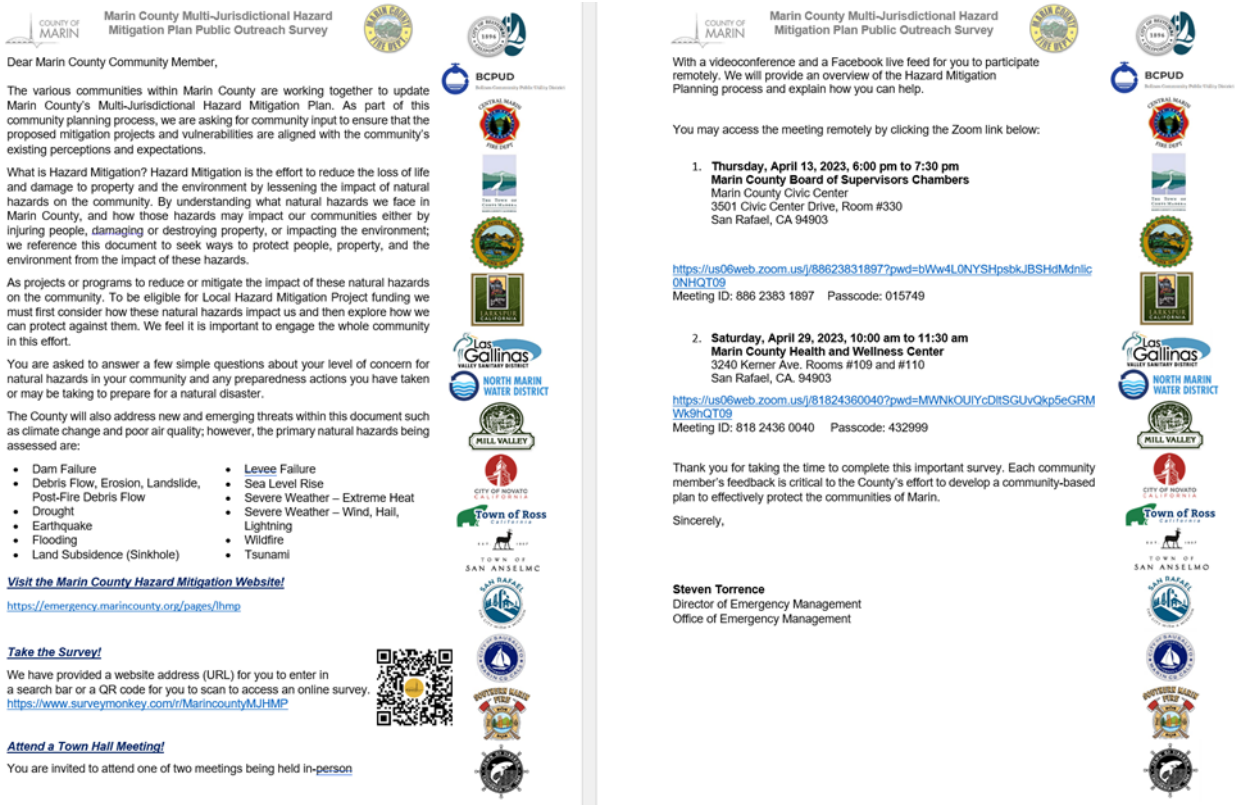
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 3: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.

- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

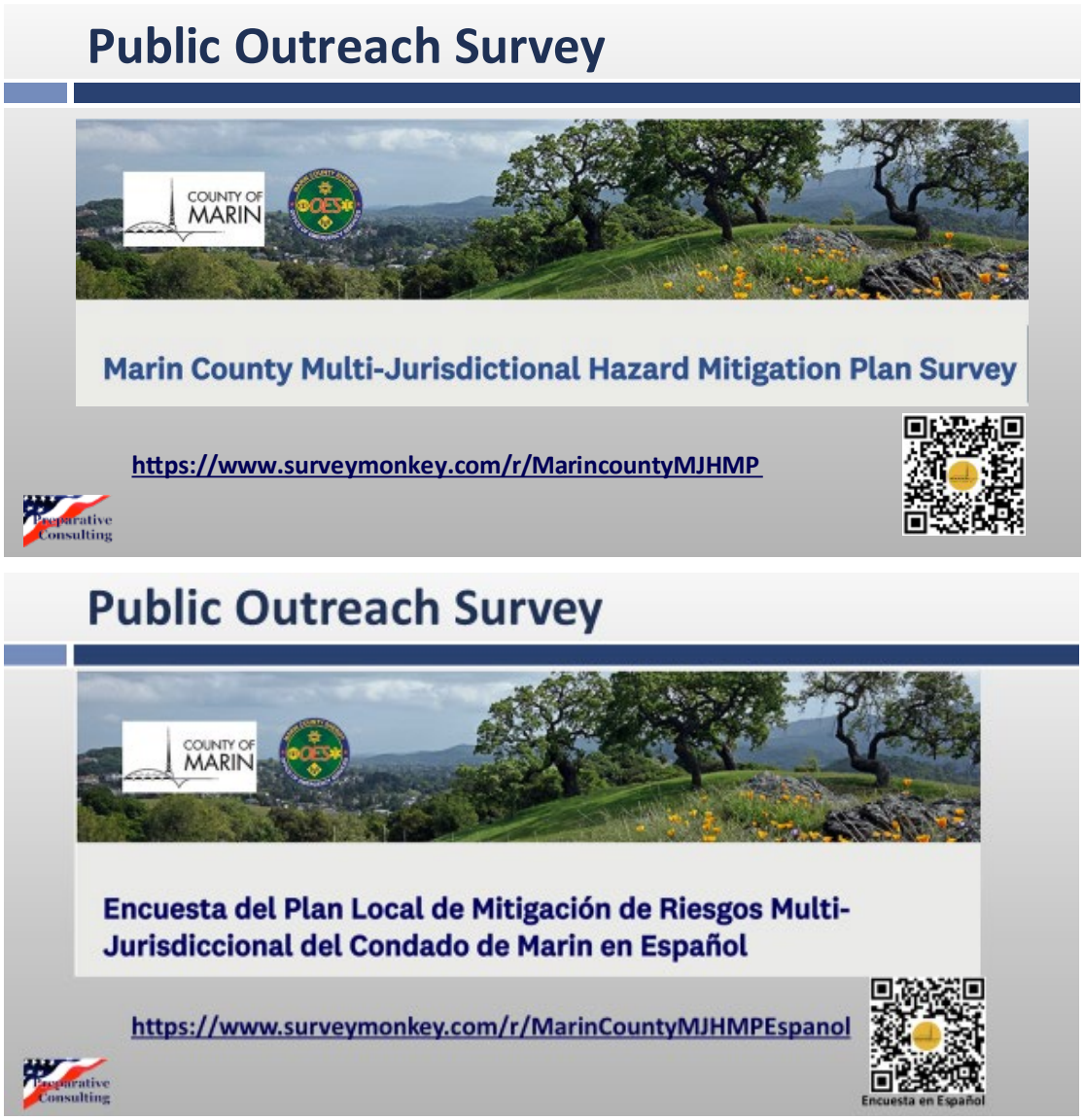


Figure 4: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of Belvedere had an additional 14-day comment period for the City of Belvedere Community Profile where their profile was posted on the City website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The City of Belvedere distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the

Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

Approximately seven miles north of San Francisco and at the tip of the Tiburon Peninsula, Belvedere is flanked by the Richardson Bay to the west and north, Belvedere Cove and Raccoon Straits to the south, and the Town of Tiburon to the east. In addition to being surrounded by water, Belvedere also has an interior lagoon and two land "bridges" that connect the largest portion of the City to the rest of the Tiburon Peninsula. Regional access to the Tiburon Peninsula is provided by U.S Highway 101 (U.S. 101), a major north-south freeway linking Marin County with Sonoma County (north) and San Francisco (south). There are two main gateways into the City of Belvedere: San Rafael Avenue at Tiburon Boulevard and Beach Road at Tiburon Boulevard. Bus service to the Tiburon Peninsula is provided by Golden Gate Transit, which is operated by the Golden Gate Bridge, Highway, and Transportation District. Just outside of the Planning Area, the ferry terminal in Tiburon provides Marin residents with ferry access to San Francisco. Two nearby creeks, Arroyo Corte Madera del Presidio and Corte Madera Creek, empty into the Richardson and San Francisco bays.

Home to approximately 2,100 residents, the City of Belvedere is the smallest jurisdiction in Marin County. The City encompasses just 2.2 square miles, of which 1.75 square miles is water. This leaves only 0.45 square miles (287 acres) of developable land. Belvedere can be represented by four distinct districts. Belvedere Island has the largest land area and is the most varied in terms of topography and landforms. Belvedere Lagoon forms a second, flatter portion of the City that surrounds the interior waterway. West Shore Road borders Richardson Bay and is a third characteristically different area, with Bayfront homes along the western edge of Belvedere Island. A final area is located on Corinthian Island facing Belvedere Cove, where the island's residents share borders with the Town of Tiburon.

Belvedere is predominantly a residential community, with well over 90 percent of its land area either in residential use or zoned residential. Nearly all employment needs, and most residential service needs, are met outside Belvedere. Commercial uses within the City consist only of the portion of the Boardwalk Shopping Center area that lies within the City boundary and the office spaces found along Beach Road near the San Francisco Yacht Club. Overall, residential uses account for 231.4 acres, commercial uses occupy 25.2 acres, utilities and institutional uses occupy 5.7 acres, while parks and open spaces occupy 15.1 acres. Vacant land accounts for 9.8 acres. Utilities, roads, and right-of-way uses compose 59.3 acres of the City.

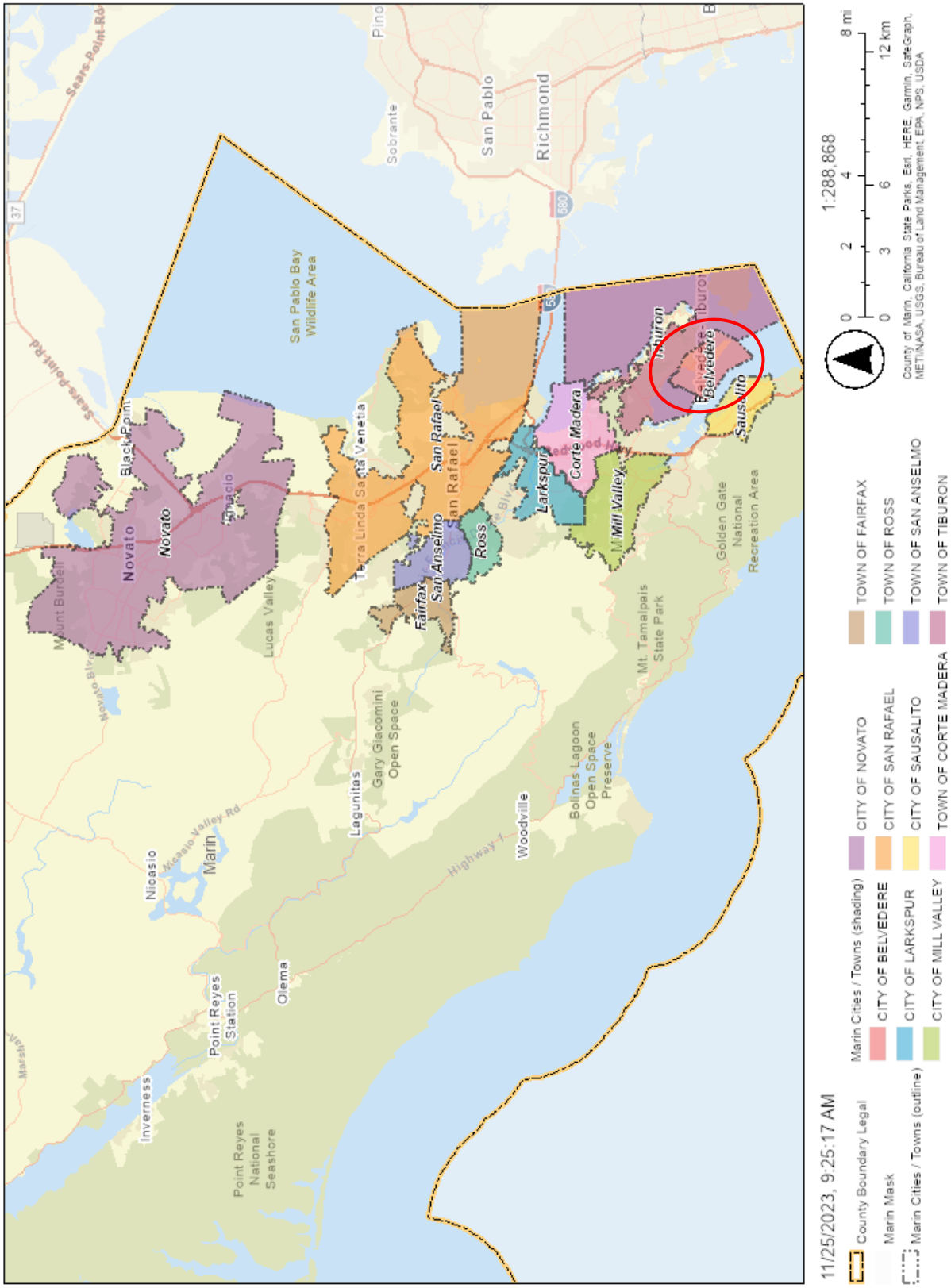


Figure 5: Map of City of Belvedere in Marin County
Source: Marin County OEM

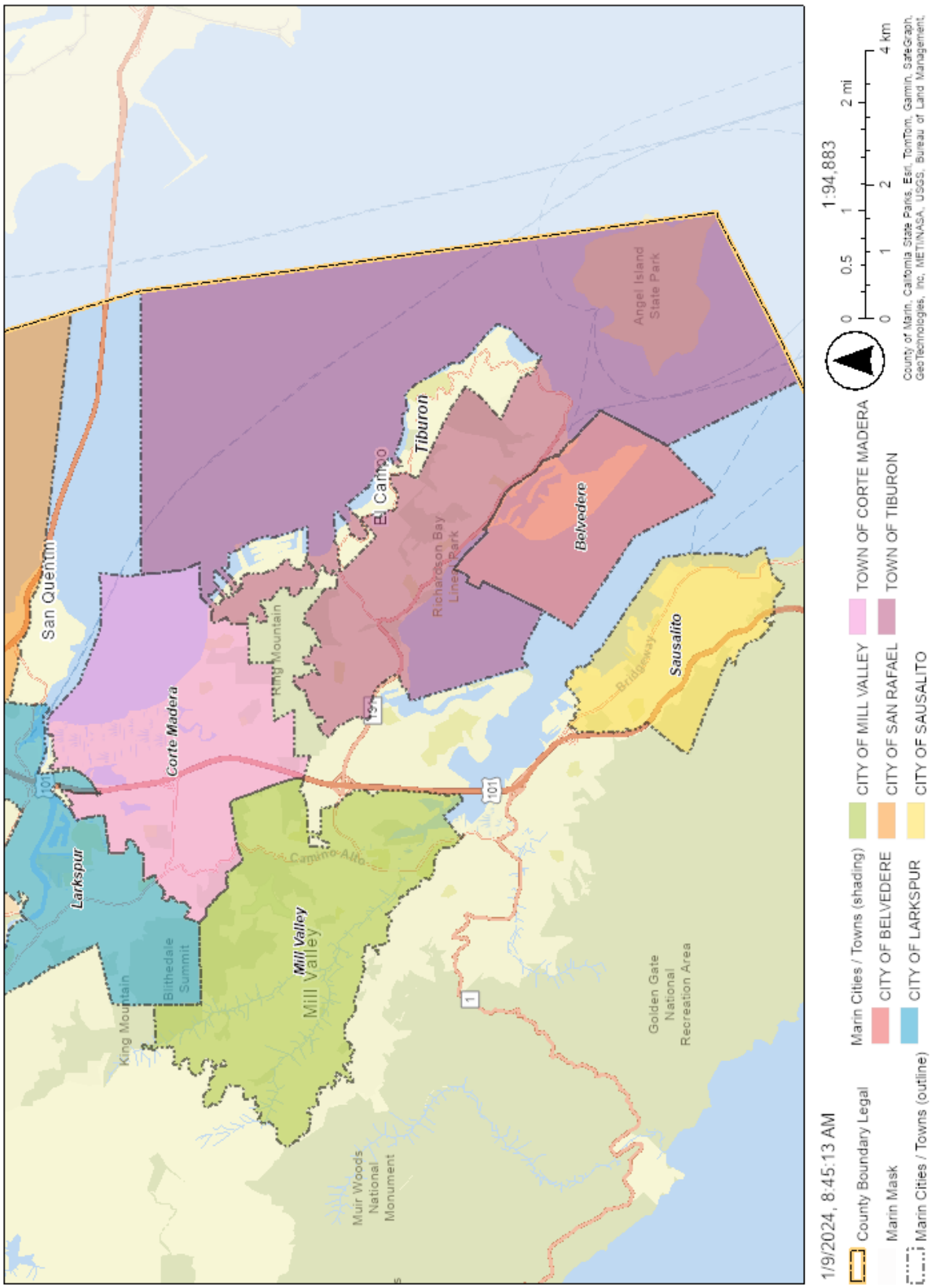


Figure 6: Map of the City of Belvedere
Source: Marin County OEM

1.4 GOVERNMENT

The City of Belvedere is governed by a five-person City Council. The City Council elects one of its members to serve as Mayor, the executive head of the City; and appoints a City Manager, the administrative head of the city. The city consists of 7 departments: the Climate and Environment, City Clerk and Elections, Finance, Human Resources, Planning and Building, Police, and Public Works.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

The City of Belvedere contracts with Tiburon Fire Protection District for both ambulatory and fire services. Tiburon Fire Protection District is a combination department with 21 career safety employees, one clerical and one finance officer, 13 volunteer firefighters, and 6 trainee firefighters. Protecting the City of Belvedere and the city of Belvedere, California and the surrounding area, the Fire District's boundaries represent a diverse community with responsibility for commercial, residential, wildland/urban interface, and parts of the San Francisco Bay to Angel Island State Park. The Tiburon Fire Protection District was established in April 1941 and remained an all-volunteer fire department until December 1959. In 1981 the Tiburon Fire District contracted with the City of Belvedere, providing emergency medical and fire related services to the City.

The Belvedere Police Department was founded in 1897. following the City's incorporation by 1896. The Police Department has seven sworn officers and has a collaborative relationship with the Tiburon Police Department. The Tiburon Police Station also houses the Emergency Operations Center, which is equipped to manage disaster response for Tiburon and Belvedere. The Police Department and Emergency Operations Center are also responsible for developing and maintaining the Emergency Operations Plan for the entire Tiburon Peninsula.

1.5 WEATHER AND CLIMATE

The City of Belvedere lies approximately 62 feet (19 meters) above sea level. In Belvedere, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 48°F to 73.1°F and is rarely below 43°F or above 62.3°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is 42 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	113 (4)	118 (4)	83 (3)	40 (1)	21 (0)	6 (0)	2 (0)	2 (0)	3 (0)	25 (0)	57 (2)	111 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	2	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.9	6.5	7.8	9.1	9.1	9.3	7.4	6.8	7.6	7.3	6.8	5.8

Figure 7: The City of Belvedere Precipitation and Monthly Temperatures
Source: en.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of Marin County and the City of Belvedere since the last plan update in 2018. Of the total estimated 257,135 residents of Marin County in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The City of Belvedere had an estimated population of 9,542 in the 2018 plan. 2020 U.S. Census Survey estimated the City's population at 9,146. However, revised estimates for 2022 estimated the population to decrease to 8,956 population.

Table 4: City of Belvedere Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County	257,135	262,321	262,179	-1.92%
City of Belvedere	2,080	2,126	2,102	-1.04%

Table 4: City of Belvedere Estimated Jurisdictional Population
Source: California Department of Finance

Table 5: Population Change of The City of Belvedere

Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County	252,409	262,321	9,912	3.9%
Belvedere, City	2,102	2,126	24	-1.04%

Table 5: Population Change of The City of Belvedere
Source: City of Belvedere Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the City of Belvedere.

Table 6: Languages Spoken in Belvedere	
Primary Language Spoken	% of Population
English only	88.8%
Spanish	3.4%
Other Indo-European languages	4.5%
Asian and Pacific Islander languages	3.3%
Other languages	0.0%

Table 6: Languages Spoken in Belvedere
Source: US Census Bureau (2020)

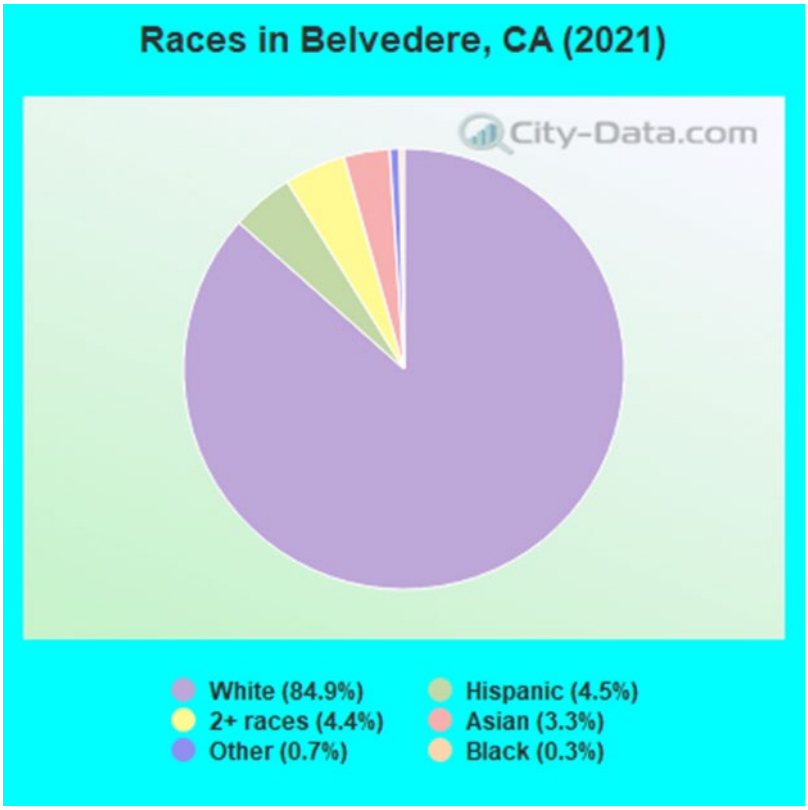
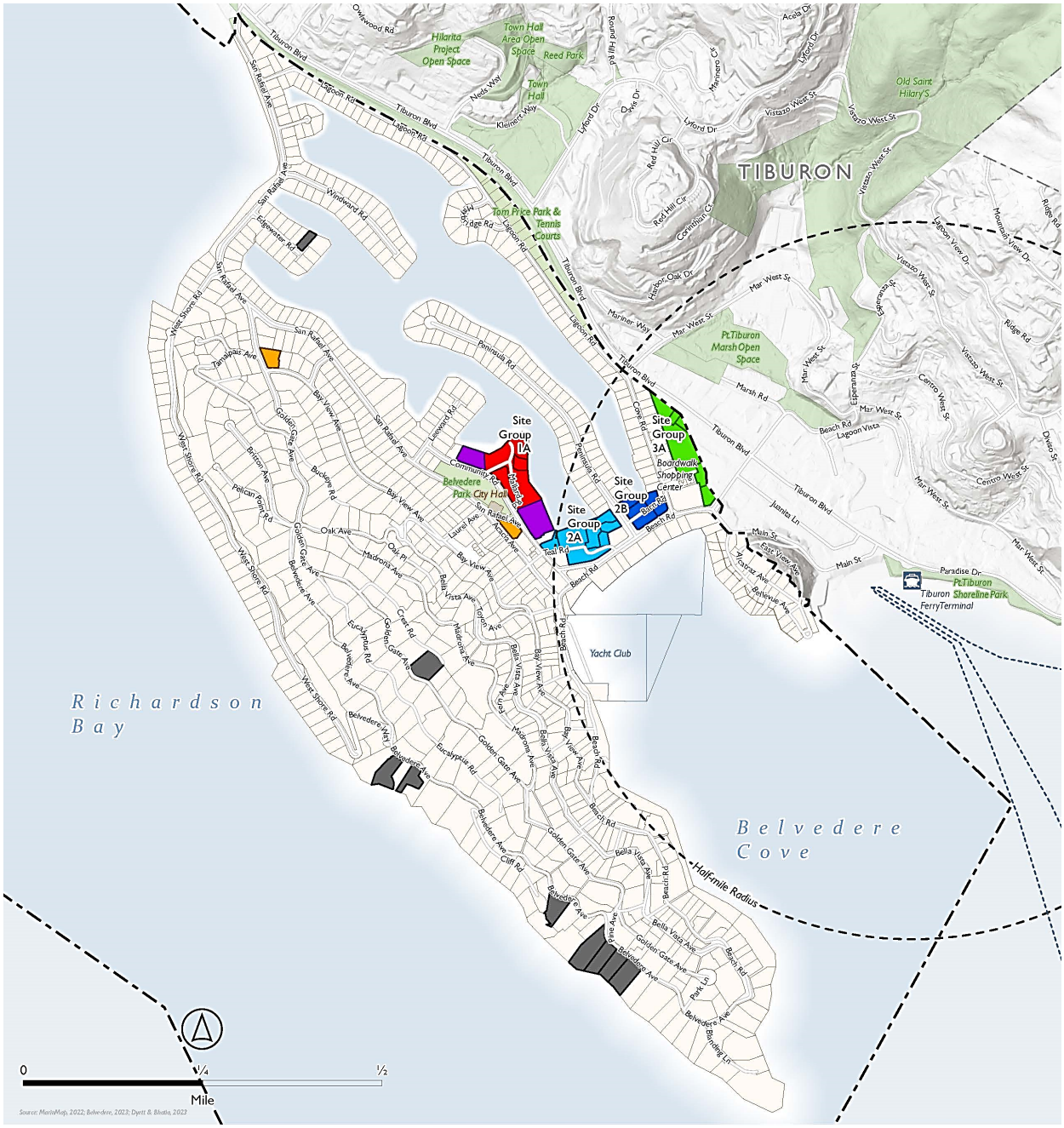


Figure 8: Races in Belvedere
Source: City-Data.com

Table 7: Marin County Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of Belvedere							
2022	Number	1,062	890	51	84	37	0
	Percent	100.00%	83.80%	4.80%	7.91%	3.48%	0.00%
2018	Number	1,048	881	49	81	37	0
	Percent	100.00%	84.06%	4.68%	7.73%	3.53%	0.00%

Table 7: Marin County Jurisdictional Housing Stock
Source: California Department of Finance



Proposed Project
Add Multifamily Capacity (Cluster 1)
Add Multifamily Capacity (Cluster 2)
Mixed Use Redevelopment
Church-Owned Site (SB 10)
Vacant Land
Sites with Existing Residential Zoning

Belvedere City Limit
Neighbor City

City Hall
Yacht Club
Park

Ferry Terminal
Ferry Route
Half-mile Radius

Figure A-1a: Sites Inventory

Figure 9: City of Belvedere Land Use Map
Source: City of Belvedere 2009 General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 8: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Table 9 illustrates the NRI Hazard Type Risk Index for Belvedere Census Tract 1230.00.

Table 9: NRI Hazard Type Risk Index for Belvedere Census Tract 1230.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Riverine Flooding	$744,354	Very Low	Very High	0.64	$474,190	96.3
Earthquake	$543,579	Very Low	Very High	0.64	$346,287	84.7
Coastal Flooding	$68,722	Very Low	Very High	0.64	$43,780	94.3
Tornado	$2,697	Very Low	Very High	0.64	$1,718	4.2
Tsunami	$1,347	Very Low	Very High	0.64	$858	96
Landslide	$1,288	Very Low	Very High	0.64	$821	61.7
Strong Wind	$131	Very Low	Very High	0.64	$84	4.1
Drought	$0	Very Low	Very High	0.64	$0	0
Heat Wave	$0	Very Low	Very High	0.64	$0	0
Wildfire	$0	Very Low	Very High	0.64	$0	0

Table 9: NRI Hazard Type Risk Index for Belvedere Census Tract 1230.00
Source: FEMA National Risk Index 2023

Figure 10 illustrates the Social Vulnerability Map for Belvedere Census Tract 1230.00.

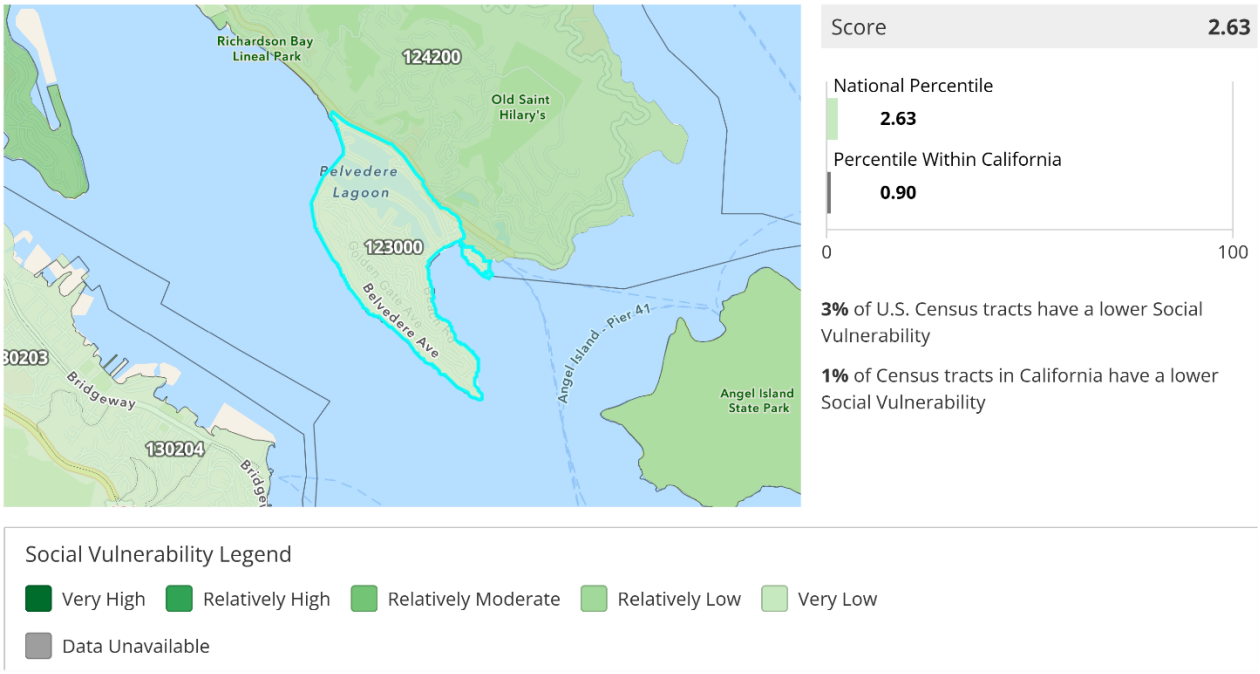


Figure 10: City of Belvedere Social Vulnerability Map Census Tract 1230.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in Marin County reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a "very high" ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a

whole to have “Relatively High” risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category (“Very High Risk”), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

The median income for a household in the City of Belvedere was $192,292 and the per capita income for the City was $119,477. Approximately 0 percent of families and 1.3 percent of the population were below the poverty line (2010 data, U.S. Census Bureau).This poverty line is lower than other communities within Marin County. The two census tracts reflect both a Relatively Low and Very Low Social Vulnerability Index in the City.

The median income for a household in the City of Belvedere was $246,500 and the per capita income for the City was $153,697. Approximately 4.4 percent of families and 5.8 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). However, the census tract reflects a Very Low Social Vulnerability Index in the City.

1.8 Economy and Tax Base

Table 10 shows income by household in The City of Belvedere as of 2021.

Table 10: Household Income for The City of Belvedere as of 2021

Household Income	Number	Percent
Total Households	900	-
Less than $10,000	42	4.7
$10,000 to $14,999	10	1.1
$15,000 to $24,999	43	4.8
$25,000 to $34,999	18	2.0
$35,000 to $49,999	24	2.7
$50,000 to $74,999	43	4.8
$75,000 to $99,999	61	6.8
$100,000 to $149,999	85	9.4
$150,000 to $199,999	62	6.9
$200,000 or more	512	56.9
Median household income (dollars)	$246,500	
Mean household income (dollars)	$389,540	

Table 10: Household Income for The City of Belvedere as of 2021
Source: US Census Bureau American Community Survey 2021 Estimates

Table 11 shows the percentage of people in The City of Belvedere over the age of 16 employed by industry.

Table 11: City of Belvedere Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	917	-
Agriculture, forestry, fishing and hunting, and mining	0	0%
Construction	24	2.62%
Manufacturing	68	7.42%
Wholesale trade	10	1.09%
Retail trade	59	6.43%
Transportation and warehousing, and utilities	7	0.76%
Information	25	2.73%
Finance and insurance, and real estate and rental and leasing	293	31.95%
Professional, scientific, and management, and administrative and waste management services	228	24.86%
Educational services, and health care and social assistance	85	9.27%
Arts, entertainment, and recreation, and accommodation and food services	38	4.14%
Other services, except public administration	66	7.20%
Public administration	14	1.53%

Table 11: City of Belvedere Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2019 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the City of Belvedere to fulfill the requirements of its mission during an emergency:

Table 12: City of Belvedere Critical Facilities					
	Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities					
1.	Law	Belvedere Police Department	450 San Rafael Ave	None	None
2.	Local Government	Belvedere City Hall	450 San Rafael Ave	None	None
3.	Evacuation Shelter	St. Stephens Church	3 Bayview Ave	None	None
4.	Evacuation Shelter	San Francisco Yacht Club	98 Beach Rd	None	X
5.	Evacuation Shelter	Corinthian Yacht Club	43 Main Street	None	X
6.	Local Government	Belvedere Lagoon Pump Station	Cove/Lagoon	None	X

Table 12: City of Belvedere Critical Facilities
Source: City of Belvedere

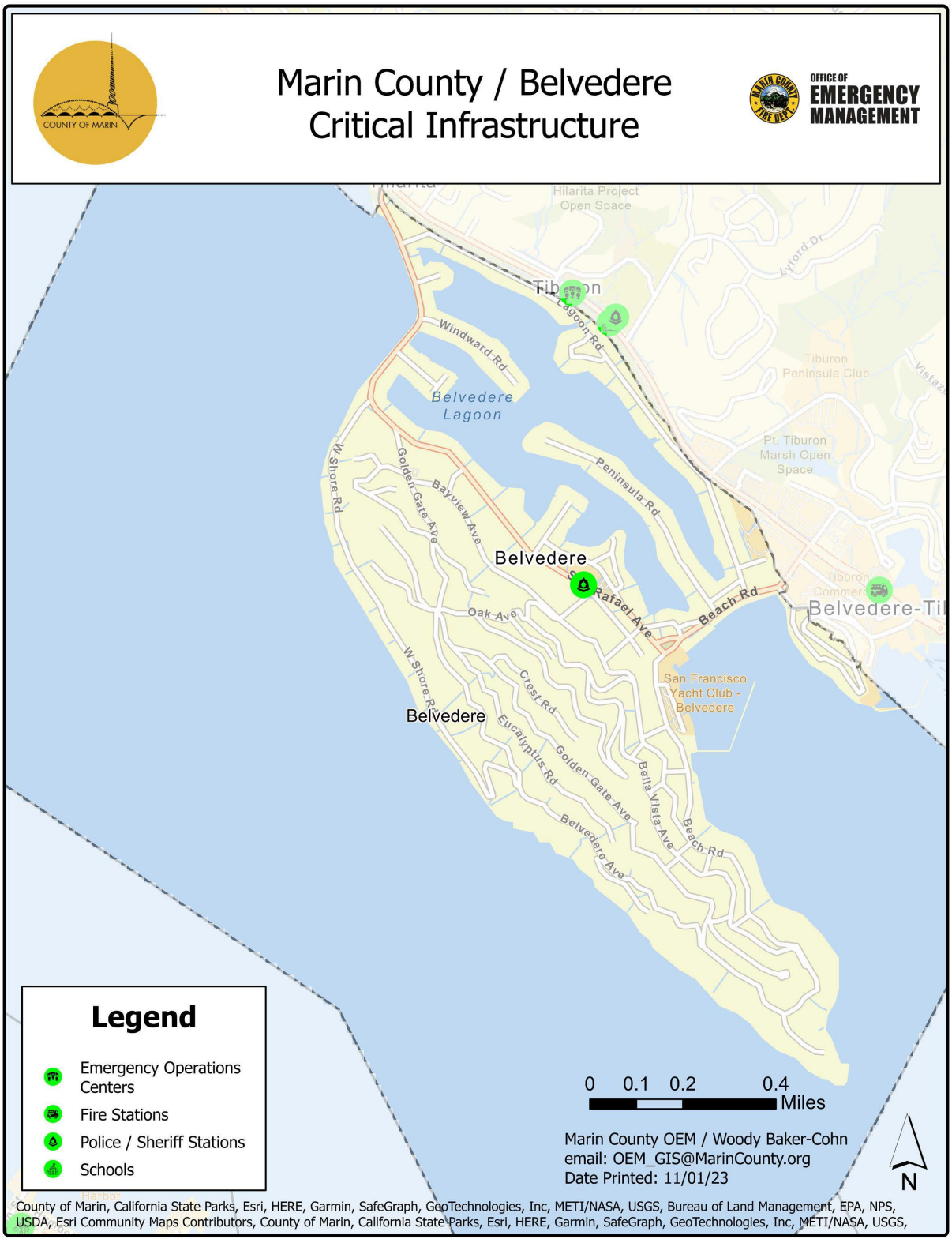


Figure 11: City of Belvedere Critical Facilities Map
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The City of Belvedere has one registered historically significant homes, public buildings, or landmarks. To inventory these resources, the Marin County OA MJHMP Planning Team collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of Belvedere Chamber of Commerce.
- City of Belvedere website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

Table 13: Historic Sites in Belvedere

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Valentine Rey House	X			4/22/1982	Belvedere

Table 13: Historic Sites in Belvedere
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of Belvedere identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 12 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

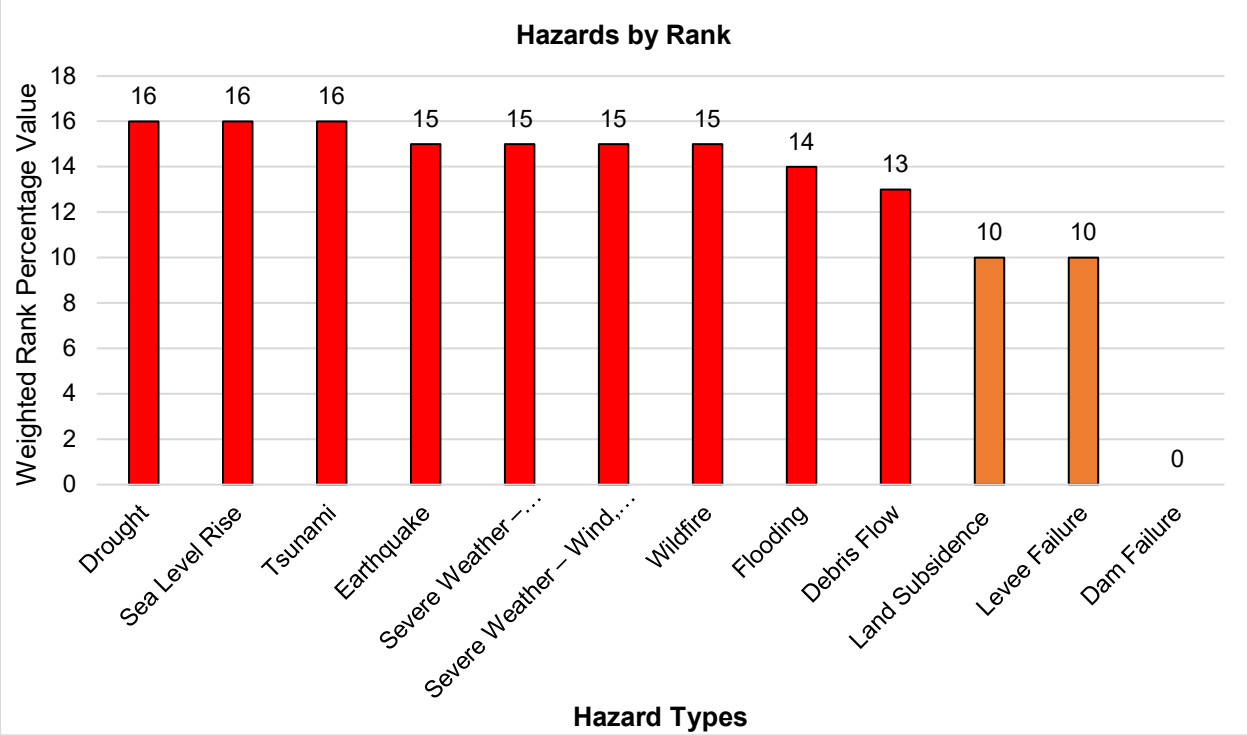


Figure 12: City of Belvedere Risk Assessment – Planning Team Top Hazards

Figure 13: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 13: Hazard Risk Categorization

Each Marin County MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 14: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact

- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS
Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS
Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

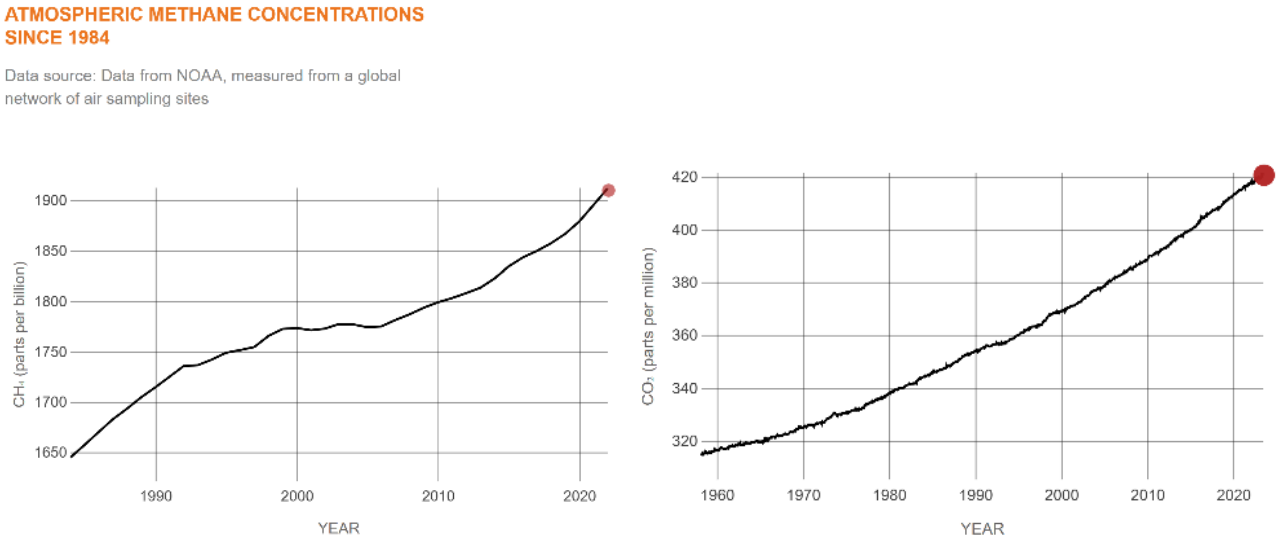


Figure 14: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

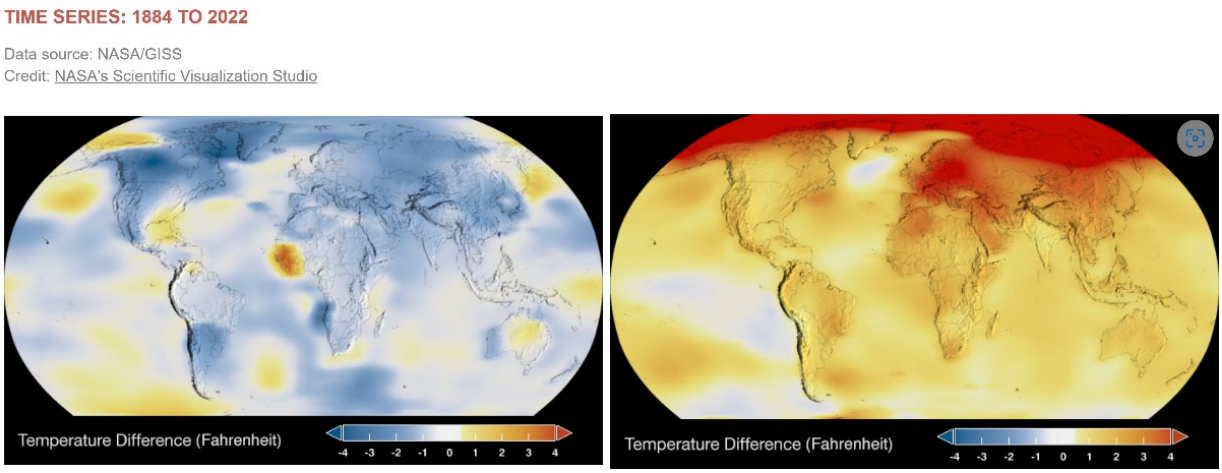


Figure 15: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.

- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

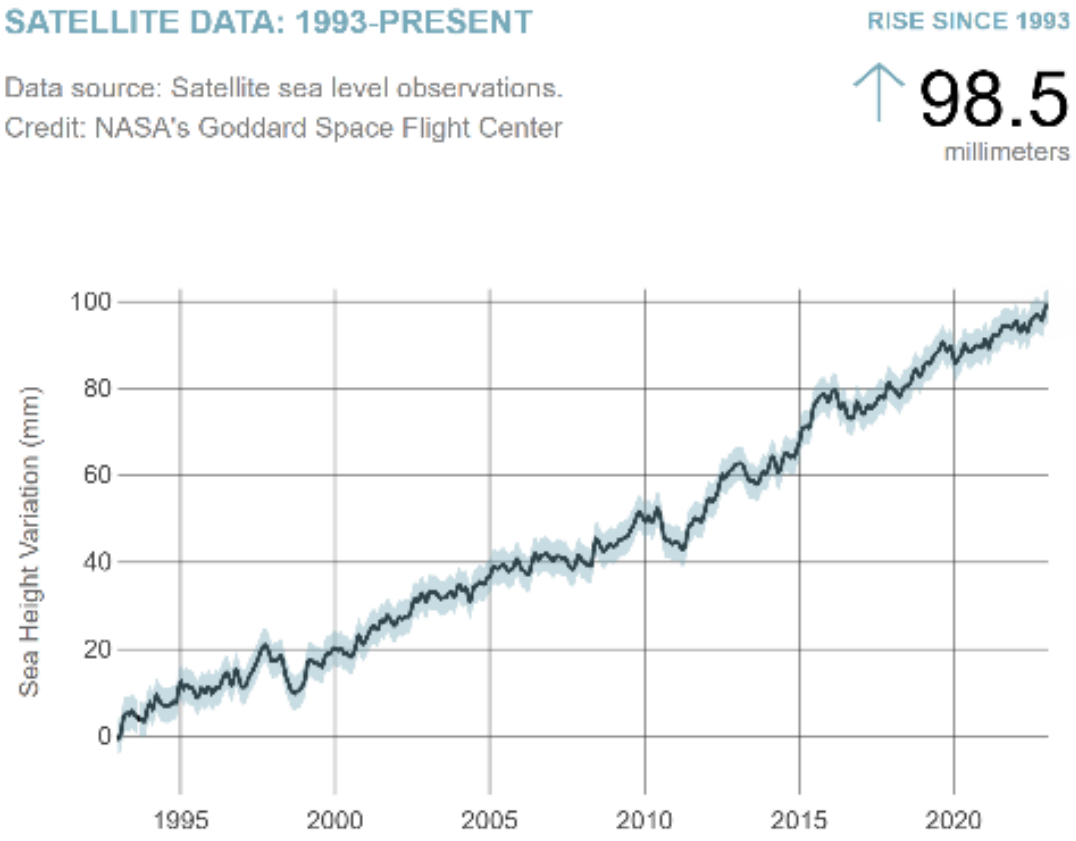


Figure 16: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals,

workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.

- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

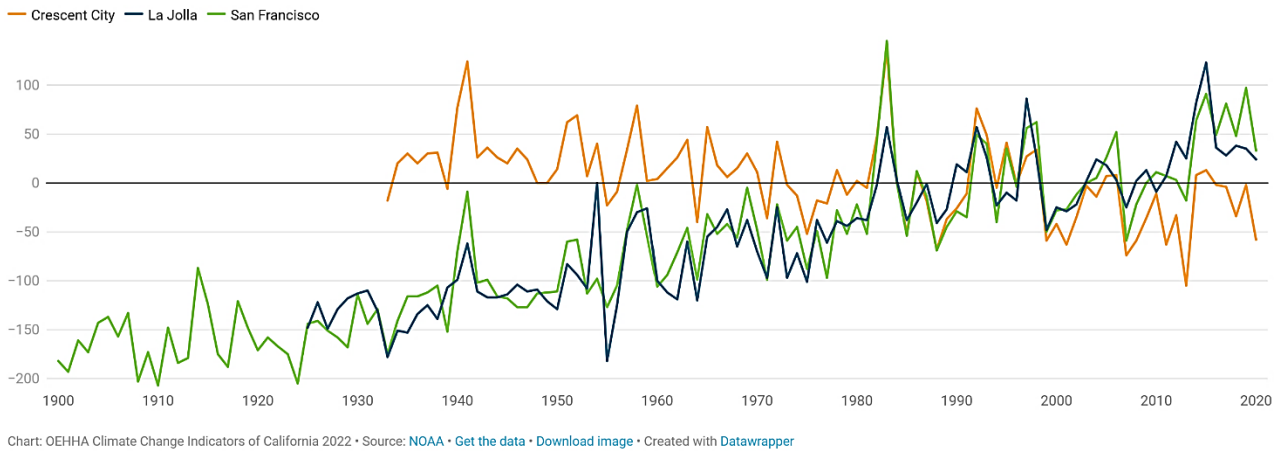


Figure 17: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires

and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.
Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the City of Belvedere as per the planning team.

Table 15: City of Belvedere Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence (Sinkhole)	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Significant	Severe	High	High	**16.00**
Wildfire	Highly Likely	Limited	Extreme	Medium	High	**15.00**

Table 15: City of Belvedere Hazard Risk Assessment
Source: City of Belvedere

Omitted Hazards

Dam Failure: The City of Belvedere does not have any exposure to flood water inundation resulting from a dam failure.

Table 16: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	None	High	**7.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 16: Hazard Risk Assessment
Source: Marin County

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in

place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Road building, excavation and grading
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 18 shows landslide susceptibility classes.

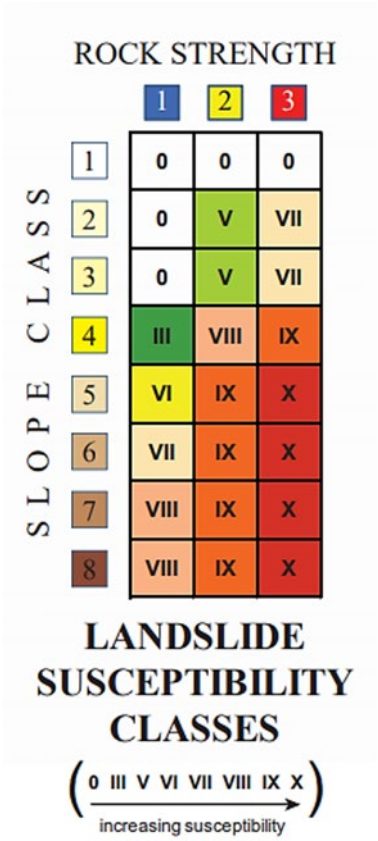


Figure 18: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour." Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 19 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

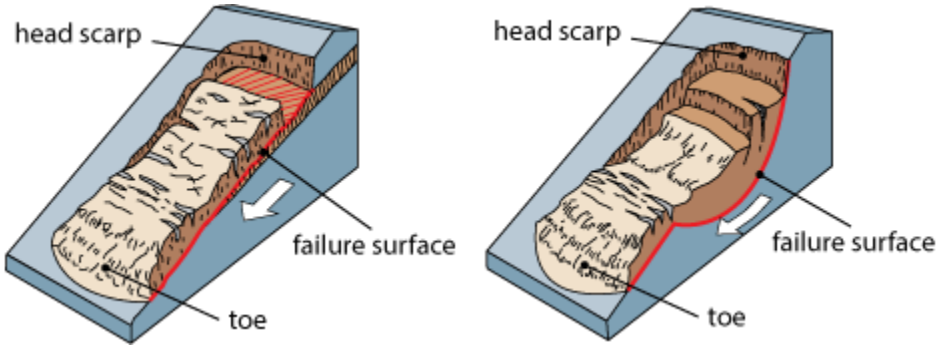


Figure 19: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in Belvedere would most likely occur in areas where the terrain is steeper and is more susceptible to movement of hill slope materials. Most of Belvedere south of San Rafael Avenue and the area around Bellevue Avenue has areas of steeper terrain and has high susceptibility to a landslide. These areas are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. The area around Bellevue Avenue near the Corinthian Yach Club also has high landslide susceptibility and consists of numerous homes that could be susceptible to a landslide. The perimeter of the Belvedere Lagoon and areas along Beach Road where there are numerous homes have some susceptibility to a landslide. Both Tiburon Boulevard and Paradise Drive, the only two primary access points to the Tiburon Peninsula, both have sections with high landslide susceptible. The Belvedere Police Department, City Hall and Community Center building lies in an area with little to no landslide susceptibility.

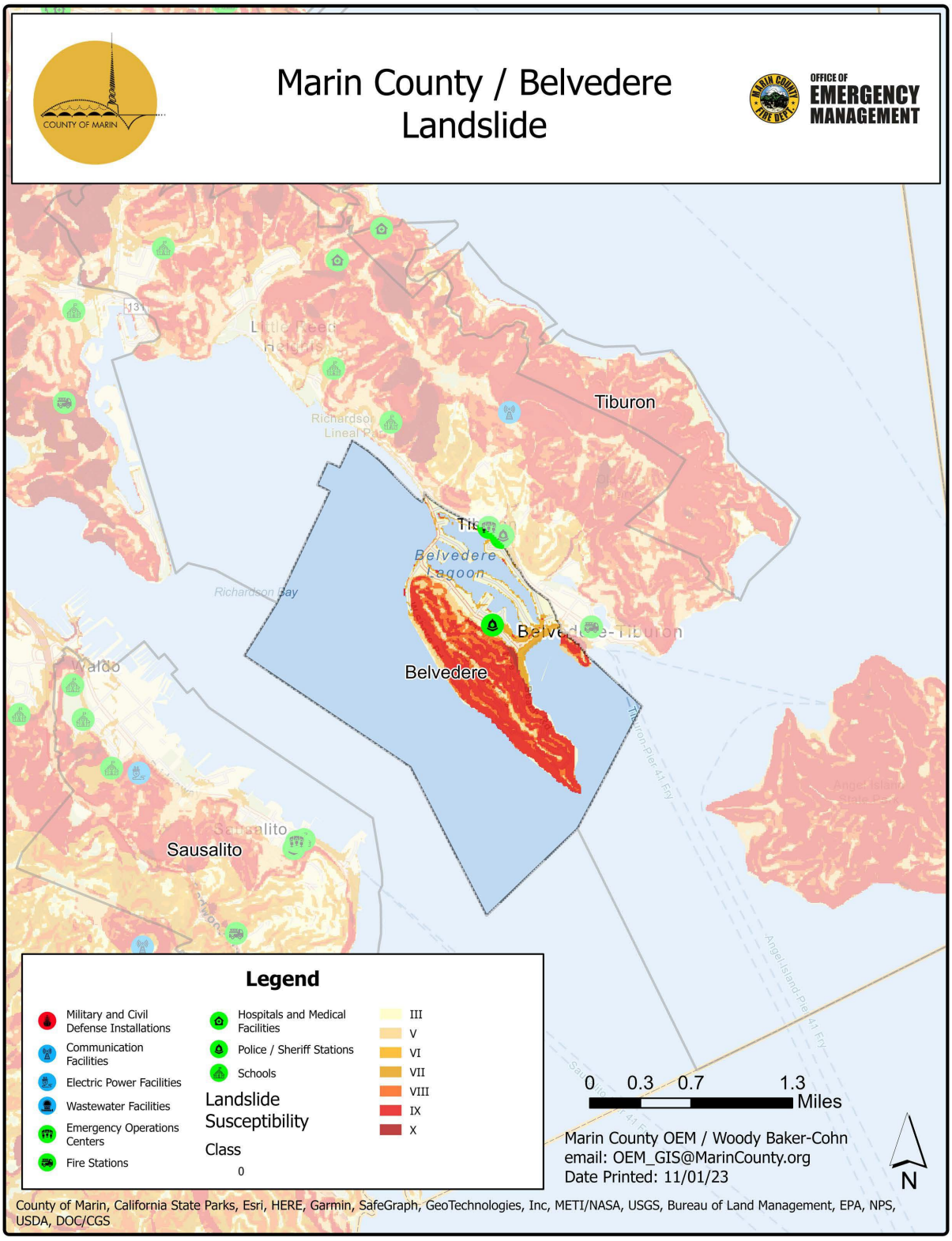


Figure 20: City of Belvedere Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in Belvedere could affect the ability of residents to reach their homes and could affect the provision of emergency and essential services. An earthquake has the potential to cause landslides in the areas of Belvedere with landslide susceptibility. A rain event in Belvedere could potentially contribute to mudslides that could impact homes in Belvedere. There are no creeks that flow directly into Belvedere.

There have been no major debris flows in Belvedere since the last plan update.

On 12/16/2014, an overnight cloudburst triggered flood and mudslide damage on the Tiburon Peninsula. Mud flooded driveways and lawns, and garbage cans floated away on a Belvedere Street. Mud, water and debris cascaded down a short stretch of the road that angles southward into San Rafael Avenue just north of Richardson Bay. One driveway was 6 inches deep in mud and leaves. A blocked culvert contributed to the mud flows.

Figure 21: City of Belvedere Mud Flows – December 16, 2014
Source: Marin County OEM

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[1], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Belvedere that have a higher landslide susceptibility, including south of San Rafael Avenue, will expose more people and property to landslide risk. With increased rain events as a result of climate change, more residents throughout Belvedere could be susceptible to mud flows. Future development should take into account the movement of mud and debris after a

[1] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

major rain event, particularly down streets and driveways in areas where there are no natural water channels.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Belvedere, though its effects would be most felt in the hilly areas and the area along the Tiburon Boulevard bike path where the risk of brush fires and tree mortality would increase. Dry trees in public spaces and in the tree-lined hillside neighborhoods of Belvedere can become a safety hazard to the public due to falling limbs or the toppling of the tree itself. An increase in brush fires as a result of drought could impact residences in the area.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Belvedere may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like

wells in the Marin County OA. As more people move into the Marin County OA and Belvedere, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces around Belvedere. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous and hilly areas of the Marin County OA including Belvedere where wildfires are more likely to occur. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Belvedere can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 22).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 22: Modified Mercalli Intensity Scale
Source: USGS

Figure 23 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 23: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 24). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 24: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Belvedere due to the number of active faults within and near Marin County.

Earthquake Shake Intensity

The colors on Figures 25 and 26 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

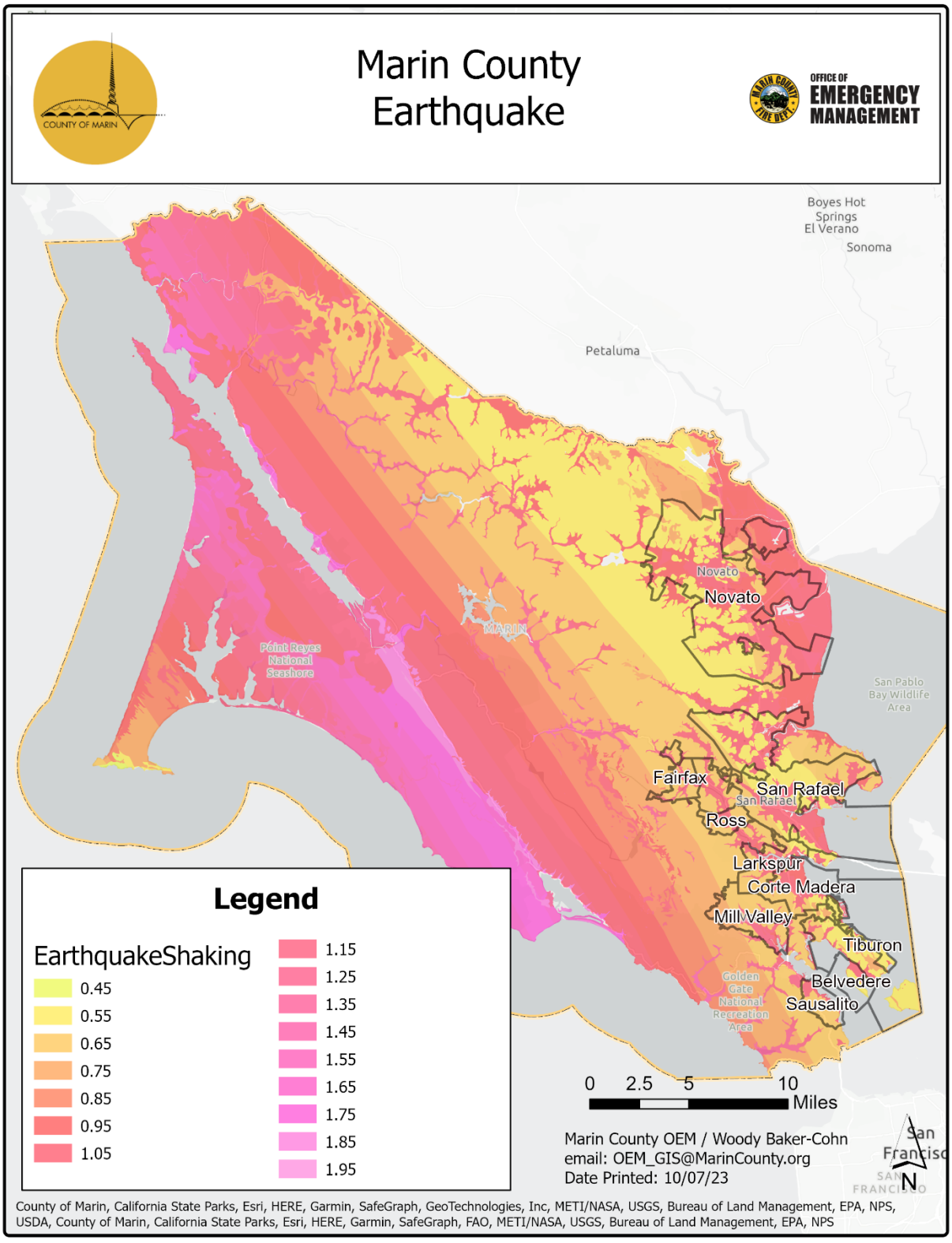


Figure 25: Marin County Earthquake Impact and Fault Lines
Source: Marin County OEM

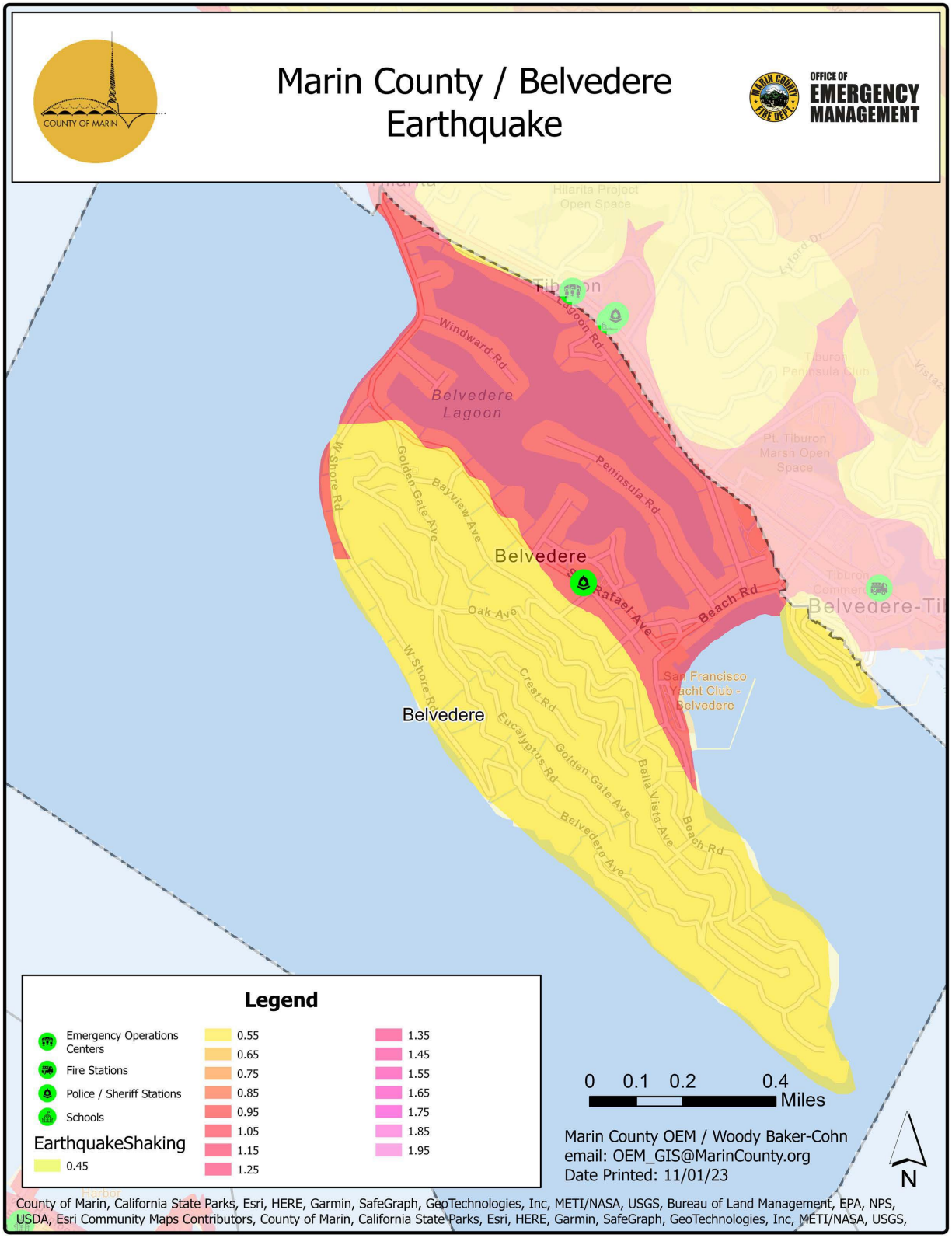


Figure 26: City of Belvedere Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Belvedere is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the city. All buildings located in Belvedere are vulnerable to earthquake damage, but depending upon construction, some buildings are expected to perform better than others. There is increased risk of shaking and liquefaction in lowland areas of Belvedere from an earthquake, particularly in the area around the Belvedere Lagoon where superficial deposits and fill are more prevalent. Belvedere used to be an island before fill was used to create the lagoon and surrounding neighborhood. There are hundreds of residences and several commercial buildings that lie around the Belvedere Lagoon in areas with higher earthquake shaking vulnerability. Tthe Belvedere Police Department, City Hall and Community Center building lies in this area. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the city could be impacted by an earthquake.

Earthquakes could also cause landslides in areas of Belvedere with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Belvedere hasn't yet experienced a significant earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Belvedere.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Belvedere, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[2], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Belvedere. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Belvedere, particularly around Belvedere and including Mallard Pointe, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

[2] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is a flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 27.

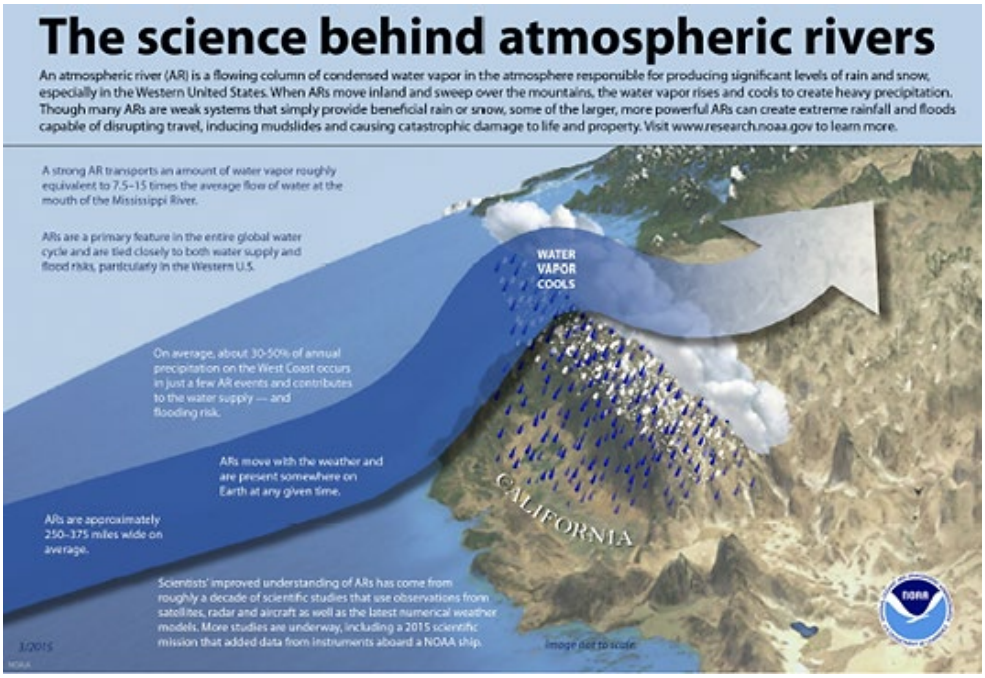


Figure 27: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above

the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in Belvedere generally results from a combination of high tides from Richardson Bay and San Francisco Bay and from storm runoff in low-lying areas around the Belvedere Lagoon. There are no creeks in Belvedere, though significant flooding events can cause flooding and mud flows down local roads. Most of the lowland areas in Belvedere, including around the Belvedere Lagoon, are in the 100-year floodplain, with a few areas along West Shore Road and San Rafael Avenue in the 500-year floodplain. Hundreds of residences and several commercial buildings around the Belvedere lagoon lie in the 100-year floodplain and could be susceptible to flooding. Both San Rafael Avenue and Beach Road lie in the 100-year floodplain. Dozens of residences and the Belvedere Police Department, City Hall and Community Center building lie in the 500-year floodplain and could be susceptible to flooding. The Tiburon Fire Protection District Station #11 lies in the 100-year floodplain.

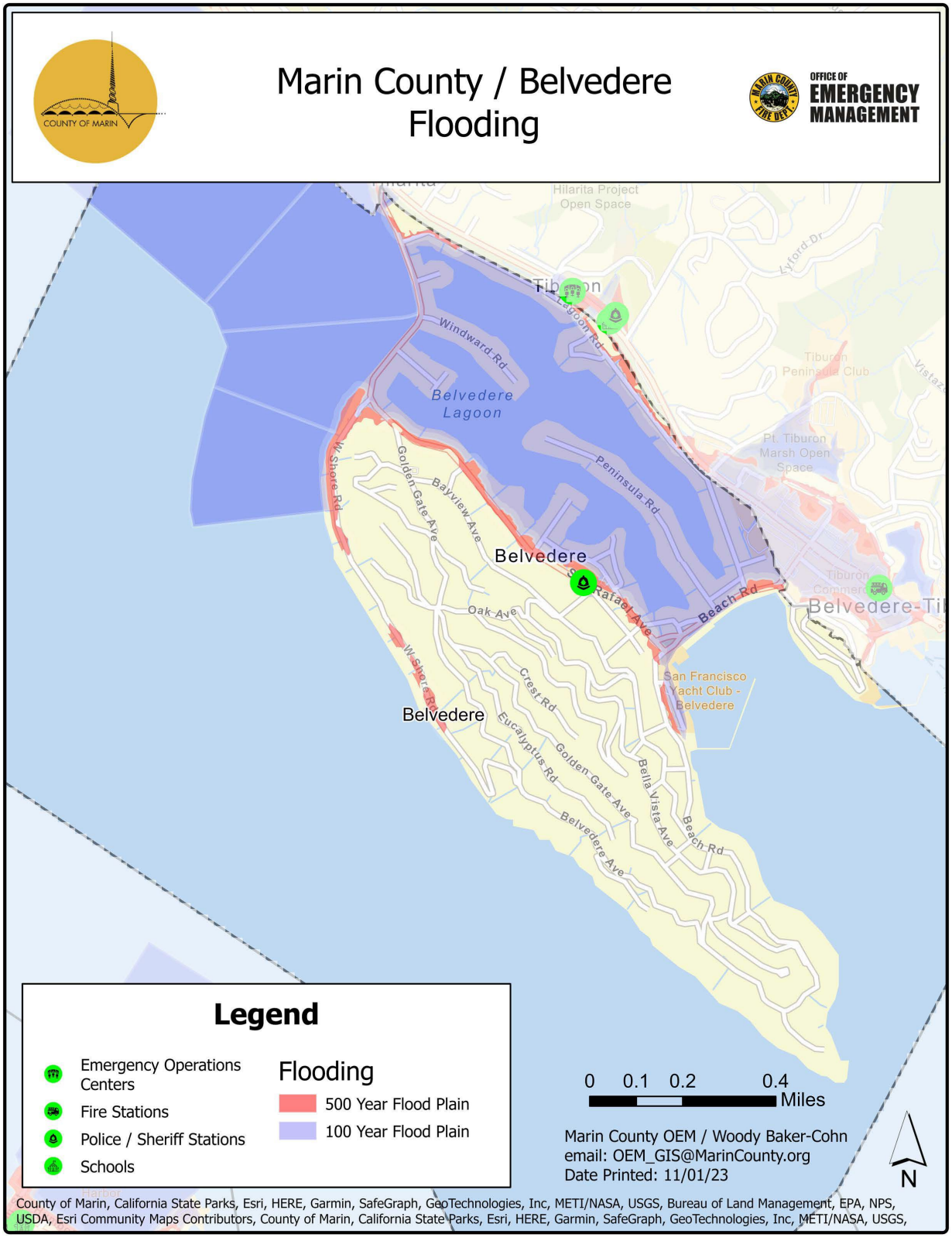


Figure 28: City of Belvedere Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 17 shows the number of residential structures by flood zone in the City of Belvedere.

Table 17: Residential Structures in The City of Belvedere by Flood Zone		
Flood Zone	FEMA Flood Zone Designations	Improved Residential Parcels
High Risk Areas		
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.	
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.	**1245**
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).	
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.	
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.	
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.	
High Risk - Coastal Areas		
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.	
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	**17**

Moderate to Low-Risk Areas		
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile	**2390**
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.	
Undetermined Risk Areas		
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.	
Total		**3,652**

Table 17: Residential Structures in The City of Belvedere by Flood Zone
Source: FEMA

Table 18 shows the number of City of Belvedere critical facilities by flood zone.

Table 18: City of Belvedere Critical Facilities in the Flood Zones				
#	Category	Name	Address	Flood Zone
Critical Facilities				
1.	Law	Belvedere Police Department	450 San Rafael Ave Belvedere, CA 94920	None
2.	Local Government	Belvedere City Hall	450 San Rafael Ave Belvedere, CA 94920	None
3.	Evacuation Shelter	St. Stephens Church	3 Bayview Ave Belvedere, CA 94920	None
4.	Evacuation Shelter	San Francisco Yacht Club	98 Beach Rd Belvedere, CA 94920	X
5.	Evacuation Shelter	Corinthian Yacht Club	43 Main Street Belvedere, CA 94920	X
6.	Local Government	Belvedere Lagoon Pump Station	Cove/Lagoon Belvedere, CA 94920	X

Table 18: City of Belvedere Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Although the City of Belvedere has not experienced recent catastrophic flooding, floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when

strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay and San Francisco Bay have the potential to significantly impact the Belvedere storm drain system. Belvedere sees flooding from king tides in Richardson Bay and San Francisco Bay and this is only expected to increase with sea level rise and climate change, placing increased stress on Belvedere's San Rafael Avenue sea wall. Flooding of both San Rafael Avenue and Beach Road simultaneously could impact ingress and egress into the residential area of Belvedere south of San Rafael Avenue, including the Belvedere Police Department, City Hall and Community Center, and potentially cut off access into the area entirely.

The Tiburon Peninsula saw nearly 40 inches of rain between October 2022 and March 2023, including nearly 24 inches between 12/29/2022 and 1/15/2023 that wreaked havoc, with storms frequently downing trees and power lines and flooding roads.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[3] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Belvedere. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Belvedere will likely experience more rain inundation events that lead to flooding and increase the potential threat of levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including around the Belvedere Lagoon. Future development in these areas including in Mallard Pointe will expose more people and infrastructure to the effects of tidal flooding and storm surge as a result of climate change.

2.2.5 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 29 for a picture and description of how dissolution sinkholes form.

[3] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

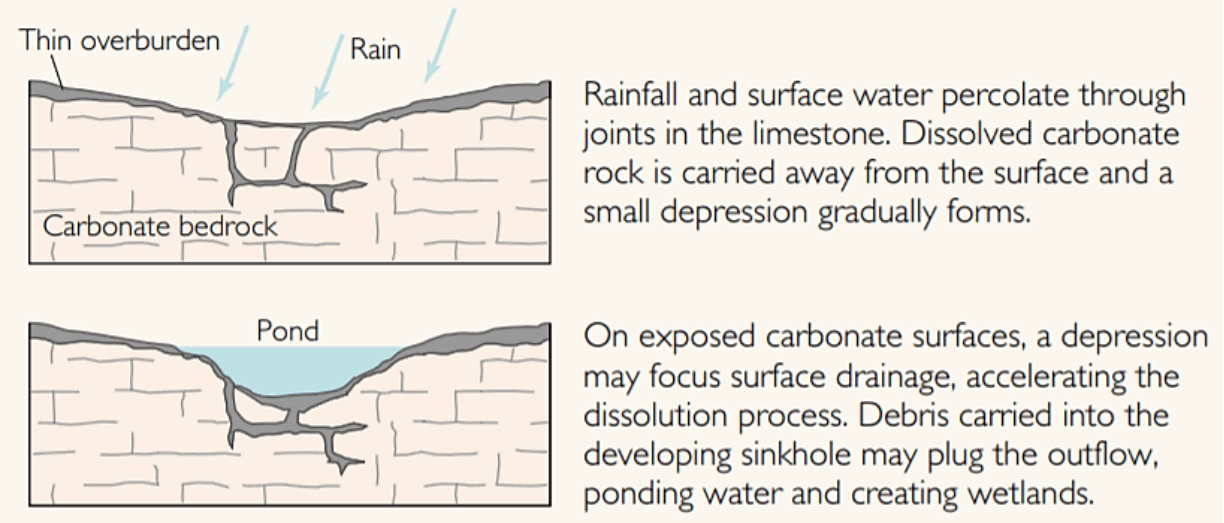


Figure 29: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 30 for a picture and description of how cover-subsidence sinkholes form.

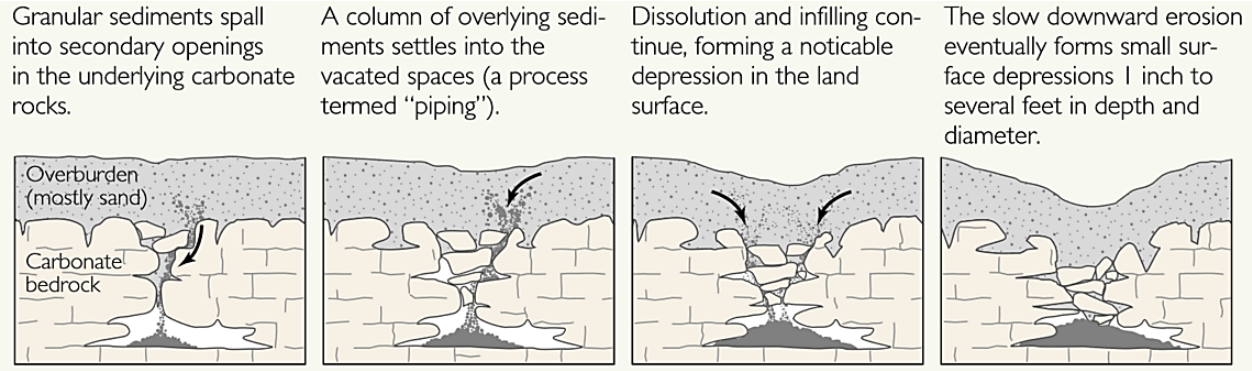


Figure 30: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 31 for a picture and description of how cover-collapse sinkholes form.

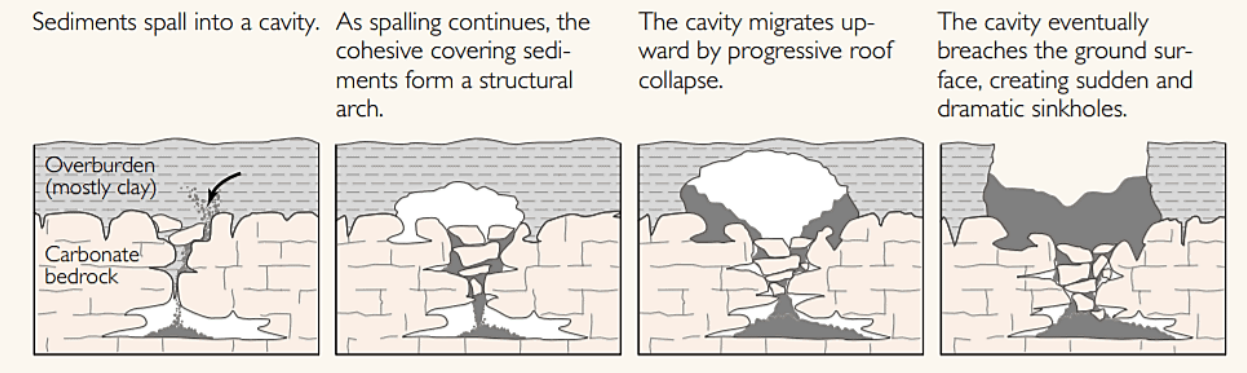


Figure 31: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Areas in Belvedere designated with very high potential for land subsidence are generally located the Belvedere Lagoon. This area consists of hundreds of residences, several commercial buildings and the Belvedere Police Department, City Hall and Community Center building. Land subsidence could have numerous impacts for Belvedere, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the city. The lowland areas of Belvedere could anticipate increased rates of subsidence as bay waters saturate the soil from below.

There have been no major sinkholes recorded in Belvedere.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Belvedere, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Belvedere as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Belvedere could increase with future development in the lowland populated areas of the city, particularly the area around the Belvedere Lagoon and including Mallard Pointe, where land subsidence is more likely to occur.

2.2.6 LEVEE FAILURE

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 32 shows a levee and the multiple ways it can fail.

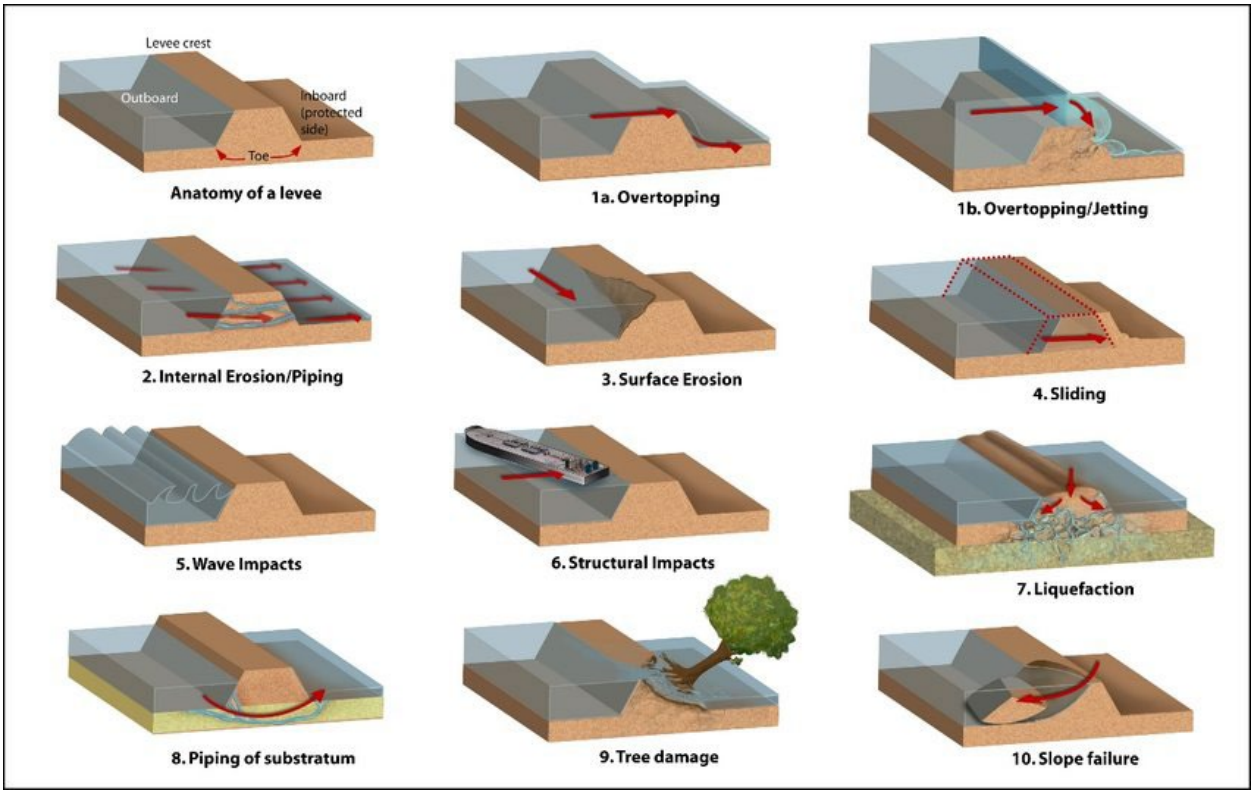


Figure 32: Levee Failure Mechanisms
Source: University of California

Belvedere is protected by one levee, the San Rafael Avenue sea wall along Richardson Bay. The seawall is 0.4 miles long with an undocumented height. Approximately 1,266 people and 349 buildings with a property value of $347 million in both the Town of Tiburon and Belvedere combined are at risk of a failure of the sea wall, including the area around the Belvedere Lagoon. The Belvedere Police Department, City Hall and Community Center building does not lie in the area at risk of a failure of the sea wall, though it lies just outside the area. A failure of the seawall during a high rain event could cause flooding across San Rafael Avenue and Beach Road. This could impact ingress and egress into the southern area of the city south of San Rafael Avenue, which includes the Belvedere Police Department, City Hall and Community Center building, and could potentially cut off access to this area entirely if both roads flood simultaneously.

On 10/10/2018, Belvedere declared a state of emergency due to increased shifting of the San Rafael Avenue sea wall. An inspection of the sea wall in 2017 revealed that portions of the concrete had crumbled and cracked and that a portion of the sea wall was sagging toward the water. The most problematic section directly across from Peninsula Road was at a high risk for failure. The levee had to be shored up.

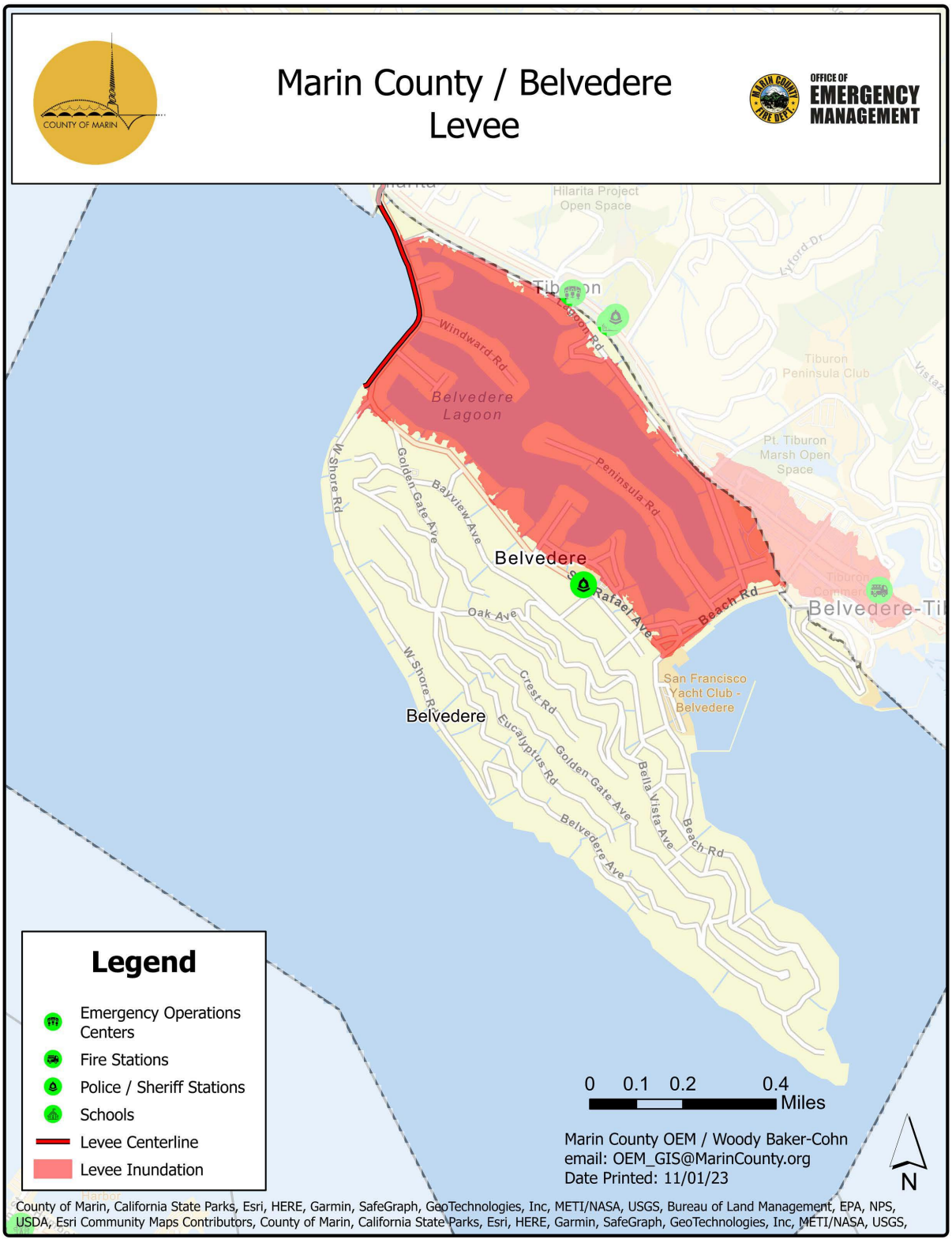


Figure 33: City of Belvedere Levee inundation and Critical Facilities Map
Source: Marin County OEM

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Belvedere, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Belvedere, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Belvedere, particularly around the Belvedere Lagoon including Mallard Pointe, the potential for significant impacts to residences, businesses and infrastructure will only increase.

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Parts of Belvedere are at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in Belvedere, including the area around the Belvedere Lagoon that was built with fill, are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these neighborhoods continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017). Hundreds of residences, several commercial buildings, and the Belvedere Police Department, City Hall and Community Center, lie in areas of Belvedere susceptible to sea level rise.

The following are key issues related to Belvedere sea level rise and a 100-year storm surge:

- San Rafael Avenue could be impacted after the medium-term, cutting off the first access point to the area of Belvedere south of it.
- Shoreline homes along West Shore and Beach Roads could expect impacts to utilities in the near and medium-terms, and potential structural impacts to any in water structures during storms, especially in the long-term.
- Residences around Belvedere Lagoon would be vulnerable to sea level rise flooding if the San Rafael Avenue sea wall is overtopped. These residences are also vulnerable to worsening subsidence.
- The Belvedere Corp Yard could be vulnerable to storm surge flooding in the near-term and tidal flooding in the long-term.
- Belvedere's Police Department, City Hall and Community Center building could expect impacts in the long-term, especially during storms. The park facility and roads fronting the building could expect flood waters sooner, creating potential access issues.

The assets most vulnerable to sea level rise and storm surges in Belvedere are single-family residential homes and San Rafael Avenue. Because the Belvedere Lagoon area was built on fill, several homes in the neighborhood around the lagoon could be vulnerable to subsidence. Several residences have already sunk below mean sea level, exposing them to additional potential flooding from sea level rise. Much of the Belvedere Lagoon area is protected from Richardson Bay by the San Rafael Avenue sea wall on the north and a wall with tides gates to the south. Some of the residences around the lagoon have vents and other utility lines under

the homes that could be vulnerable to increased saltwater exposure. Even if the lagoon is managed well enough to keep those homes bordering it dry, these homes may become isolated if tidewaters overtop the San Rafael Avenue sea wall or Beach Road. The lagoon area roads may experience increasing subsidence issues in addition to, and even before, flooding. In time, several additional roads in the lagoon area could be impacted by high tides on a regular basis. If the low-lying roads are compromised, people who live in the homes south of San Rafael Avenue could become isolated or prevented through travel for several hours or even several days a month. People with mobility or health constraints will be affected. If sea level rise occurs at the worst-case scenario predicted of five feet of sea level rise and a 100-year storm, much of the Belvedere Lagoon area could be lost to the sea, rendering the rest of Belvedere a potential island as it used to be. This would present major complications for those who travel through the lagoon area to get to their homes or jobs in the area of Belvedere south of San Rafael Avenue. The largest threat to emergency services is lost emergency vehicle access to Belvedere. High tides and storms could flood the roads in front of the Belvedere Police Department and, in the long-term, up to four feet of flooding could impact the property and the vehicles. In addition, though technically in Tiburon, the Tiburon Fire Department serves Belvedere and could be blocked from providing service if roads are severely flooded or if the station itself is flooded. Water transportation for recreational purposes is a major use of the San Francisco Yacht Club Marina off Belvedere. As sea level rises, the facility may need to make some adjustments or relocate. Several private piers and docks could also be damaged in storms and/or may need to be elevated.

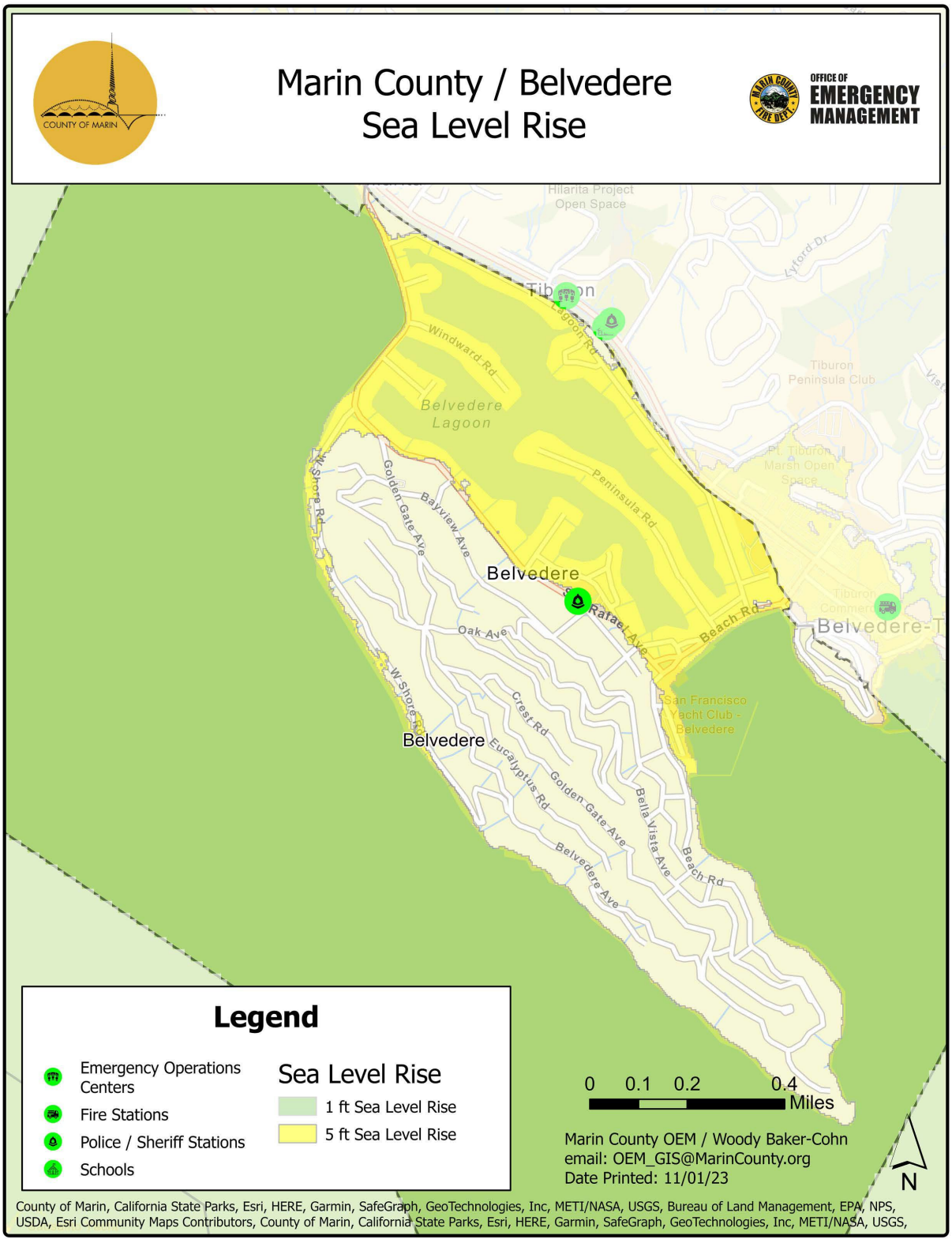


Figure 34: City of Belvedere Sea Level Rise
Source: Marin County OEM

The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that Belvedere could anticipate impacts to over 2,000 people and 550 living units with over $8.6 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. Structures throughout the city can become damaged extensively with their foundations compromised over time. Of particular concern are those structures and infrastructure that have not been elevated to projected sea level rise heights over the next century. Sea level rise in Belvedere has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from the bays over their banks and into adjacent neighborhoods. Sea level rise can also cause increased subsidence along Belvedere's shoreline, which may damage underground water and wastewater pipelines and disrupt services. Belvedere would begin to experience seasonal, king tide, and storm surge flooding more frequently in the future.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

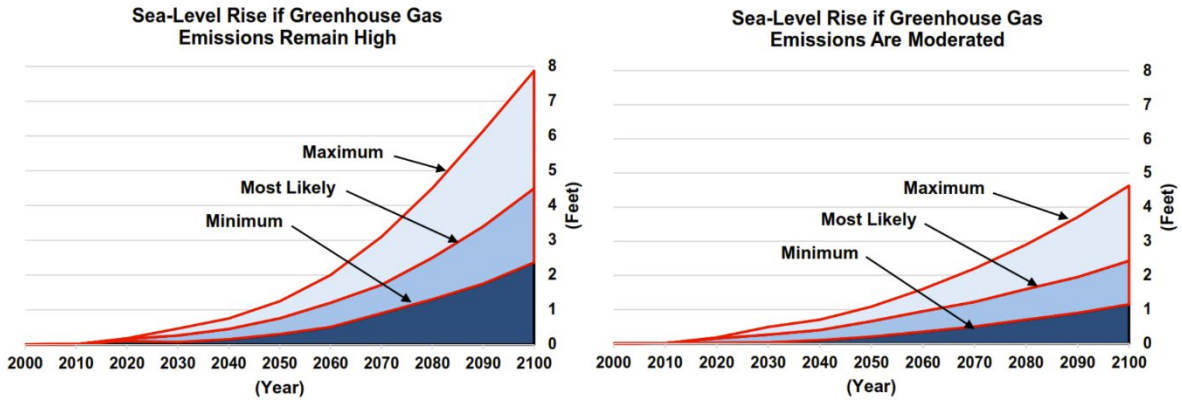


Figure 35: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Belvedere already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Belvedere with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around the Belvedere Lagoon will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure, particularly with the San Rafael Avenue sea wall. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Belvedere, including the Belvedere Lagoon area, will put more people and property at risk from flooding as a result of sea level rise. Roads

and utility infrastructure across Belvedere will continue to become inundated, impacting ingress and egress into the area of Belvedere south of San Rafael Avenue.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 36):

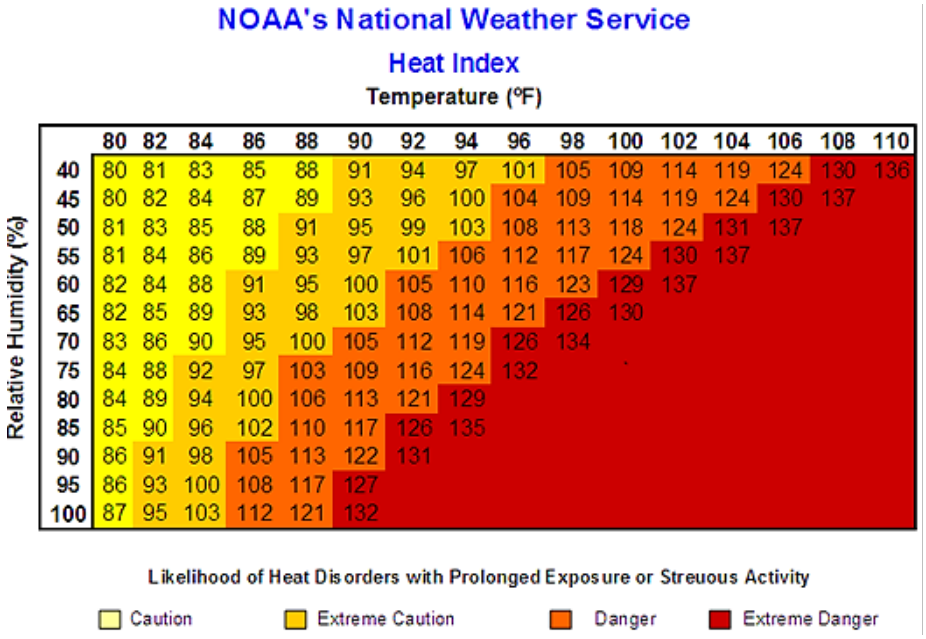


Figure 36: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Belvedere and would be felt more at lower elevations in the city closer to the Town of Tiburon. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate,

annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

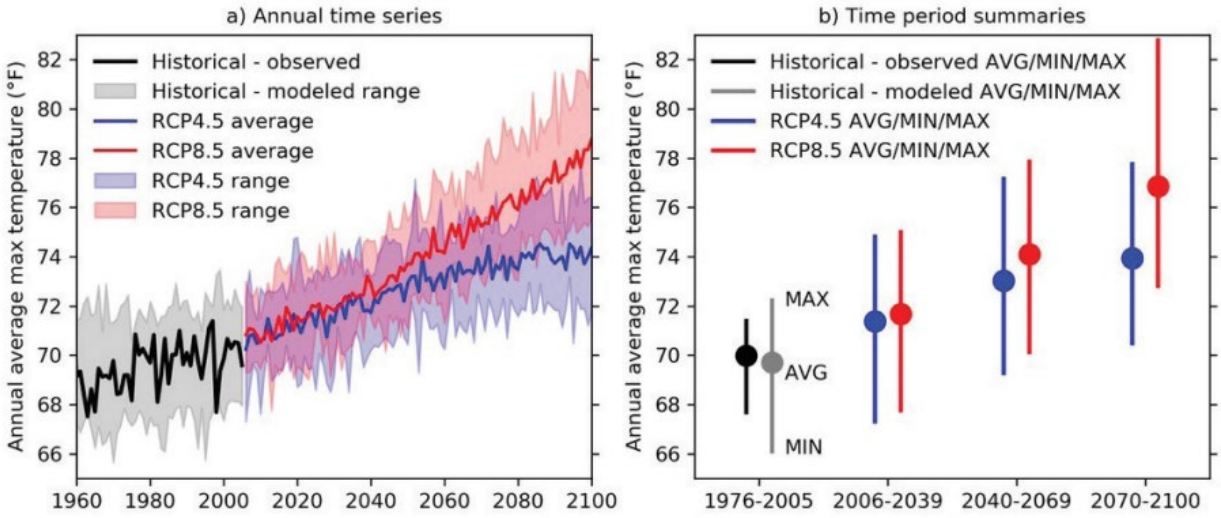


Figure 37: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Belvedere. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Belvedere where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Belvedere could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Belvedere as conditions become hotter and drier. These effects will primarily be felt in the open space areas of Belvedere including along the Tiburon Boulevard bike path where hotter and drier conditions are more apt to lead to wildfires. Future development near the open spaces around Belvedere could expose more people and infrastructure to the threat of wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 38).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 38: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 39) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 39: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 40: Waterspout Formation
Source: MarineInsights

All of Belvedere is susceptible to storms and damage from wind and tornadoes particularly those areas throughout the city that have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees

and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

Belvedere has not experience a high wind event or tornado that caused notable damage.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Belvedere. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Belvedere as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the areas of high tree cover throughout Belvedere including in residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Belvedere would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the city. Areas of Belvedere in the 100 and 500-year floodplain are at a lower elevation and lie in a tsunami hazard area, including most of the area around the Belvedere Lagoon. This area includes hundreds of residences, several commercial buildings and the Belvedere Police Department, City Hall and Community Center. Both San Rafael Avenue and Beach Road, the two access points into Belvedere, lie in a tsunami inundation zone. The California Geological Survey and the California Office of Emergency Services estimate that a thirteen-foot wall of water could impact the Belvedere Lagoon area in a major tsunami event. The tsunami inundation zone extends into the Town of Tiburon and includes the Tiburon Fire Protection District Station #11 that serves Belvedere. Belvedere could essentially become isolated in a major tsunami event, affecting the provision of emergency services to Belvedere residents. A major tsunami event could place increased stress on the San Rafael Avenue sea wall in Belvedere.

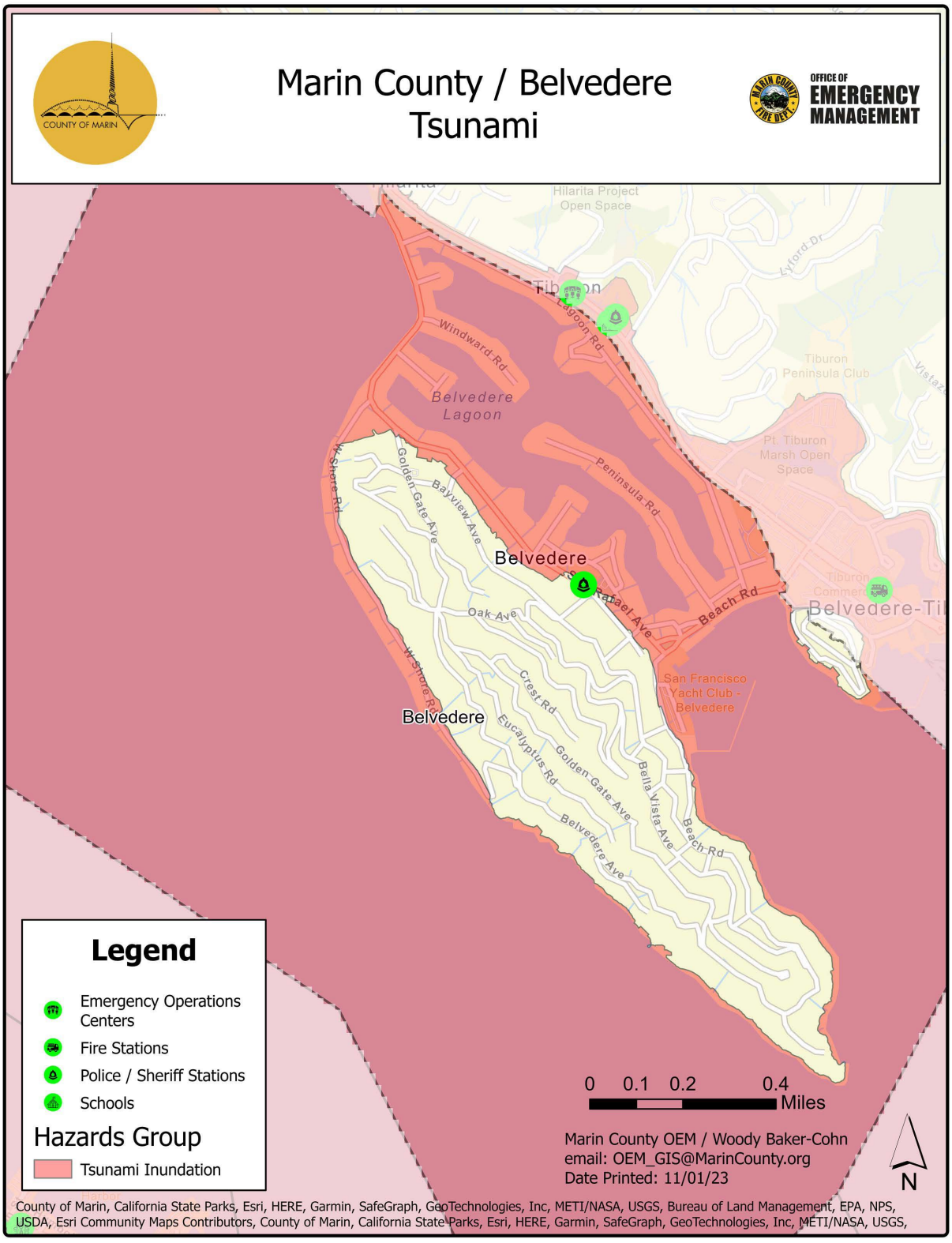


Figure 41: City of Belvedere Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Belvedere has never experienced a tsunami, however, given its proximity to Richardson Bay and San Francisco Bay, it could potentially experience the impacts of one.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Belvedere, where the Belvedere Lagoon area lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Belvedere. This is particularly true in the Belvedere Lagoon area where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in this area including Mallard Pointe will expose more people and infrastructure to the effects of flooding in as tsunami inundation areas expand with climate change. Flooding could be exacerbated in Belvedere with a failure or overtopping of the San Rafael Avenue sea wall as a result of higher wave heights associated with a more significant tsunami and higher sea levels as a result of climate change.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA.. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 42 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

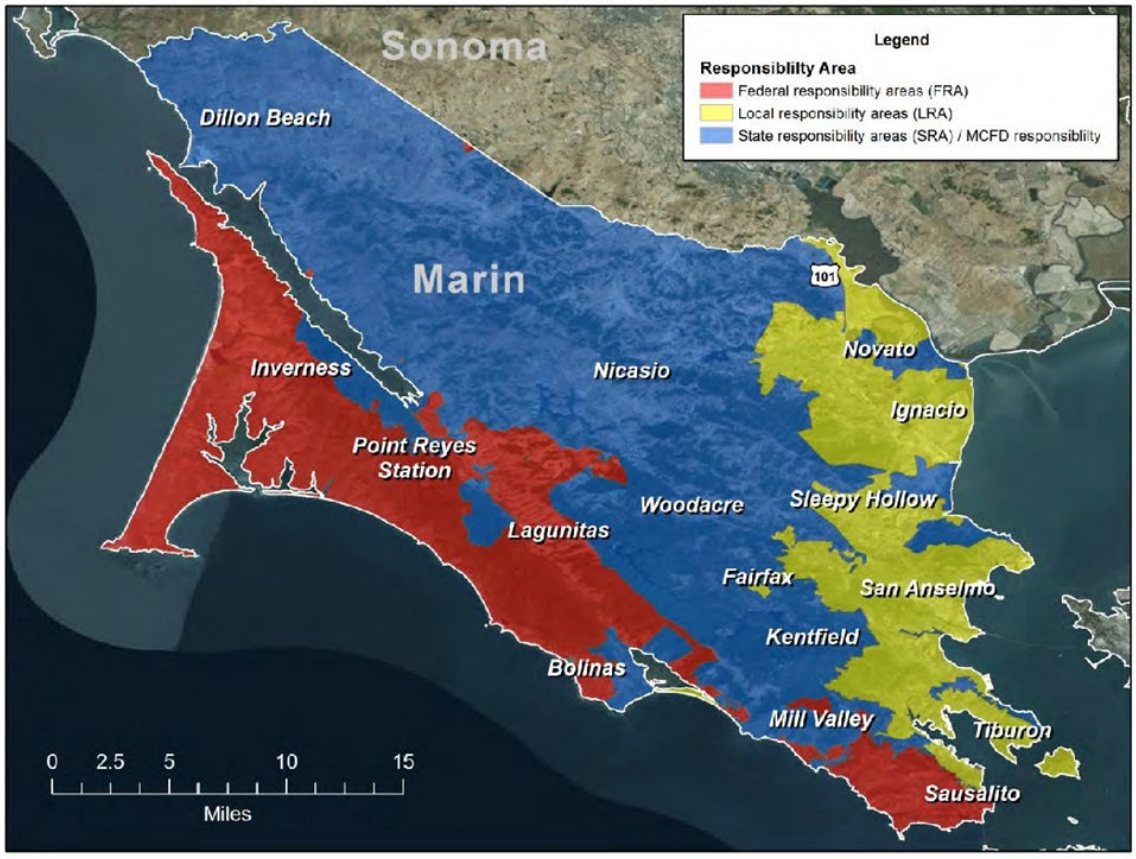


Figure 42: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan, 11/27/23

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern

Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios

due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

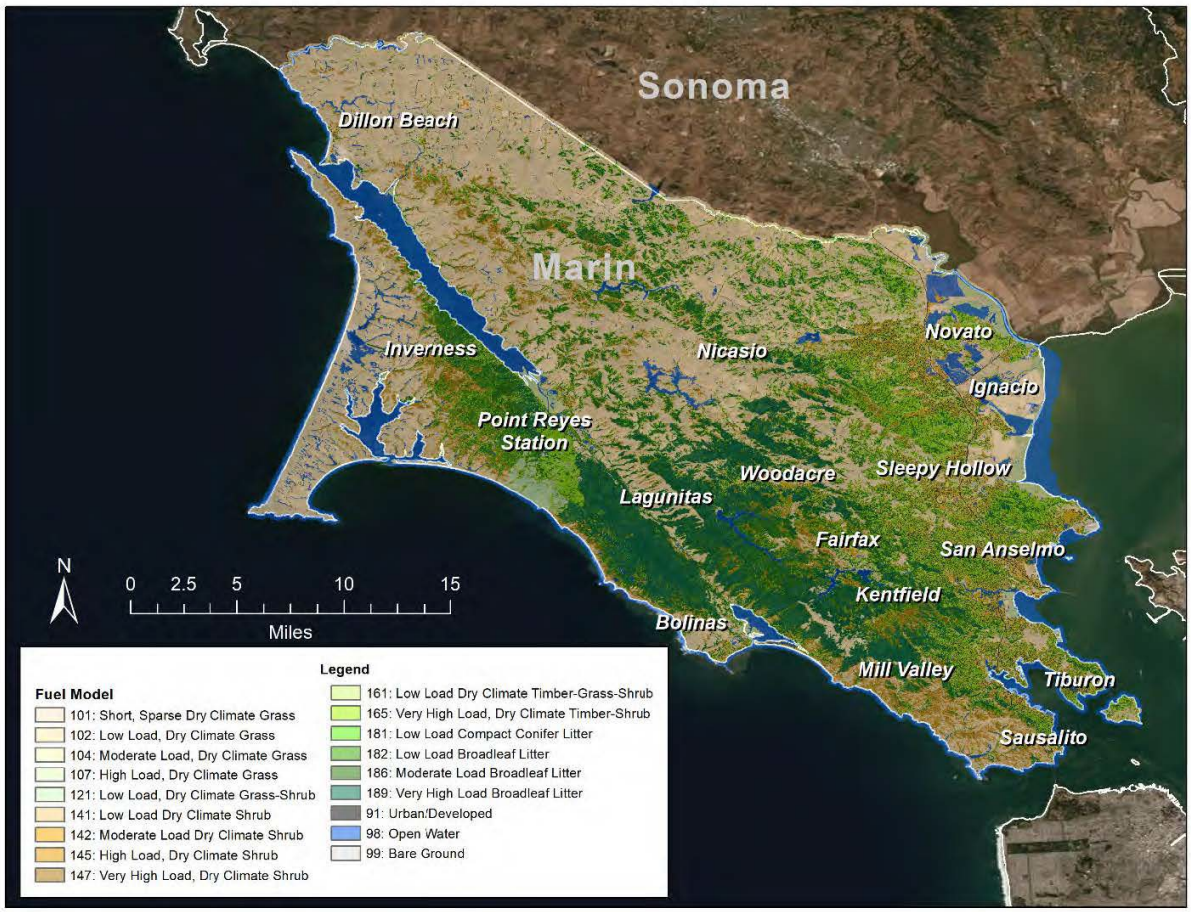


Figure 43: Fuel Model Map for the Marin County OA
Source: Marin CWPP, 11/27/23

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species) and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread

more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to 70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)

- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 Marin County and the City of Belvedere experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in Belvedere would most likely occur in any of the open spaces throughout Belvedere. While there are not many open spaces in Belvedere, there are open patches of land in Belvedere's hillside areas and along the Tiburon Boulevard bike path where a brush fire could occur. These areas of Belvedere are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by wildfire. Only a very small fraction of Belvedere lies in an a high FHSZ. This area lies in the northwest corner of Belvedere along the Tiburon Boulevard bike path and consists of five residences that could be susceptible to a brush fire. A small area adjacent to this area along Lagoon Road and San Rafael Avenue lies in a moderate FHSZ with ten residences that could be susceptible to a brush fire. No other area of the Belvedere Lagoon, including the Belvedere Police Department, City Hall and Community Center building, lie in a FHSZ. Another moderate FHSZ lies in the southern area of Belvedere, and there are several dozen residences in this area that could be susceptible to a brush fire.

All of Belvedere could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As open areas around Belvedere become drier due to climate change, the risk of a wildfire occurring and impacting the city will continue to increase. Brush fires in the city may increase over time as parks and other open spaces experience drier conditions.

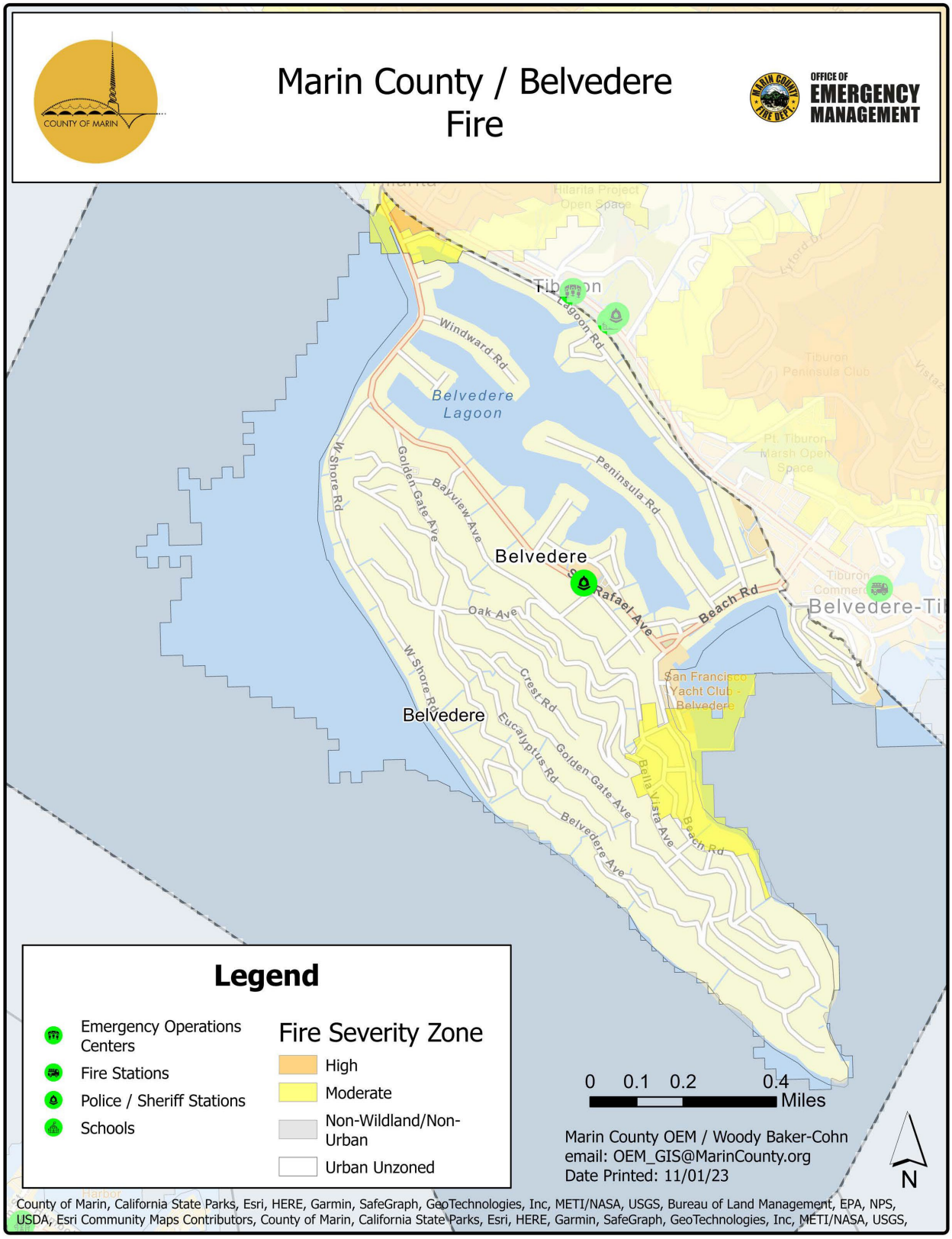


Figure 44: City of Belvedere Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Belvedere has never experienced a significant wildfire of note.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

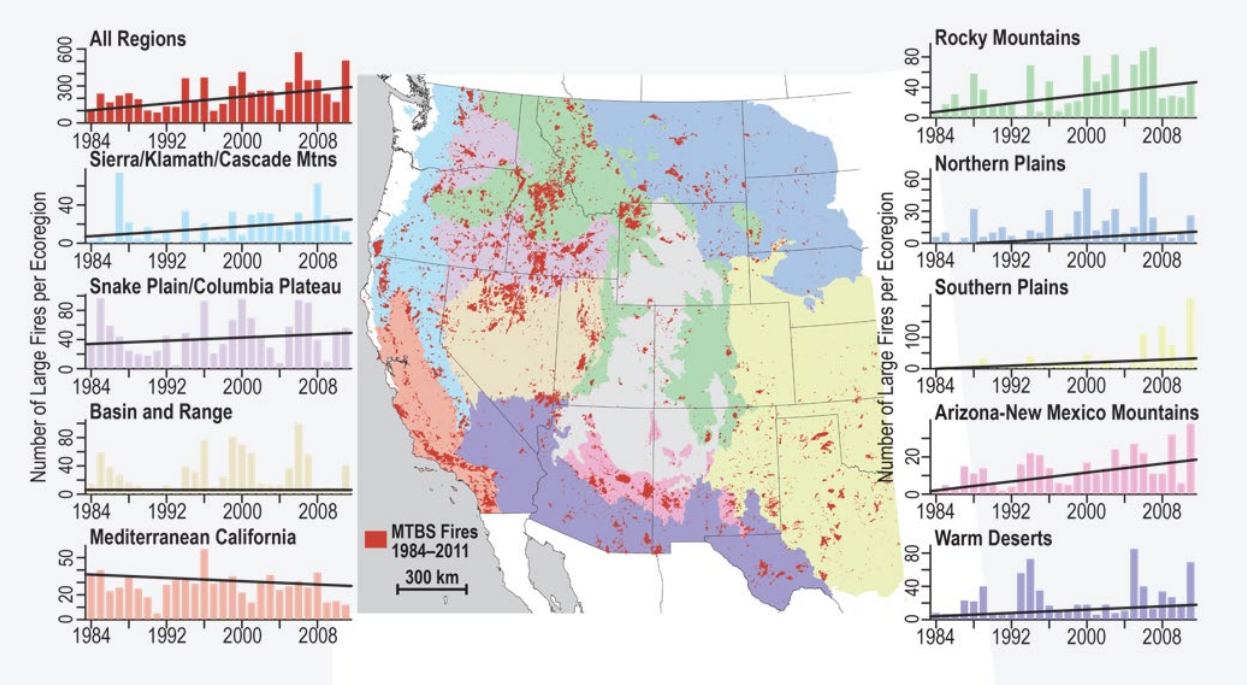


Figure 45: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Belvedere is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open areas around Belvedere. Future development in the open areas around Belvedere will expose more people and property to the impacts of a potentially significant wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character.

The City of Belvedere's lack of housing production overall has resulted in limited affordable housing opportunities at all income levels, and a lack of housing type choices has prevented low- and moderate-income households in the county and broader region from residing in the City. Belvedere is com-mitted to playing its part in meeting this growing demand for housing, and the Housing Element includes strategies to expand the development of housing as well as the availability of housing types at a more diverse range of price points and promote more equitable housing opportunities.

The Plan Bay Area 2050 Final Blueprint forecasts that the nine-county Bay Area will add 1.4 million new households between 2015 and 2050. For the eight-year time frame covered by the City of Belvedere Housing Element Update, the Department of Housing and Community Development has identified the region's housing need as 441,176 units. The total number of housing units assigned by HCD is separated into four income categories that cover housing types for all income levels. For the 2023-2031 period, Belvedere must identify sites sufficient to accommodate 160 new housing units with the following number of units designated as affordable to each income category: Extremely Low-Income (24), Very Low- income (25), Low-Income (28), Moderate-Income (23), and Above Moderate-Income (60).

The Mallard Pointe development project will increase the vulnerability to Flooding, Tsunami, Sea Level Rise, Earthquake, and Land Subsidence.

Table 19: City of Belvedere Future Growth Areas

Development	# of Units	# of Parcels	Project Date	Acres	Fire Severity Zone	Flood Zone
Mallard Pointe	40	3	Submitted 6/18/2021 Under Planning Review	2.8	No	AE
Total	**40**	**3**		**2.8**		

Table 19: City of Belvedere Future Growth Areas
Source: City of Belvedere

Figure 46: Mallard Pointe Project Map
Source: City of Belvedere General Plan, 6th Cycle Housing Element Update, 2023

On June 18, 2021, a preliminary application was received for a proposed residential redevelopment submitted is a "SB 330 preliminary housing application" for a housing development on three parcels, currently developed with 22 residential units (duplexes).

The project proposal includes demolition of the existing residential units and construction of forty (40) new residential units, which include single-family dwellings, accessory dwelling units, duplexes and apartments. As submitted, the project would contain sixteen (16) single-family and duplex units, one (1) ADU, and twenty-three (23) apartments. Based on its SB 330 application, the project will include 36 market rate and 2 very low- and 2 moderate-income (deed-restricted) units. Five units will be one-bedroom apartments presumed to be affordable to moderate incomes. In accounting for existing units, the project represents a total net gain of eighteen (18) units.

The project submitted its application prior to the City's adoption of objective design and development standards (ODDS), so requirements of the R-2 zone apply. The project has requested a density bonus for waivers of development standards and a cost concession related to the allowable housing choices in the R-2 zone.

3.2 CAPABILITY ASSESSMENT

The overall priorities in the City of Belvedere have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the City of Belvedere General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 20: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y 2023	The City is completing the 6th cycle housing element update which is a component of the General Plan. Additionally we will start the process of updating our Safety Element.
Strategic Plan	N	
Capital Improvements Plan	Y 2022	The Capital Improvement Plan provides an annual 5-year forecast of capital infrastructure. It includes funding for a variety of hazard mitigation projects, including flood protection, fire-fuel reduction, hillside stability, and drainage.
Economic Development Plan	N	
Local Emergency Operations Plan	Y 2022	The plan addresses hazards and resources that can be used to mitigate disasters and emergencies. The plan can be used to implement mitigation actions.
Continuity of Operations Plan	N	
Flood Mitigation Plan (FMP)	N	
Engineering Studies for Streams	N	
Open Space Management Plan	N	
Regional Transportation Plan (RTP)	Y	The City participated in the Marin County Travel Safety

	2018	Plan – Systematic Safety Analysis.
Stormwater Management Plan/Program	Y 2022	The City partners with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to manage the City's stormwater discharge permit.
Community Wildfire Protection Plan	Y 2020	The City, through TFPD, is a member of the Marin Community Wildfire Protection Plan
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	Yes. Projects are reviewed for compliance with building code standards. Building permit applications are routed to various departments for review (Building, Planning, Fire, and Public Works) as necessary to ensure compliance with applicable codes and standards.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Central Marin Fire Department has an ISO rating of 2.
Site plan review requirements	Y	Yes. Projects are reviewed for compliance with development standards, including required setbacks. The majority of building permit applications submitted to the City are required to provide a site plan.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	Yes
Zoning ordinance	Y	Yes
Subdivision ordinance	Y	Yes
Floodplain ordinance	Y	Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)		
Flood insurance rate maps	Y	Yes
Elevation Certificates	Y	Yes
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Y	Yes

Table 20: City of Belvedere Legal and Regulatory Capabilities
Source: City of Belvedere

City of Belvedere General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of Belvedere General Plan, adopted in May 22, 2023, was prepared over a one year period that included an extensive public review process. The General Plan is the most important policy and planning document in the City and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety. The Housing, Land Use, and Safety Elements of the General Plan were updated in 2023.

City of Belvedere specific goals and policies related to mitigation of natural hazards are as follows:

Table 21: City of Belvedere General Plan

Goal/Policy/ Program	Explanation
Land Use Element	
Goal LU-2	Maintain the character of Belvedere Island with refinement of development standards.
Policy LU-2.5	Review opportunities to repair or mitigate environmental hazards such as pyrophytic plants and trees, sub-standard retaining walls and foundations, hazardous site access and obstructions, and roadway repair at time of development review.
Program LU-2.5.1	The Planning Commission shall consider amendments to the Zoning Ordinance and Architectural and Environmental Design Review Ordinance to mitigate or remove hazards at the time of development review that are related to fire protection, hillside stability, safe traffic and circulation, site line obstruction, and other issues that have been identified in the Environmental Hazards Element associated with private improvements.
Conservation and Open Space Element	
Goal REC-1	Support ongoing efforts to maintain Belvedere's public parks and open spaces. Belvedere's existing public spaces, including Community Park, Tom Price Park, Centennial Park, Belvedere Cove, Land Company Park, and the community's many lanes and paths, are appreciated and well-utilized by the community.
Policy REC-1.2	Support the ongoing maintenance of Belvedere's historic lanes and steps.
Program REC 1.2.1	Facilitate improvements to lanes that have fallen into disrepair or are no longer open. Consider the installation of low-impact lighting on some lanes to encourage their use and also to provide safer access down Belvedere Island in the event of necessary evacuation.
Public Safety	
Goal HAZ-1	Strive to protect the community from injury and damage resulting from injury and damage resulting from natural catastrophes and other hazard conditions
Policy HAZ1.1	Construction shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, and fire.
Program HAZ-1.1.1	Institutionalize the Environmental Hazards policies through review for possible amendment of the grading, subdivision, zoning, building code, design review, and other sections of the Belvedere Municipal Code. Particular attention should be paid to the adequacy of building setbacks with respect to fire safety concerns.
Program HAZ	All new construction in the City shall ensure that it follows current seismic codes as set

Table 21: City of Belvedere General Plan	
Goal/Policy/ Program	**Explanation**
1.1.2	forth by the California Building Code (CBC).
Program HAZ 1.1.4	New construction must not compromise public infrastructure which is key to emergency access, egress, and flood prevention.
Policy HAZ 1.2	Require thorough field investigation of geologic hazards as a prerequisite to Design Review and construction approval and require site stabilization to minimize such risks.
Program HAZ-1.2.3	Investigate potential landslide hazards associated with specific project locations as part of Design Review for project applications.
Policy HAZ-1.3	Maintain adequate roadway clearances for emergency vehicles and evacuation and plan for safe pedestrian evacuation.
Policy HAZ 1.4	Ensure that the City is equipped for disaster, evacuation, and survival thereafter.
Policy HAZ-1.4.2	Ensure that risk to public lifeline utilities, such as those along Beach Road and San Rafael Avenue, be reduced by installing excess flow valves, bracing, flexible materials, flexible joints and connections, joint restraint, strengthening of support structures, or other means.

Table 21: City of Belvedere General Plan
Source: **City of Belvedere** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the City personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 22: Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Planning Commission	Yes	Yes. The Planning Commission reviews planning applications for conformance with town policies, ordinances, and design standards.
Administrative Services	Yes	Yes. The Admin Services Department oversees finance and purchasing, budgets, risk management and human resources.
Hazard Mitigation Planning Committee	Yes	Yes, the City participates in the county-wide hazard mitigation planning process and team.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Vegetation clearing and replanting work coordinated annually with city, fire department, utility agencies and residents.
Mutual aid agreements	No	
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor	Yes	Alert Marin Emergency Notification system sends text, phone and email notifications to residents or community

warning signals)		members that opt in to receive information
Hazard data and information	Yes	Regional and local GIS database of flood hazard
Grant writing	Yes	Department heads conduct grant writing with support of consultants when necessary.
Hazus analysis	No	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	Yes
Floodplain Administrator	Y/FT	Yes
Emergency Manager	Y/PT	Yes
Community Planner	Y/FT	Yes
Civil Engineer	Y/FT	Yes
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Y/FT and PT	Yes
GIS Coordinator	No	The City is a JPA member of Main Map for GIS.
Community Development Staff	Y/FT	Yes
Town Planning, Building, and Public Works Staff	Y/FT	Yes
Police Department Staff	Y/FT	Yes
Fire Protection District Staff	Y/FT	Yes
Community Development Staff	Y/FT	Yes

Table 22: City of Belvedere Administrative and Technical Capabilities
Source: **City of Belvedere**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 23: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in the past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	Yes, through voter-approved tax measures.
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.

Table 23: City of Belvedere Fiscal Capabilities
Source: **City of Belvedere**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of Belvedere and the City of Belvedere partnerships utilized to promote those programs.

Table 24: City of Belvedere Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	The Belvedere Block Captains are trained to assist neighbors with preparedness and emergency response.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	The Get Ready disaster preparedness program teaches how to prepare for, respond to and recover from all kinds of disasters.
Natural disaster or safety related school programs	Yes	The Get Ready program was modified for 5th grade students and is called GR5. The 5th graders are taught about natural disasters as part of their curriculum and then the GR5 program teaches them how to prepare their family and home for any disaster. Homework given to the students takes the information into their home.
StormReady certification	Yes	
Firewise Communities certification	No	
Community Rating System	No	
Public-private partnership initiatives addressing disaster-related issues	Yes	The City of Belvedere works closely with the Belvedere Block Captains and residents, assisting with training and information.

Table 24: City of Belvedere Community Outreach
Source: **City of Belvedere**

3.2.5 PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Detailed below is a description of City of Belvedere flood management program to ensure continued compliance with the NFIP.

City of Belvedere has participated in the Regular Phase of the NFIP since May 16, 1977. Since then, the City of Belvedere has administered floodplain management regulations that meet or exceed the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the City

of Belvedere. The Community Rating System (CRS) was created in 1990. It is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. City of Belvedere are not currently CRS participants.

In addition to the capabilities in the municipal code regarding floodplains, the City of Belvedere has additional capabilities. Table 25 shows the City of Belvedere participation in and continued compliance with the NFIP, as well as identify areas for improvement that could be potential mitigation actions.

Table 25: City of Belvedere NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	There are 200 active policies. The total premium is $340,778 and coverage is $75,270,000.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	There has been a total of 54 claims with $597,578.58 paid on those claims. There are # of substantial damage claims.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	364
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	No, it is a primary function of plan review and inspection
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Plan review, inspections, engineering review, and public outreach and information.
What are the barriers to running an effective NFIP program in the community, if any?	Having the community understand these requirements/statutes are for public safety and wellbeing and buy into the process.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	2019
Is a CAV or CAC scheduled or needed?	No

Regulation	
When did the community enter the NFIP?	05/02/1977
Are the FIRMs digital or paper?	Both
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Floodplain regulations meet the standards of State and Federal regulations through the adoption of the California Building Codes and local Municipal Codes complying with these standards
Provide an explanation of the permitting process.	Applicant submits permit application and supplemental construction documents to the Building Dept. Should the proposed project be located within one of the local, designated Floodplains, the plan review is conducted through the Floodplain prism. The proposed project would then be reviewed for local Municipal Floodplain Code compliance, as well as State Building Code and Federal Code compliance. Once the project is deemed compliant with the applicable Codes, permit fees would be paid, and the building permit issued.
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
What categories and activities provide CRS points and how can the class be improved?	N/A
Does the plan include CRS planning requirements	N/A

Table 25: City of Belvedere NFIP Status
Source: FEMA, City of Belvedere

NFIP Insurance Coverage Details

City of Belvedere joined the NFIP on May 2, 1977. The City of Belvedere does not participate in the Community Rating System. NFIP insurance data provided by DWR indicates that as of 2023 there were 200 policies in force in the City of Belvedere with $340,778 in premiums, resulting in $75,270,000 of insurance in force. There have been 54 closed paid losses totaling $597,578.58. None of the claims were considered substantial damage losses. There were no repetitive loss structures in the City. There were no severe repetitive loss properties in the City of Belvedere.

Repetitive Loss Properties

- Repetitive Loss (RL) Residential Structures: 0
- Repetitive Loss (RL) Non-Residential Structures: 0
- Severe Repetitive Loss (SRL) Residential Structures: 0
- Severe Repetitive Loss (SRL) Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 26 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 26: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Lane Design & Engineering: Lanes are critical egress and evacuation routes for all types of hazard, disaster.		X			X
Lane Maintenance, Minor Repairs: Lanes are critical egress and evacuation routes for all types of hazard, disaster.		X			X
Park Lane Stairs: Upgrade of section of stairs on this lane, including new landing/seating area.		X			X
Hawthorne Lane Stairs: Upgrades to stairs and seating area in Centennial Park section of Hawthorne Lane.		X			X
Retaining Walls Evaluation: Failure of retaining walls along roads would result in blocked access in an emergency. Evaluation project is to identify any vulnerable walls .		X			X
Wooden Retaining Walls Repairs: Identify needed repairs on wooden retaining walls and make repairs.		X			X
Corrugated Metal Pipe Replacement: CMP pipes are critical drainage infrastructure, some of these are in poor condition and need repair/replacement.		X			X
Emergency Drainage Repairs: Fund to be used in case of emergency.		X			X
Levee evaluation – EIR completion: Completion of EIR process that was initiated as part of a potential levee/sea wall repair and		X			X

Table 26: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
upgrade project, which is currently on hold as no funding has been identified.					
Community Center Founder's Room Furniture Replacement: CC is a potential cooling center, project is planned to install suitable furniture for this purpose.		X			X
Vegetation/Fire Fuel Reduction: City properties with high amounts of dead, brushy and other fire prone vegetation to have work done to remove this material.		X			X

Table 26: Status of Previous Hazard Mitigation Actions
Source: City of Belvedere

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County MJHMP and City of Belvedere Annex were revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the City of Belvedere based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Marin County and City of Belvedere Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 27 lists the Current Hazard Mitigation Actions for the City of Belvedere.

Table 27: City of Belvedere Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
B-1	Lane Design & Engineering: Lanes are critical egress and evacuation routes for all types of hazards or a disaster.	All Hazards/ 1, 2, 4, 5	Marin County and City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	
B-2	Lane Maintenance, Minor Repairs: Lanes are critical egress and evacuation routes for all types of hazard, disaster.	All Hazards/ 1, 2, 4, 5	Marin County and City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	
B-3	Park Lane Stairs Alternate Pedestrian Evacuation Route	All Hazards/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	Upgrade of section of stairs on this lane, including new landing.
B-4	Hawthorne Lane Stairs Alternate Pedestrian Evacuation Route	All Hazards/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	Upgrades to stairs and seating area in Centennial Park section of Hawthorne Lane.
B-5	Retaining Walls Evaluation Route	All Hazards/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	Failure of retaining walls along roads would result in blocked access in an emergency. Evaluation project is to identify any vulnerable walls .
B-6	Corrugated Metal Pipe Replacement for flood control	Flooding; Sea Level Rise; Tsunami; Levee Failure/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD: General Fund; FEMA BRIC	1-5 years/ High	CMP pipes are critical drainage infrastructure, some of these are in poor condition and need repair/replacement.
B-7	Emergency Drainage Repairs	Flooding; Sea Level Rise; Tsunami;	City of Belvedere	Existing	Cost TBD: General Fund; FEMA BRIC	1-5 years/ High	Fund to be used in case of emergency.

Table 27: City of Belvedere Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
		Levee Failure/ 1, 2, 4, 5					
B-8	Levee evaluation – EIR completion	Flooding; Sea Level Rise; Tsunami; Levee Failure/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD: General Fund; FEMA BRIC	1-5 years/ High	Completion of EIR process that was initiated as part of a potential levee/sea wall repair and upgrade project, which is currently on hold as no funding has been identified.
B-9	Enhance Community facilities to support the socially vulnerable population during extreme weather events.	Severe Weather – Heat, All Hazards/ 1, 2, 4, 5	City of Belvedere, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1 - 2 years/ High	Community Center Founder's Room
B-10	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	City of Belvedere, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Removing fire prone vegetation around power poles or under grounding lines reduces the risk of wind causing wildfire to vegetation dried by drought or heat.
B-11	Shoreline adaptation project to protect against flooding, sea level rise and earthquake; strengthen existing levees and raise vulnerable above-ground critical infrastructure out of the flood zone.	Flooding; Sea Level Rise; Tsunami, Debris Flow/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD: General Fund; FEMA BRIC	1-5 years/ High	Seismic Upgrade Component EIR Completed and Certified
B-12	Earthquake natural gas valves are required in new construction or during substantial remodel work.	Earthquake/ 1, 2, 4, 5	City of Belvedere	New (2023)	Cost TBD: HMGP, BRIC, CDAA	2 -5 Years/ High	

Table 27: City of Belvedere Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
B-13	Increase height and retrofit existing levees in town	Levee Failure/ 1, 2, 4, 5	City of Belvedere	New (2023)	Cost TBD: HMGP, FMA, BRIC, CDAA Grants	5-20 Years/ High	
B-14	Enhance and promote community and individual emergency preparedness.	All Hazards/ 1, 2, 3, 4, 5	City of Belvedere; Tiburon Fire Protection District	Existing	Cost TBD: General Fund	1 - 2 years/ High	Focus on signing residents up for Alert Marin and establish a personal evacuation kit and plan.
B-15	Update Safety Element of the General Plan.	All Hazards/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD: General Fund	1-2 years High	City Adopted. Awaiting certification from State of California
B-16	Review and adopt current California Building codes for seismic, flood, fire and other disaster. Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	City of Belvedere	Existing	Cost TBD: General Fund	3 - 5 years/ Medium	The City continues to review and adopt current California Building codes.
B-17	Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species.	Wildfire, Severe Weather-Wind, Drought, Debris Flow/ 1, 2, 4, 5	City of Belvedere; Tiburon Fire Protection District	Existing	Cost TBD: HMGP, CDAA, Wildfire Protection Grants.	1 - 5 years/ High	Reduces the chance of a wildland fire igniting the structure(s). Supports environmental restoration by using native plant resistant to debris flow, drought, and wind.
B-18	Updating or enhancing flood control pump stations, storm force mains, and gravity storm lines around city. This will also include maintaining and dredging existing flood control open channels, canals, and lagoons.	Flooding, Sea Level Rise, Levee, Tsunami/ 1, 2, 4, 5	City of Belvedere; Belvedere Lagoon Property Owners Association	Existing	Cost TBD: HMGP, FMA, CDAA, General Fund.	1 -5 years/ High	Stormwater Pumping Stations in the Lagoon Upgraded for Capacity, Reliability and Redundancy

Table 27: City of Belvedere Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
B-19	Marin Emergency Radio Authority (MERA) Upgrades.	All Hazards/ 1, 2, 4, 5	Marin County and City of Belvedere	Existing	Cost TBD; State and/or Federal grants, existing budgets	1-5 years/ High	City as Participant

Table 27: City of Belvedere Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the City of Belvedere. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 26 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the City of Belvedere identified and prioritized the mitigation actions as detailed in Table 27, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the City of Belvedere will maintain this plan and will serve as a lead staff for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into City plans and mechanisms. Where possible the City of Belvedere will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of Belvedere already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the City. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

City Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the City.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

1. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
2. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
3. Using the risk assessment information to update the hazards section in the County, City and City Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

Belvedere residents are more affluent than the regional population as a whole. In Belvedere, 72.7 percent of households make more than 100 percent of the Area Median Income (AMI), compared to 8.5 percent making less than 30 percent of AMI, which is considered extremely low-income. Many households with multiple wage earners, including food service workers, full-time students, teachers, farmworkers and healthcare professionals, can fall into lower AMI categories due to relatively stagnant wages in many industries.

The number of residents who own their homes compared to those who rent can help identify the level of housing insecurity (i.e., ability for individuals to stay in their homes) in a city and region. Generally, renters may be displaced more quickly if prices increase. In Belvedere, there are a total of 895 households (2019 American Community Survey estimate), and the majority of households own their homes rather than rent: 76.3 percent versus 23.7 percent. By comparison, 36.3 percent of households in Marin County are renters, while 44.0 percent of Bay Area households rent their homes.

In recent years, most housing produced in the region and across the state consisted of single-family homes and larger multi-unit buildings. However, some households are increasingly interested in "missing middle housing," including duplexes, triplexes, townhomes, cottage clusters and accessory dwelling units. These housing types may open up more options across incomes and tenure, from young households seeking more affordable homeownership options

to seniors looking to downsize and age-in-place. Zoning districts in Belvedere, including R-2 and R-3, offer some flexibility for new construction. Some in the community have suggested that new single-family uses could be prohibited in these zones.

Availability of a variety of housing types is important in order to meet the needs of a community today and in the future. In 2020 Belvedere's mix of housing types was as follows:

- 84.0 percent of homes were single-family detached;
- 4.8 percent were single-family attached;
- 7.7 percent were small multifamily (2-4 units);
- 3.5 percent were medium or large multifamily (5+ units); and
- There were no mobile homes in Belvedere.

The Mallard Pointe development project will increase the vulnerability to Flooding, Tsunami, Sea Level Rise, Earthquake, and Land Subsidence.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of Belvedere.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of Belvedere Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of Belvedere plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of Belvedere is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of Belvedere Public Works Director will monitor and update the City of Belvedere Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of Belvedere, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of Belvedere, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of Belvedere Public Works Director will monitor and update the City of Belvedere Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of Belvedere and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin

County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 1-18
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 1-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 1-20
Figure 4: Hazard Mitigation Plan Survey 1-21
Figure 5: Map of City of Belvedere in Marin County 1-24
Figure 6: Map of the City of Belvedere 1-25
Figure 7: The City of Belvedere Precipitation and Monthly Temperatures 1-27
Figure 8: Races in Belvedere 1-28
Figure 9: City of Belvedere Land Use Map 1-30
Figure 10: City of Belvedere Social Vulnerability Map Census Tract 1230.00 1-33
Figure 11: City of Belvedere Critical Facilities Map 1-37
Figure 12: City of Belvedere Risk Assessment – Planning Team Top Hazards 1-39
Figure 13: Hazard Risk Categorization 1-39
Figure 14: NASA Global Temperature Change CO2 Gas 1-43
Figure 15: NASA Global Temperature Change 1884 to 2022 1-43
Figure 16: NASA Global Temperature Change Sea Level 1-44
Figure 17: Annual Mean Sea Level Trends 1-46
Figure 18: Landslide Susceptibility Classes 1-51
Figure 19: Mud Flow Areas 1-52
Figure 20: City of Belvedere Debris Flow Critical Facilities and Infrastructure 1-53
Figure 21: City of Belvedere Mud Flows – December 16, 2014 1-54
Figure 22: Modified Mercalli Intensity Scale 1-57
Figure 23: Mercalli Scale vs. Magnitude 1-57
Figure 24: Soil Types 1-58
Figure 25: Marin County Earthquake Impact and Fault Lines 1-60
Figure 26: City of Belvedere Earthquake Critical Facilities and Infrastructure 1-61
Figure 27: Diagram of an Atmospheric River Event 1-64
Figure 28: City of Belvedere Flooding Critical Facilities and Infrastructure 1-66
Figure 29: Dissolution Sinkhole Formation 1-70
Figure 30: Cover-Subsidence Sinkhole Formation 1-70
Figure 31: Cover-Collapse Sinkhole Formation 1-71
Figure 32: Levee Failure Mechanisms 1-72
Figure 33: City of Belvedere Levee inundation and Critical Facilities Map 1-74
Figure 34: City of Belvedere Sea Level Rise 1-78
Figure 35: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 1-79
Figure 36: Heat Index 1-80
Figure 37: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 1-81
Figure 38: Beaufort Wind Scale 1-82
Figure 39: Enhanced Fujita Scale 1-83
Figure 40: Waterspout Formation 1-83
Figure 41: City of Belvedere Tsunami Critical Facilities and Infrastructure 1-85
Figure 42: Federal, State and Local Responsibility Areas in the Marin County OA 1-88
Figure 43: Fuel Model Map for the Marin County OA 1-91

Figure 44: City of Belvedere Wildfire Critical Facilities and Infrastructure 1-95
Figure 45: Trends in the Annual Number of Large Wildfires in the United States 1-96
Figure 46: Mallard Pointe Project Map 1-98

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 1-8
Table 2: 2023 MJHMP Planning Team Members 1-12
Table 3: City of Belvedere & Marin County MJHMP Planning Meetings 1-16
Table 4: City of Belvedere Estimated Jurisdictional Population 1-27
Table 5: Population Change of The City of Belvedere 1-27
Table 6: Languages Spoken in Belvedere 1-28
Table 7: Marin County Jurisdictional Housing Stock 1-29
Table 8: NRI Hazards and Marin County MJHMP Hazards 1-31
Table 9: NRI Hazard Type Risk Index for Belvedere Census Tract 1230.00 1-32
Table 10: Household Income for The City of Belvedere as of 2021 1-34
Table 11: City of Belvedere Civilian Employed Population 16 years+ by Industry 1-35
Table 12: City of Belvedere Critical Facilities 1-36
Table 13: Historic Sites in Belvedere 1-38
Table 14: Select Hazards Magnitude/ Severity Scale or Index 1-40
Table 15: City of Belvedere Hazard Risk Assessment 1-48
Table 16: Hazard Risk Assessment 1-49
Table 17: Residential Structures in The City of Belvedere by Flood Zone 1-68
Table 18: City of Belvedere Critical Facilities in the Flood Zones 1-68
Table 19: City of Belvedere Future Growth Areas 1-97
Table 20: City of Belvedere Legal and Regulatory Capabilities 1-100
Table 21: City of Belvedere General Plan 1-102
Table 22: City of Belvedere Administrative and Technical Capabilities 1-103
Table 23: City of Belvedere Fiscal Capabilities 1-104
Table 24: City of Belvedere Community Outreach 1-105
Table 25: City of Belvedere NFIP Status 1-107
Table 26: Status of Previous Hazard Mitigation Actions 1-111
Table 27: City of Belvedere Current Hazard Mitigation Actions 1-116

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AMI	Area Median Income
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency

CNRA	California Natural Resource Agency
CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance

FMP	Flood Mitigation Plan
FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department

MCOSD	Marin County Open Space District
MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management

OHP	Office of Historic Preservation
OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System

UCERF2	Uniform California Earthquake Rupture Forecast, Version 2
UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

2. Bolinas Community Public Utility District Profile

BCPUD

Bolinas Community Public Utility District

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Bolinas Community Public Utility District would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the Bolinas Community Public Utility District more disaster resistant and sustainable.

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TABLE OF CONTENTS

BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT PROFILE 2-1
Acknowledgements 2-3
Table of Contents 2-5
1.0 Introduction 2-7
1.1 Introduction 2-7
1.2 Planning Process 2-7
1.2.1 Steering Committee Members (District Representatives) 2-8
1.2.2 Steering Committee Planning Process 2-8
1.2.3 Coordination with Stakeholders and Agencies 2-9
1.2.4 Public Engagement 2-16
1.3 Overview and History 2-23
1.4 Service Area 2-23
1.5 Administration 2-28
1.6 Weather and Climate 2-28
1.7 Social Vulnerability and Risk 2-29
1.8 Critical Facilities 2-32
2.0 Hazard Identification and Risk Assessment 2-35
2.1 Climate Change 2-37
2.2 Hazards 2-44
2.2.1 Dam Failure 2-45
2.2.2 Debris Flows 2-51
2.2.3 Drought 2-56
2.2.4 Earthquake 2-58
2.2.5 Flooding 2-64
2.2.6 Land Subsidence/Sinkholes 2-69
2.2.7 Levee Failure 2-72
2.2.8 Sea Level Rise 2-74
2.2.9 Severe Weather – Extreme Heat 2-80
2.2.10 Severe Weather – High Wind & TORNADO 2-82
2.2.11 Tsunami 2-86
2.2.12 Wildfire 2-88
3.0 Mitigation Strategy 2-99
3.1 Changes in Development 2-99

3.2 Capability Assessment 2-100
3.2.1 Regulatory Capabilities 2-100
3.2.2 Administrative and Technical Capabilities 2-102
3.2.3 Fiscal Capabilities 2-104
3.2.4 Community Outreach 2-105
3.2.5 Participation in the National Flood Insurance Program 2-106
3.3 Mitigation Goals 2-107
3.4 Status of Previous Mitigation Actions 2-109
3.5 Hazard Mitigation Actions 2-109
3.6 Progress in Local Mitigation Efforts 2-114
3.7 Plan Integration 2-114
3.8 Future Development Trends 2-115
4.0 Plan Review, Evaluation, and Implementation 2-116
4.1 Plan Adoption 2-116
4.2 Plan Monitoring 2-116
4.3 Plan Evaluation 2-117
4.4 Plan Update 2-117
Figures and Tables 2-119
Acronyms/Abbreviations 2-121

1.0 INTRODUCTION

1.1 INTRODUCTION

The Bolinas Community Public Utility District Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Bolinas Community Public Utility District (PUD).

1.2 PLANNING PROCESS

The majority of Marin County consists of unincorporated, sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and special districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and special districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County is very different from most California counties in that the populated portion of the County where the jurisdictions and special district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the members of the Planning Team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and special district. The reduced number of meetings allowed the Planning Team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the Bolinas Community Public Utility District involved additional internal planning team members to support the broader planning process. The Bolinas Community Public Utility District jurisdictional representatives for the coordinated

Marin County Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (District Representatives)

Primary Point of Contact
Jennifer Blackman, General Manager
Telephone: 415-868-1224
e-mail Address: Jblackman@bcpud.org

Alternate Point of Contact
Stephen Marcotte, Assistant Fire Chief
Telephone: 415-868-1566
e-mail Address: smarcotte@bolinasfire.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1.

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, eleven incorporated jurisdictions, and five special districts, including the Bolinas Community Public Utility District. All participating jurisdictions and special districts are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction and special district established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions and special districts will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identifying potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Bolinas Community PUD Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Bolinas Community PUD communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Bolinas Community PUD Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Bolinas Community PUD and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table1.

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Community PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Assistant Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 28: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the local planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 2: Bolinas Community Public Utility District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update

Table 2: Bolinas Community Public Utility District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process

Table 2: Bolinas Community Public Utility District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
				• Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes.

Table 2: Bolinas Community Public Utility District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Emergency Management Website	• Opportunity for public comment and questions and answers.

Table 29: BCPUD & Marin County MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and special districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and special districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and special districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and special districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

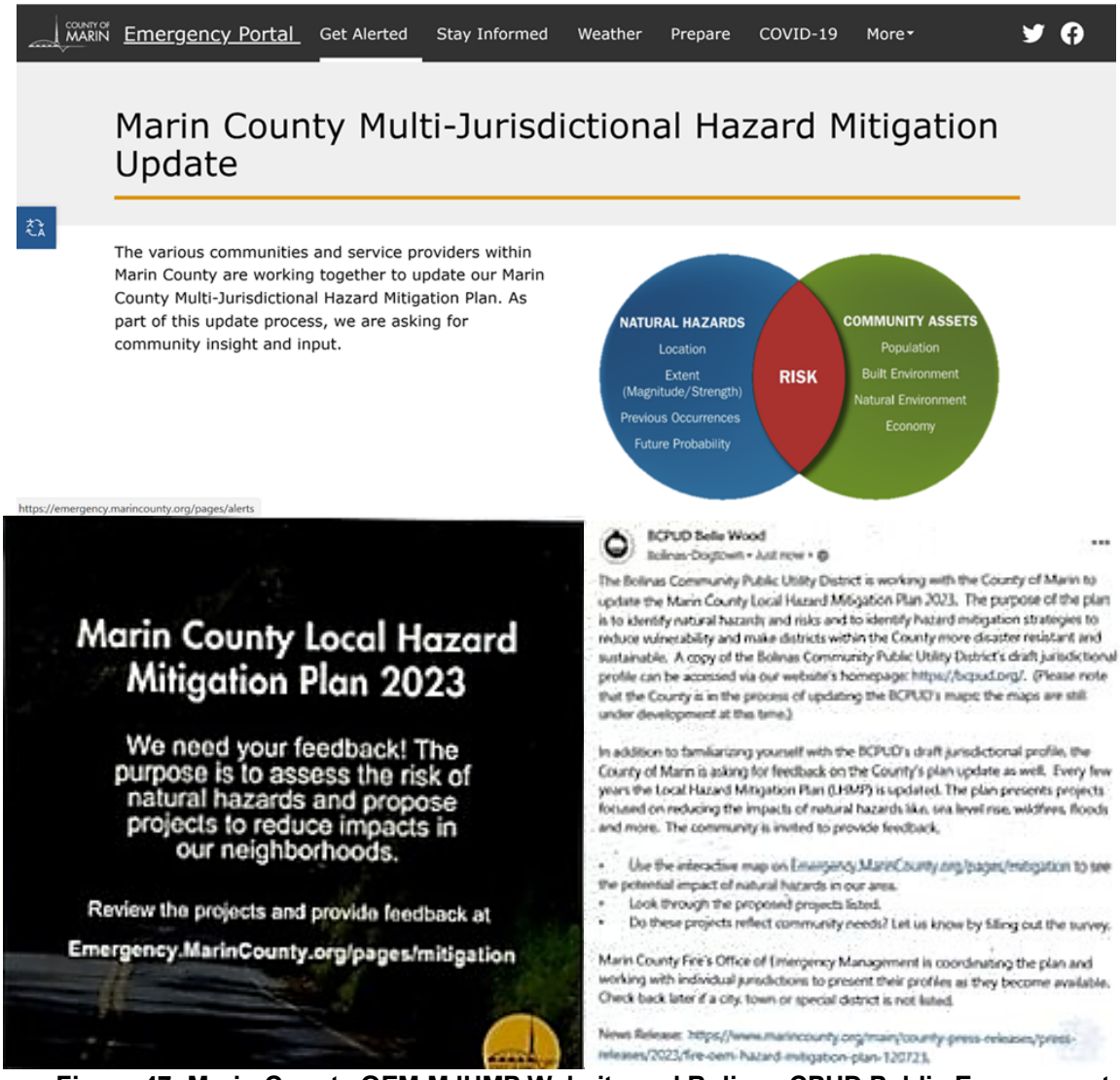


Figure 47: Marin County OEM MJHMP Website and Bolinas CPUD Public Engagement

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 48: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

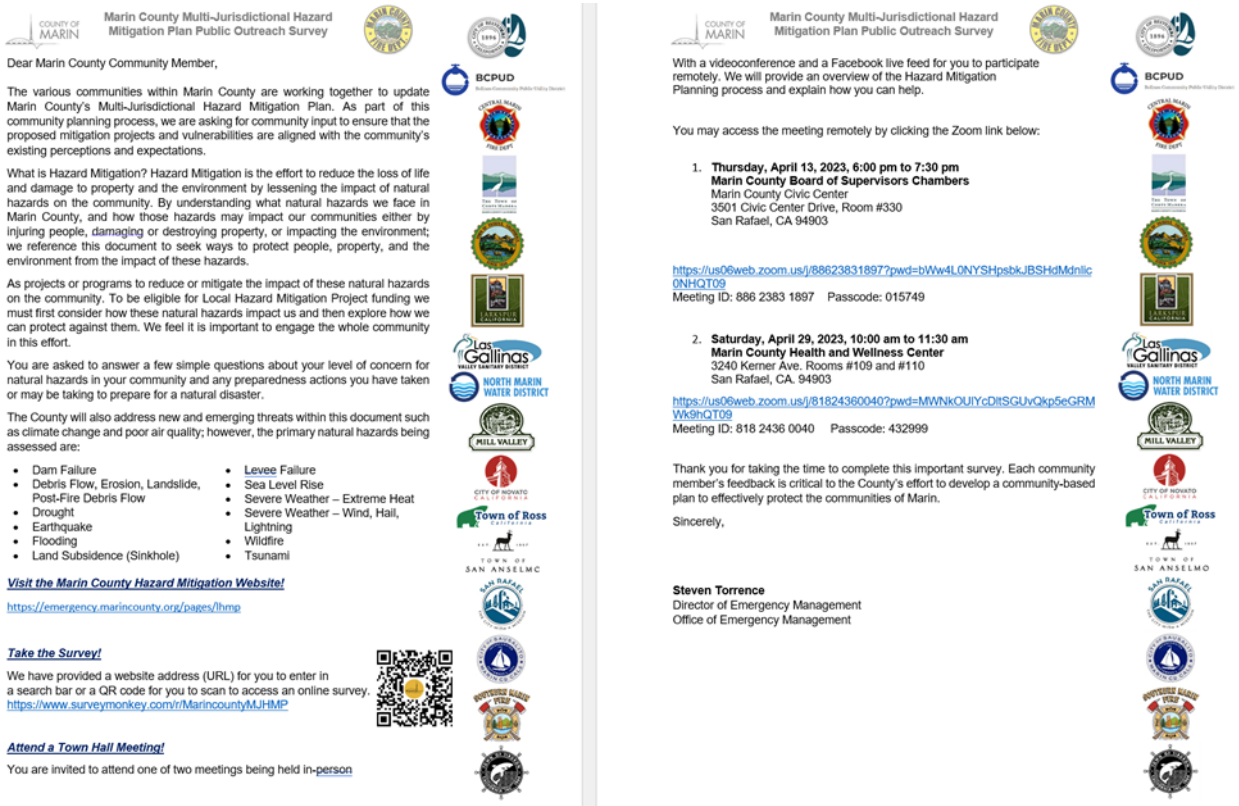
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 49: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process over 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 50: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article. Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The Bolinas Community PUD had an additional 14-day comment period for the Bolinas Community PUD Profile where their profile was posted on the District website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Bolinas Community PUD posted social media alerts directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

The Bolinas Community Public Utility District ("BCPUD") was formed in 1967 pursuant to a resolution of the Marin County Board of Supervisors which consolidated two previously existing districts: the Bolinas Beach Public Utility District (formed in 1927 to serve the Big Mesa) and the Bolinas Public Utility District (formed in 1935 to serve the Little Mesa and downtown areas).

As a public utility district, the BCPUD's governance authority is codified in the California Public Utilities Act of 1913, which empowers the district to provide a range of municipal services. The district is governed by a five-member Board of Directors, who are elected by registered voters (or appointed in-lieu of a contested election) to staggered four-year terms, and managed by a General Manager who supervises of staff of four shift operators and one administrative assistant. At present, the BCPUD directly or indirectly provides water, sewer, solid waste, drainage, and parks and recreation services within its boundaries.

1.4 Service Area

The BCPUD is located in unincorporated western Marin County, immediately to the south of the Point Reyes National Seashore and to the west of the Golden Gate National Recreation Area.

The BCPUD has a jurisdictional boundary of approximately 2.6 square miles and covers 1,649 acres of unincorporated Marin County, as depicted in the map below. Approximately one-fifth of that acreage (350 acres) is part of the Point Reyes National Seashore. In total there are 1,168 legal parcels encompassed within BCPUD's boundary.

Figure 51: Map of the Bolinas Community Public Utility District
Source: Marin County OEM

Figure 6 on the next page illustrates the Bolinas Community Public Utility District service area in Salmon and the jurisdictional boundaries of the Cities and Towns within Marin County.

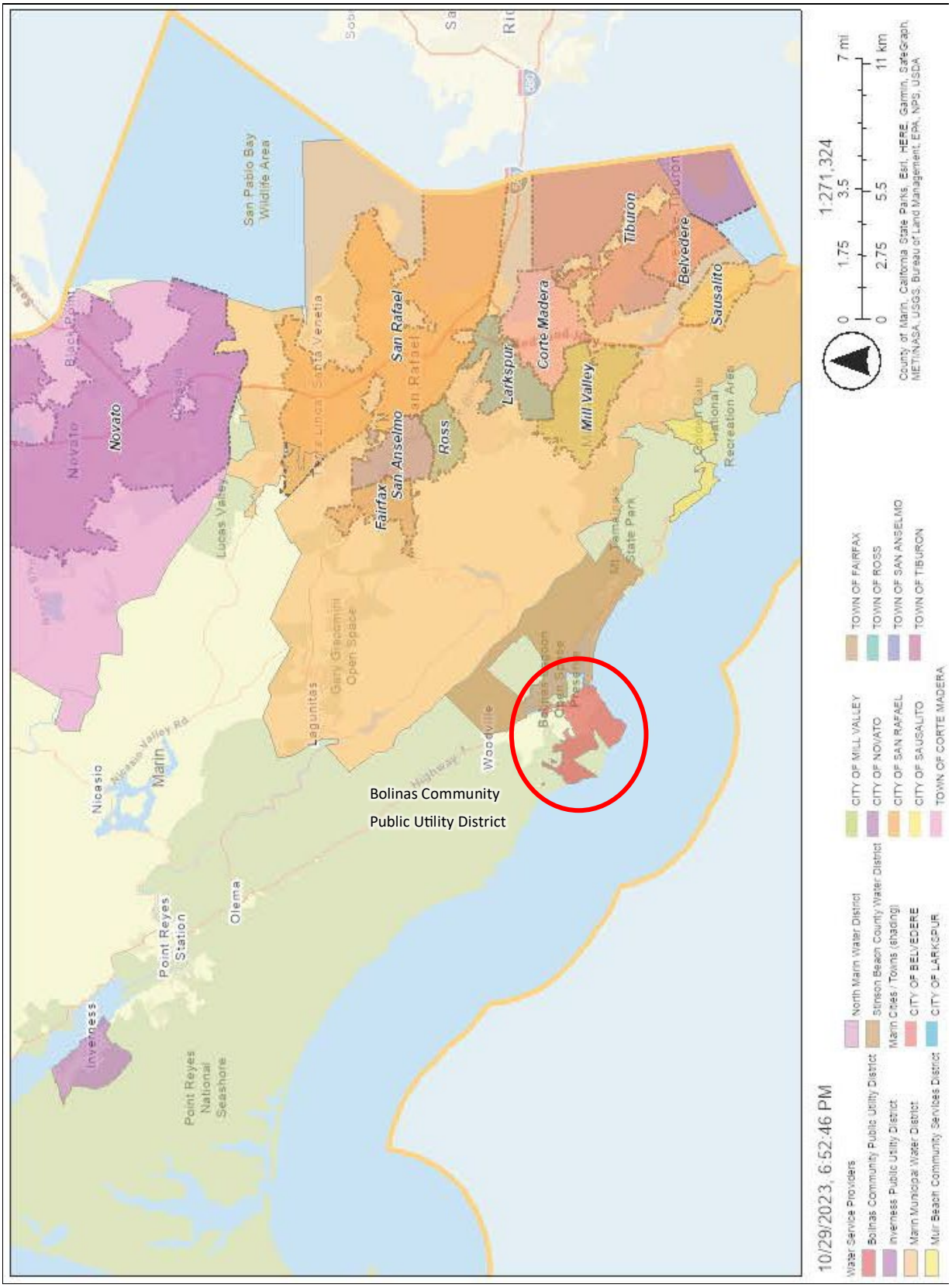


Figure 52: Map of the Bolinas Community Public Utility District and Jurisdictions
Source: Marin County OEM

Water Service

The BCPUD provides potable water services through its own supply, transmission, treatment, storage, and distribution facilities to 587 homes and businesses in the community of Bolinas. The BCPUD serves a population of approximately 1,500 full-time residents and an additional 1,000 seasonal or part time residents. All water diverted by BCPUD from its surface water sources receives treatment via inline coagulation and low-pressure microfiltration at its Woodrat Water Treatment Plant, constructed in 1995.

The majority of the BCPUD's distribution infrastructure was constructed prior to World War II by its two predecessor agencies, the Bolinas Beach Public Utility District and the Bolinas Public Utility District. The distribution system is comprised of approximately 19 miles of water mains which are gravity-fed from the District's two treated water storage tanks, the West Tank and the East Tank, which store a combined volume of 860,000 gallons of treated water.

The District's water is obtained from surface sources – the Arroyo Hondo Creek and two small emergency reservoirs supplied by unnamed streams -- contained within a 2 square mile watershed area of the Point Reyes National Seashore. In combination with the District's permitted diversions, these sources provide the BCPUD with an estimated maximum available annual yield of 167 acre-feet of water. Due to the limited nature of the BCPUD's surface water supplies, the BCPUD Board of Directors in 1971 declared a water shortage emergency and enacted a moratorium on new connections to the water system which remains in effect today. Water conservation is a way of life in Bolinas, with most households using less than 100 gallons of water per day

In 2021, the BCPUD received approval from the State Water Resources Control Board ("SWRCB") to add two existing groundwater wells as emergency sources to its water system to provide some resilience for the district in times of drought. The district applied to the California Department of Water Resources ("DWR") Small Communities Drought Relief Program for grant funding to install the treatment facilities and infrastructure needed to connect the wells to the district's distribution system. The DWR approved the funding in September 2022 and a funding agreement was finalized in September 2023. The BCPUD currently is in the process of applying for coastal permits to install the new facilities.

Wastewater Service

The BCPUD is the successor agency to the Marin County Sanitary District #3, organized in 1908. The District's sewer service area encompasses approximately three square miles with a collection system of pipelines stretching approximately three linear miles and consisting of pipes ranging in size from two inches to six inches. The collection system was constructed in two phases prior to and immediately after World War I and serves 162 connections (residential and business) in the downtown area of the community of Bolinas, as well as one additional connection on the Bolinas Mesa.

In 1975, responding to an order from the State of California to cease and desist disposing of the system's effluent in the channel of the Bolinas Lagoon, the BCPUD constructed a pump station, force main and treatment facility. The treatment facility is an integrated pond system which uses no chemicals in the treatment process, relying instead on a biological process of methane fermentation, with aeration and recirculation for odor control, and with ultimate disposal through pond evaporation and spray disposal on 45 acres of grasslands.

In 1990, the BCPUD completed an infiltration and inflow ("I&I") correction project to eliminate unwanted storm runoff and seawater intrusion into the collection system. While the project reduced I&I by 70%, the district continues to experience capacity problems in years when rainfall exceeds 50 inches. As a result, the district has continued a moratorium on new service connections enacted in 1985 as a requirement for state funding.

The BCPUD's sewer system is regulated by the Regional Water Quality Control Board for the San Francisco Bay Region ("Regional Board"). Since 1988, the district's sewer treatment facility has been subject to Waste Discharge Order 88-100. In 2021, Regional Board staff notified the district this permit is outdated and the Regional Board intends to transition to district's treatment facility to either the statewide General Order for Small Domestic Wastewater Treatment Systems (SWRCB Order WQ 2014-0153-DWQ) or an updated facility-specific permit. Among other things, the district will be required to upgrade its treatment facility in order to meet the requirements of the updated permit.

Drainage Service

The majority of residences within the District's jurisdictional boundaries are located on the Big Mesa and served by on-site wastewater treatment systems (septic systems). In the early 1990's the BCPUD hired Todd Engineering to prepare a set of drainage improvement maps with the objective of providing a high-level integrated approach to improving drainage on the Big Mesa by lowering the water table and improving septic system functioning via a series of projects to be executed by residents (or groups of residents) and their contractors over time. BCPUD provides project consultation services to District residents who are interested in implementing surface drainage projects on the Big Mesa. The District also provides culverts for project implementation "at cost" for those that are eligible.

Parks and Recreation

BCPUD does not have direct involvement in day-to-day parks and recreation activities within the District's jurisdictional boundaries. While the district owns the property on which Mesa Park (12-acres) is located and which has been improved with a parking lot, soccer field, baseball field, basketball court, playground and skate park, the land and the activities programmed there are managed by the Fire House Community Park Agency ("FHCPA"). FHCPA is a joint powers authority (JPA) whose member agencies include BCPUD and the Bolinas-Stinson Union School District. The JPA was created on January 21, 1985, with the stated intention of providing recreational opportunities to the taxpayers and residents of the area and to the students of the school and their families. FHCPA is a separate special district and receives no direct funding from BCPUD but rather receives revenue by way of Measure A funds and ad valorem property taxes.

Solid Waste Disposal Services

BCPUD provides residential and commercial properties within the District with weekly solid waste disposal, recycling and organic waste collection services pursuant to a franchise agreement with Recology Sonoma Marin.

1.5 ADMINISTRATION

The BCPUD has a five-member board that is elected to staggered four-year terms. All directors are required to be registered voters within the District's jurisdictional boundaries. The Board of Directors meets regularly on the 3rd Wednesday of each month at 7:30 p.m. at the BCPUD's Administrative Building located at 270 Elm Road in Bolinas, and holds special meetings as needed. The Board has a President, a Vice-President and three directors; the district's General Manager serves as Secretary to the Board. The Board also has several standing committees including Finance, Legal, Personnel, and Operations. Full time employees include the General Manager, Administrative Assistant, Chief Operator and three Shift Operators; the addition of an Assistant General Manager position is planned for 2024. The Board of Directors appoints the General Manager, who serves on an at-will basis, to oversee all District activities and implement the policies established by the Board of Directors. The Board provides policy direction to the General Manager on matters within the authority of the Board by majority vote of the Board members present during duly convened public meetings.

1.6 WEATHER AND CLIMATE

The Bolinas Community Public Utility District sits within an elevation range of 36 - 170 feet above sea level. The summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 42°F to 77°F and is rarely below 41°F or above 78°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The BCPUD records and average annual rainfall of 32 inches. The month which sees the most rainfall is December. The driest month of the year is July.

Climate data for Bolinas, California [hide]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °F (°C)	55.2 (12.9)	59.6 (15.3)	63.0 (17.2)	66.1 (18.9)	69.8 (21.0)	74.1 (23.4)	76.7 (24.8)	77.1 (25.1)	77.0 (25.0)	72.1 (22.3)	62.6 (17.0)	55.3 (12.9)	67.4 (19.7)
Daily mean °F (°C)	48.8 (9.3)	52.2 (11.2)	54.5 (12.5)	56.8 (13.8)	55.8 (13.2)	59.9 (15.5)	65.4 (18.6)	65.8 (18.8)	65.4 (18.6)	61.7 (16.5)	54.8 (12.7)	49.1 (9.5)	57.5 (14.2)
Average low °F (°C)	42.3 (5.7)	44.7 (7.1)	45.9 (7.7)	47.4 (8.6)	50.0 (10.0)	52.7 (11.5)	54.0 (12.2)	54.4 (12.4)	53.8 (12.1)	51.3 (10.7)	47.0 (8.3)	42.9 (6.1)	48.9 (9.4)
Average precipitation inches (mm)	7.7 (200)	7.8 (200)	5.5 (140)	2.2 (56)	1.3 (33)	0.3 (7.6)	0 (0)	0.1 (2.5)	0.3 (7.6)	1.9 (48)	5.3 (130)	8.3 (210)	40.7 (1,034.7)

Source: Bestplaces.net[18]

Figure 53: The BCPUD Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 3: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 30: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for

a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

The following Tables and Figures illustrates the NRI Hazard Type Risk Index and the Social Vulnerability Map for the Bolinas Community Public Utility District for the various Census Tracts within its service area.

Table 4: NRI Hazard Type Risk Index Census Tract 1321.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,334,090	Very Low	Very High	0.79	$1,051,384	91.6
Riverine Flooding	$296,155	Very Low	Very High	0.79	$233,397	92.5
Landslide	$25,977	Very Low	Very High	0.79	$20,472	98.3
Coastal Flooding	$19,189	Very Low	Very High	0.79	$15,122	91.1
Wildfire	$11,259	Very Low	Very High	0.79	$8,873	83.3
Tsunami	$4,427	Very Low	Very High	0.79	$3,489	98.3
Tornado	$2,307	Very Low	Very High	0.79	$1,818	4.4
Drought	$1,339	Very Low	Very High	0.79	$1,055	84.1
Heat Wave	$316	Very Low	Very High	0.79	$249	16.9
Strong Wind	$122	Very Low	Very High	0.79	$96	4.5

Table 31: NRI Hazard Type Risk Index for Census Tract 1321.00
Source: FEMA National Risk Index 2023

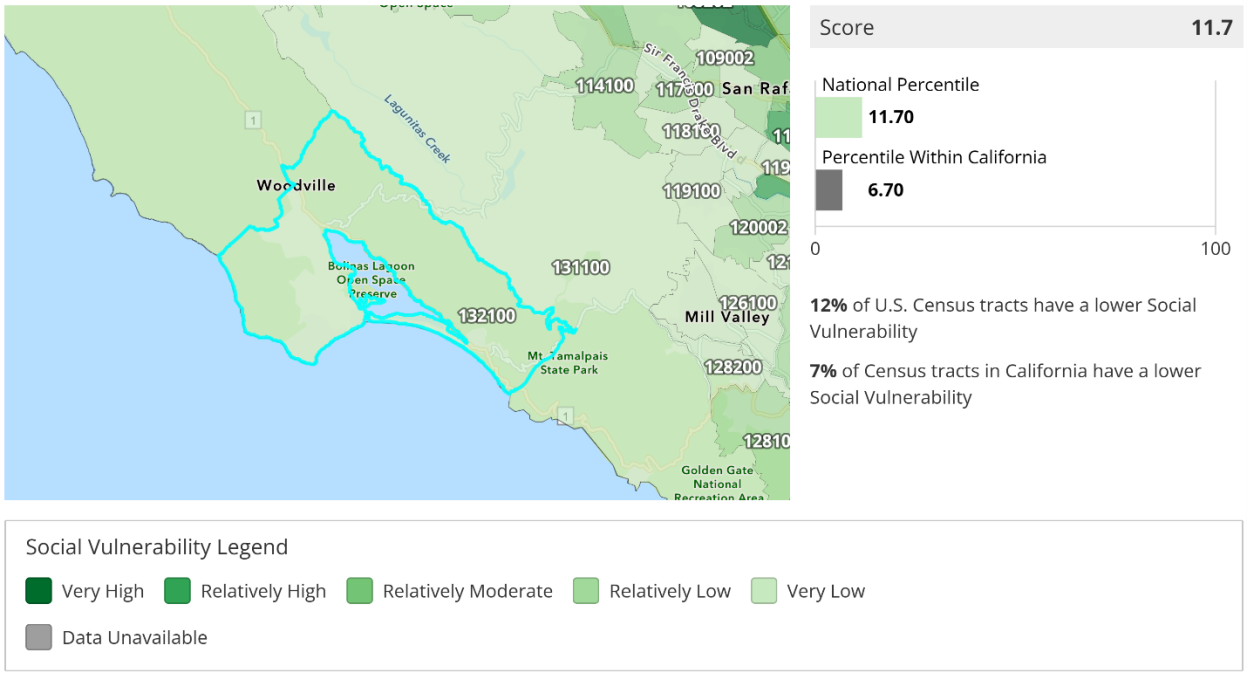


Figure 54: BCPUD Social Vulnerability Map Census Tract 1321.00
Source: FEMA National Risk Index 2023

Social Vulnerability in Marin County and the Bolinas Community Public Utility District

Most socially vulnerable residents in Marin County reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the County. West Marin is comprised of seven villages, including Bolinas[4], and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary schools in West Marin (2022-2023 school year), including Bolinas, students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a "very high" ability to prepare for anticipated natural hazards, adapt to changing conditions, and

[4] Bolinas is categorized as a "low income community" by California Air Resources Board's Community Investments: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/communityinvestments.htm

withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a whole to have "Relatively High" risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category ("Very High Risk"), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

Customers within the Bolinas Community Public Utility District service area reside within census tracts that have a Social Vulnerability Index of "Very Low". However, BCPUD residents have only one way in and out of their community (Olema-Bolinas Road) and this road floods frequently, making it unsafe to cross and rendering the residents unable to access their workplaces, groceries or medical resources. The Bolinas Community Public Utility District's scope of service to this community is limited to the water, sewer, solid waste, drainage, and parks and recreation services it provides within its jurisdictional boundaries. The district's influence may be realized during an emergency by ensuring the continued delivery of water, sewer, and solid waste services which are considered a community lifeline. The district may also work with these impacted customers to provide fee relief through local, state, and or federal programs where appropriate. The majority of socially vulnerable population services are provided through the county, state, and federal government or other non-governmental or volunteer agencies or organizations.

1.8 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Bolinas Community Public Utility District to fulfill the requirements of its mission during an emergency:

Table 5: Bolinas Community Public Utility District Critical Facilities

	Category	Name	Address	Fire Severity Zone	Flood Zone
7.	**Dams**	Woodrat 1 Reservoir	400 Mesa Road, Bolinas	Moderate	None
8.	**Dams**	Woodrat 2 Reservoir	450 Mesa Road, Bolinas	Moderate	None
	Critical Infrastructure				
9.	**Water/Wastewater Facilities**	Administrative Building	270 Elm Road, Bolinas	Moderate	None
10.	**Water Facilities**	Corporation Yard and Shop Buildings	270 Elm Road, Bolinas	Moderate	None
11.	**Water Facilities**	Woodrat Water Treatment Plant	400 Mesa Road, Bolinas	Moderate	None
12.	**Water Facilities**	West Tank (potable water storage)	390 Mesa Road, Bolinas	Moderate	None

13.	**Water Facilities**	East Tank (potable water storage)	390 Mesa Road, Bolinas	Moderate	None
14.	**Water Facilities**	Booster Pump Station	390 Mesa Road, Bolinas	Moderate	None
15.	**Water Facilities**	Water distribution system (serves residents with potable water)	BCPUD jurisdictional boundary	Moderate	None
16.	**Water Facilities**	Water transmission system (conveys raw water to treatment plant)	Arroyo Hondo watershed, Point Reyes National Seashore	Moderate	None
17.	**Water Facilities**	Upper Impoundment (fixed concrete structure)	Arroyo Hondo Creek, Point Reyes National Seashore	Moderate	None
18.	**Water Facilities**	Lower Impoundment (radial gate structure)	Arroyo Hondo Creek, Point Reyes National Seashore	Moderate	None
19.	**Water Facilities**	Pump house (conveys water from Woodrat 2 reservoir to treatment plant)	510 Mesa Road, Bolinas	Moderate	None
20.	**Wastewater Facilities**	Laboratory	101 Mesa Road, Bolinas	Moderate	None
21.	**Wastewater Facilities**	Wharf Road Sewer Lift Station	51 Wharf Road, Bolinas	Moderate	None
22.	**Wastewater Facilities**	Force Main	Wharf Road, Olema-Bolinas Road to Treatment Ponds at 101 Mesa Road, Bolinas	Moderate	None
23.	**Wastewater Facilities**	Wastewater Treatment Ponds Facility (integrated ponds/levees, disposal fields, seepage ponds and groundwater wells)	101 Mesa Road, Bolinas	Moderate	None
24.	**Wastewater Facilities**	Wastewater Irrigation Pump Station	101 Mesa Road, Bolinas	Moderate	None
25.	**Wastewater Facilities**	Wastewater collection system (serves customers on sanitary sewer system)	BCPUD jurisdictional boundary	Moderate	None
26.	**Electrical Power Facilities**	Solar PV System	400 Mesa Road (water treatment plant)	Moderate	None
27.	**Electrical Power Facilities**	Solar PV System	101 Mesa Road, Bolinas (wastewater treatment plant)	Moderate	None

Table 32: Bolinas Community Public Utility District Critical Facilities
Source: Bolinas Community Public Utility District

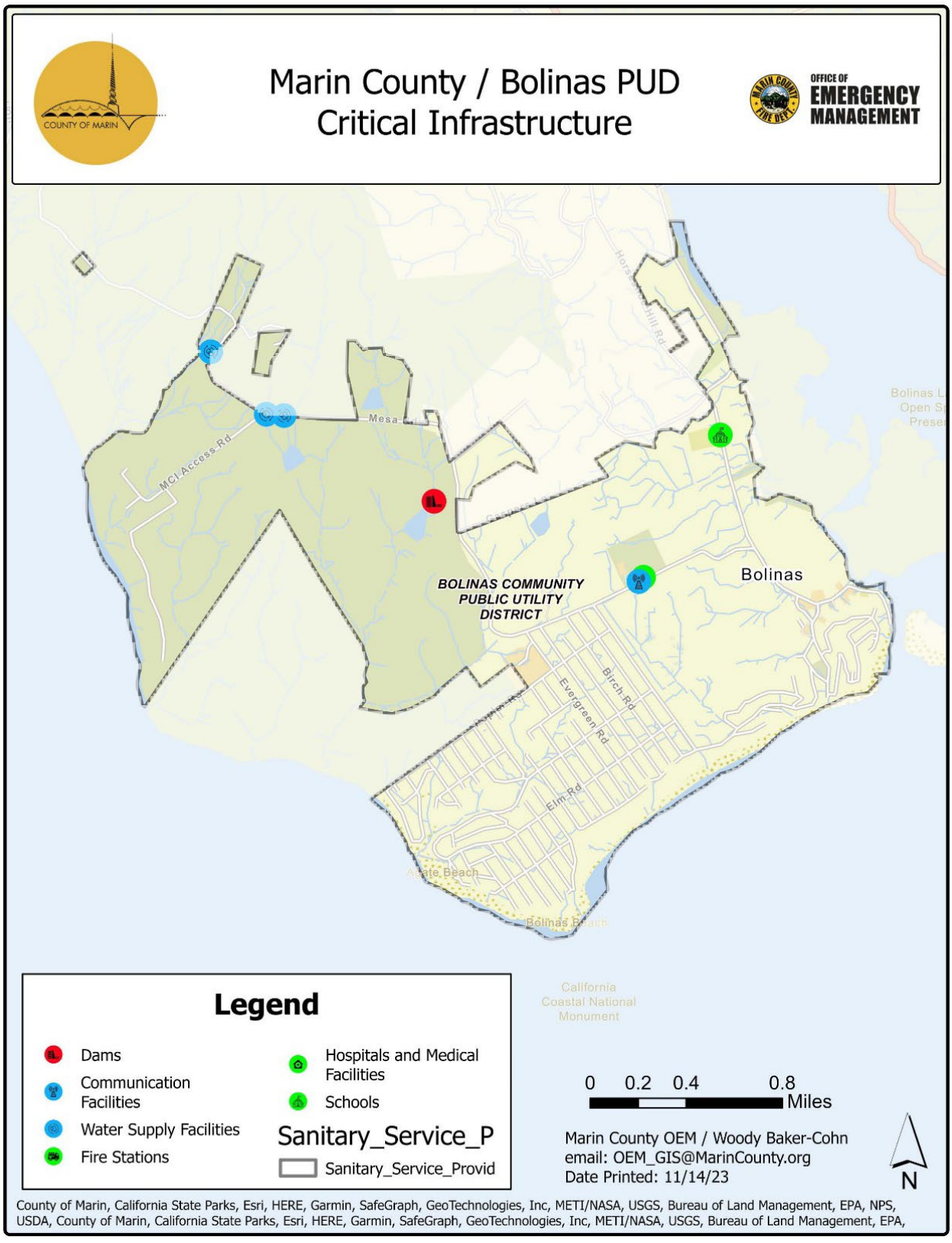


Figure 55: Bolinas Community Public Utility District Critical Facilities
Source: Marin County OEM

2.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Bolinas Community Public Utility District identified hazards that affect the District and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 10 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

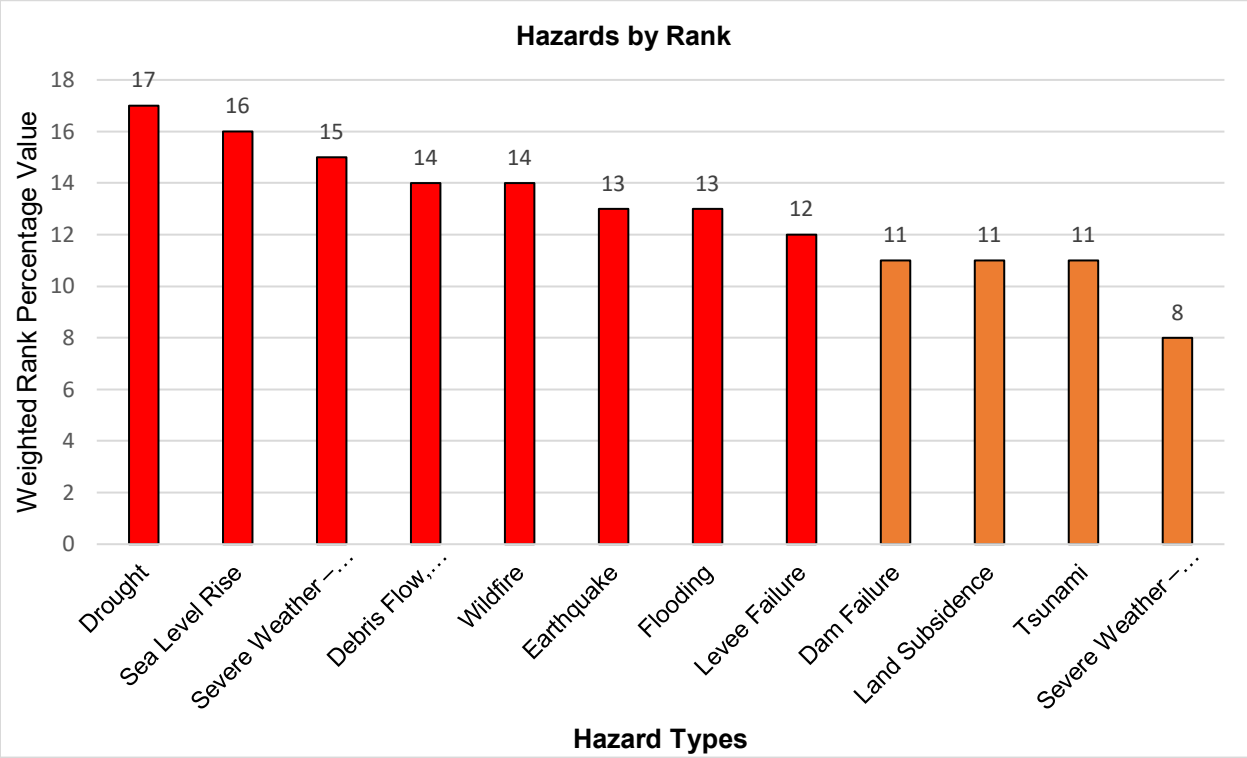


Figure 56: BCPUD Risk Assessment – Planning Team Top Hazards

Figure 11: Risk Rank Categorization	
Risk Level	Risk Numerical Score
High Risk	**12 - 18**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 57: Hazard Risk Categorization

Each Marin County MJHMP participating jurisdiction and special district reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and special district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or special district to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and special district assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 6: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 33: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 Climate Change

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS
Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS
Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

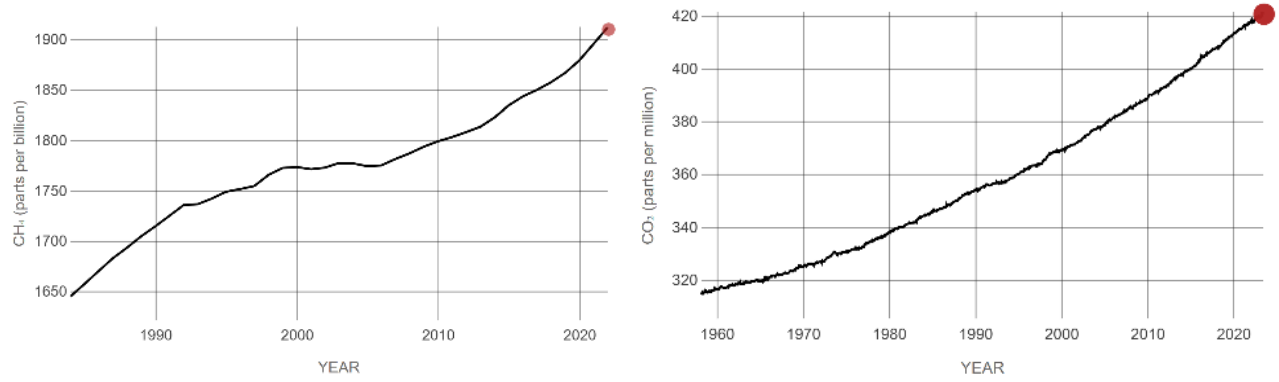


Figure 58: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

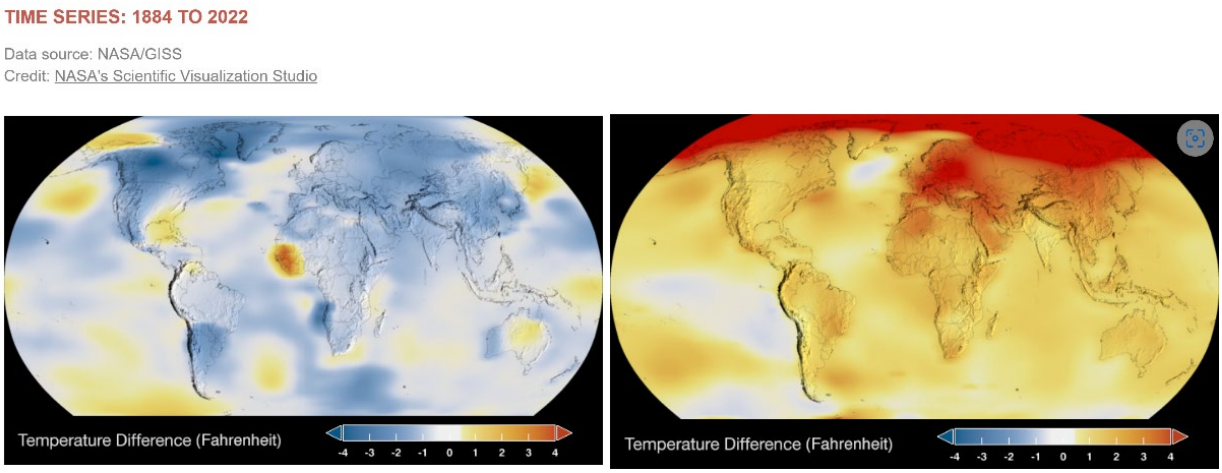


Figure 59: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.

- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

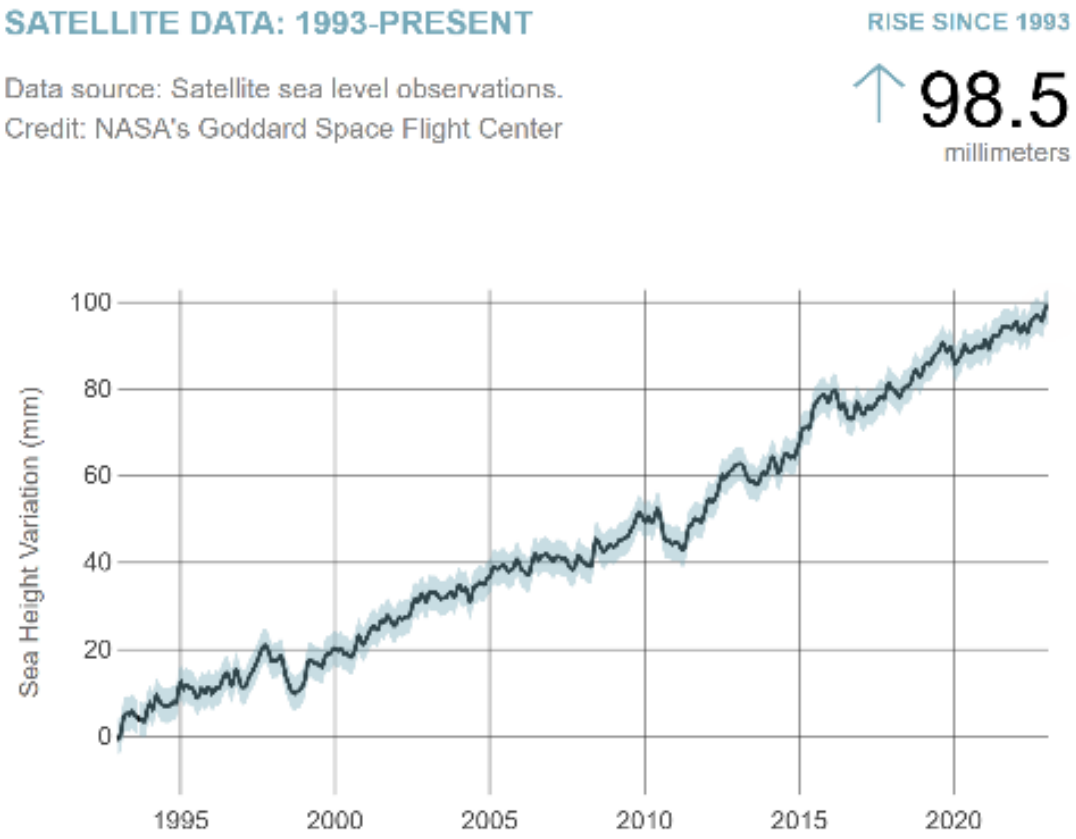


Figure 60: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County Hazard Mitigation Plan as a standalone hazard while addressing each of the other natural hazards. Marin County is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.

- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

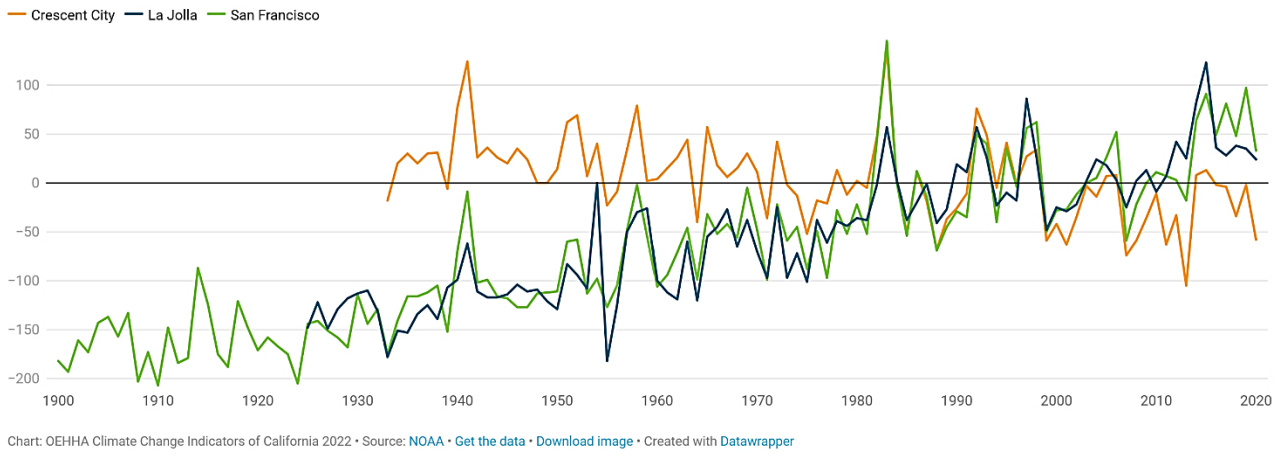


Figure 61: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate changes and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the Bolinas Community Public Utility District as per the planning team.

Table 7: Bolinas Community PUD Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Limited	Extreme	High	Medium	**11.00**
Debris Flow	Highly Likely	Limited	Moderate	High	High	**14.00**
Drought	Highly Likely	Extensive	Severe	High	High	**17.00**
Earthquake	Likely	Extensive	Extreme	None	High	**13.00**
Flooding	Likely	Significant	Moderate	High	Medium	**13.00**
Land Subsidence (Sinkhole)	Likely	Limited	Moderate	Medium	Medium	**11.00**
Levee Failure	Unlikely	Limited	Extreme	High	Medium	**12.00**
Sea Level Rise	Likely	Extensive	Severe	High	High	**16.00**
Severe Weather – Extreme Heat	Unlikely	Extensive	Weak	Low	Low	**8.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	High	**15.00**
Tsunami	Occasional	Limited	Severe	Low	High	**11.00**
Wildfire	Occasional	Extensive	Severe	High	Medium	**14.00**

Table 34: Bolinas Community PUD Hazard Risk Assessment
Source: Bolinas Community Public Utility District

Table 8: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 35: County of Marin Hazard Risk Assessment
Source: Marin County

2.2.1 Dam Failure

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design

- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

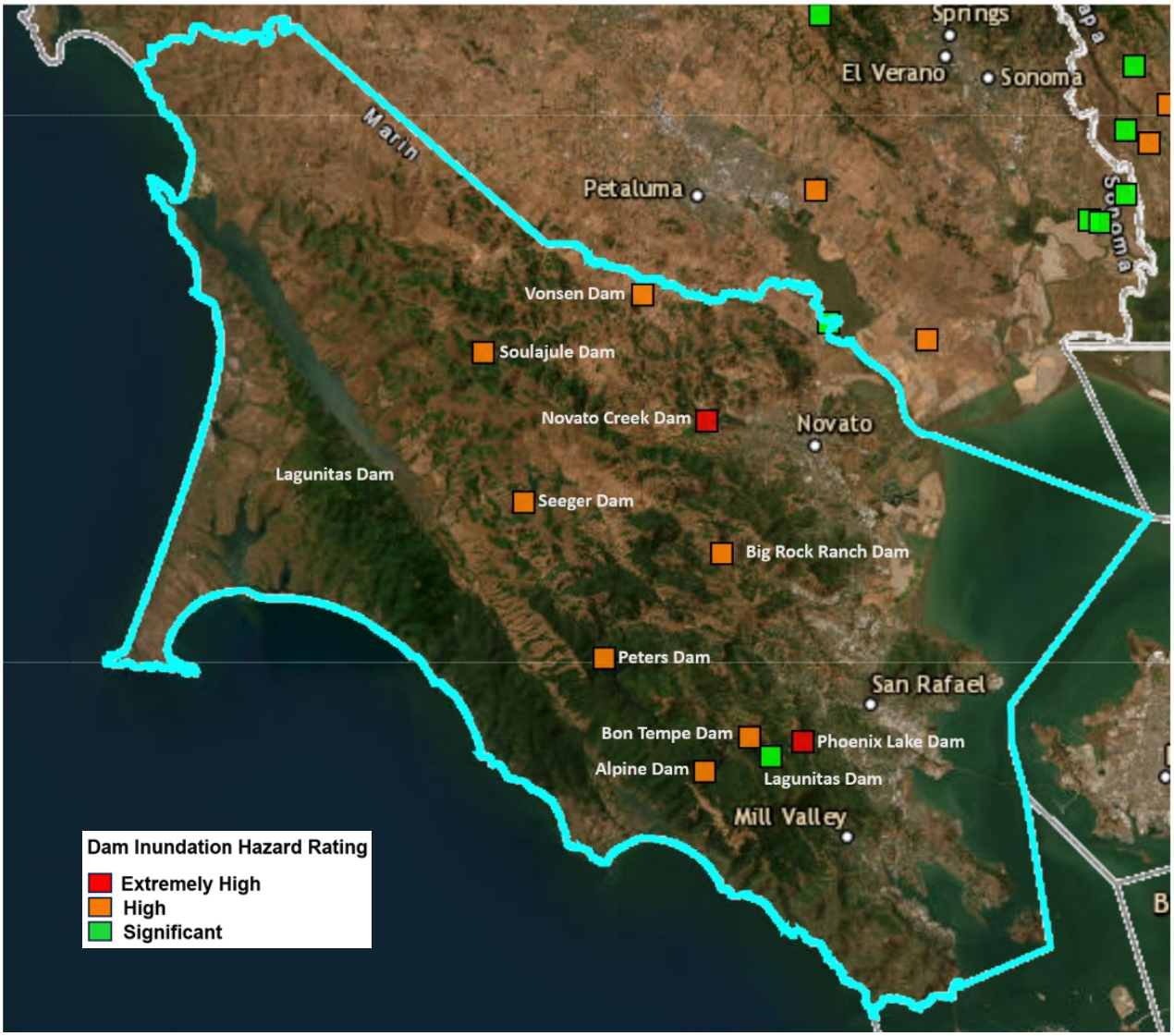


Figure 62: Dams in and around the Marin County OA
Source: Cal OES, Department of Water Resources, DSOD

Figure 17 illustrates the Dam Failure risk to Marin County.

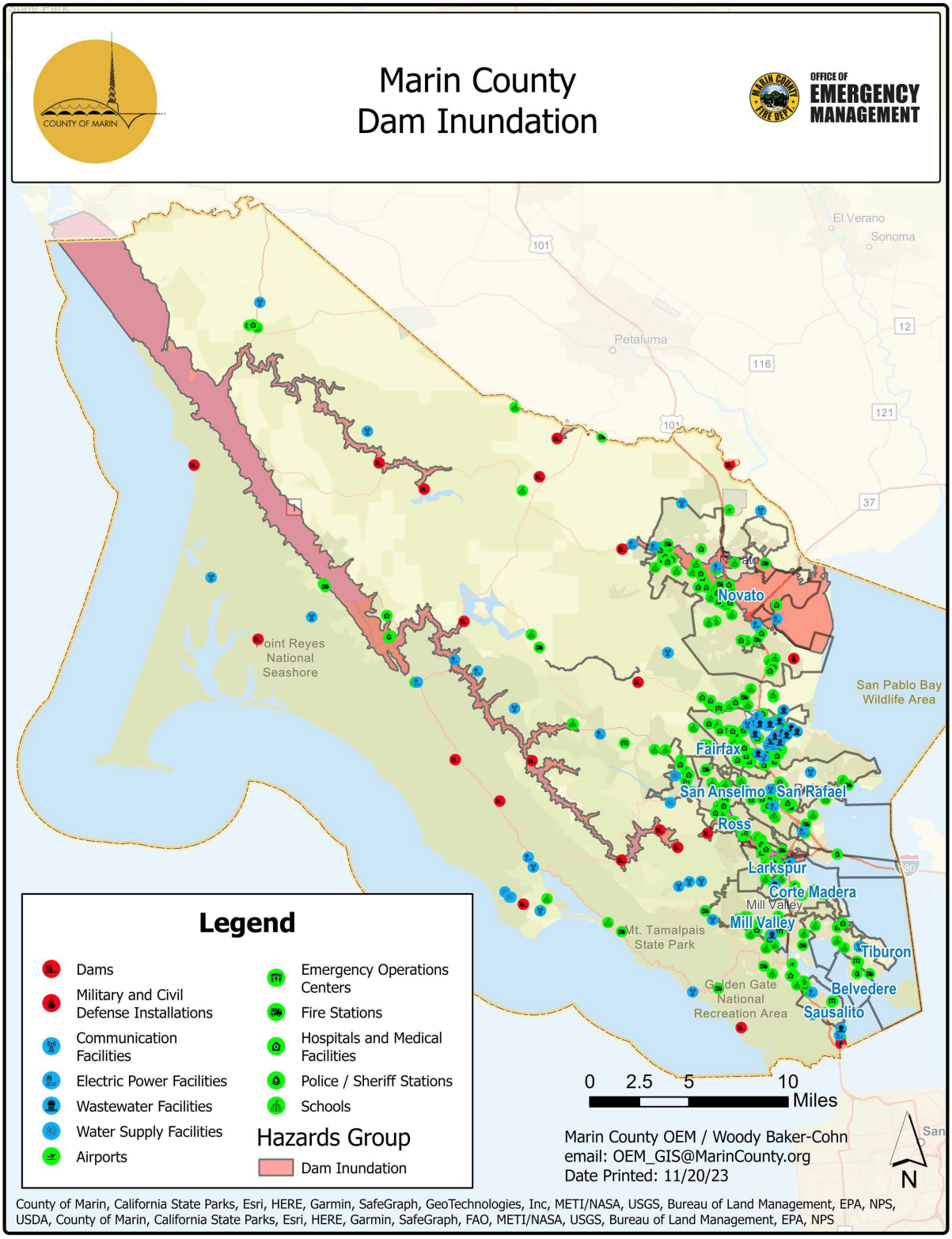


Figure 63: Marin County Dam Inundation Susceptibility to Critical Facilities
Source: Marin County OEM

The BCPUD is not within any classified dam inundation zones, though the district maintains small private dams or reservoirs. These facilities are not certified by the California Department of Water Resources, Division of Safety of Dams and are not known to pose potential downstream impacts to life and private property apart from one ranch home located downstream of the Woodrat 1 Reservoir.

The BPCUD maintains the Woodrat 1 Reservoir, which is directly behind the Woodrat Water Treatment Plant. The treatment plant is a small building with an adjacent solar array and may be at risk of damage should the reservoir flood control structure fail. The Woodrat Water Treatment Plant is the only water treatment plant in the district. If it were to be offline for any significant period of time or rendered inoperable, the district would be unable to provide treated drinking water to the community, posing a significant impact to public health and safety. The district does have two treated water storage tanks which hold a combined amount of water equal to approximately 800,000 gallons, or approximately two weeks of water (assuming significant conservation during this period), but the district has no other option to provide treated water from its surface water sources past that amount of time without operating the Woodrat Water Treatment Plant.

The image in Figure 18 shows the proximity of the Woodrat 1 Reservoir to the BCPUD Treatment Plant.

Figure 64: Woodrat 1 Reservoir and BCPUD Treatment Plant
Source: Bolinas Community Public Utility District

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam in the Marin County OA are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. Currently only one ranch home is within the inundation area of the Woodrat 1 Reservoir Dam, however, future development within the inundation area has the potential for significant impacts to residents and infrastructure to increase. Future development in the unincorporated community of Bolinas could expose additional people and structures to risk of a dam failure and subsequent loss of the BCPUD's Woodrat Water Treatment Plant.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 19 shows landslide susceptibility classes.

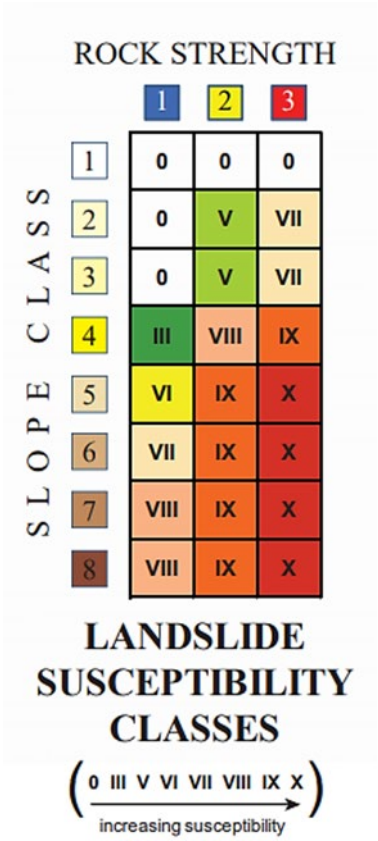


Figure 65: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 20 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

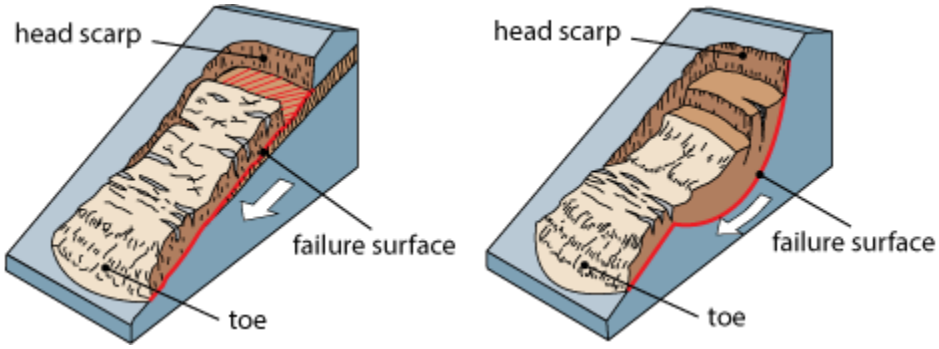


Figure 66: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in the BCPUD would most likely occur in any of the open spaces throughout the District where the terrain is steeper and is more susceptible to movement of hill slope materials; in general, this characterizes the areas of the community on the edge of the coastal bluffs (i.e., the Little Mesa (downtown), the Francisco Mesa (downtown) and the Big Mesa). Landslides on the coastal bluffs directly threaten portions of the BCPUD's water distribution system and portions of its wastewater collection system, as well as critical egress roads. In 2004, the BCPUD relocated a critical pressurized water main off of Terrace Avenue at the intersection with Overlook on the Big Mesa due to its proximity to the coastal bluff. In 2011, there was a major landslide at this location that heavily damaged/closed Terrace Avenue, one of only two egress roads off of the Big Mesa. The County of Marin's Department of Public Works installed an extensive repair and reopened Terrace Avenue the following year. In 2013, the BCPUD relocated another critical pressurized water main off of Terrace Avenue near Surfer's Overlook due to its proximity to the coastal bluff; a gravity sewer collection main currently remains at this location. In addition, the BCPUD has relocated several other smaller water mains as and when it determined coastal bluff erosion threatened these facilities.

Additional BCPUD critical facilities are susceptible to landslides, including the Woodrat 1 Reservoir/dam, the Woodrat 2 Reservoir/dam, the Woodrat Water Treatment Plant, the Solar Arrays at the Woodrat Water Treatment Plant, the district's raw water transmission line from the Arroyo Hondo Creek to the Woodrat Water Treatment Plant, and the BCPUD's two impoundments on the Arroyo Hondo Creek, all of which lie in areas of non-coastal bluff related landslide susceptibility.

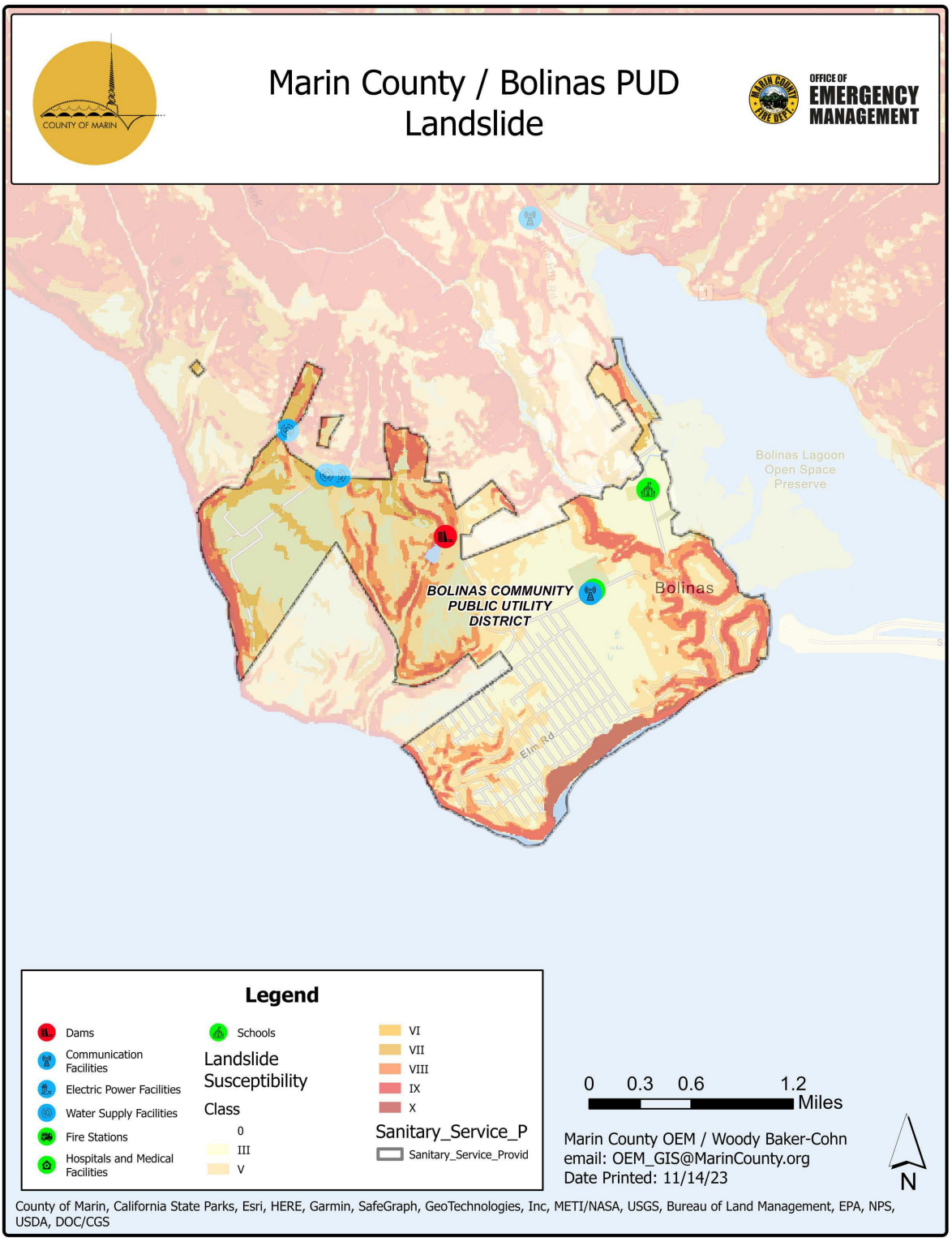


Figure 67: BCPUD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in the Bolinas area could affect the ability of District employees to reach District facilities or infrastructure. An earthquake has the

potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open spaces could potentially contribute to debris flows within the District. There are several creeks that flow directly into the BCPUD's jurisdiction that could contribute to a debris flow, particularly from the mountainous areas in the western part of Marin County.

There have been no recorded debris flows in BCPUD since the last plan update.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[5], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of the BCPUD that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in the BCPUD's jurisdiction could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.

[5] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.

Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought regularly occurs in all areas of the BCPUD and has a profound effect on the delivery of potable water service to the approximately 1,500 full-time residents and an additional 1,000 seasonal or part time residents served by the district. The BCPUD currently obtains its raw water exclusively from surface water sources -- the Arroyo Hondo Creek in the Point Reyes National Seashore and two small emergency reservoirs. Due to the limited nature of the BCPUD's surface water supplies, the BCPUD Board of Directors in 1971 declared a water shortage emergency and enacted a moratorium on new connections to the water system which remains in effect today. Drought quickly reduces the surface water flows in the BCPUD's primary water source, the Arroyo Hondo Creek, as well as the amount of water stored in the BCPUD's two emergency reservoirs, the Woodrat 1 and 2 Reservoirs, reducing the available supply potable water to customers and for fire suppression purposes, which also reduces revenue for the district which is used to operate the water delivery systems to these customers and renders the district more at risk in a wildfire. In 2009 and in 2021, in response to prolonged drought conditions, the BCPUD implemented mandatory conservation measures (i.e., rationing) to ensure the reliability of the water supply for public health, safety and fire suppression purposes.

Drought conditions throughout the district would also be felt in the mountainous areas just outside the District boundaries (in the Point Reyes National Seashore) where the risk of wildfire would increase and threaten BCPUD's facilities, particularly the Woodrat Water Treatment Plant. There have been two fires in the Point Reyes National Seashore in recent years: the Vision Fire in 1995 and the Woodward Fire in 2020. The wetland areas of the District, particularly the marshlands along the Bolinas Lagoon, could become drier during prolonged period of drought and experience marshland fires that could impact the District's critical facilities. Dry trees in public spaces adjacent to public roads, such as the eucalyptus grove to the east of the BCPUD's sewer treatment plant and in numerous other locations throughout the district, can become a safety hazard to the public due to falling limbs or tree failure.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including the BCPUD may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may

lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the BCPUD, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around the BCPUD. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including the BCPUD where wildfires are more likely to occur. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including the BCPUD can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 22).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 68: Modified Mercalli Intensity Scale
Source: USGS

Figure 23 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 69: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 24). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 70: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around BCPUD due to the number of active faults within and near Marin County, most notably the San Andreas and San Gregorio-Hosgri faults.

Earthquake Shake Intensity

The colors on Figures 25 and 26 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

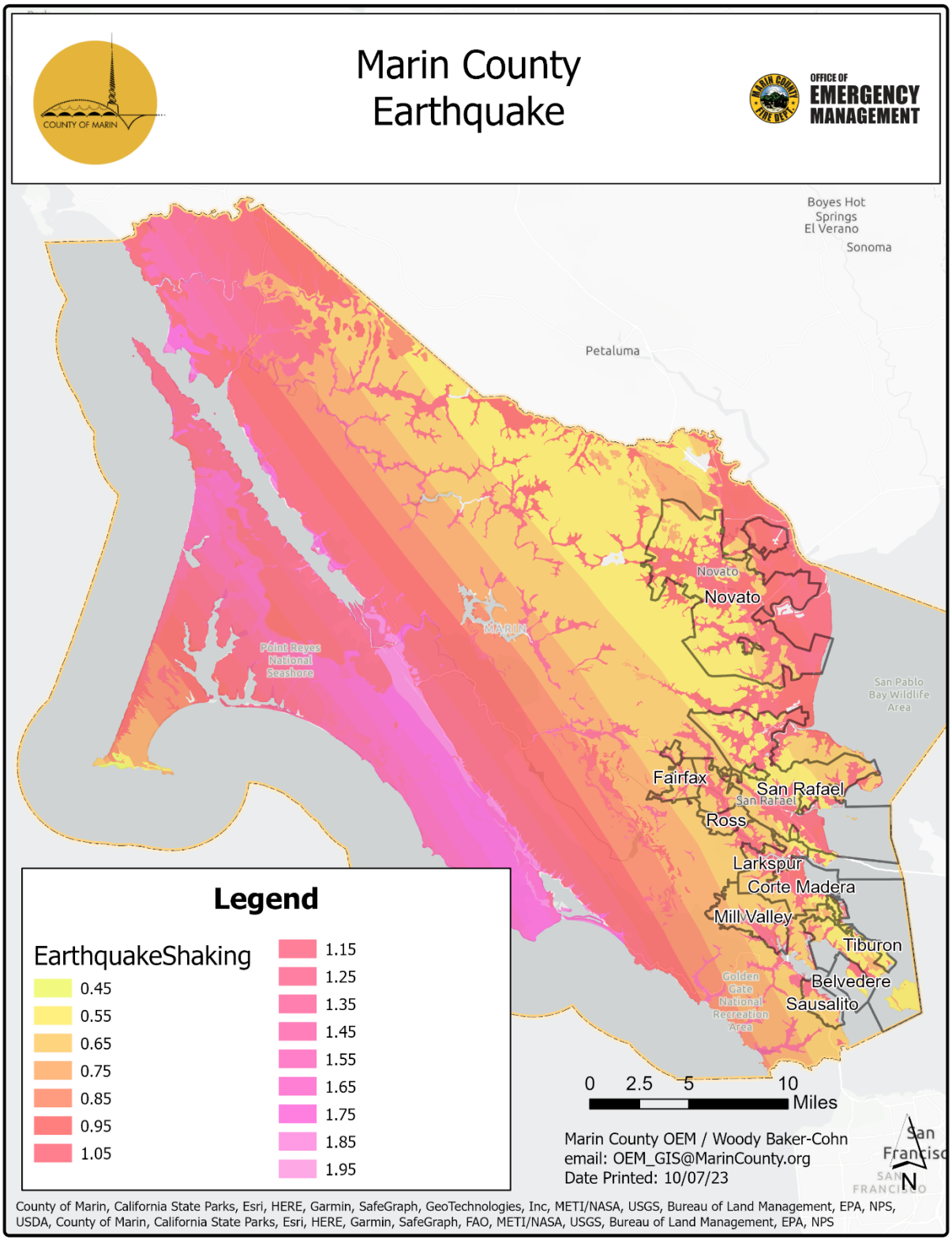


Figure 71: Marin County Earthquake Impact
Source: Marin County OEM

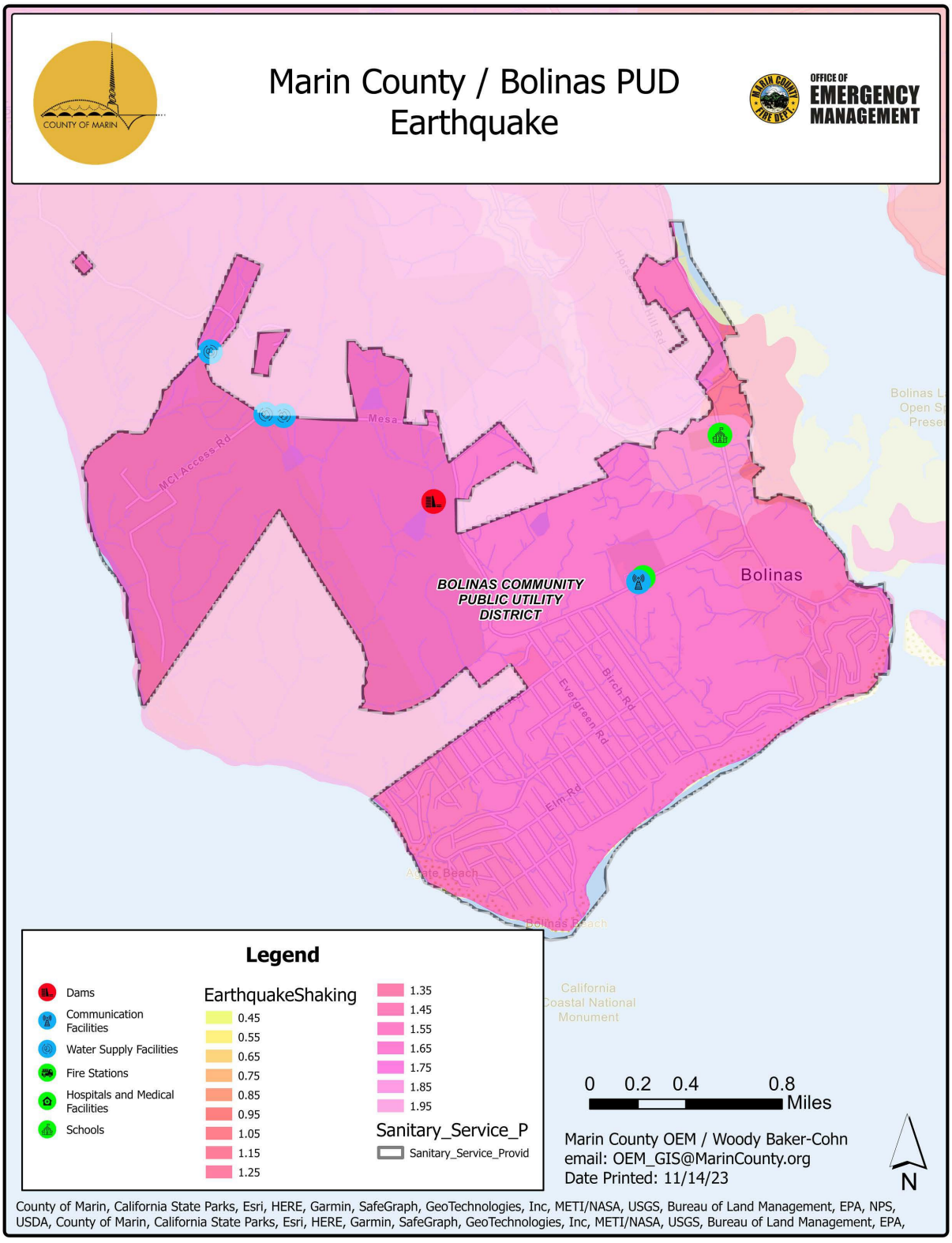


Figure 72: BCPUD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

The BCPUD is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the District. The Bolinas Peninsula in particular, including the District and the unincorporated community of Bolinas, has some of the highest earthquake shaking potential in the Marin County OA. There is increased risk of shaking and liquefaction in the District from an earthquake, particularly in the central and eastern lowland areas where superficial deposits and fill are more prevalent. All of the BCPUD critical facilities lie in these areas and have a high susceptibility to earthquake shaking. Vulnerable structures include District infrastructure and facilities that have not undergone major seismic retrofitting. Utility infrastructure throughout the District could be impacted by an earthquake, disrupting service to District customers.

Earthquakes could also cause landslides in the western areas of Bolinas with steeper terrain, causing damage to homes and roads as a result of shifting soils.

The BCPUD has not experienced a major earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in the District.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including the BCPUD, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[6], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including the BCPUD. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the entire BCPUD, including the unincorporated community of Bolinas, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one

[6] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), or Pine Gulch Creek in Bolinas, the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events

that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow are the most damaging in Marin County.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 27.

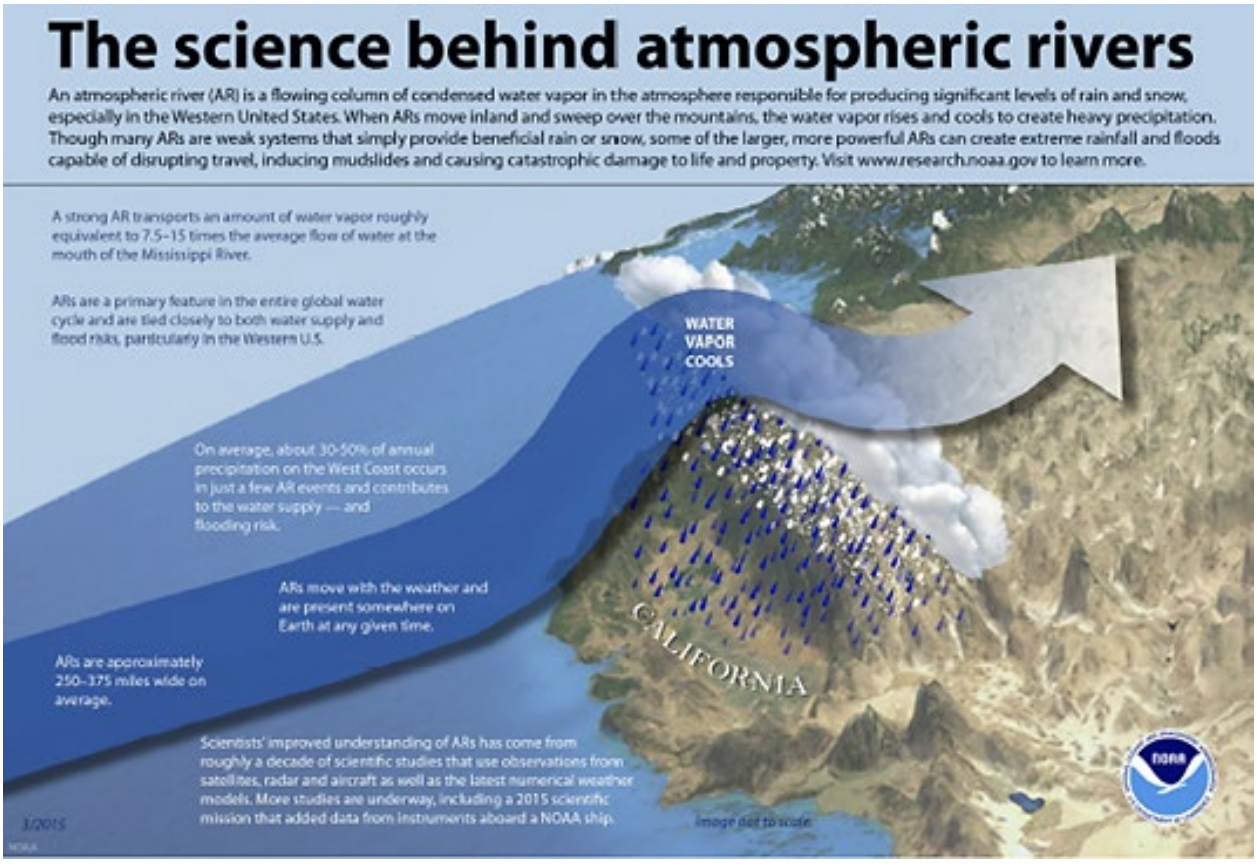


Figure 73: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in the BCPUD generally results from a combination of high tides and storm runoff in low-lying areas. Downtown Bolinas and Olema-Bolinas Road (the only egress road out of town) also have flooded in the past during the period of high tides and storm runoff. Wharf Road and Brighton Avenue in downtown Bolinas follow former riverbeds that cut through the topography, so both streets are at the bottom of small valleys and Olema-Bolinas Road is in a mapped floodplain. These past floods have impacted the water and sewer systems.

The BCPUD does not have any critical facilities within a flood zone. However, the BCPUD maintains small private dams or reservoirs that, should they fail, could result in flooding and damage to their facilities, specifically, to the Woodrat Water Treatment Plant, the only source of potable water for the community. These dams or reservoir facilities are not certified by the California Department of Water Resources, Division of Safety of Dams and are not known to pose potential downstream impacts to life or private property.

The impact of king tides (which typically occur in November, December and January of each year) at the same time as high rainfall events - the combination of the two occurring at the same time specifically affects low-lying areas of Marin such as Bolinas near the coast and the Bay and have impacts on the BCPUD's sewer system.

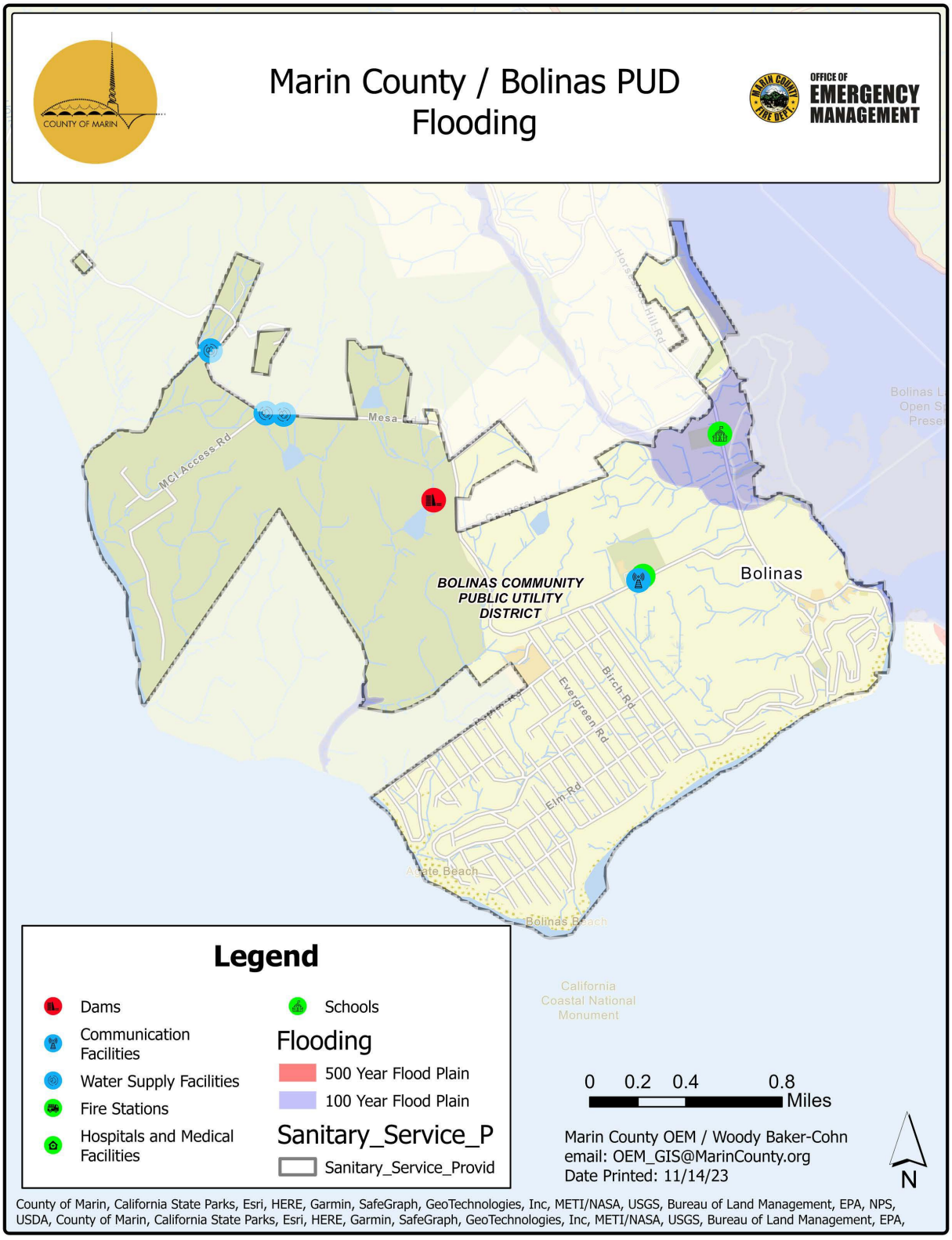


Figure 74: BCPUD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within the Bolinas Lagoon and Bolinas Bay have the potential to significantly impact the County's storm drain system in Bolinas, as well as the BCPUD's sewer system.

In Bolinas, Olema-Bolinas Road – the only egress road out of town -- has been closed due to flooding on numerous occasions, nearly always during a combination of heavy rains and King Tides, isolating the community for hours and rendering evacuation nearly impossible.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[7] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including the BCPUD. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including the BCPUD will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of the BCPUD. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development along creeks would expose more people, structures and infrastructure including major roads to creek flooding and storm surge from creeks as a result of climate change.

2.2.6 Land Subsidence/Sinkholes

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock,

[7] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 29 for a picture and description of how dissolution sinkholes form.

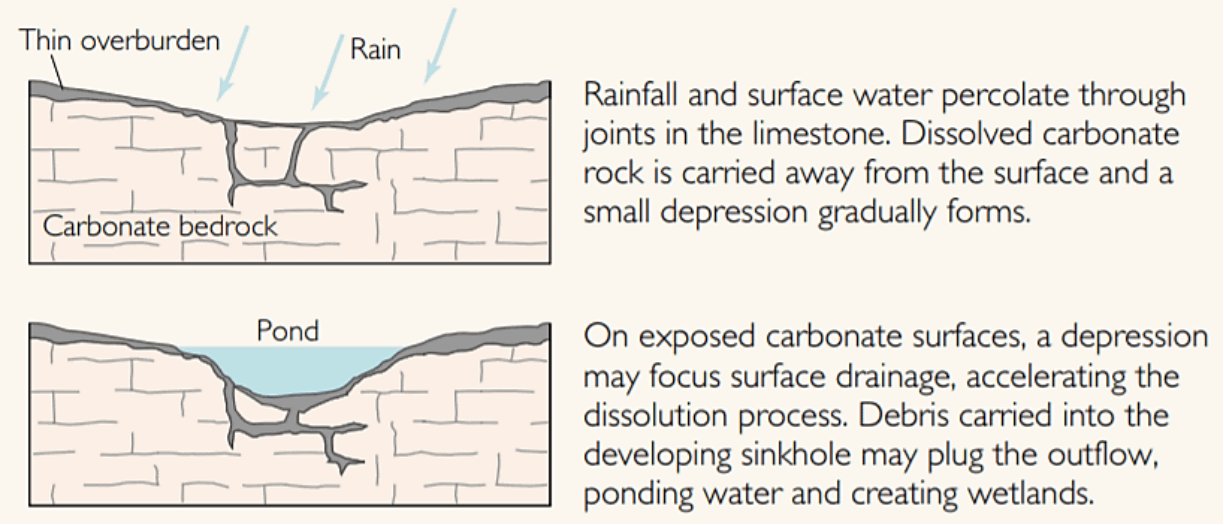


Figure 75: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 30 for a picture and description of how cover-subsidence sinkholes form.

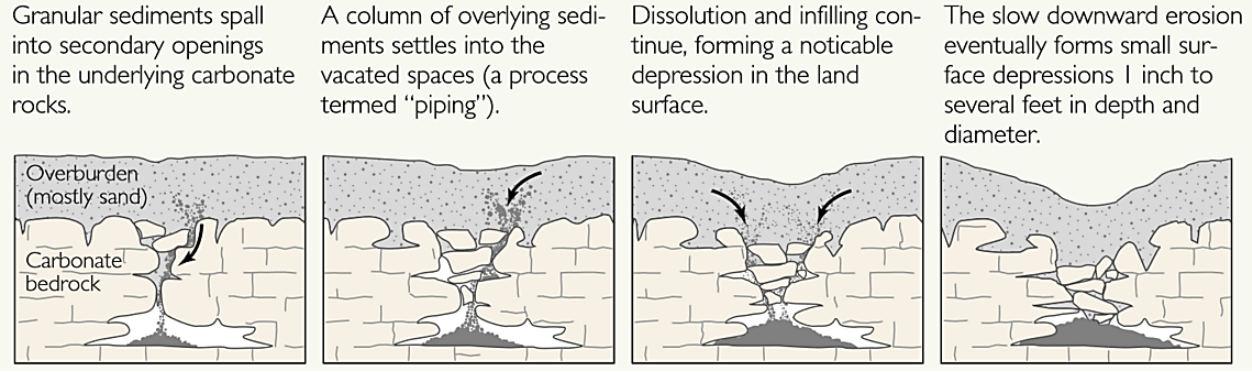


Figure 76: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 31 for a picture and description of how cover-collapse sinkholes form.

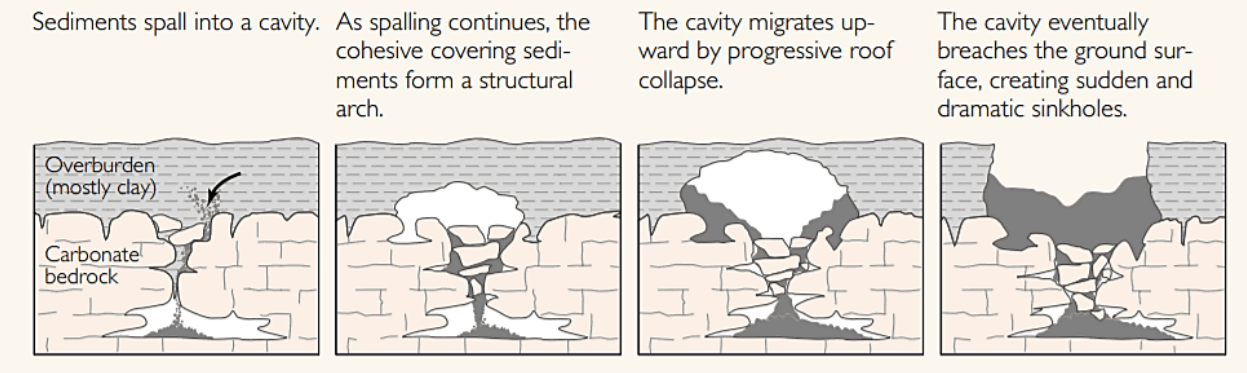


Figure 77: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the lowland areas of the BCPUD where superficial deposits and fill are more prevalent. Land subsidence could have numerous impacts for the BCPUD, including the settling of district facilities and infrastructure as well as the shifting of roadways that run through the District.

In recent years, numerous sinkholes have appeared under Wharf Road (a County-maintained road) in downtown Bolinas where the road is adjacent to the Bolinas Lagoon. These sinkholes appear to be related to wave scour undermining a County seawall that supports the road. These sinkholes and the shifting of Wharf Road threaten the BCPUD's water and sewer infrastructure in this area.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including the BCPUD, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the BCPUD as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in the BCPUD as a result of climate change could increase with future development in the populated areas of the District, including the unincorporated community of Bolinas.

2.2.7 LEVEE FAILURE

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 32 shows a levee and the multiple ways it can fail.

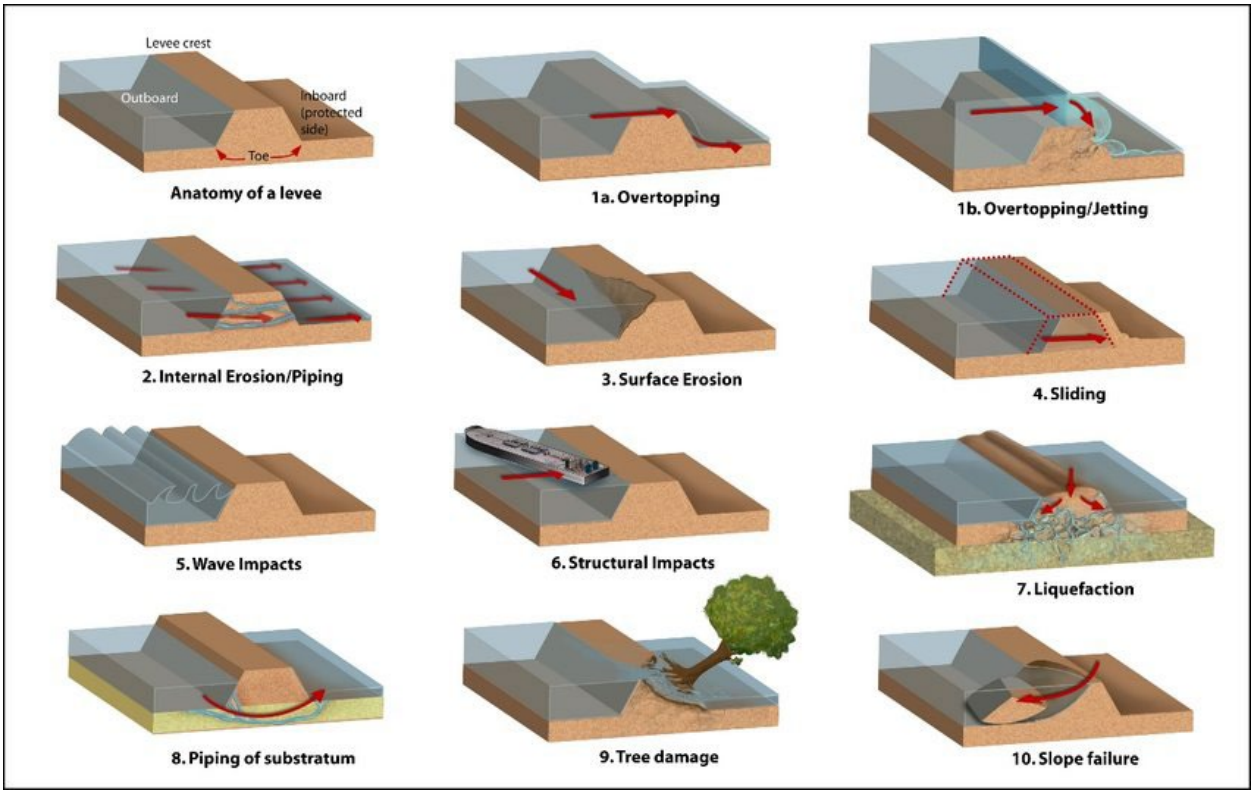


Figure 78: Levee Failure Mechanisms
Source: University of California

The BCPUD has levees in the form of four primary treatment ponds at its sewer treatment facility at 101 Mesa Road. The facility is an integrated pond system which uses no chemicals in the treatment process, relying instead on a biological process of methane fermentation, with aeration and recirculation for odor control. Following primary and secondary treatment, the effluent is spray-irrigated to land surrounding the treatment facility. Pursuant to the terms of the Waste Discharge Order 88-100 applicable to this facility, the BCPUD is not permitted to discharge from the ponds between November 15 and April 15 in any given year and must maintain two feet of freeboard in the ponds at all times. However, during years when the BCPUD receives 50-inches or more of rain, the BCPUD's levees are vulnerable to overtopping, which could cause flooding into the District, with property and critical infrastructure down

gradient of the treatment facility (including downtown unincorporated Bolinas) being most susceptible.

There has never been a failure of any of the BCPUD's levees.

Figure 79: Bolinas CPUD Primary Treatment Ponds Levees
Source: Bolinas Community PUD

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in the BCPUD, increasing the potential for a levee failure. As development increases in the populated areas of the BCPUD downstream of its levees, particularly in the unincorporated community of Bolinas, the potential for significant impacts to residents and infrastructure will only increase.

2.2.8 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

All residents in the Marin County OA, including in the unincorporated area, are susceptible to climate change, with effects being more prevalent in those with pre-existing health conditions and the elderly. Communities most vulnerable to the impacts of sea level rise in unincorporated Marin County include Muir Beach, Stinson Beach, Bolinas, Inverness, Pt. Reyes Station, Marshall, and Dillon Beach.

The Marin Ocean Coast Sea Level Rise Vulnerability Assessment and Marin Shoreline Sea Level Rise Vulnerability Assessment estimate that by 2100 around 7,000 acres, 9,000 parcels, 10,000 buildings and 120 miles of roads throughout the Marin County OA will be exposed to sea level rise and 100-year storm events.

In their current conditions, the most vulnerable coastal Marin County OA infrastructure, in order of onset and flood depth, includes

Near term (ten years):

- Beaches, underground on-site wastewater treatment systems (OWTS), buildings, and streets in Stinson Beach west of Shoreline Highway
- Shoreline Highway between Stinson Beach and Bolinas, at Green Bridge over Lagunitas Creek in Pt. Reyes Station, the Walker Creek crossing in Marshall, and bridges on Middle Road and Valley Ford Lincoln School Road
- Beaches and beach front and downtown buildings and streets (where critical BCPUD water and sewer infrastructure is located) in Bolinas
- Septic systems, beaches, marshes, and buildings along the eastern and western shores of Tomales Bay
- The water distribution pipe underneath Shoreline Highway and Sir Francis Drake
- Boulevard serving many Inverness residents
- Intertidal rocky lands in Muir Beach and Duxbury Reef in Bolinas
- Fire service facilities and tsunami evacuation routes in Stinson Beach
- Blufftop buildings in Muir Beach, Bolinas, and Dillon Beach may be vulnerable to accelerated erosion

Medium Term (thirty years):

- Olema-Bolinas Road, which is the only road into Bolinas, and the Bolinas-Stinson Union School District's Bolinas campus, along with numerous public, non-profit and private (commercial and residential) properties
- Additional buildings and streets in downtown Bolinas, including the historic district and the College of Marin's Bolinas Field Station
- Bolinas Community Public Utility District's sewer lift station on Wharf Road
- Shoreline Highway in Pt. Reyes Station and East Shore, and Sir Francis Drake Blvd. in Inverness

Long Term (seventy years):

- Shoreline Highway along the East Shore
- Buildings in Inverness west of Sir Francis Drake Blvd
- Downtown Bolinas up to the intersection of Wharf Road and Brighton Avenue, including the markets, shops, library, community center, gas station, museum, and other valued places

Along the bay shoreline, in the near-term timeframe, tidal flooding at 10 inches of sea level rise could reach 5,000 acres, 1,300 parcels, and 700 buildings, potentially impacting tens of thousands of residents, employees, and visitors. With an additional 100-year storm surge, the previously impacted acres, parcels, and buildings could face tidal and storm surge flooding. An additional 3,000 acres, 2,500 parcels, and 3,800 buildings could anticipate storm surge flooding across the Marin County OA.

Beaches, estuaries, marshes, wetlands, and intertidal areas on the Marin County OA coast, including in the unincorporated area, are vulnerable to sea level rise and storms. Nearly all beaches except Dillon Beach and the federal portion of Stinson Beach, could be lost entirely in the long-term. Roughly 9,000 acres in the estuaries of Tomales Bay, Bolinas Lagoon, and Esteros Americano and San Antonio, 1,800 acres of wetlands and marshlands could be impacted to varying degrees across all of the scenarios in all of the communities. Sea level rise may push coastal habitats inland where possible, flooding tidal areas more frequently and new inland areas with saltwater. The North Central California Coast and Ocean Vulnerability Assessment identified the five most vulnerable species to sea level rise as the Western snowy plover, black oystercatcher, black rail, California mussel, and red abalone.

Much of the BCPUD is at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in BCPUD are particularly vulnerable to sea level rise and could experience between one and six feet of inundation.

Critical facilities throughout the District can become damaged extensively with their foundations compromised over time. Of particular concern are those facilities that have not been elevated to projected sea level rise heights over the next century. Sea level rise in the District has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into areas were critical facilities lie. Sea level rise can also cause increased subsidence in the District, which may damage underground water and wastewater pipelines and disrupt services.

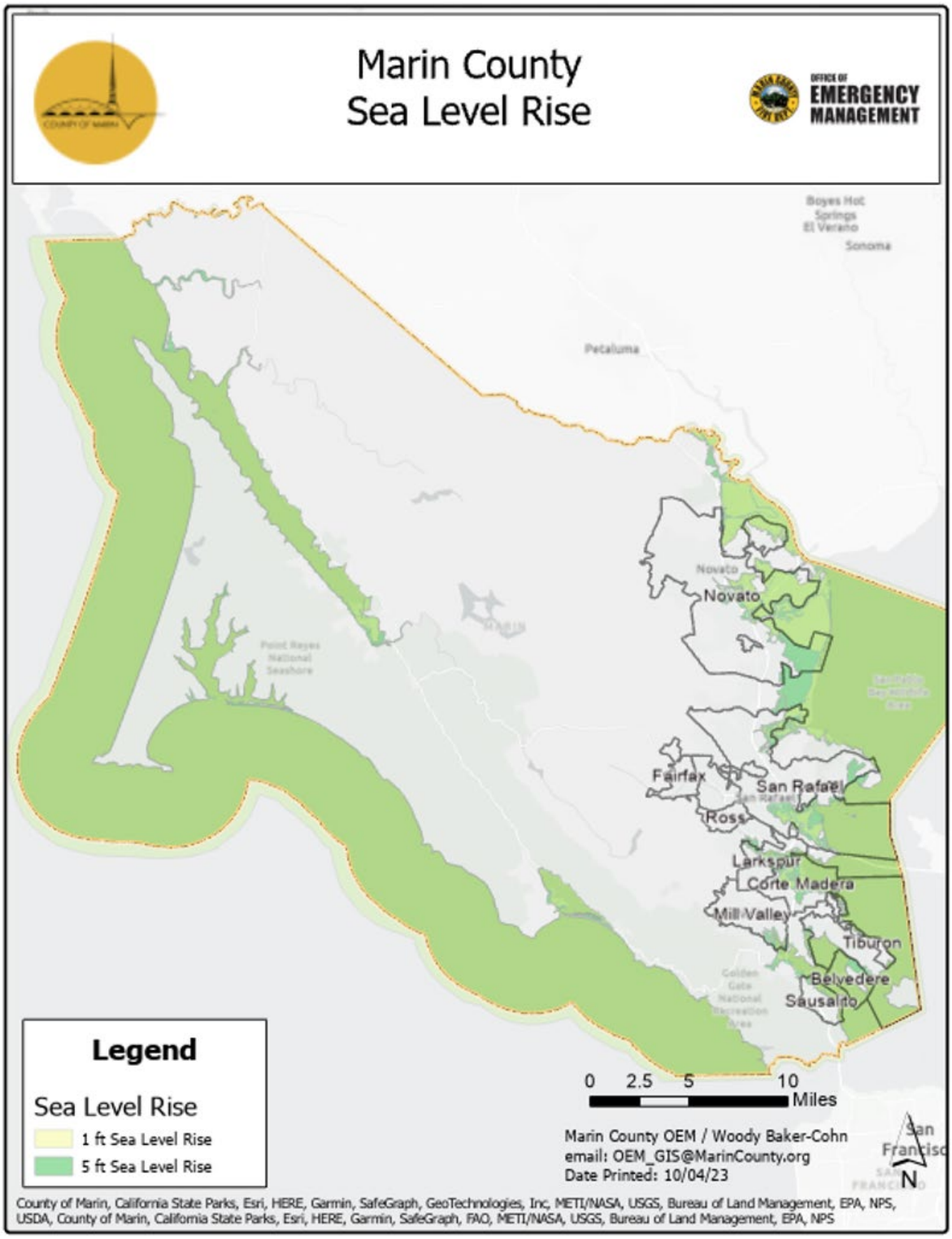


Figure 80: Marin County Sea Level Rise Impact
Source: Marin County OEM

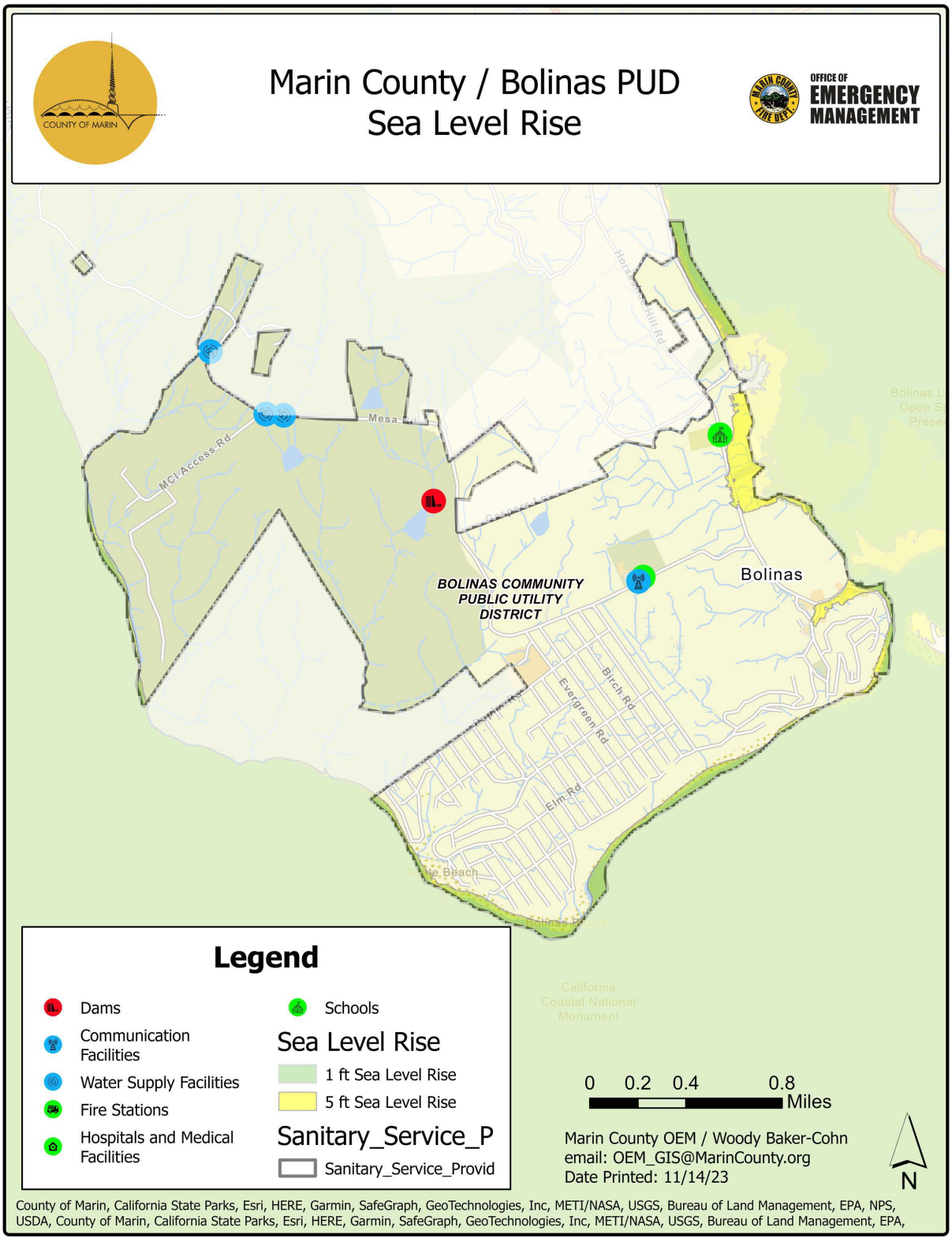


Figure 81: BCPUD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

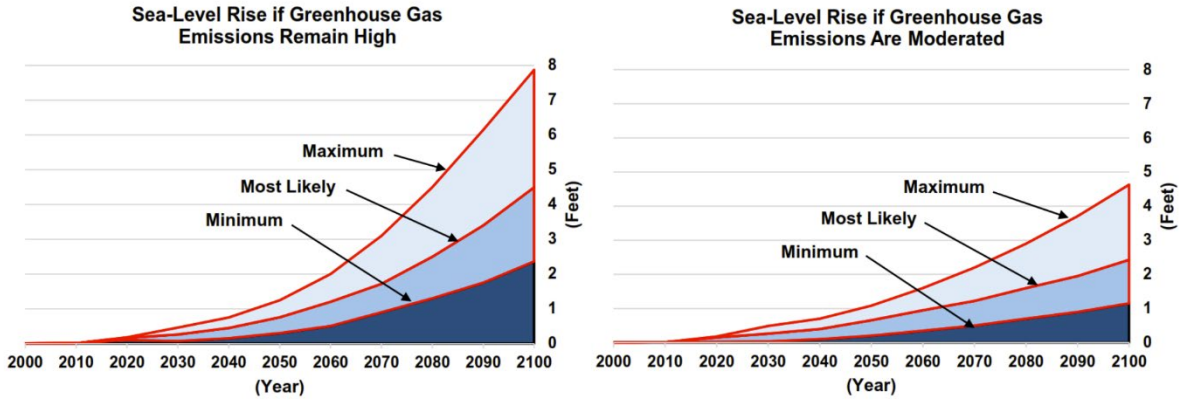


Figure 82: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around the BCPUD already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including the BCPUD with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around the BCPUD will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of the BCPUD, including in the unincorporated community of Bolinas, will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across the BCPUD will continue to become inundated.

2.2.9 SEVERE WEATHER – EXTREME HEAT

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 37):

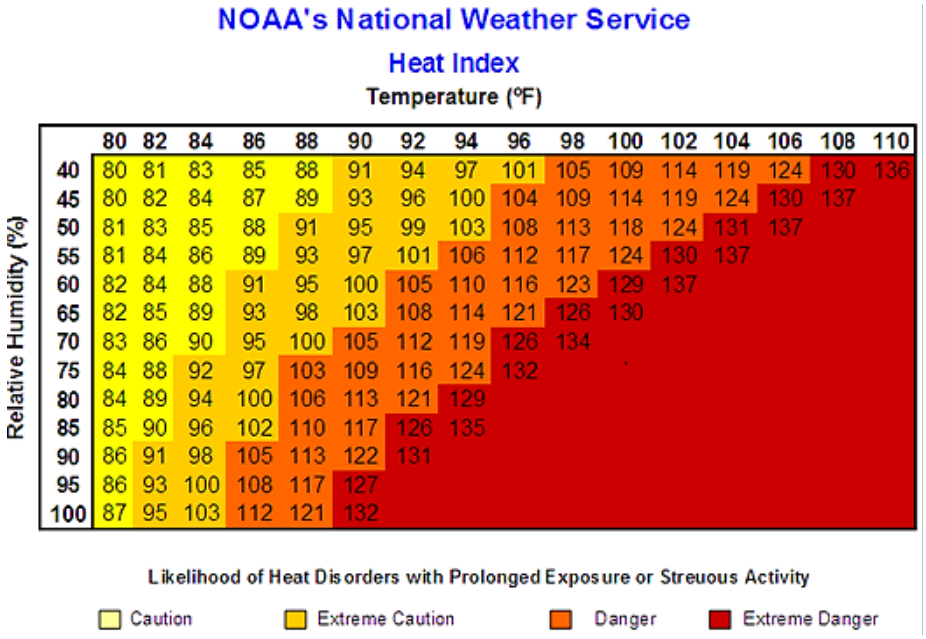


Figure 83: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat can affect a range of key infrastructure from energy systems, water and wastewater treatment systems, the operation of government buildings, and public transit. While higher summer temperatures increase electricity demand for cooling, at the same time, it also can lower the ability of transmission lines to carry power, possibly leading to electricity reliability issues during heat waves. Increased temperatures also impact the efficiency of solar power infrastructure by increasing the surface temperature of solar panels, which reduces the voltage that panels can generate and thereby lowers efficiency. Although warmer winters will reduce the need for heating, modeling suggests that total U.S. energy use will increase in a warmer future. Extreme heat can also increase the risk of other types of disasters and exacerbate the urban heat island effect. Heat can exacerbate drought, and hot dry conditions can in turn create wildfire conditions. In cities, buildings, roads and infrastructure can be heated to 50 to 90 degrees hotter than the air while natural surfaces remain closer to air temperatures. The heat island effect is most intense during the day, but the slow release of heat from the infrastructure overnight (or an atmospheric heat island) can keep cities much hotter than surrounding areas. People who are required to work outside during extreme heat are especially vulnerable to the effects of extreme heat. In California, between 2000-2017, 15,996 workers experienced heat

related illness (Risk factors for occupational heat-related illness among California workers, 2000-2017 - PubMed (nih.gov).

Extreme heat has the potential to impact all areas of the BCPUD and would be felt more at lower elevations in the central and eastern areas of the District. Heat waves can cause power outages, which can impact the operability of the District's critical facilities and impede the delivery of services. Heat waves can also impact district employees who are exposed to high temperatures while working outside in the heat.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

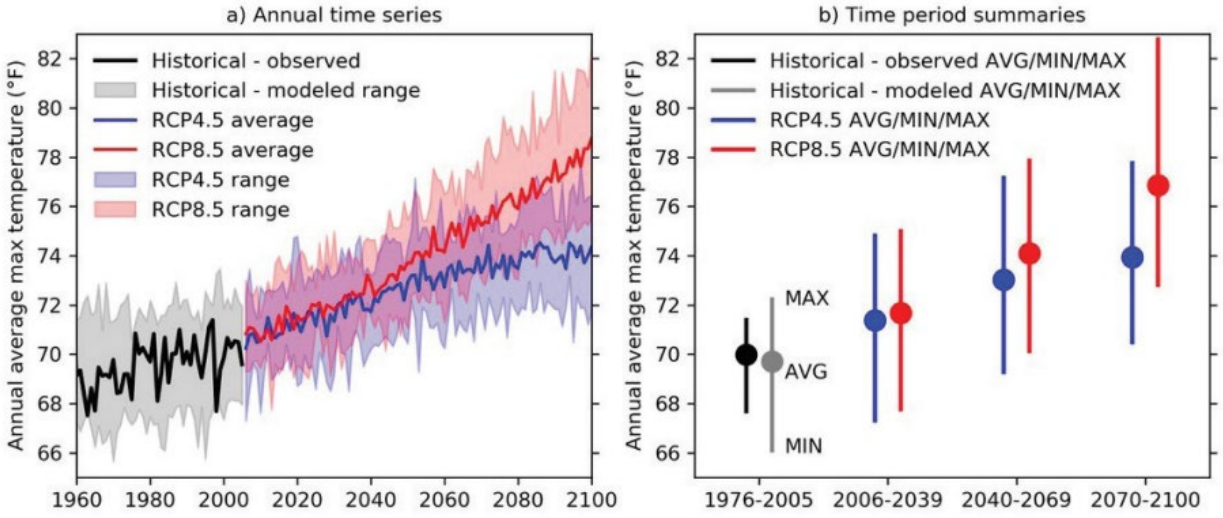


Figure 84: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in the BCPUD. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of the BCPUD where heat builds in developed areas, including in the unincorporated community of Bolinas. Heat waves also tax the energy grid. Future development in the Marin County OA including the BCPUD could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including the BCPUD as conditions become hotter and drier. These effects will primarily be felt in the upland and marshland areas of the District where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around the BCPUD could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.10 SEVERE WEATHER – HIGH WIND & TORNADO

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 39).

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Straight-line winds may exacerbate existing weather conditions by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snow storms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel around the region, and increasing the ferocity of exiting fires. These winds may cause personal injury, damage crops, push automobiles off roads, damage roofs and structures, overturn mobile homes, tear roofs off of houses, topple trees, snap power lines, shatter windows, sandblast paint from cars, and cause secondary damage due to flying debris. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire. Due to the wildfire threat posed by trees falling or leaning on power lines as a result of high winds and other conditions, Pacific Gas and Electric began initiating PSPS events after the 2017 Northern California Wildfires and the 2018 Camp Fire (see wildfire profile) in order to prevent the start of wildfires. These PSPS events can have numerous impacts on residents who rely on electricity for cooling their homes, powering water pumps, keeping critical medical equipment operable and other needs.

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 85: Beaufort Wind Scale
Source: NOAA

In the Marin County OA, storms with strong winds knock down trees and power lines nearly every year and continue to slowly erode vulnerable coastal areas and critical inland ponds (i.e. reservoirs/dams, berms/levees around stormwater detention ponds, wastewater treatment/storage ponds). Although the entire OA is affected by wind, coastal areas tend to be impacted more frequently by the strongest winds (9+ on the Beaufort scale) than inland areas. The Marin County OA's coastal areas have small resident populations but large visiting populations, such as Muir Beach, Stinson Beach, and Bolinas that can be impacted by strong winds. Beachgoers and boaters would be particularly impacted by wind hazards. Tourism is a key part of the economy in Marin County, particularly in coastal communities, and thus there are potentially significant economic impacts of wind events. Some communities, such as Oceana Marin and Olema, rely on water and wastewater infrastructure that has potential to be impacted by coastal erosion, wind driving up wave elevations, and erosion from waves forming due to

wind over treatment and storage ponds. Inland critical ponds are also impacted by wind-driven wave erosion such as dams on drinking water reservoirs, and levees/berms containing stormwater retention and detention ponds. Across the county powerlines are potentially impacted by wind, potentially affecting commercial, industrial, and residential areas, and most years downed trees lead to temporary road closures.

1/2023 – In unincorporated Bolinas, extreme high winds estimated at close to 100 mph knocked down numerous trees across Mesa Road, closing the road several times, causing power outages and, in one case, injury. These winds also toppled a tree across Terrace Avenue, closing that road at the same time one of the Mesa Road closures occurred, temporarily blocking both egress roads out of town.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 40) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 86: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 87: Waterspout Formation
Source: MarineInsights

All of the BCPUD is susceptible to storms and damage from wind and tornadoes, though the higher elevation areas throughout the District have increased susceptibility due to a greater number of trees. Lower elevations could be susceptible to a waterspout. Drought and/or heavy rainfall can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage critical facilities and infrastructure and endanger the public. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, impacting public safety and affecting the delivery of services and access to critical facilities.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and the BCPUD. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in the BCPUD as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of the BCPUD with high tree cover including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.11 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by the BCPUD would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the District. A tsunami poses threat primarily to the coastal areas of the District.

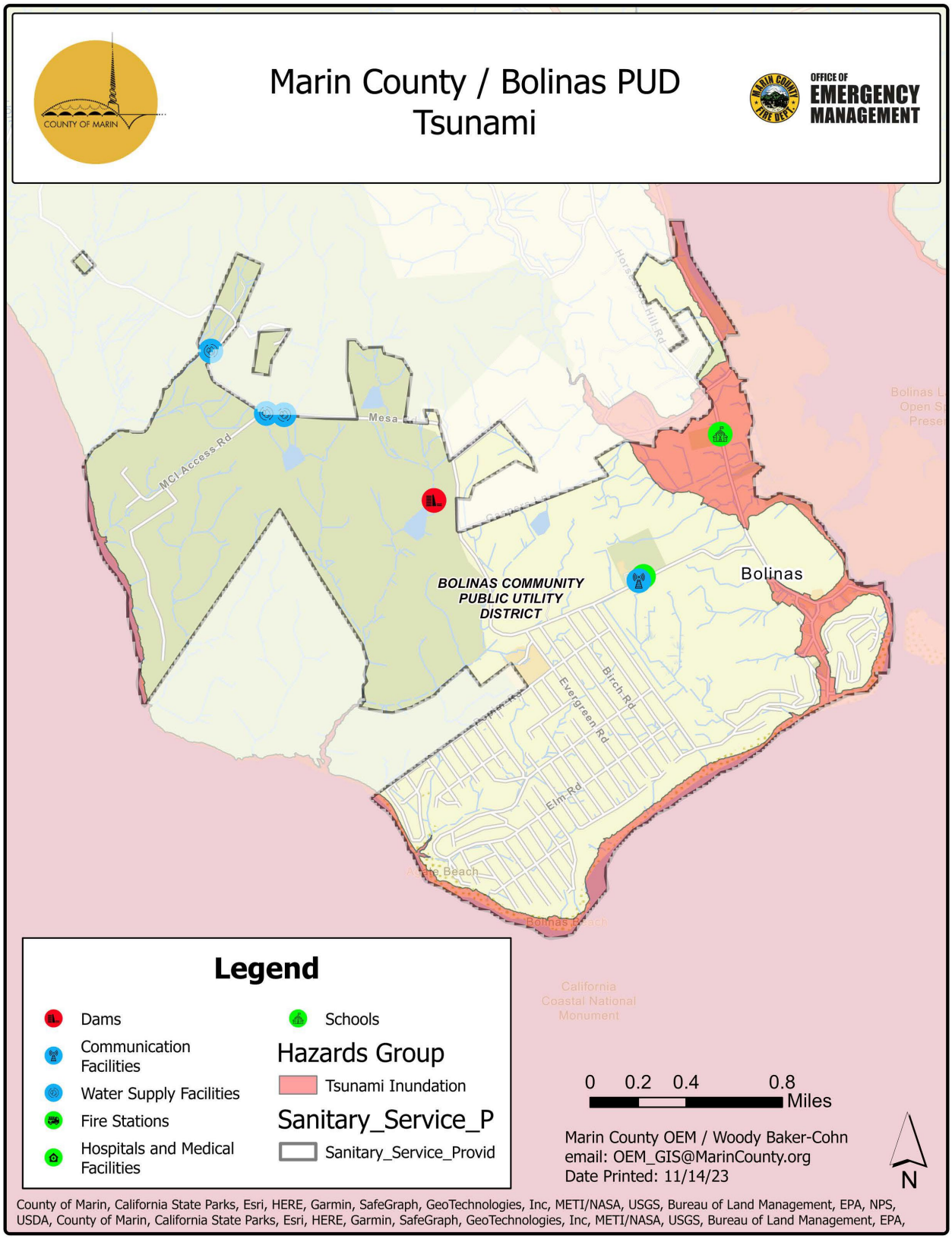


Figure 88: BCPUD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

The BCPUD has never experienced a significant tsunami however, given its proximity to the San Francisco Bay, it is within a tsunami zone and could potentially experience the impacts of one, primarily in downtown Bolinas and along Olema-Bolinas Road.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including the BCPUD, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including the BCPUD.

2.2.12 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new developments, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure

easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. Marin County is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerous fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in Marin County, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. Marin County is one of six counties in the state who contract with CAL FIRE to protect SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 43 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

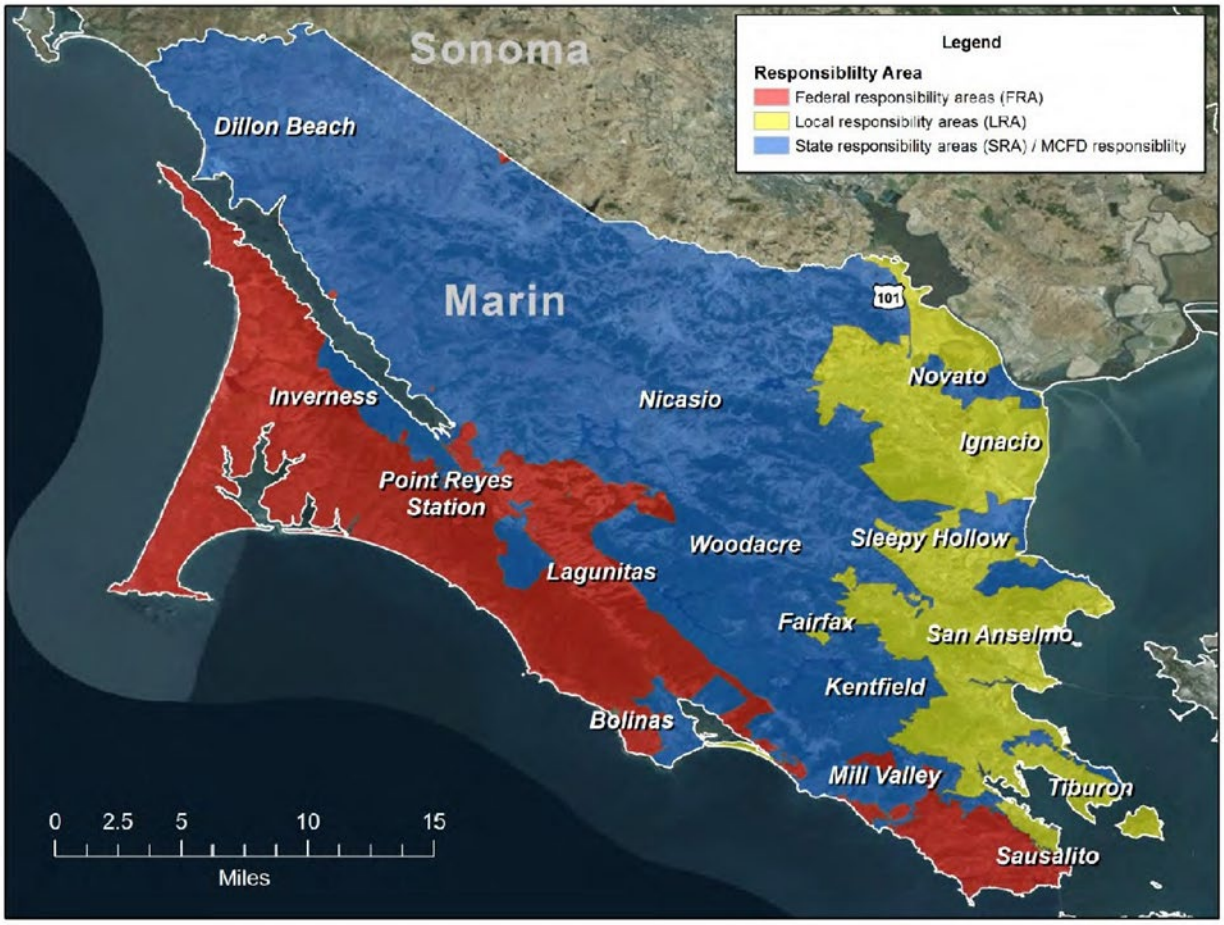


Figure 89: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

Marin County is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as winter. While these general weather conditions are fairly representative of the typical Marin County weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over southern Marin County near the San Francisco Bay). The fog often penetrates into the inland valleys of northern and central Marin County, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, and Lucas Valleys. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Great Basin to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph) and gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires.

A few times per year in the summer and early fall, monsoonal flow from Mexico brings in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, the lightning can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the CWPP, an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

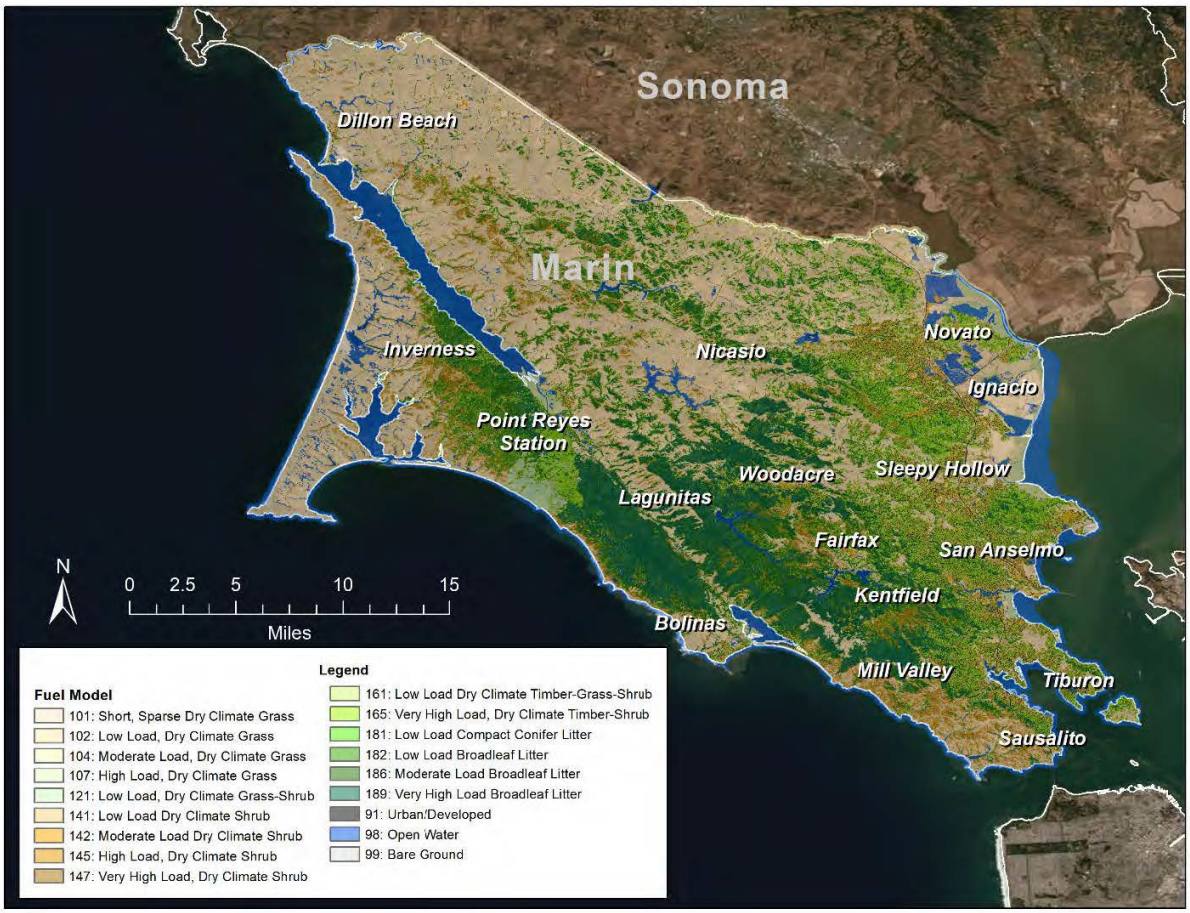


Figure 90: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread

mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt.

Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles

can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA.

A wildfire in the BCPUD would most likely occur in the areas north of the District (i.e., in the Point Reyes National Seashore) where there is more forested terrain. With the exception of the BCPUD's raw water transmission pipeline and it two impoundment structures, there are no District critical facilities in these areas, although the BCPUD's jurisdictional boundaries are relatively small, so the critical facilities are nearby this forested terrain. District critical facilities, including the Woodrat 1 Reservoir/dam, the Woodrat 2 Reservoir/dam, the Woodrat Water Treatment Plant, and the BCPUD's treated water storage tanks and booster pump station are in a Moderate FHSZ and could be impacted by a brush fire in the vegetated areas of the District. All of the BCPUD could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of wildlfire anywhere in Marin County or the surrounding region. As wildland areas around the District become drier due to climate change and drought, the risk of a wildfire or brush fire occurring and impacting the District will continue to increase as open spaces experience drier conditions.

The BCPUD has never experienced a major wildfire or brush fire.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

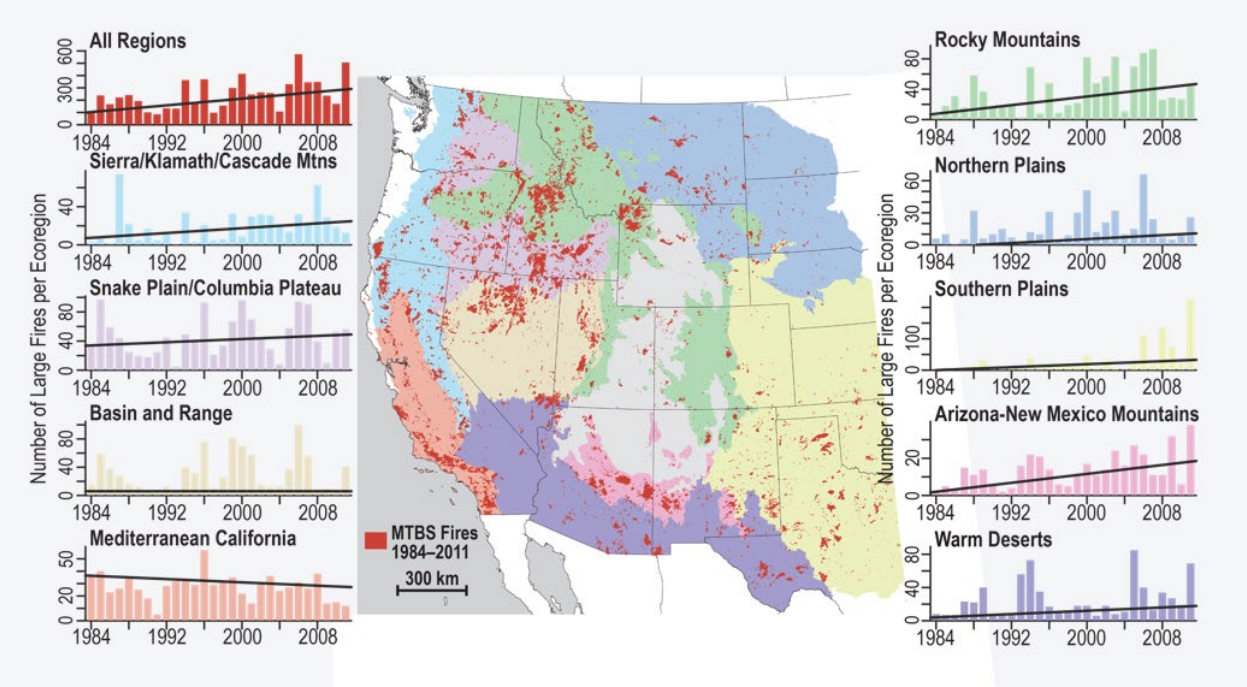


Figure 91: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including the BCPUD is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas the BCPUD. Future development in the WUI throughout the Bolinas Community PUD will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the BCPUD WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the marshlands in the District would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

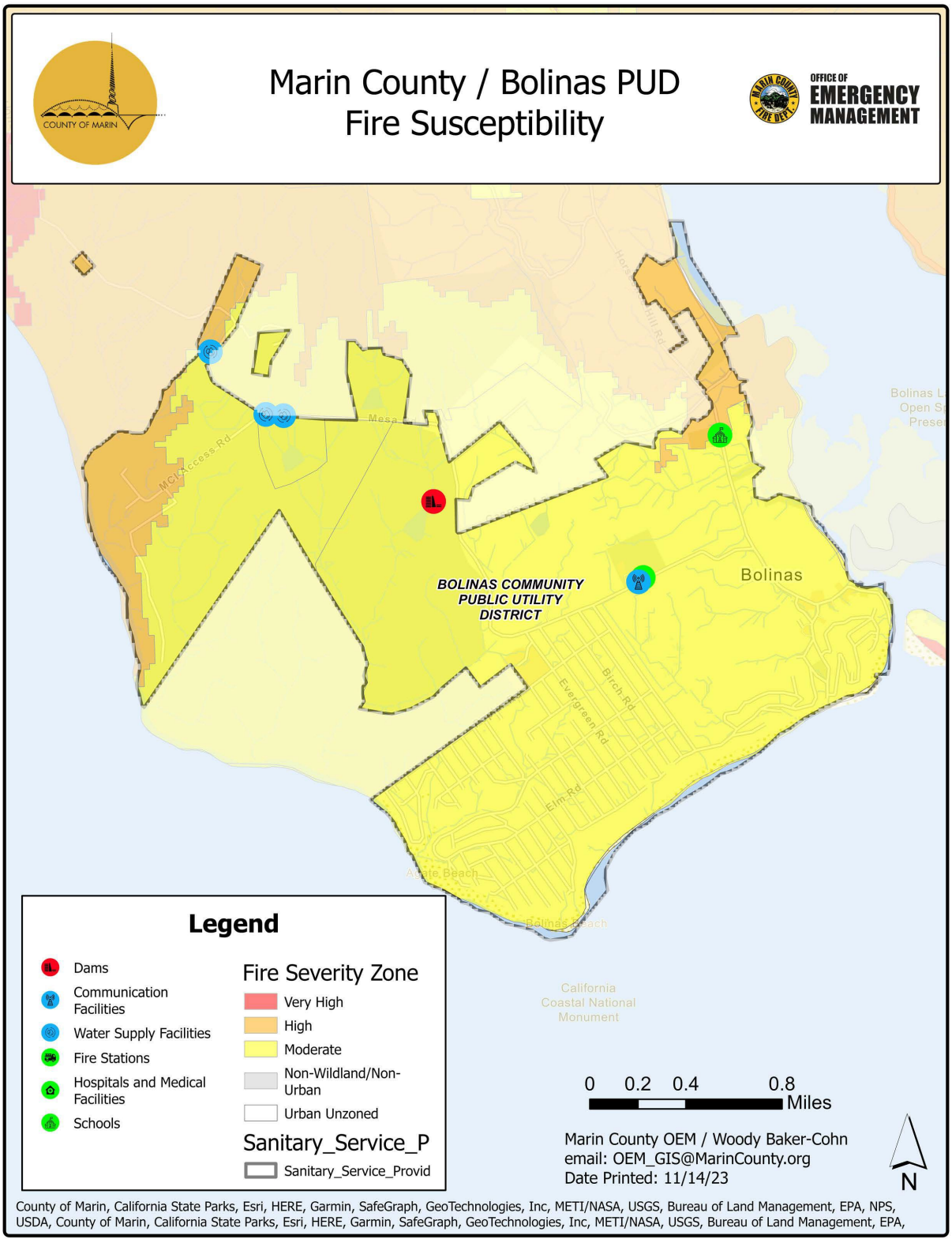


Figure 92: BCPUD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

3.0 MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

There has been some development within the Bolinas Community Public Utility District over the last five years. However, the development has been in the form of numerous capital improvements to existing district facilities or within the facility footprint of the BCPUD. There has not been any increased risk to the District as a result of new development.

As a small special district in unincorporated Marin County, the BCPUD does not have jurisdiction over land use or planning in the community (that responsibility lies with the Marin County Community Development Agency). Significant development is not anticipated for Bolinas within the next 5 years given development constraints and the limited nature of the local water supply and consequent moratorium on new connections to the water system. The table below identifies projects planned for new district facilities or infrastructure in the next five years.

Future land use and growth management strategies in the Bolinas Community Public Utility District are consistent with priorities detailed in the 2023 Marin County MJHMP and aim to concentrate future development into and toward existing areas away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in BCPUD has occurred and will continue to occur throughout the District in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 9: BCPUD Future Growth Areas						
Project Location	**# of Units**	**# of Parcels**	**Application Status**	**Acres**	**Fire Severity Zone**	**Flood Zone**
New Administrative Building – 270 Elm Road, Bolinas	1	1	3-5 years		Moderate	None
Wharf Well – new treatment facilities (31 Wharf Road, Bolinas)	N/A	1	Completion 12/31/24		Moderate	None
Resource Recovery Well – new treatment facilities (100 Mesa Road, Bolinas)	N/A	2	Completion 12/31/24		Moderate	None
Connect homes on Canyon Road to the BCPUD's sewer system.	N/A	6	2 years		Moderate	None
Total	**1**	**10**				

Table 36: BCPUD Future Growth Areas
Source: Bolinas Community PUD

3.2 CAPABILITY ASSESSMENT

The Bolinas Community Public Utility District did not participate in the 2018 MJHMP update. However, the strategies to support the overall District priorities are reflected in the sections below. Several actions were added to coincide with the priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the District's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the Bolinas Community PUD an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Community Wildfire Protection Plan:** The District plans to take an active role in mitigation actions to enhance wildfire protection.
- **StormReady certification and Firewise Communities certification:** The District will consider participation in these programs.

Table 10: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive /Master Plan	Yes	Integrated Coastal Watershed Management Plan (July 2007) addresses water supply and reliability, water and wastewater treatment, and water conservation, among other things in the Tomales Bay and neighboring watersheds; it identifies hazards and watershed planning efforts; may be used to implement mitigation actions. Marin County LAFCO Countywide Water Service Study (March 2016) – independent assessment of public water service in Marin County over next 5 – 10 years, including

		but not limited to an evaluation of supply and demand Countywide and within service areas; may be used to implement mitigation actions. BCPUD Sewer System Management Plan (2023); identifies planned improvement projects, can be used to implement mitigation actions.
Strategic Plan	No	
Capital Improvements Plan	Yes	Hazards identified in the district's Five-Year CIP are funded based on priority via the district's annual budget process. Mitigation projects could be included in the CIP. The Board of Directors reviews and approves the CIP funding on an annual basis. If the Board approves CIP funding, the plan supports implementation of hazard mitigation actions and addresses resiliency/redundancy in general.
Economic Development Plan	No	N/A
Local Emergency Operations Plan	Yes	The district's plan addresses district-specific responses to hazards and various emergencies that may involve district facilities; the EOP does not identify specific projects to mitigate impacts of hazards.
Continuity of Operations Plan	Yes	The district's operations plan is designed to ensure continuity of operations for water and wastewater systems; the operations plan does not identify specific projects to mitigate impacts of hazards.
Flood Mitigation Plan (FMP)	No	N/A
Engineering Studies for Streams	Yes	The district has developed a base flow recession model for the Arroyo Hondo Creek; this model can be used to implement drought-related hazard mitigation actions.
Open Space Management Plan	No	N/A
Regional Transportation Plan (RTP)	No	N/A
Stormwater Management Plan/Program	No	N/A
Community Wildfire Protection Plan	Yes	Marin County Community Wildfire Protection Plan; identifies hazards, can be used to implement wildfire mitigation actions.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Yes	Marin County Local Coastal Program and Marin County Collaboration: Sea-level Marin Adaptation Response Team (C-SMART); both programs identify hazards and can be used to implement mitigation actions.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Yes	Yes, District adheres to city, county, state, & federal codes.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	Yes, District adheres to city, county, state, & federal codes.

Fire department ISO rating:	No	
Site plan review requirements	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
District Code	Yes	District ordinances and resolutions authorize, among other things, the collection of water and sewer service fees to fund all operations, capital improvements, debt service and mitigation projects. Adequately administered; no enforcement relating to hazard impacts.
Floodplain ordinance	Yes	Yes, District participates with Marin County.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Yes, District participates with Marin County plan reviews.
Flood insurance rate maps	Yes	Yes, District participates Marin County plan reviews.
Elevation Certificates	Yes	Yes, District participates Marin County plan reviews.
Acquisition of land for open space and public recreation uses	No	
Erosion or sediment control program	Yes	Yes, District participates Marin County plan reviews.

Table 37: Bolinas Community Public Utility District Legal and Regulatory Capabilities
Source: Bolinas Community Public Utility District

Bolinas Community Public Utility District Comprehensive Plan or Master Plan

The BCPUD's jurisdictional boundaries are located entirely within unincorporated Marin County, which is required to have a General Plan or Master Plan per California Government Code Section 65300. Please see the Marin County General Plan for Details.

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the District personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 11: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Operations Department	Yes	The BCPUD's Operations staff have a variety of duties, principally related to the operation and maintenance of the BCPUD's critical infrastructure to ensure the safe and reliable provision of utility services within the district.

Administrative and Financial Services	Yes	The BCPUD's administrative and financial functions are performed by the General Manager and Administrative Assistant, subject to oversight by the Board of Directors; these positions work together closely to handle all administrative and financial responsibilities of the district.
Hazard Mitigation Planning	Yes	The BCPUD General Manager and Chief Operator (for Water and Wastewater) coordinate with the Operations Staff to evaluate, plan and implement the district's hazard mitigation projects.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	BCPUD operations staff conduct vegetation management (mowing, brush removal, tree pruning/thinning/removal) on district lands and easements to reduce wildfire risk and facilitate access; culvert clearing and road-side ditch maintenance to reduce flooding.
Mutual aid agreements	Yes	The BCPUD is a member of CalWARN and has a mutual aid agreement with the Bolinas Fire Protection District; informal mutual agreements are under discussion with neighboring water districts.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Yes	The BCPUD's water and wastewater treatment facilities have alarm systems to notify staff in the event of a mechanical or other emergency failure of critical facilities.
Grant writing	Yes	The BCPUD's General Manager administers grants from federal and state entities (such as FEMA, CalFire and the California Department of Water Resources) to conduct hazard mitigation activities such as fire fuel reduction projects on district lands (to reduce wildfire risk) and to connect existing groundwater wells to the district's water system (to reduce drought risk).
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Emergency Manager	Yes	The BCPUD's General Manager and Chief Operator serve this role and coordinate with other districts and/or Marin County as needed during emergencies; they are trained on hazard mitigation. The District plans to work with Marin OEM for EM training.
Civil Engineer	Yes	The district's consulting water and wastewater engineers assist the district in the enforcement of regulations, have training on hazard mitigation, and facilitate coordination with other agencies as needed.
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Yes	The BCPUD does not have an in-house engineering department but rather contracts with outside consulting engineers; see response above re: the district's Operations Department. The district's General Manager and Chief Operator oversee the planning, permitting, design and construction management of the water and

		sewer facilities serving district customers.
Fire Protection District Staff	No	Fire protection in the district is the responsibility of the Bolinas Fire Protection District and Marin County Fire.

Table 38: Bolinas Community Public Utility District Administrative and Technical Capabilities
Source: **Bolinas Community Public Utility District**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 12: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	The Board of Directors reviews and approves CIP funding on an annual basis, which supports implementation of projects that often mitigate impacts from hazards, development, or address resiliency/redundancy in general.
Fees for water, sewer, gas, or electric services	Yes	The district has the authority to assess water and sewer service fees to fund operations, maintenance, capital improvement projects, debt service, staff salaries and benefits and various other expenses. When mitigation projects are identified in the CIP, service fee revenue can be adopted with the annual CIP budget to fund projects that have a mitigation component.
Impact fees for new development	No	
Storm water utility fee	Yes	The district has the authority to assess a septic/drainage service fee. This resource has been used to improve surface water drainage to improve septic system performance and can be used to fund future mitigation actions (property flooding).
Incur debt through general obligation bonds and/or special tax bonds	Yes	The BCPUD has incurred debt through general obligation and special tax bonds, as well as loans, to finance larger capital improvement projects, and these resources can be used to fund future mitigation actions.
Other federal funding programs	Yes	USDA Rural Development funding programs have been used by the BCPUD in the past for large capital improvement projects and other federal grant program funding and infrastructure awards could be used to fund hazard mitigation projects to address sea level rise, drought, wildfire, earthquake, and severe weather event

		hazards.
State funding programs	Yes	State grant program funding could be used to fund hazard mitigation projects, such as sea-level rise, wildfire prevention and drought contingency. California's Drinking Water State Revolving Fund, Clean Water State Revolving Fund, CalFIRE's Fire Prevention and the California Department of Water Resources' Small Communities Drought Relief Fund have been used by the BCPUD in the past for infrastructure upgrades and fire fuel reduction projects and can be used to fund future mitigation actions.

Table 39: Bolinas Community Public Utility District Fiscal Capabilities
Source: **Bolinas Community Public Utility District**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Bolinas Community Public Utility District and the Bolinas Community Public Utility District partnerships utilized to promote those programs.

Table 13: Bolinas Community Public Utility District Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Yes, the community of Bolinas has many local citizen groups and non-profit organizations dedicated to disaster and emergency preparedness, wildfire risk reduction, preservation of emergency access and egress, preservation of critical facilities and roads, as well as environmental protection. These groups and organizations have partnered with the BCPUD in the past (and several are doing so now) on hazard mitigation projects and would be very important partners in the implementation of future mitigation activities.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	The district is actively engaged with the community of Bolinas via the Board of Directors' regular monthly meetings, a quarterly newsletter, periodic special mailings, and social media on a variety of topics including, but not limited to, responsible water use, sewer system "dos and don'ts", solid waste disposal rules, and so forth. These platforms can be used to help implement future mitigation activities.
Public-private partnership initiatives addressing disaster-related issues	Yes	The district has participated in a public-private partnership to stabilize a critical access road where critical infrastructure (water and sewer mains) are located (Terrace Avenue) in Bolinas and this partnership has continued as the road is threatened by bluff erosion. The district also is working with of a local citizens' group to evaluate and address the wildfire and public safety risks

		posed by a eucalyptus grove on district lands. These and other public-private partnerships can be used to help implement future mitigation activities.

Table 40: Bolinas Community Public Utility District Community Outreach
Source: **Bolinas Community Public Utility District**

3.2.5 Participation in the National Flood Insurance Program

As a Special District the Bolinas Community Public Utility District does not participate in the national flood insurance program. The BCPUD does not have any facilities within a flood plain and does not have any repetitive loss and severe repetitive loss structures are defined as a structures covered under an NFIP flood insurance policy (44 CFR § 77.2(i)). None of the jurisdictions the BCPUD serves are incorporated. However, Marin County is a participant in the NFIP.

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

The Bolinas Community Public Utility District did not participate in the 2018 Marin County MJHMP and therefore, did not have any previous mitigation actions.

3.5 Hazard Mitigation Actions

The 2023 Marin County MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Bolinas Community Public Utility District based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires District Board of Directors regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 14 lists the Current Hazard Mitigation Actions for the Bolinas Community Public Utility District.

Table 14: Bolinas Community Public Utility District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
BC-1	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies or risk.	All Hazards/ 1, 2, 3, 4, 5	Bolinas Community Public Utility District / Marin County	New (2023)	Cost TBD: General Funds	1-2 years/ High	
BC-2	Emergency Operations Plan (EOP) Update	All Hazards 1, 2, 3, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost: TBD General Fund	1-2 years/ High	Update to existing EOP; in progress.
BC-3	Emergency Generator(s)	All Hazards 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1 - 5 years/ High	Ongoing – secure funding for installation of permanent generators at critical district facilities.
BC-4	Inspect Woodrat 1 and Woodrat 2 reservoir impoundments and install any recommended monitoring technology and/or improvements to structure(s) or spillway(s).	Dam Failure/ 1, 2, 4, 5, 6	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, [other grant sources)	1-2 years/ High	Reduces the risk of a dam failure that could destroy the district's water treatment plant (located below Woodrat 1) and/or these emergency stored water supplies.
BC-5	Relocate gravity sewer main off of Terrace Avenue at Surfer's Overlook	Debris Flow, Erosion, Landslide, Post-Fire Debris Flow/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ High	Eliminates the risk of a sewer main failure/spill due to bluff erosion at this location (BCPUD relocated its high pressure water main off of this location in 2013).
BC-6	Repair County-owned seawall under Terrace Avenue at Surfer's Overlook to stabilize it and prevent land subsidence.	Debris Flow/ 1, 2, 4, 5	Bolinas Community Public Utility District; Marin County Department of Public Works	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Reduces risk of failure of Terrace Avenue, a critical public egress road, and risk of sewer main failure/spill due to bluff erosion at this location.
BC-7	Retrofit or replace the existing concrete dam at the district's upper diversion point on the Arroyo Hondo Creek.	Debris Flow, Erosion, Landslide,	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ Medium	Eliminates the potential for impoundment of erosion materials/debris behind this structure and the need for

		Post-Fire Debris Flow/ 1, 2, 4, 5					associated reservoir siltation removal projects.
BC-8	Inspect and install any necessary improvements to/replacement of the existing radial gate at the district's lower diversion point on the Arroyo Hondo Creek.	Drought/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Eliminate leaks/water loss currently occurring when this diversion point is in use to improve drought resiliency.
BC-9	Engage consultant to evaluate feasibility of desalination, water recycling or additional groundwater sources as supplemental sources of water supply.	Drought/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ High	Add resiliency to the district's water supply and prepare for climate change impacts to surface water sources.
BC-10	Seismic retrofit of the district's West Tank (potable water storage tank, 440,000 gallons)	Earthquake/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Retrofit of critical water storage tank that is vulnerable to damage in an earthquake (BCPUD completed retrofit of East Tank in 2021) to ensure reliability of district's water supply.
BC-11	Replace existing district office building	Earthquake/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ Medium	Building is 100+ years old and not built to current code; inspection confirms replacement needed; site assessment underway. Eliminate threat to public safety.
BC-12	Replace existing A/C water and/or sewer mains with C900	Earthquake/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3 – 5 years/ Medium	Reduce possibility of catastrophic failure of critical facilities during earthquake.
BC-13	Engage engineers to evaluate the feasibility of a project to render the district's raw water transmission line less vulnerable to natural disasters, erosion, land subsidence and earthquakes.	Earthquake, Debris Flow, Drought, Severe Weather-Heat/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Reduces the risk of loss of the district's primary raw water supply as a result of numerous different natural disasters.
BC-14	Conduct feasibility analysis and upgrade sewer treatment facility to perform during extreme rainfall (50 year+) events.	Flooding/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ Medium	Enable the district to operate in compliance with its Waste Discharge Order and eliminate the possibility of discharging untreated wastewater.

BC-15	Convert Wharf Road Lift Station to a submersible pump station and install protective coating and associated improvement to wet well	Sea Level Rise/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost: $1 million: HMGP, BRIC, CDAA	1-2 years/ High	Adapt the facility in light of sea level rise
BC-16	Repair County-owned seawall under Wharf Road to stabilize it and prevent land subsidence.	Land Subsidence (Sinkhole)/ 1, 2, 4, 5	Bolinas Community Public Utility District, Marin County Department of Public Works	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Eliminate recurrent sinkholes in Wharf Road and protect critical district infrastructure (water and sewer).
BC-17	Wharf Road Slip-line	Land Subsidence (Sinkhole)/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3 – 5 years/ Medium	Slip line sewer to prevent raw sewage spills into the Bolinas Lagoon.
BC-18	Inspect sewage treatment and storage pond levees and install any recommended improvements.	Levee Failure/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	2 – 5 years/ High	Reduces risk of levee failure and catastrophic flooding
BC-19	Assess and remove trees (or portions thereof) on district properties that pose a threat to public safety during severe wind events.	Severe Weather – Wind, Tornado/ 1, 2, 4, 5	Bolinas Community Public Utility District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-2 years/ High	Reduce threat to public safety during extreme wind event storms in Bolinas.
BC-20	Consult with Fire authorities and licensed tree professionals and implement recommended projects to treat/remove trees on district property and replace them with safer vegetation.	Wildfire/ 1, 2, 4, 5	BCPUD, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Fire Safe Marin	1-2 years/ High	Reduces chance of wildland fire and supports environmental restoration.

Table 41: Bolinas Community Public Utility District Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Bolinas Community Public Utility District. The planning team for the Bolinas Community Public Utility District identified and prioritized the mitigation actions as detailed in Table 14, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as master planning, strategic planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where the 2023 MJHMP will be used for further integration.

The planning team for the Bolinas Community Public Utility District will maintain this plan and will serve as a lead staff for grant project applications on District projects selected for application under the Hazard Mitigation Assistance grant programs.

Where possible the Bolinas Community Public Utility District will use existing plans and/or programs to implement hazard mitigation actions within the District and through the coordinated efforts with the County, the Bolinas Fire Protection District, and other state or local entities, as appropriate.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Bolinas Community Public Utility District already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

District Master & Strategic Plans - Integrates hazard mitigation through the consideration of hazards most likely to impact the district.

District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the district.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while

promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

4. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
5. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
6. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

As a small special district in unincorporated Marin County, the BCPUD does not have jurisdiction over land use or planning in the community (that responsibility lies with the Marin County Community Development Agency). Significant development is not anticipated for Bolinas within the next 5 years given development constraints, the limited nature of the local water supply and consequent moratorium on new connections to the water system, as well as an ongoing moratorium on new connections to the sewer system.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in BCPUD has occurred and will continue to occur throughout the District in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

4.0 Plan Review, Evaluation, and Implementation

The strategies presented are deemed appropriate and effective by recommendation of the Bolinas Community Public Utility District.

4.1 Plan Adoption

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Bolinas Community Public Utility District Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 Plan Monitoring

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Bolinas Community PUD plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Bolinas Community PUD is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Bolinas Community PUD General Manager will monitor and update the Bolinas Community PUD Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan

requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the Bolinas Community PUD, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Bolinas Community PUD, to evaluate the plan after each update meeting.

4.4 Plan Update

The Bolinas Community PUD General Manager will monitor and update the Bolinas Community PUD Annex to the Marin County OA MJHMP. During the five-year update cycle, the Bolinas Community PUD and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local

stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

List of Figures

Figure 1: Marin County OEM MJHMP Website and Bolinas CPUD Public Engagement..... 2-18
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting..... 2-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release..... 2-20
Figure 4: Hazard Mitigation Plan Survey..... 2-22
Figure 5: Map of the Bolinas Community Public Utility District..... 2-24
Figure 6: Map of the Bolinas Community Public Utility District and Jurisdictions..... 2-25
Figure 7: The BCPUD Precipitation and Monthly Temperatures..... 2-28
Figure 8: BCPUD Social Vulnerability Map Census Tract 1321.00..... 2-31
Figure 9: Bolinas Community Public Utility District Critical Facilities..... 2-34
Figure 10: BCPUD Risk Assessment – Planning Team Top Hazards..... 2-35
Figure 11: Hazard Risk Categorization..... 2-35
Figure 12: NASA Global Temperature Change CO2 Gas..... 2-39
Figure 13: NASA Global Temperature Change 1884 to 2022..... 2-39
Figure 14: NASA Global Temperature Change Sea Level..... 2-40
Figure 15: Annual Mean Sea Level Trends..... 2-42
Figure 16: Dams in and around the Marin County OA..... 2-48
Figure 17: Marin County Dam Inundation Susceptibility to Critical Facilities..... 2-49
Figure 18: Woodrat 1 Reservoir and BCPUD Treatment Plant..... 2-50
Figure 19: Landslide Susceptibility Classes..... 2-53
Figure 20: Mud Flow Areas..... 2-54
Figure 21: BCPUD Debris Flow Critical Facilities and Infrastructure..... 2-55
Figure 22: Modified Mercalli Intensity Scale..... 2-59
Figure 23: Mercalli Scale vs. Magnitude..... 2-59
Figure 24: Soil Types..... 2-60
Figure 25: Marin County Earthquake Impact..... 2-62
Figure 26: BCPUD Earthquake Critical Facilities and Infrastructure..... 2-63
Figure 27: Diagram of an Atmospheric River Event..... 2-66
Figure 28: BCPUD Flooding Critical Facilities and Infrastructure..... 2-68
Figure 29: Dissolution Sinkhole Formation..... 2-70
Figure 30: Cover-Subsidence Sinkhole Formation..... 2-70
Figure 31: Cover-Collapse Sinkhole Formation..... 2-71
Figure 32: Levee Failure Mechanisms..... 2-72
Figure 33: Bolinas CPUD Primary Treatment Ponds Levees..... 2-73
Figure 34: Marin County Sea Level Rise Impact..... 2-77
Figure 35: BCPUD Sea Level Rise Impact on Critical Facilities..... 2-78
Figure 36: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100..... 2-79
Figure 37: Heat Index..... 2-80
Figure 38: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100..... 2-81
Figure 39: Beaufort Wind Scale..... 2-83
Figure 40: Enhanced Fujita Scale..... 2-84
Figure 41: Waterspout Formation..... 2-85
Figure 42: BCPUD Tsunami Critical Facilities and Infrastructure..... 2-87
Figure 43: Federal, State and Local Responsibility Areas in the Marin County OA..... 2-90

Figure 44: Fuel Model Map for the Marin County OA 2-93
Figure 45: Trends in the Annual Number of Large Wildfires in the United States..... 2-97
Figure 46: BCPUD Wildfire Critical Facilities and Infrastructure..... 2-98

List of Tables

Table 1: 2023 MJHMP Planning Team Members..... 2-12
Table 2: BCPUD & Marin County MJHMP Planning Meetings..... 2-16
Table 3: NRI Hazards and Marin County MJHMP Hazards..... 2-29
Table 4: NRI Hazard Type Risk Index for Census Tract 1321.00 2-30
Table 5: Bolinas Community Public Utility District Critical Facilities 2-33
Table 6: Select Hazards Magnitude/ Severity Scale or Index..... 2-36
Table 7: Bolinas Community PUD Hazard Risk Assessment 2-44
Table 8: County of Marin Hazard Risk Assessment..... 2-45
Table 9: BCPUD Future Growth Areas 2-99
Table 10: Bolinas Community Public Utility District Legal and Regulatory Capabilities 2-102
Table 11: Bolinas Community Public Utility District Administrative and Technical Capabilities.... 2-104
Table 12: Bolinas Community Public Utility District Fiscal Capabilities..... 2-105
Table 13: Bolinas Community Public Utility District Community Outreach..... 2-106
Table 14: Bolinas Community Public Utility District Current Hazard Mitigation Actions 2-113

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

3. Town of Corte Madera and Sanitary District Number 2 Profile

THE TOWN OF CORTE MADERA
MARIN COUNTY CALIFORNIA

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Town of Corte Madera and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the Town of Corte Madera more disaster resistant and sustainable.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS 3-3
TABLE OF CONTENTS 3-5
SECTION 1.0: INTRODUCTION 3-7
1.1 Introduction 3-7
1.2 Planning Process 3-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 3-8
1.2.2 Steering Committee Planning Process 3-9
1.2.3 Coordination with Stakeholders and Agencies 3-9
1.2.4 Public Engagement 3-16
1.3 Overview and History 3-24
1.4 Government 3-27
1.5 Sanitary District Number 2 3-27
1.6 History and Administration of Sanitary District Number 2 3-28
1.5 Weather and Climate 3-29
1.6 Demographics 3-29
1.7 Social Vulnerability and Risk 3-33
1.8 Economy and Tax Base 3-38
1.9 Critical Facilities 3-39
1.10 Historical Properties 3-40
SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT 3-41
2.1 Climate Change 3-43
2.2 Hazards 3-51
2.2.1 Dam Failure 3-52
2.2.2 Debris Flows 3-57
2.2.3 Drought 3-62
2.2.4 Earthquake 3-64
2.2.5 Flooding 3-71
2.2.6 Land Subsidence 3-78
2.2.7 Levee Failure 3-81
2.2.8 Sea Level Rise 3-82
2.2.9 Severe Weather – Extreme Heat 3-88
2.2.10 Severe Weather – High Wind & Tornado 3-90
2.2.11 Tsunami 3-93

2.2.12 Wildfire 3-95
SECTION 3.0: MITIGATION STRATEGY 3-107
3.1 Changes in Development 3-107
3.2 Capability Assessment 3-108
3.2.1 Regulatory Capabilities 3-108
3.2.2 Administrative and Technical Capabilities 3-119
3.2.3 Fiscal Capabilities 3-121
3.2.4 Community Outreach 3-122
3.2.5 Participation in the National Flood Insurance Program 3-123
3.3 Mitigation Goals 3-127
3.4 Status of Previous Mitigation Actions 3-129
3.5 Hazard Mitigation Actions 3-130
3.6 Progress in Local Mitigation Efforts 3-137
3.7 Plan Integration 3-137
3.8 Future Development Trends 3-138
SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION 3-140
4.1 Plan Adoption 3-140
4.2 Plan Monitoring 3-140
4.3 Plan Evaluation 3-141
4.4 Plan Update 3-141
FIGURES AND TABLES 3-143
ACRONYMS/ABBREVIATIONS 3-145

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Town of Corte Madera, Community Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Town of Corte Madera.

1.2 PLANNING PROCESS

The majority of Marin County is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Marin County and Town of Corte Madera Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small participating jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County, the Town of Corte Madera and the other participating planning areas to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving the Town of Corte Madera and all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County is very different from most California Counties in that the populated portion of the County where the participating jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Marin County and Town of Corte Madera Steering Committee to establish a more robust Planning Team representing local Corte Madera, countywide, regional, state, and federal stakeholders servicing the Marin County and Town of Corte Madera planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County and Town of Corte Madera Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the Town of Corte Madera involved additional internal planning team members to support the broader planning process. The Town of Corte Madera jurisdictional representatives for the coordinated Marin

County Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
RJ Suokko, Director of Public Works
Telephone: 415-927-5118
E-mail Address: rsuokko@tcmmail.org

Alternate Point of Contact
Chris Good, Senior Civil Engineer
Telephone: 415-927-5794
E-mail Address: cgood@tcmmail.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members				
Jurisdiction	**Name**	**Title/ Department**	**Phone**	**Email**
Corte Madera	RJ Suokko	Director of Public Works	415-927-5118	rsuokko@tcmmail.org
Corte Madera	Chris Good	Senior Civil Engineer	415-927-5794	cgood@tcmmail.org
Corte Madera	Adam Wolff	Town Manager		
Central Marin Fire	Ezra Colman	Battalion Chief/Fire	415-927-5077	ecolman@centralmarinfire.org
Corte Madera/ Sanitary District No. 2	RJ Suokko	Director of Public Works District Manager	415-927-5118	rsuokko@tcmmail.org
Corte Madera	Martha Battaglia	Senior Planner	415-927-5791	mbattaglia@tcmmail.org
Corte Madera	Phoebe Goulden	Climate Action and Adaptation Coordinator	628-258-0327	pgoulden@tcmmail.org

Table 42: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the Town of Corte Madera. All participating jurisdictions are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Marin County and Town of Corte Madera Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Marin County and Town of Corte Madera Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Marin County and Town of Corte Madera Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Marin County and Town of Corte Madera Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Marin County and Town of Corte Madera Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County and Town websites. The County and City website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit

interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Town of Corte Madera Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Town of Corte Madera communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Town of Corte Madera Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Town of Corte Madera and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Svcs	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 43: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Town of Corte Madera's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their Town of Corte Madera website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Town of Corte Madera & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment

Table 3: Town of Corte Madera & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website.

Table 3: Town of Corte Madera & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Marin County BOS Chambers	• Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years

Table 3: Town of Corte Madera & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 44: Town of Corte Madera & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM and the Town of Corte Madera, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release from Marin County and the Town of Corte Madera informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by Marin County, the Town of Corte Madera, and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the Marin County and Town of Corte Madera website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Marin County and Town of Corte Madera Steering Committee prioritized equity and engagement of the whole community in the development of the Marin

County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Marin County and Town of Corte Madera Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in

the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 93: Marin County OEM MJHMP and Town of Corte Madera Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom

videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 94: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible

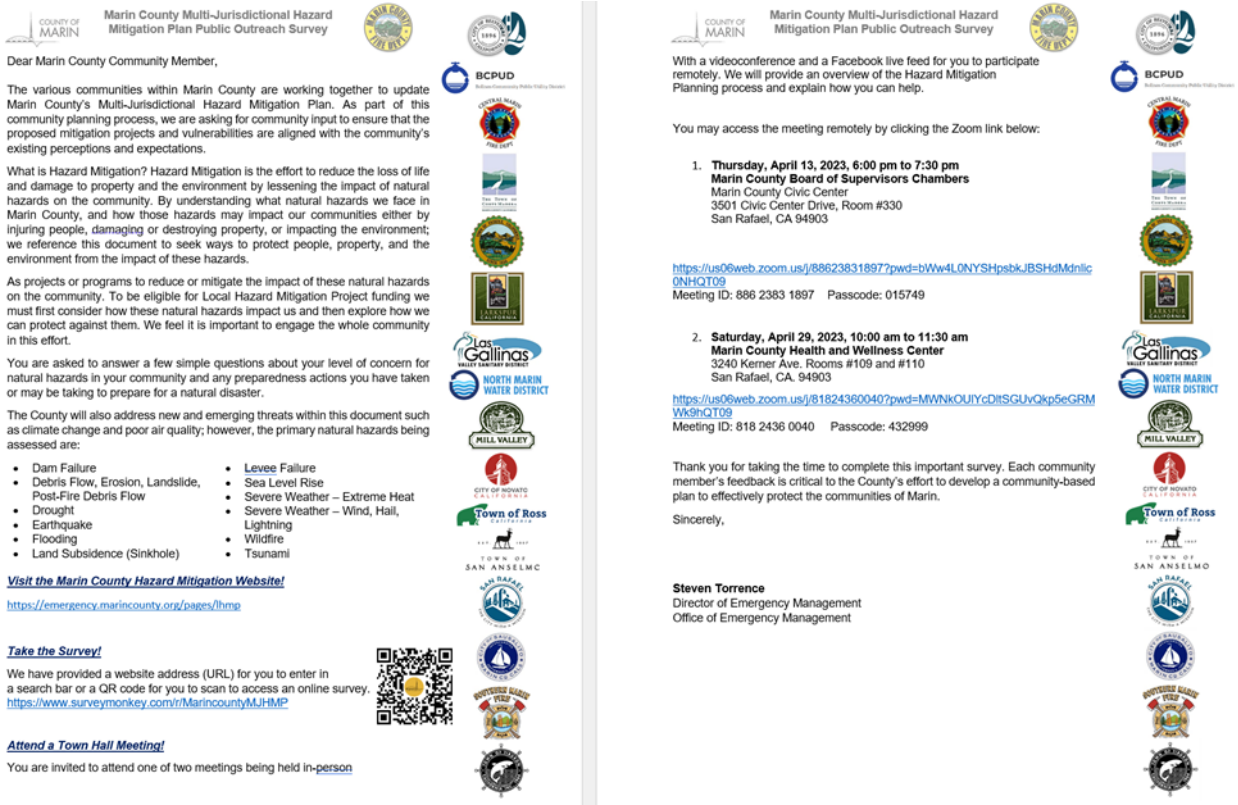
via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnllc0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 95: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was

designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 96: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of Corte Madera distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 4.9 Hazard Mitigation Actions.

1.3 Overview and History

The Town of Corte Madera is named after Corte Madera del Presidio, an 1834 Mexican land grant of the area to Irish immigrant John Reed that also established several communities in Marin County. Spanish for "cut wood", Corte Madera provided redwood and oak timber for the growth of early San Francisco, including much of the construction at the Presidio. As the timber disappeared, Corte Madera became a farming and ranching community. Corte Madera continued to grow with the formation of the North Pacific Coast Railroad Company in 1872, and a railroad station was constructed by 1875 with freight and commuter service. Development of the town's harbor allowed for further trade of goods. The town grew around the railroad station with the development a town square and several neighborhoods. The Adams' Hotel and Tavern was the town's first commercial business when built in 1898 and it served as the town's first post office. The town was officially incorporated on June 10th, 1916. Further growth of the town occurred during World War II, when the Marinship Corporation built a shipyard in Sausalito and attracted thousands of ship workers to the area. The town currently has a total area of 3.2 square miles and is situated just south of the South Quentin Peninsula on San Francisco Bay. The terrain consists of hills and marshland where numerous creeks empty into San Francisco Bay.

The Town of Corte Madera had an estimated population of 10,222 in 2020, with 4,174 housing units in the town. The town has a total area of 4.406 square miles. The median income for a household in the town was $183,661 and the per capita income for the town was $95,257. Approximately 2.1 percent of families and 4.9 percent of the population were below the poverty line (2020 data, U.S. Census Bureau).

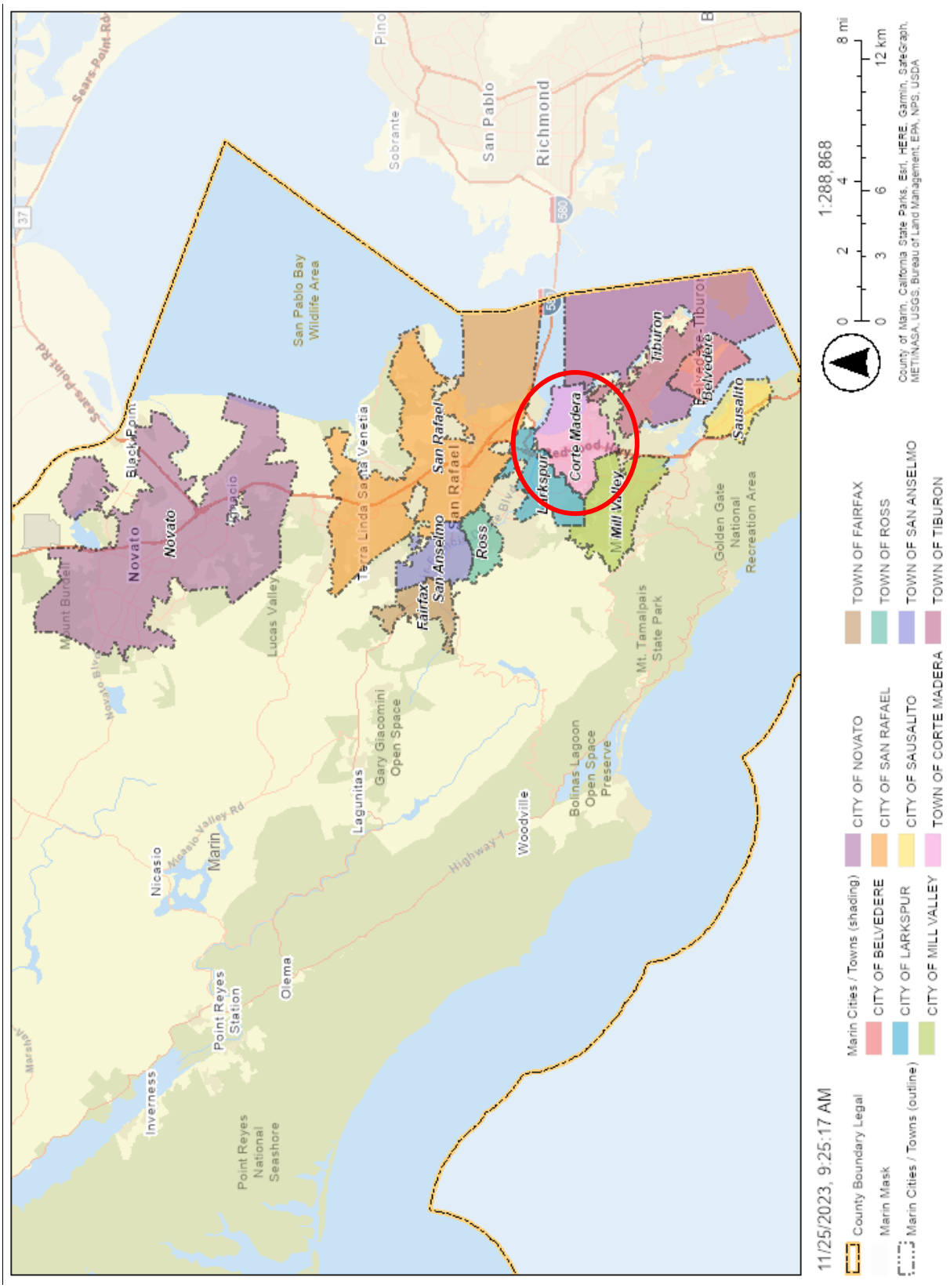


Figure 97: Map of Town of Corte Madera in Marin County
Source: Marin County OEM

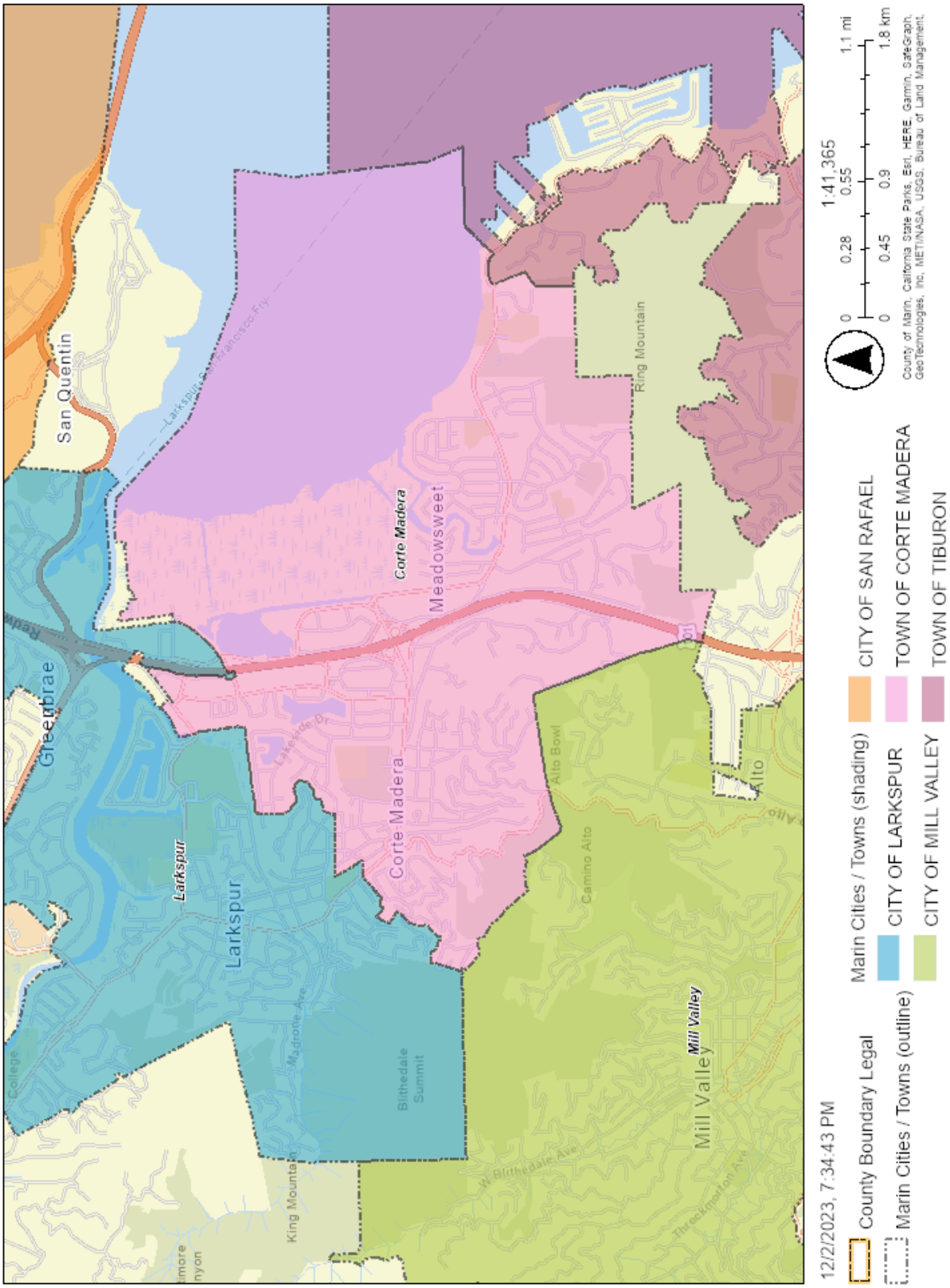


Figure 98: Map of the Town of Corte Madera
Source: Marin County OEM

1.4 GOVERNMENT

The Town of Corte Madera is governed by a five-person Town Council. The Town Council elects one of its members to serve as Mayor, the executive head of the town; and appoints a town Manager, the administrative head of the town. The town consists of 10 departments: the Administration, Community Development, Code Enforcement, Finance, Fire, Human Resources, Parks and Recreation, Police, Public Works, and Sanitary District No. 2.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

In 2018, the Towns of Corte Madera and Larkspur formed the Central Marin Fire Department, a Joint Powers Authority to provide fire protection.

In 1980 the town merged its police department with the of neighboring town of Larkspur to become the Twin Cities Police Authority, which subsequently merged in 2013 with the police department of San Anselmo to form the Central Marin Police Authority.

1.5 SANITARY DISTRICT NUMBER 2

Sanitary District No. 2 was incorporated on January 21, 1901, and was re-incorporated as a subsidiary district to the Town of Corte Madera (Town) on January 15, 1969. The District provides sewage collection services for the town, limited areas of the surrounding communities of Larkspur and Tiburon, and certain unincorporated land within Marin County. These services include the installation and maintenance of sanitary sewer pipelines and pump stations, regulation of sanitary sewer connections, and waste collection services within the boundary of the District.

Treatment of sanitary sewer flow is provided by the Central Marin Sanitation Agency (CMSA). Waste collection services are provided by Mill Valley Refuse.

The Corte Madera Town Council also serves as Board Members for Sanitary District No. 2. The Corte Madera Town Council/Board is the community's part-time legislative body consisting of five members including the Mayor, Vice Mayor and three Councilmembers (Town Council) and Board President, Board Vice-President and three Board Members (Sanitary District No. 2). They are elected at-large on a non-partisan basis for a four-year term. The terms are staggered so that a measure of continuity is maintained in the transitions from one Council to the next. Council members receive compensation in the amount of $300 per month, with the Mayor receiving $350 per month.

Citizen participation at Council/Sanitary District meetings is encouraged. Public Open Time for any item not on the current agenda is scheduled at the beginning of each meeting. Council meetings are normally held on the 1st and 3rd Tuesday of each month at 6:30 P.M. in the Town Hall Council Chambers (300 Tamalpais Drive). Sanitary District meetings are normally held on the 1st and 3rd Tuesday of each month at 6:45 P.M. or upon conclusion of the Corte Madera Town Council meeting, whichever is later, in the Town Hall Council Chambers (240 Tamal Vista Blvd., Ste. 108).

1.6 History and Administration of Sanitary District Number 2

The Sanitary District No. 2 came into existence by historical necessity because the town was not yet organized and therefore could not correct cesspools and raw sewage flows that were becoming commonplace at the beginning of the 20th century. The District was incorporated on January 21, 1901, approximately 15½ years prior to the Town's incorporation on June 10, 1916. Although legally separate, the Town and District operated in conjunction with each other including sharing equipment, office space, and meeting facilities.

Due to a change in the Municipal Organization Act, the Town was able to legally absorb the District. The District was re-incorporated as a subsidiary district to the Town on January 15, 1969. The Town Council became the Town Council/District Board of Directors. On April 1, 1969, the District ceased being an employer and its former employees were absorbed by the Town. Subsequently, the State Controller's Office requested that the merger be formalized with a Joint Powers Agreement. Town Resolution 1510 and District Resolution No. 9-73, both of which consummated the Joint Powers Agreement, were adopted by the Town Council/District Board of Directors on September 17, 1973.

Although the District is no longer independent, it does have a legal existence separate and apart from the Town. Currently, the boundaries of the Town and District are essentially contiguous, with three principal exceptions. Portions of the Tiburon Peninsula served by the District are either in the incorporated limits of the Town of Tiburon or in the unincorporated sphere of influence of the Town of Tiburon. That portion of Greenbrae to the east of Highway 101 and south of Corte Madera Creek served by the District is either in the incorporated limits of the City of Larkspur or in the unincorporated sphere of influence of the Town of Corte Madera. A residential area known as Palm Hill in the City of Larkspur features a boundary with the District that is dependent on gravity flow into the District. There are several smaller exceptions such as East Lucky Drive, which is in the unincorporated sphere of influence of the Town of Corte Madera.

The District is presented as a business-type activity and an enterprise fund under the category of proprietary fund types in the fund based financial statements.

The District is a member of the Central Marin Sanitation Agency (CMSA), established on October 15, 1979, which is a joint powers agency administered by its own board, separate from the Town Council/District Board of Directors. Financial information of this agency is not included in the accompanying basic financial statements except for the operating expenses included as sewage collection-pump station maintenance, the "FOG" (Fats, Oils, & Grease) source control program, and sewage treatment and disposal, which are expenses reimbursed by the District to CMSA. The District contracts under the Joint Powers Agreement with CMSA for CMSA personnel to provide all engineering, management, and operational services for the treatment and disposal of wastewater. By a separate contractual agreement, CMSA personnel provide for sewage collection pump station maintenance and the FOG source control program (inspection and enforcement) as part of the District's sewer system management plan as mandated by the State.

Town personnel provide all engineering, management and operational services to the wastewater collection system, exclusive of management and operational services for sewage collection pump station maintenance. In excess of 80% of the funding of CMSA's sewage

facilities were funded by Federal and State sources, with the remainder of the funding by the participants. The District provides one of the six members of the governing board of the CMSA. The operating agreement provides that members (including the District) are not obligated for the debts, liabilities, or obligations of the Agency. Pursuant to GASB Statements 14 and 39 regarding "The Financial Reporting Entity", the CMSA operating arrangement has been categorized as a "jointly governed organization."

1.5 Weather and Climate

The Town of Corte Madera lies 39 feet above sea level. In Corte Madera, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43°F to 73°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month of highest relative humidity is February (79.73 %). The month with the lowest relative humidity is June (69.32 %). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 99: The Town of Corte Madera Precipitation and Monthly Temperatures
Source: en.Climate-Data.org

1.6 Demographics

The California Department of Finance shows an overall estimated decrease in the population of Marin County and the Town of Corte Madera since the last plan update in 2018. Of the total estimated 257,135 residents of Marin County in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The Town of Corte Madera had an estimated population of 10,104 in the 2018 plan. 2020 U.S. Census Survey estimated the Town's population at 10,222. However, revised estimates for 2022 estimated the population to decrease to 10,028 population.

Table 4: Town of Corte Madera Estimated Jurisdictional Population				
Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County	257,135	262,321	262,179	-1.92%
Town of Corte Madera	10,028	10,222	10,104	-0.75%

Table 45: Town of Corte Madera Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The Town of Corte Madera is 10,222 as of 2020. Between 2018-2020, the City's growth rate increased at an average annual rate of 1.12%, lower than the historic twenty-year average growth rate of 3.2%. Table 5 shows the population growth comparison of the State of California, County of Marin and the Town of Corte Madera between 2010 - 2020.

Table 5: Population Change of The Town of Corte Madera				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County	252,409	262,321	9,912	3.9%
Corte Madera, town	9,253	10,222	969	10.5%

Table 46: Population Change of The Town of Corte Madera
Source: Town of Corte Madera Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the Town of Corte Madera.

Table 6: Languages Spoken in Corte Madera	
Primary Language Spoken	% of Population
English only	86.2%
Spanish	4.3%
Other Indo-European languages	5.7%
Asian and Pacific Islander languages	3.0%
Other languages	0.8%

Table 47: Languages Spoken in Corte Madera
Source: US Census Bureau (2020)

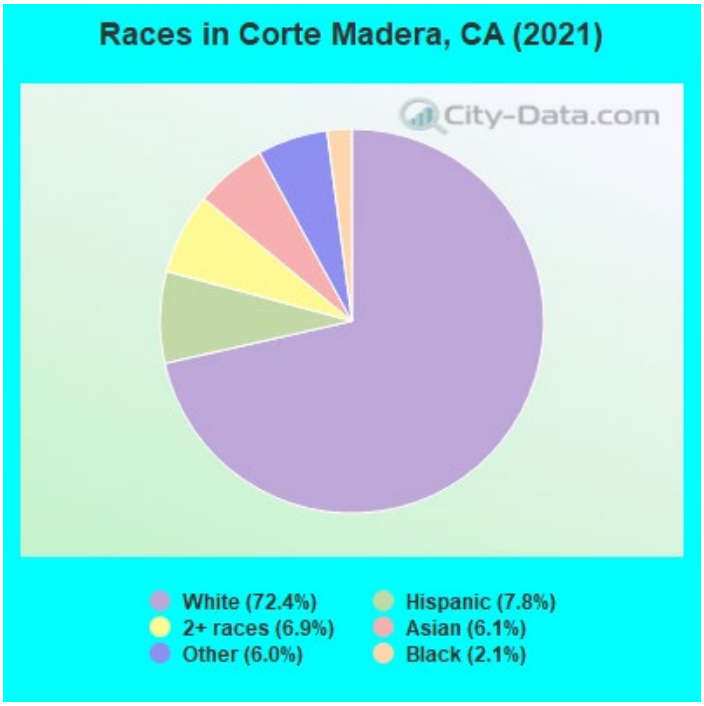


Figure 100: Races in Corte Madera
Source: City-Data.com

Table 7: Marin County Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
Town of Corte Madera							
2022	Number	4,182	2,468	621	376	717	0
	Percent	100.00%	59.01%	25.16%	60.55%	190.69%	0.00%
2018	Number	4,207	2,498	609	373	727	0
	Percent	100.00%	59.38%	24.38%	61.25%	194.91%	0.00%

Table 48: Marin County Jurisdictional Housing Stock
Source: California Department of Finance

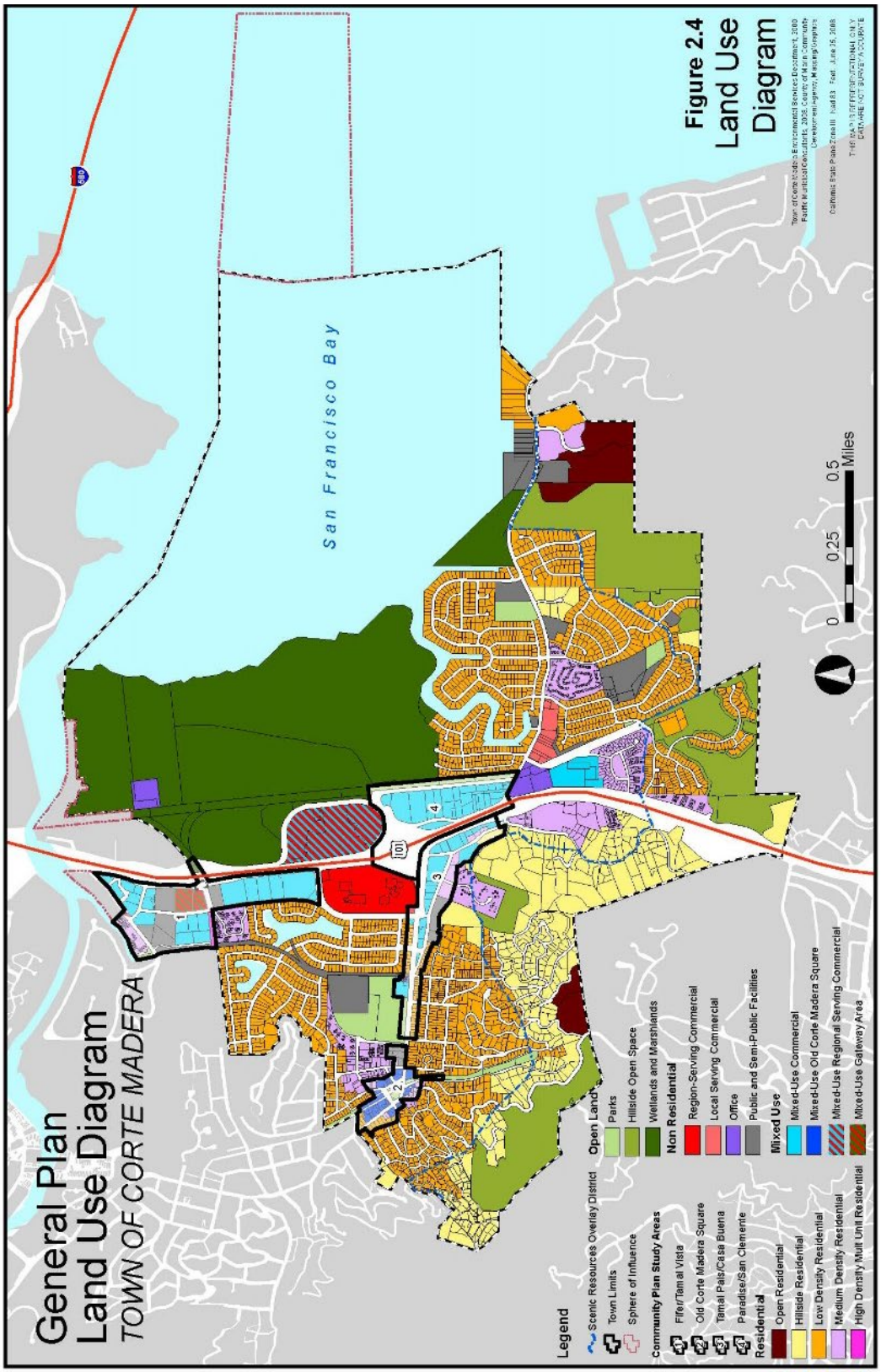


Figure 101: Town of Corte Madera Land Use Map
Source: Town of Corte Madera 2009 General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 49: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Table 9 illustrates the NRI Hazard Type Risk Index for Corte Madera Census Tract 1212.00.

Table 9: NRI Hazard Type Risk Index for Corte Madera Census Tract 1212.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,555,358	Relatively Moderate	Very High	1.13	$2,880,541	97.9
Riverine Flooding	$1,669,266	Relatively Moderate	Very High	1.13	$1,881,689	99.2
Coastal Flooding	$257,460	Relatively Moderate	Very High	1.13	$290,224	98.2
Heat Wave	$10,058	Relatively Moderate	Very High	1.13	$11,338	53.9
Landslide	$3,769	Relatively Moderate	Very High	1.13	$4,249	87.8
Wildfire	$1,679	Relatively Moderate	Very High	1.13	$1,893	73.6
Tsunami	$1,130	Relatively Moderate	Very High	1.13	$1,274	96.8
Lightning	$424	Relatively Moderate	Very High	1.13	$478	9.3
Strong Wind	$346	Relatively Moderate	Very High	1.13	$390	12.2
Hail	$32	Relatively Moderate	Very High	1.13	$36	6.7
Drought	$0	Relatively Moderate	Very High	1.13	$0	0

Table 50: NRI Hazard Type Risk Index for Corte Madera Census Tract 1212.00
Source: FEMA National Risk Index 2023

Figure 10 illustrates the Social Vulnerability Map for Corte Madera Census Tract 1212.00.

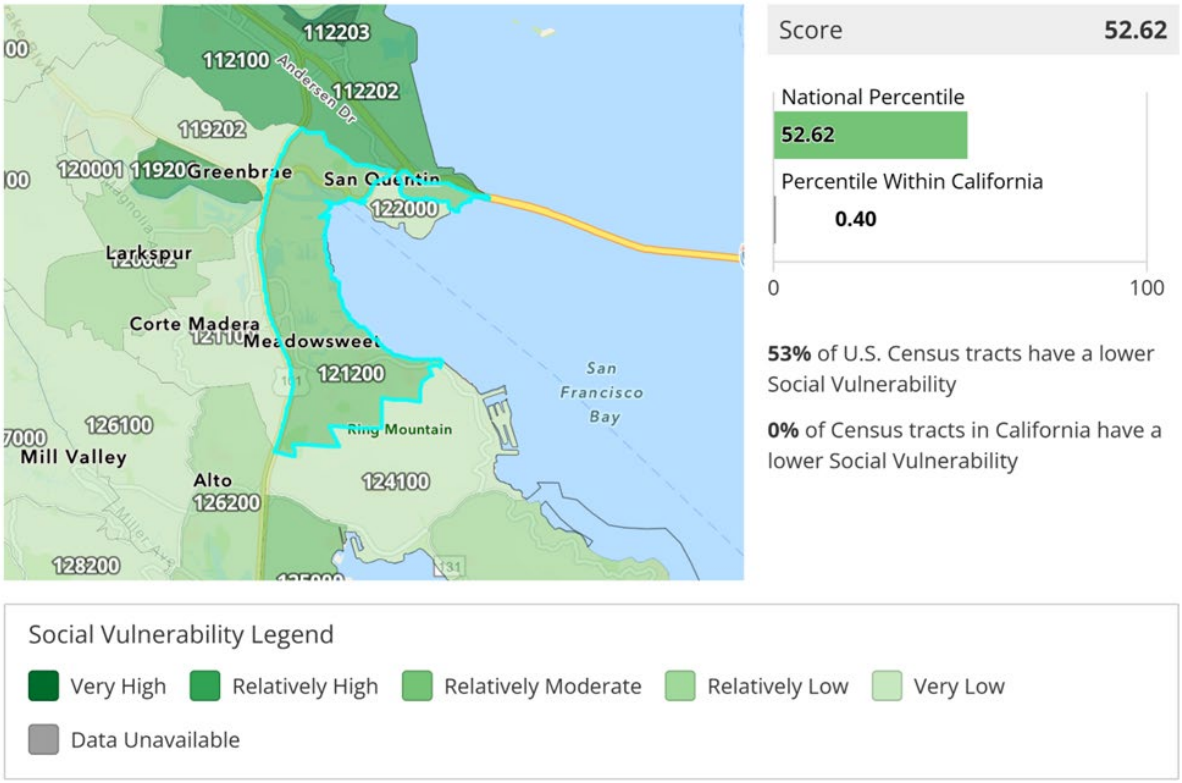


Figure 102: Town of Corte Madera Social Vulnerability Map Census Tract 1212.00
Source: FEMA National Risk Index 2023

Table 10 illustrates the NRI Hazard Type Risk Index for Corte Madera Census Tract 1211.00.

Table 10: NRI Hazard Type Risk Index for Corte Madera Census Tract 1211.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,910,576	Very Low	Very High	0.78	$1,485,891	94.2
Riverine Flooding	$1,101,903	Very Low	Very High	0.78	$856,971	98
Coastal Flooding	$258,502	Very Low	Very High	0.78	$201,042	97.7
Landslide	$32,361	Very Low	Very High	0.78	$25,167	98.6
Wildfire	$9,394	Very Low	Very High	0.78	$7,306	82.4
Heat Wave	$9,036	Very Low	Very High	0.78	$7,027	45.4
Drought	$661	Very Low	Very High	0.78	$514	81.5
Lightning	$356	Very Low	Very High	0.78	$277	5.8
Strong Wind	$305	Very Low	Very High	0.78	$237	8.4
Tsunami	$231	Very Low	Very High	0.78	$180	93.2
Hail	$29	Very Low	Very High	0.78	$22	3.6

Table 51: NRI Hazard Type Risk Index for Corte Madera Census Tract 1211.00
Source: FEMA National Risk Index 2023

Figure 11 illustrates the Social Vulnerability Map for Corte Madera Census Tract 1211.00.

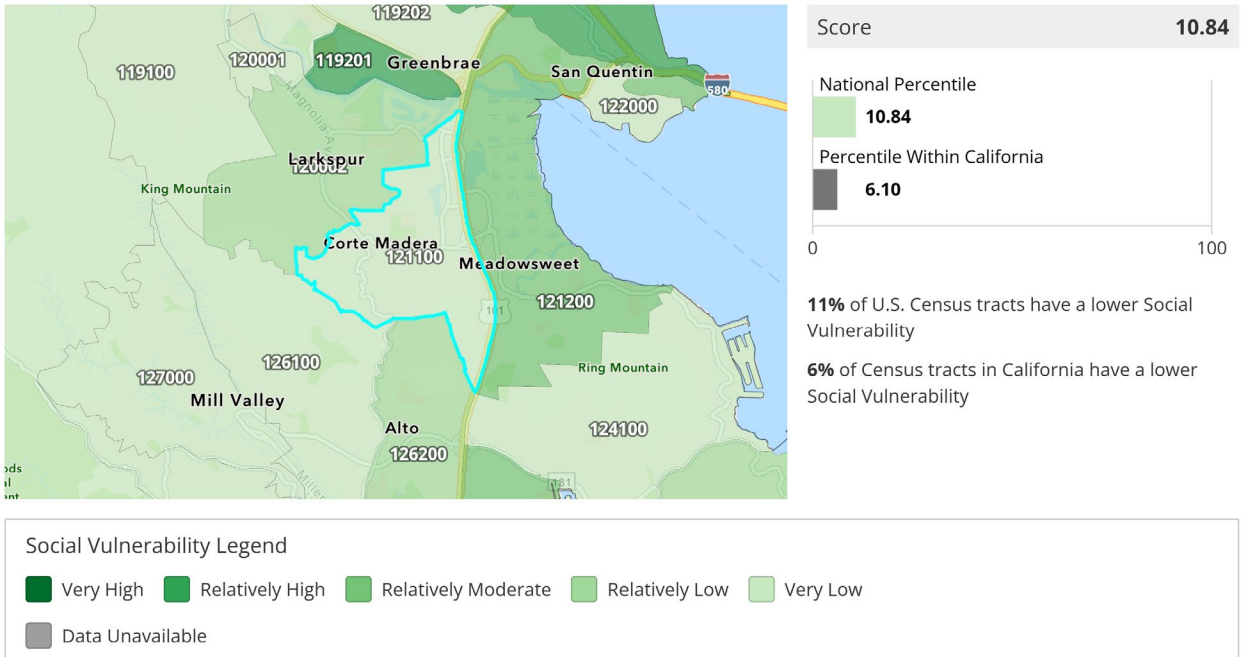


Figure 103: Town of Corte Madera Social Vulnerability Map Census Tract 1211.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in Marin County reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a “very high” ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a whole to have “Relatively High” risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category (“Very High Risk”), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

However, Marin City is ranked as “Very Low” risk for the National Risk Index. Previous discussion highlighted why the Expected Annual Loss was low, but further discussion is required. As a County, we know Marin City should not be classified as “Very Low” on the NRI. Marin City residents, for example, only have one way in and out of their community and this road floods frequently, making it unsafe to cross and leave the community for work, school, and medical resources. Additionally, there is only one “grocery” store, a Target, in Marin City. Both of these elements contribute to the vulnerability of residents as they may be unable to leave or return home and have limited access to groceries, relying on a single store’s supply chain. At the local elementary school in Marin City, 47% of students are eligible for free and reduced-price meals (2022 – 2023 school year), a reflection of the financial capacity of local families. All this means, we can expect the social and built capacity of Marin City to be limited.

The median income for a household in the Town of Corte Madera was $183,661 and the per capita income for the Town was $95,257. Approximately 2.1 percent of families and 4.9 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). This poverty line is higher than other communities within Marin County but is also significantly lower than some communities within the County of Marin. The two census tracts reflect both a Relatively Moderate and Very Low Social Vulnerability Index in the Town, which reflects the Towns SVI position within the County.

In Corte Madera, 59.1% of households make more than 100% of the Area Median Income (AMI)14, compared to 12.1% making less than 30% of AMI, which is considered extremely low-income. Regionally, more than half of all households make more than 100% AMI, while 15% make less than 30% AMI. In Marin County, 30% AMI is the equivalent to the annual income of $44,000 for a family of four. Many households with multiple wage earners – including food service workers, full-time students, teachers, farmworkers, and healthcare professionals – can fall into lower AMI categories due to relatively stagnant wages in many industries. (Housing Element for the Town of Corte Madera 2023-2031)

There are approximately 470 extremely low-income households in Corte Madera (12.1% of the total number of households), and approximately two-thirds of these households own their homes. In order to remain in their homes, extremely low-income owner households need programs to help reduce housing costs, while extremely low income renter households need programs to limit rent increases. (Housing Element for the Town of Corte Madera 2023-2031)

1.8 ECONOMY AND TAX BASE

Table 11 shows income by household in The Town of Corte Madera as of 2019.

Table 11: Household Income for The Town of Corte Madera as of 2019		
Household Income	Number	Percent
Total Households	1,842	-
Less than $10,000	90	4.9%
$10,000 to $14,999	195	10.6%
$15,000 to $24,999	228	12.4%
$25,000 to $34,999	164	8.9%
$35,000 to $49,999	138	7.5%
$50,000 to $74,999	385	20.9%
$75,000 to $99,999	155	8.4%
$100,000 to $149,999	212	11.5%
$150,000 to $199,999	194	10.5%
$200,000 or more	81	4.4%
Median household income (dollars)	$53,622	
Mean household income (dollars)	$75,134	

Table 52: Household Income for The Town of Corte Madera as of 2019
Source: US Census Bureau American Community Survey 2019 Estimates

Table 12 shows the percentage of people in The Town of Corte Madera over the age of 16 employed by industry.

Table 12: Town of Corte Madera Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	4,909	-
Agriculture, forestry, fishing and hunting, and mining	0	0%
Construction	272	5.54%
Manufacturing	107	2.18%
Wholesale trade	108	2.20%
Retail trade	336	6.84%
Transportation and warehousing, and utilities	56	1.14%
Information	309	6.29%
Finance and insurance, and real estate and rental and leasing	589	12.0%
Professional, scientific, and management, and administrative and waste management services	1179	24.02%
Educational services, and health care and social assistance	1369	27.89%

Arts, entertainment, and recreation, and accommodation and food services	114	2.32%
Other services, except public administration	294	5.99%
Public administration	176	3.59%

Table 53: Town of Corte Madera Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2019 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Town of Corte Madera to fulfill the requirements of its mission during an emergency:

Table 13: Town of Corte Madera Critical Facilities

	Category	Name	Address	Fire Severity Zone	Flood Zone
28.	Fire	Corte Madera Fire Department & Larkspur Fire Department/ Headquarters & Station 14	342 Tamalpais Drive Corte Madera, CA 94925	No	X
29.	Fire	Corte Madera Fire Department & Larkspur Fire Department/ Station 13	5600 Paradise Drive Corte Madera, CA 94925	Moderate	AE
30.	Law	California Highway Patrol Station (Marin Area)	53 San Clemente Drive Corte Madera, CA 94925	No	AE
31.	Local Government	Corte Madera Town Hall	300 Tamalpais Drive Corte Madera, CA 94925	No	X
32.	Local Government	Corte Madera Corporation Yard	81 Lucky Dr, Corte Madera, CA 94925	No	AE
33.	School	Neil Cummins Elementary School	58 Mohawk Avenue Corte Madera, CA 94925	No	AE
34.	School	The Cove School	330 Golden Hind Passage Corte Madera, CA 94925	No	AE
35.	School	The Mountain School The Kids Place of Marin Corte Madera Montessori	50 El Camino Drive Corte Madera, CA 94925	No	X
36.	School	Marin Country Day School	5221 Paradise Drive Corte Madera, CA 94925	Moderate	AE
37.	School	Marin Montessori	5200 Paradise Drive Corte Madera, CA 94925	No	AE
38.	Evacuation Shelter	Aegis Living Corte Madera	5555 Paradise Drive, Corte Madera, CA 94925	No	AE
39.	Evacuation Shelter	Casa Buena Shelter	1591 Casa Buena Dr. Corte Madera, CA 94925	No	AE

Table 54: Town of Corte Madera Critical Facilities
Source: Town of Corte Madera

1.10 HISTORICAL PROPERTIES

The Town of Corte Madera does not have any registered historically significant homes, public buildings, or landmarks. To inventory these resources, the Marin County OA MJHMP Planning Team collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- Town of Corte Madera Chamber of Commerce.
- Town of Corte Madera website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Town of Corte Madera identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 12 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

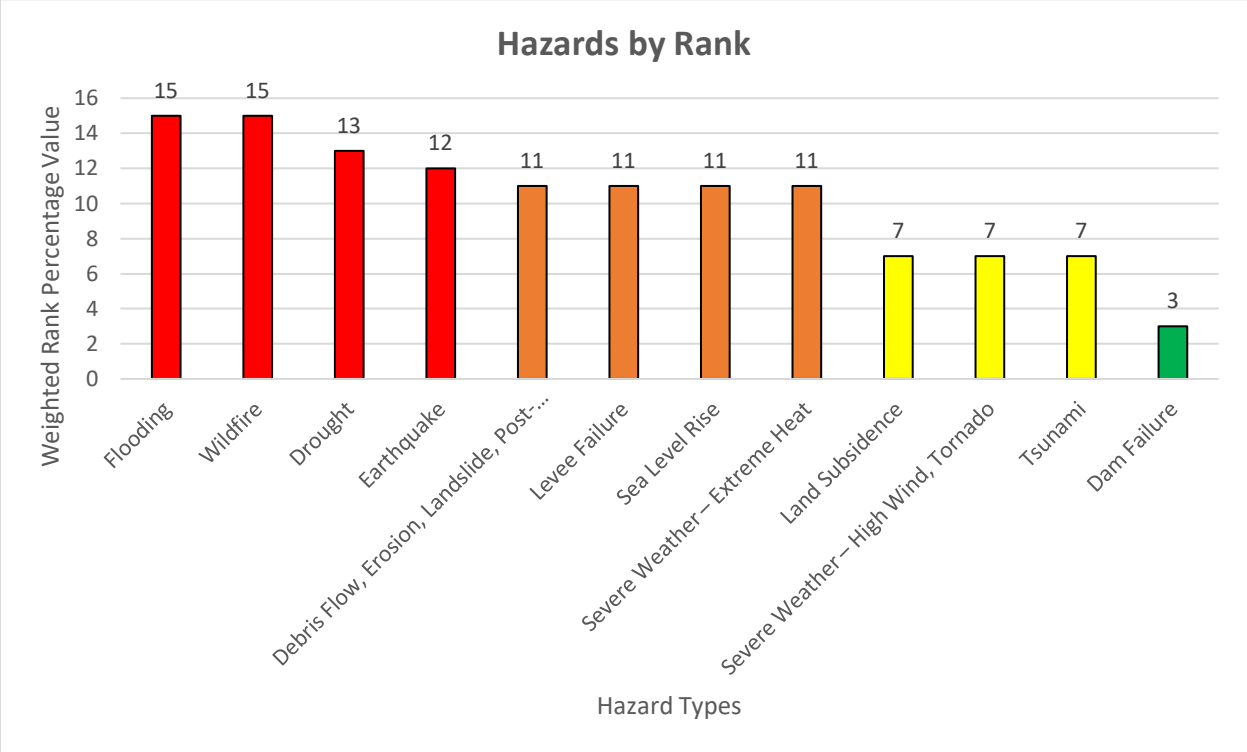


Figure 104: Town of Corte Madera Risk Assessment – Planning Team Top Hazards

Figure 13: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 105: Hazard Risk Categorization

Each Marin County MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 55: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

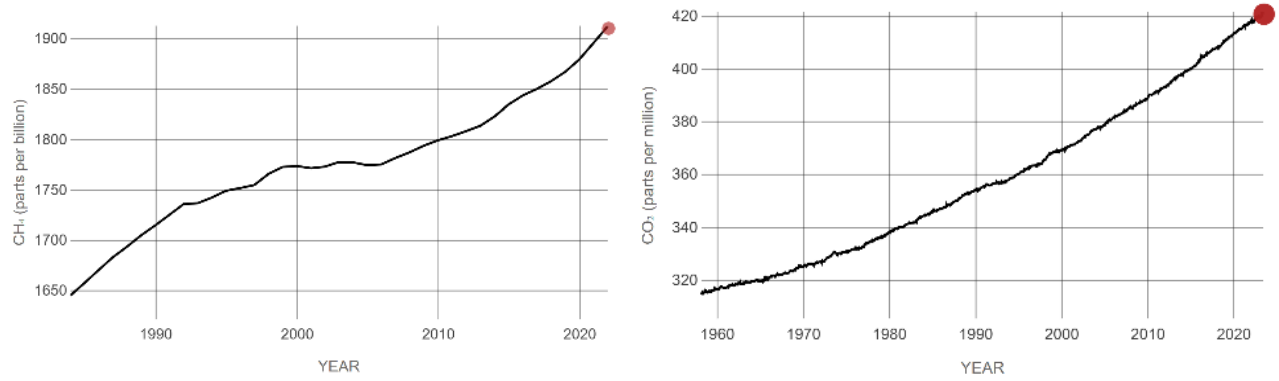


Figure 106: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

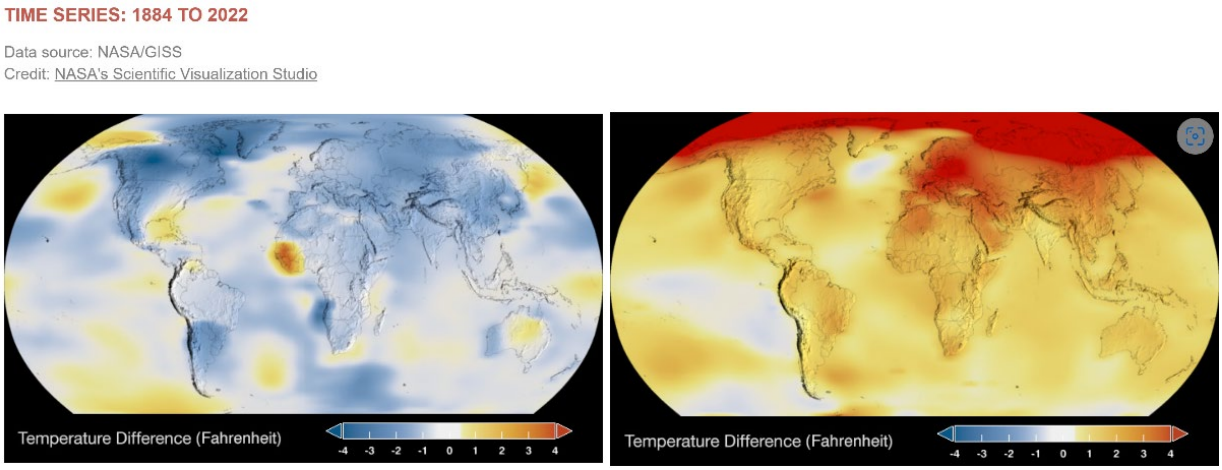


Figure 107: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.

- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

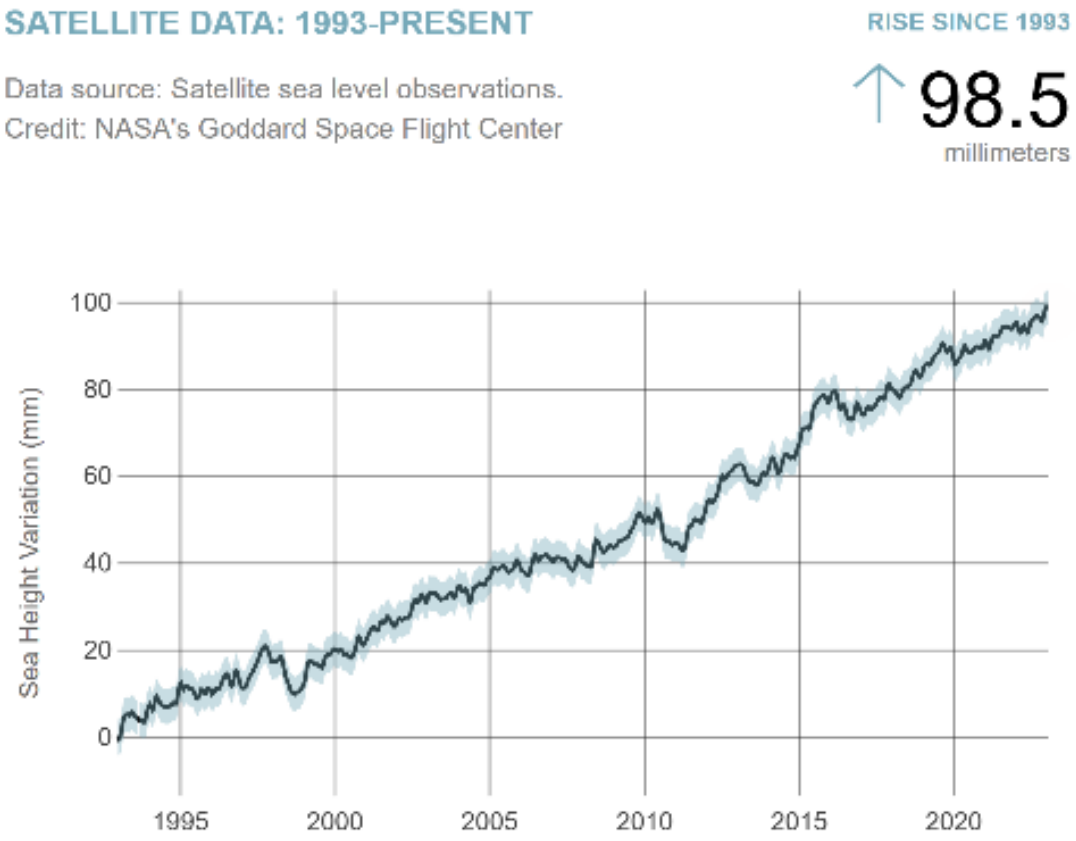


Figure 108: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California

Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.

- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

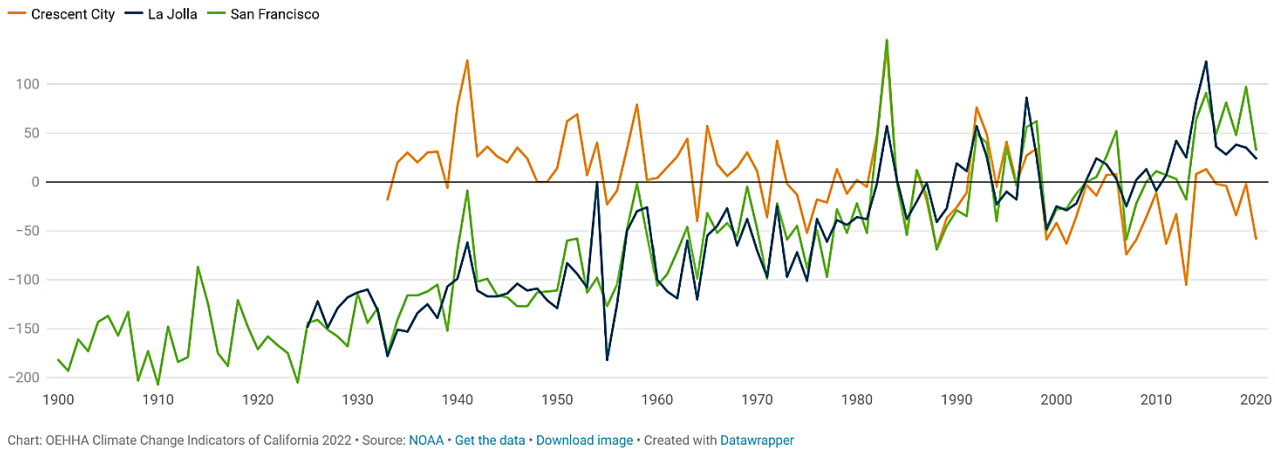


Figure 109: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions[8]. At the current rate, annual average temperatures in the San Francisco Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

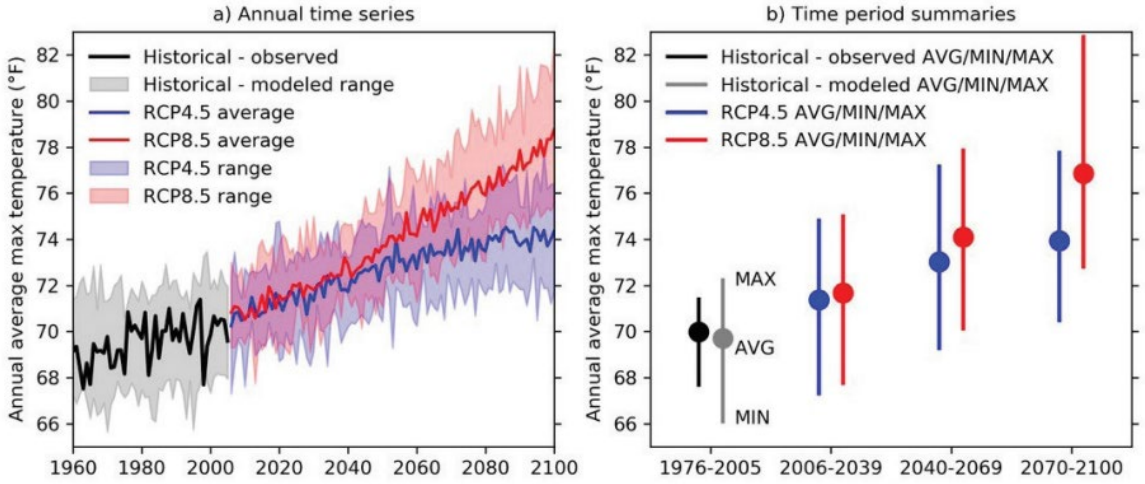


Figure 110: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced. Marin Shoreline Sea Level Rise Vulnerability Assessment: https://www.marincounty.org/-/media/files/departments/cd/planning/slr/baywave/vulnerability-assessment-final/final_allpages_bvbconsulting_reduced.pdf?la=en

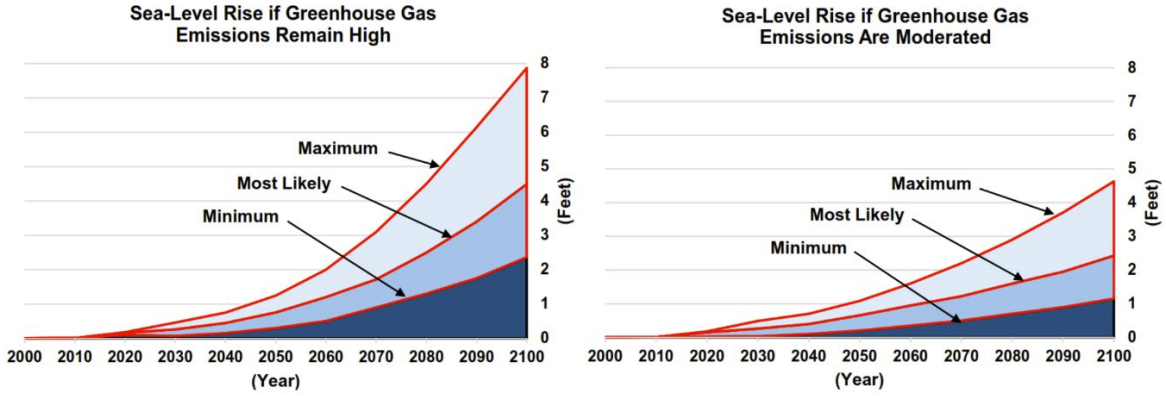


Figure 111: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change:, How Will Marin Adapt?

[8] California Adaptation Planning Guide

Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the Town of Corte Madera as per the planning team.

Table 15: Town of Corte Madera Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Weak	None	None	**3.00**
Debris Flow	Likely	Limited	Severe	Low	Medium	**11.00**
Drought	Likely	Extensive	Weak	High	Medium	**13.00**
Earthquake	Occasional	Extensive	Severe	None	High	**12.00**
Flooding	Likely	Significant	Severe	High	High	**15.00**
Land Subsidence	Likely	Negligible	Weak	Low	Low	**7.00**
Levee Failure	Unlikely	Limited	Severe	High	Medium	**11.00**
Sea Level Rise	Occasional	Significant	Weak	High	Medium	**11.00**
Severe Weather – Extreme Heat	Likely	Extensive	Weak	Medium	Low	**11.00**
Severe Weather – High Wind/Tornado	Likely	Negligible	Weak	Low	Low	**7.00**
Tsunami	Unlikely	Limited	Moderate	Low	Low	**7.00**
Wildfire	Occasional	Significant	Extreme	High	High	**15.00**

Table 56: Town of Corte Madera Hazard Risk Assessment
Source: Town of Corte Madera

Table 16: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence (Sinkhole)	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	None	High	**7.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 57: Hazard Risk Assessment
Source: Marin County

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design

- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

While there are no dams located within Corte Madera, the town could be impacted by a failure of the Phoenix Lake Dam in unincorporated Marin County. The dam has storage of 612-acre feet of water that could be released down Corte Madera Creek in the event of a full sunny-day dam failure. While most of the released water would be contained within Corte Madera Creek, numerous homes and marshland along the south side of the creek could become inundated with up to a foot of water approximately 40-45 minutes after the dam fails. Water from the dam may also be into marshland channels and the High Canal on the northern side of town but no further inundation of homes should occur.

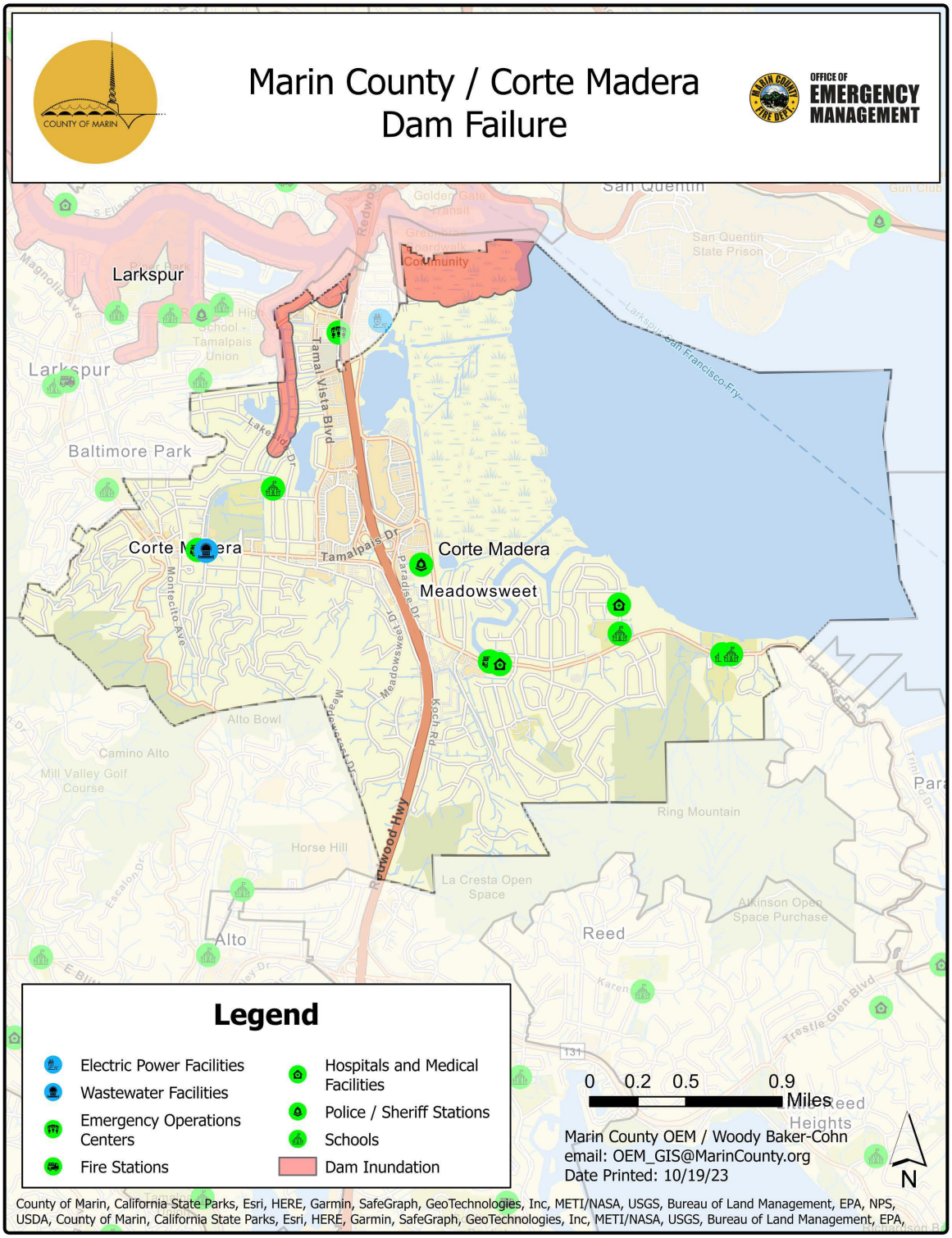


Figure 112: Town of Corte Madera Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

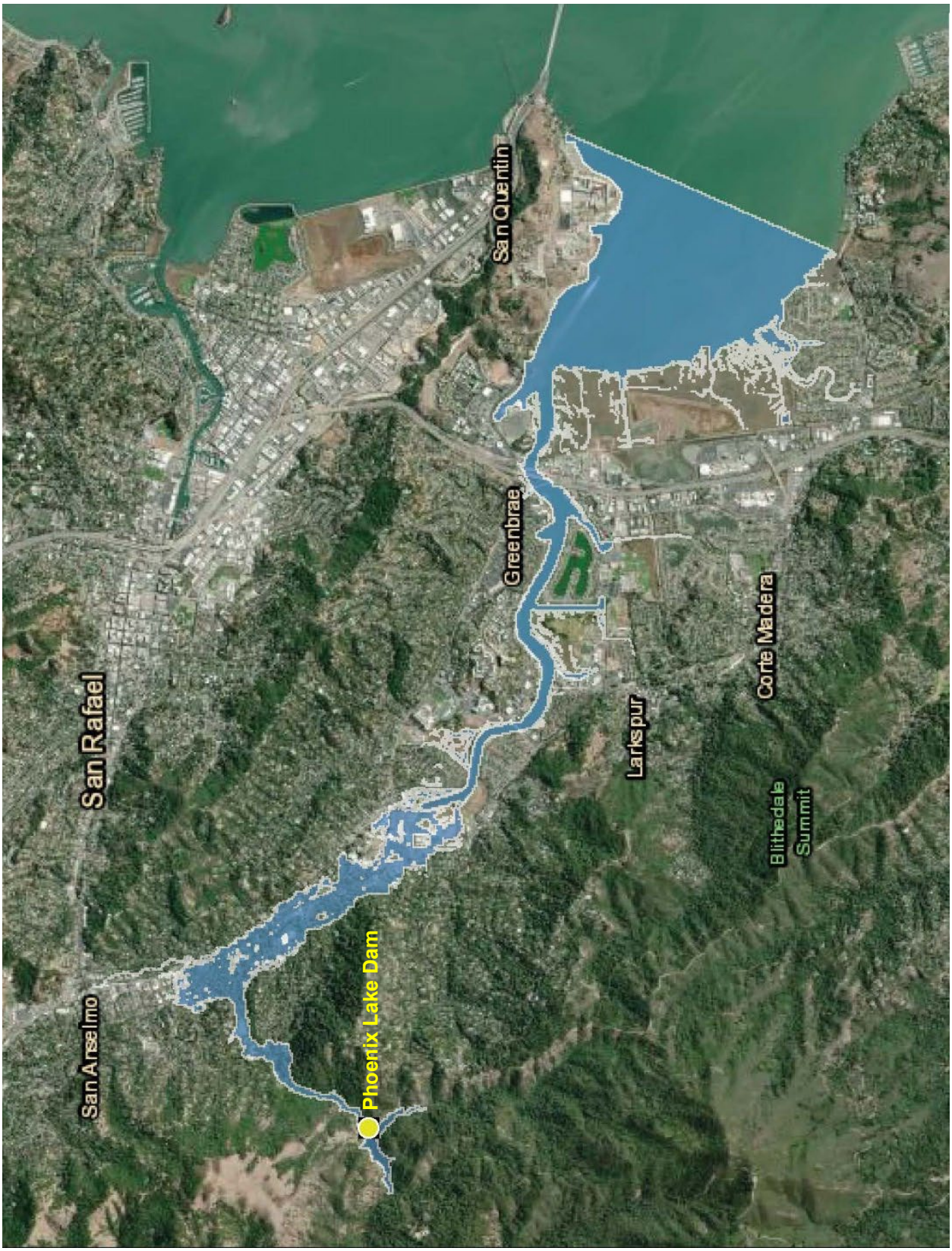


Figure 113: Town of Corte Madera Phoenix Lake Dam Inundation Impact
Source: California Department of Water Resources, DSOD, 11/27/23

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Phoenix Lake Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of the Corte Madera. Future development along the High Canal at the lower end of Corte Madera Creek could expose additional people and structures to risk of a dam failure.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Road building, excavation and grading
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 22 shows landslide susceptibility classes.

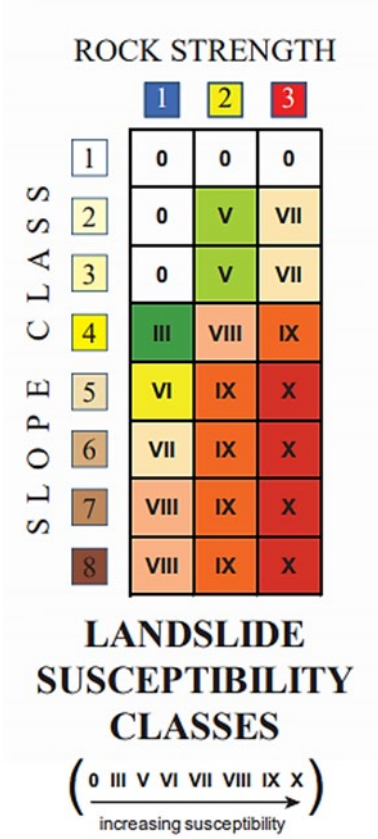


Figure 114: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour." Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 23 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

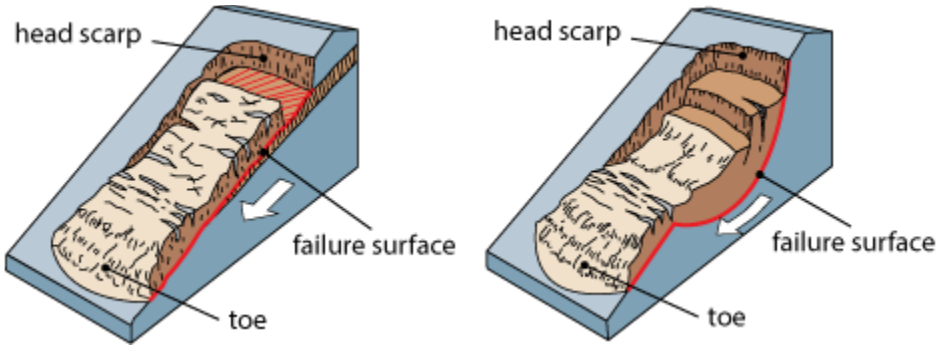


Figure 115: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in Corte Madera would most likely occur on the southern side of the town where the terrain is steeper and is more susceptible to movement of hill slope materials. This area of Corte Madera is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide.

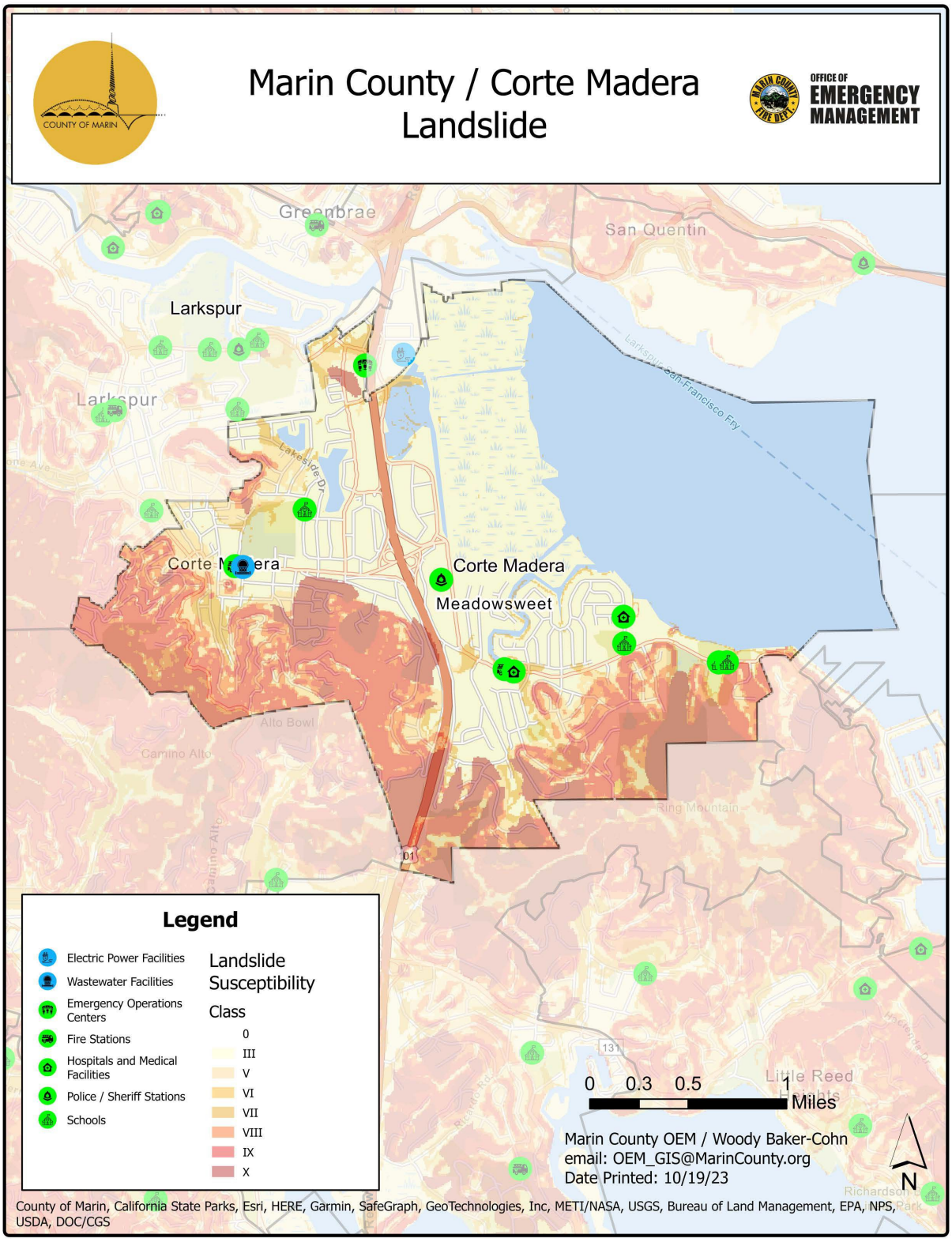


Figure 116: Town of Corte Madera Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in this area could affect the ability of residents to reach their homes. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open space to the south and west of Corte Madera, including in the Camino Alto Open Space Preserve, could potentially contribute to debris flows in Corte Madera. There are no creeks that flow directly into Corte Madera that could contribute to a debris flow, particularly from the mountainous areas in the western part of Marin County. However, there are several creeks originating from slopes of Mount Tamalpais including Larkspur Creek and Corte Madera Creek that flow into the City of Larkspur to the north of Corte Madera and could potentially experience a debris flow with mud and water that could impact the northern area of the town. There have been no recorded debris flows in Corte Madera.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[9], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of southern Corte Madera that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in southern and western Corte Madera could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

[9] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Corte Madera, though it's effects would be most felt in the mountainous areas where the risk of wildfire would increase. The wetland areas of Corte Madera, particularly the marshlands along San Francisco Bay, could become drier during prolonged period of drought and experience marshland fires that could impact local businesses and residences in the area. Dry trees in public spaces like Corte Madera's Town Park can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Corte Madera may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Corte Madera, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around southern and western Corte Madera. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Corte Madera where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Corte Madera, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of southern and western Corte Madera could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin

County OA into the future. When considering future development, the Marin County OA including Corte Madera can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 25).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 117: Modified Mercalli Intensity Scale
Source: USGS

Figure 26 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 118: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 27). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 119: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Corte Madera due to the number of active faults within and near Marin County.

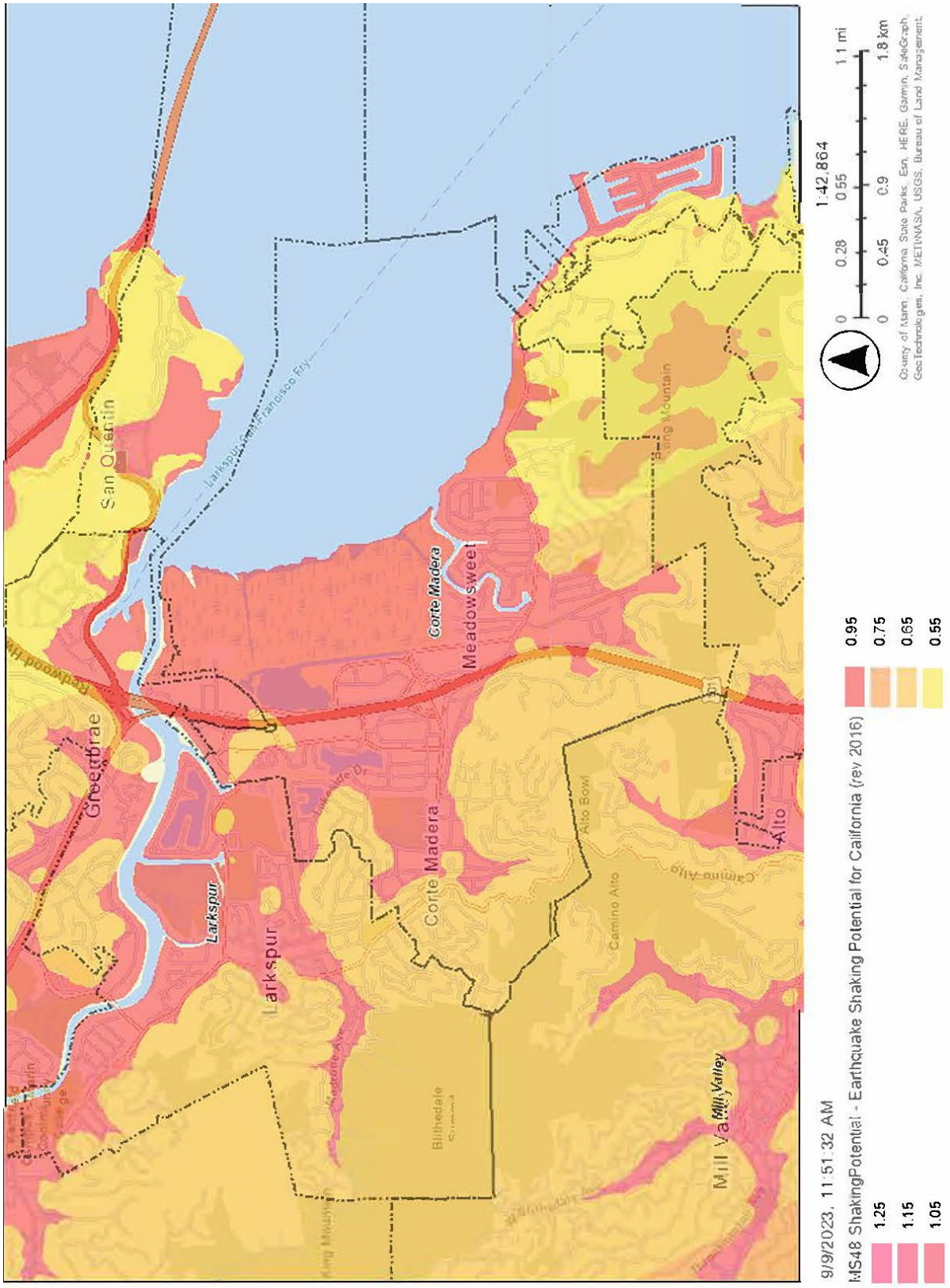


Figure 120: Town of Corte Madera Earthquake Impact
Source: Marin County OEM

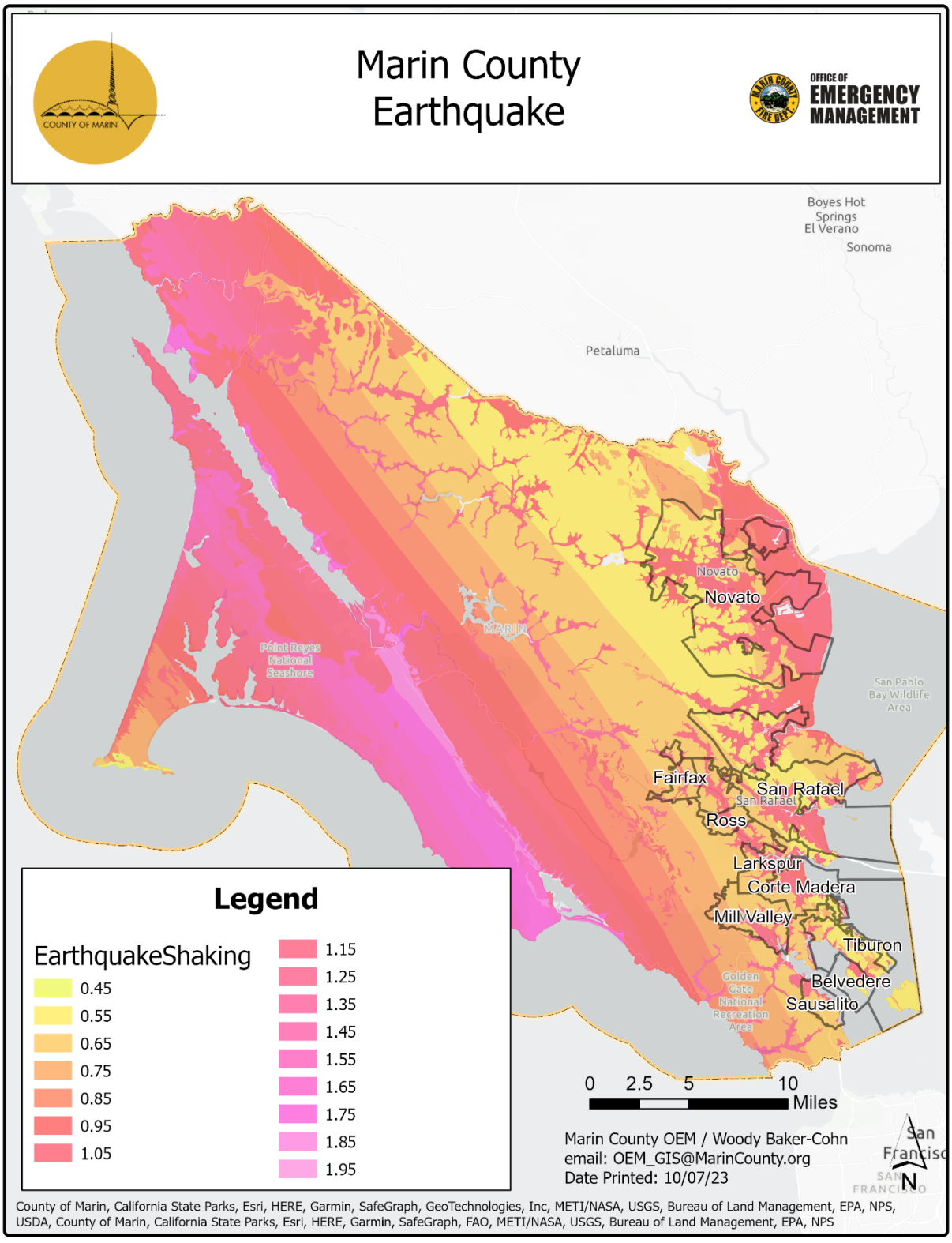


Figure 121: Marin County Earthquake Impact and Fault Lines
Source: Marin County OEM

Corte Madera is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the town. There is increased risk of shaking and liquefaction in Corte Madera from an earthquake, particularly in the central and eastern lowland areas where superficial deposits and fill are more prevalent. This includes the primary commercial area of town along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the town could be impacted by an earthquake.

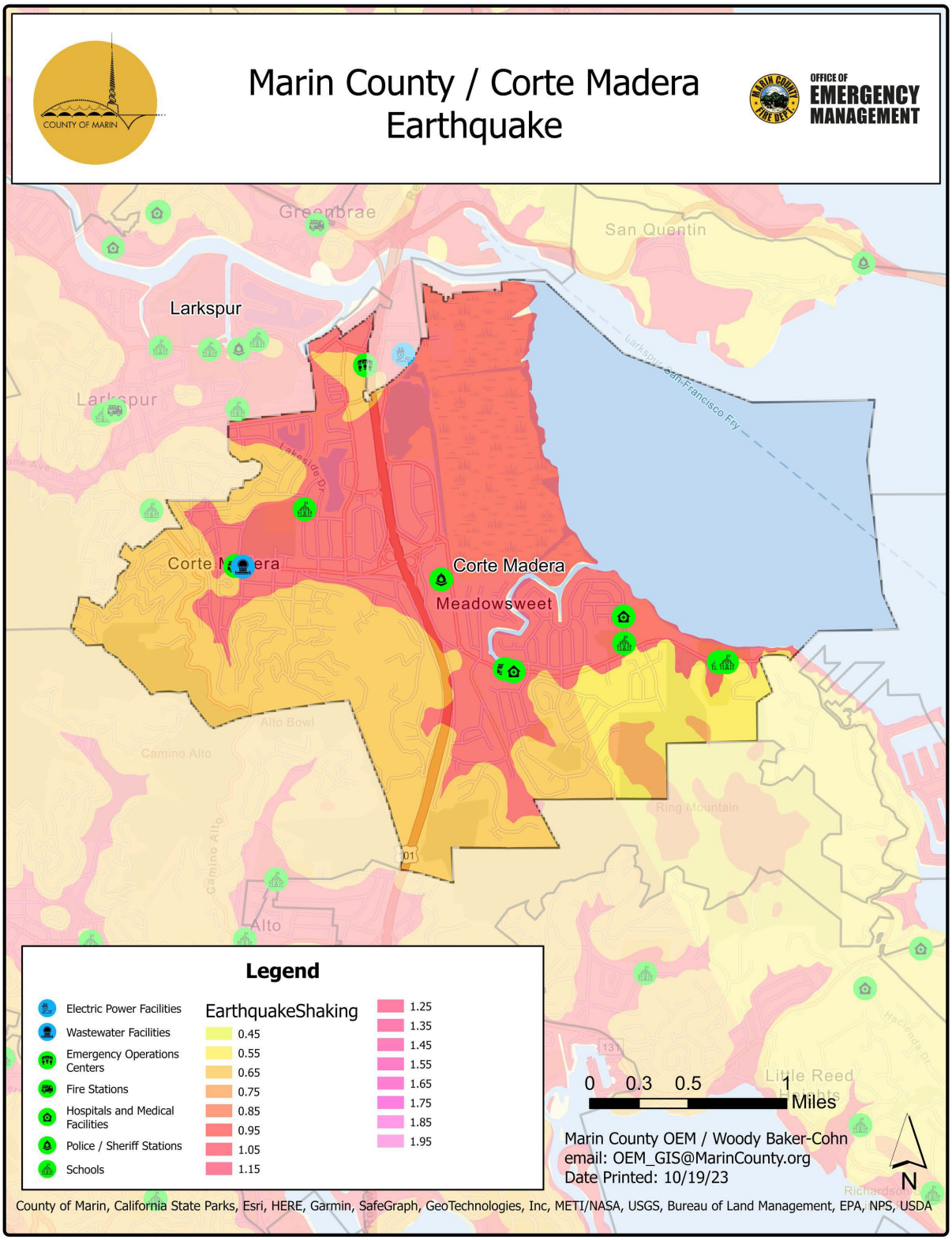


Figure 122: Town of Corte Madera Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Earthquakes could also cause landslides in the western areas of Corte Madera with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Corte Madera hasn't yet experienced a significant earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Corte Madera.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Corte Madera, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[10], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Corte Madera. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Corte Madera, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is a flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

[10] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or

Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 31.

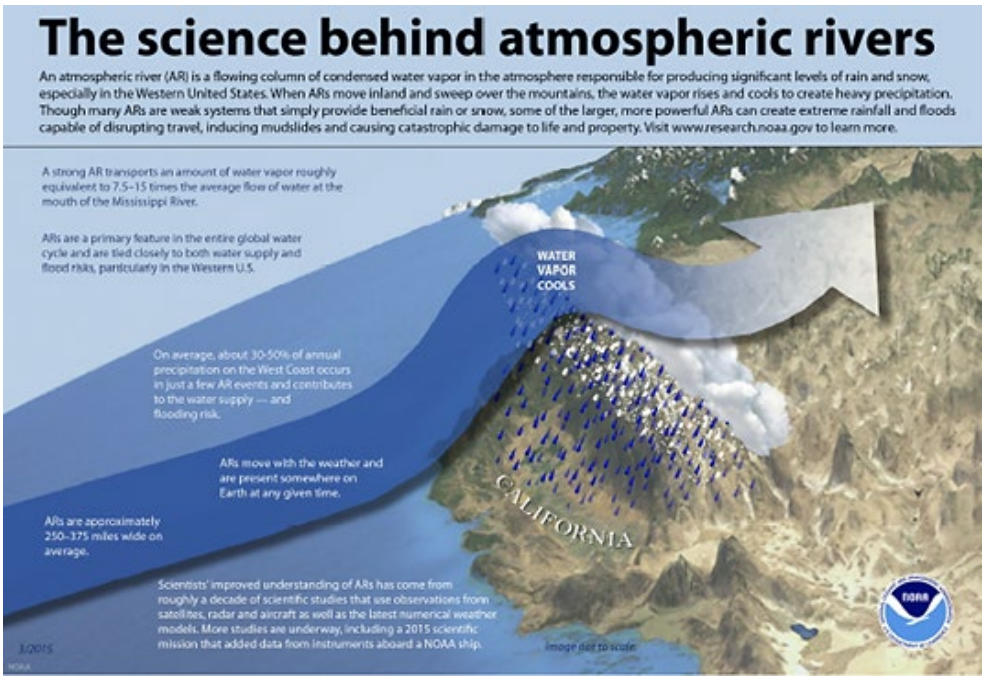


Figure 123: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in Corte Madera generally results from a combination of high tides and storm runoff in low-lying areas. Most of the lowland areas in Corte Madera are in the 100-year floodplain, with several areas in the 500-year floodplain.

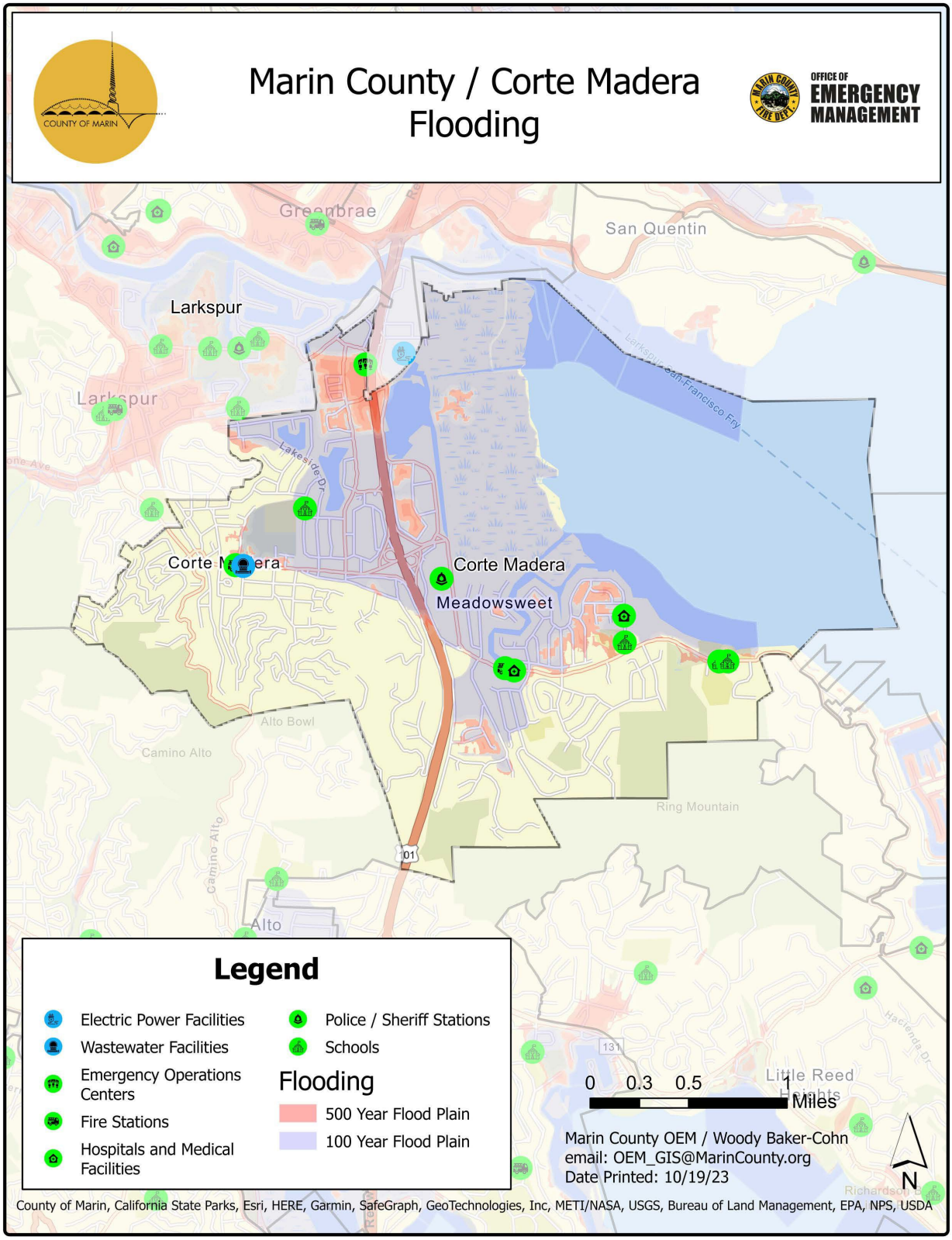


Figure 124: Town of Corte Madera Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Numerous businesses, residential neighborhoods, schools, churches, community centers, roads, and other critical facilities lie in this area and are susceptible to flooding. Table 17 shows the number of residential structures by flood zone in the Town of Corte Madera.

Table 17: Residential Structures in The Town of Corte Madera by Flood Zone

Flood Zone	FEMA Flood Zone Designations	Improved Residential Parcels
High Risk Areas		
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.	
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.	**1245**
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).	
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.	
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.	
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.	
High Risk - Coastal Areas		
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.	
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year	**17**

	mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	
Moderate to Low-Risk Areas		
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile	**2390**
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.	
Undetermined Risk Areas		
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.	
Total		**3,652**

Table 58: Residential Structures in The Town of Corte Madera by Flood Zone
Source: FEMA

Table 18 shows the number of Town of Corte Madera critical facilities by flood zone.

Table 18: Town of Corte Madera Critical Facilities By Flood Zone

Category	Name	Address	Flood Zone
Fire	Corte Madera Fire Department (CMD) & Larkspur Fire Department (LRK) / Headquarters & Station 14	342 Tamalpais Drive Corte Madera, CA 94925	X
Fire	Corte Madera Fire Department (CMD) & Larkspur Fire Department (LRK) / Station 13	5600 Paradise Drive Corte Madera, CA 94925	AE
Law	California Highway Patrol Station (Marin Area)	53 San Clemente Drive Corte Madera, CA 94925	AE
Local Government	Corte Madera Town Hall	300 Tamalpais Drive Corte Madera, CA 94925	X
Local Government	Corte Madera Corporation Yard	81 Lucky Dr, Corte Madera, CA 94925	AE
School	Neil Cummins Elementary School	58 Mohawk Avenue Corte Madera, CA 94925	AE
School	The Cove School	330 Golden Hind Passage Corte Madera, CA 94925	AE
School	The Mountain School The Kids Place of Marin Corte Madera Montessori	50 El Camino Drive Corte Madera, CA 94925	X
School	Marin Country Day School	5221 Paradise Drive Corte Madera, CA 94925	AE
School	Marin Montessori	5200 Paradise Drive	AE

		Corte Madera, CA 94925	
Evacuation Shelter	Aegis Living Corte Madera	5555 Paradise Drive, Corte Madera, CA 94925	AE
Evacuation Shelter	Casa Buena Shelter	1591 Casa Buena Dr. Corte Madera, CA 94925	AE

Table 59: Town of Corte Madera Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Significant waterways that contribute to flooding within Corte Madera include Corte Madera Creek (draining the Ross Valley watershed), San Clemente Creek (a tidal slough winding between subdivisions and open space draining runoff into the San Francisco Bay), High Canal and associated channels, lagoons, and the Shorebird Marsh ponding area. Siltation within San Clemente Creek has significantly reduced its capacity to carry floodwaters from town.

Although the Town of Corte Madera has not experienced recent catastrophic flooding, floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within San Francisco Bay have the potential to significantly impact the Corte Madera storm drain system. Corte Madera already sees flooding from king tides in San Francisco Bay and this is only expected to increase with sea level rise and climate change. A failure of the Phoenix Lake Dam or a breach and/or overtopping of the levees along Corte Madera Creek could contribute to flooding in the lowland areas of Corte Madera.

On 1/9/2023, a significant rain event flooded Corte Madera roads that fed into Highway 101, rendering them impassable. there was extensive flooding in streets of the low lying neighborhood Mariner Cove, and rainfall caused a significant landslide on Endeavor Drive.

On 12/27/2022, an atmospheric river dumped enough standing water on Highway 101 at Lucky Drive in Corte Madera to close all of the northbound lanes, affecting morning traffic.

On 10/24/2021, a large storm caused lane closures on Highway 101 at Lucky Drive in Corte Madera.

On 1/10/2017, a moderate storm flooded roads and yards in Corte Madera. Seawolf Passage wasn't passable for much of the morning and several blocks in one neighborhood were flooded.

In 2005, there was extensive roadway flooding in the Madera Gardens neighborhood of Corte Madera after Larkspur's pump station in Redwood Marsh failed and water backed up into the neighborhood.

During every king tide higher than 6.5', the lowest areas of the Mariner Cove neighborhood are inundated with saltwater as tidal water pours in between houses and floods Golden Hind Passage interrupting traffic and cutting off some residents from accessing their homes. The neighborhood relies on a gravity storm system which does not function during certain high tides.

Figure 125: Flooding on Golden Hind Passage in Corte Madera, January 10, 2017
Source: ABC 7

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[11] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Corte Madera. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Corte Madera will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of Corte Madera. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of Corte Madera would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along Corte Madera Creek and the High Canal would expose more people, structures and infrastructure including major roads to creek flooding and storm surge from Corte Madera Creek as a result of climate change.

2.2.6 LAND SUBSIDENCE

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water

[11] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

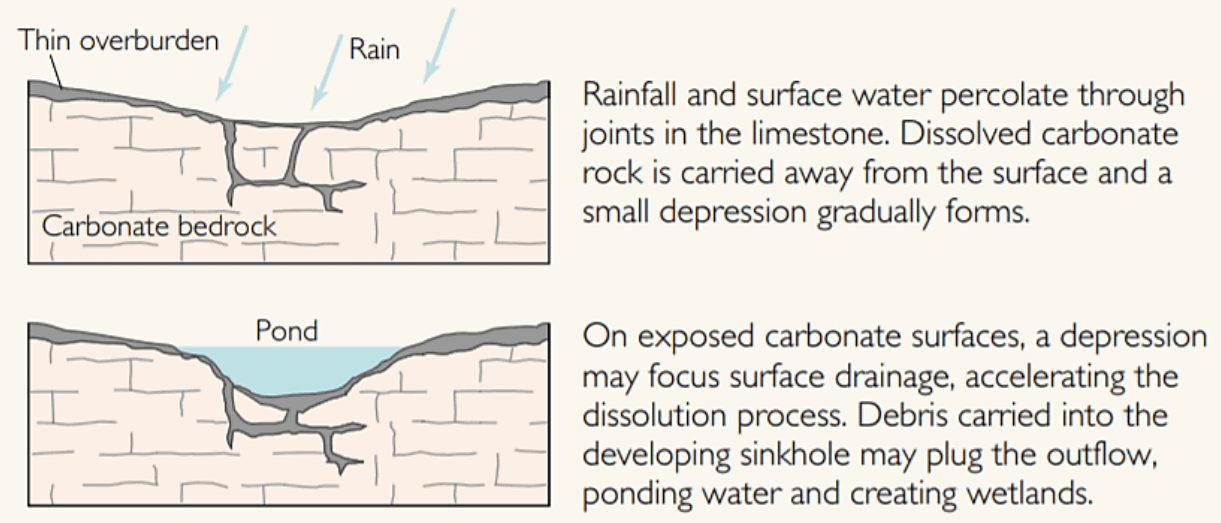


Figure 126: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 35 for a picture and description of how cover-subsidence sinkholes form.

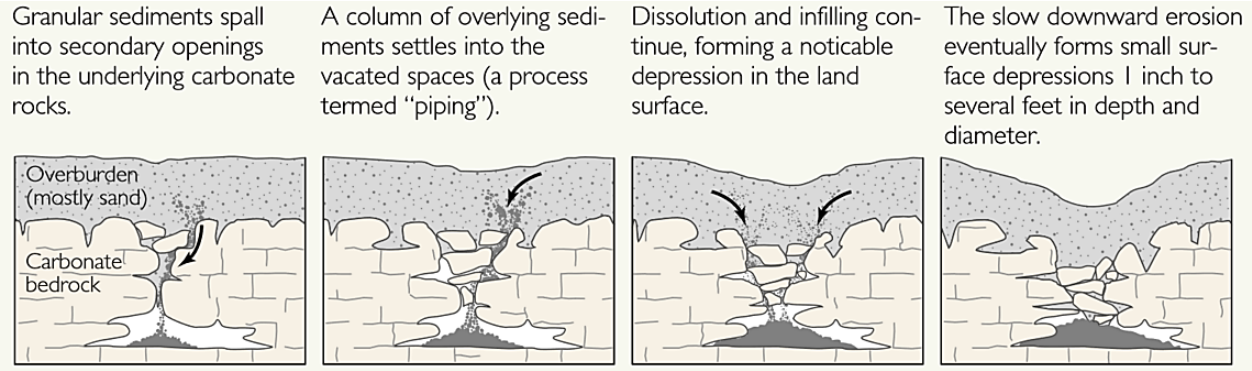


Figure 127: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over

time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 36 for a picture and description of how cover-collapse sinkholes form.

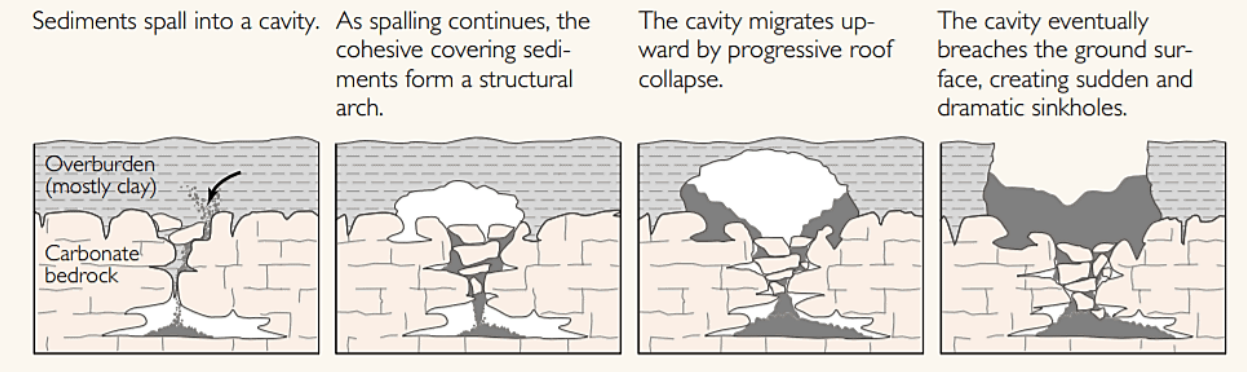


Figure 128: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central and eastern lowland areas of Corte Madera where superficial deposits and fill are more prevalent. This includes the primary commercial area of town along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for Corte Madera, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the town.

It has been observed that there has been significant subsidence occurring in the low lying neighborhoods in the central and east side of Town that were built over existing marshes and have a significant amount of bay mud below them. These neighborhoods will continue to subside in the future putting them at risk of tidal inundation and flooding.

There have been no major sinkholes recorded in Corte Madera, however, there have been several smaller sink holes around town caused by a variety of factors.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Corte Madera, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Corte Madera as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Corte Madera could increase with future development in the lowland populated areas of the city where land subsidence is more likely to occur.

2.2.7 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

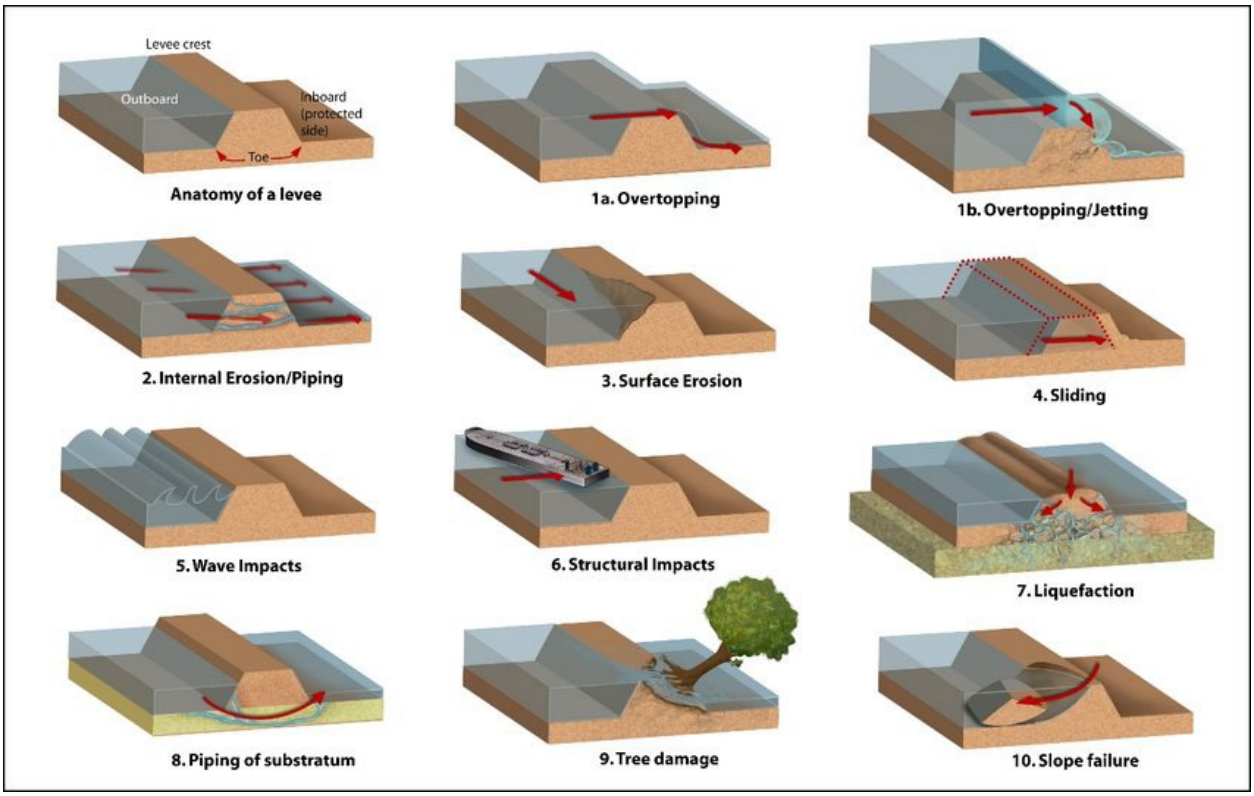


Figure 129: Levee Failure Mechanisms
Source: University of California

Corte Madera is protected by levees along Corte Madera Creek in the City of Larkspur, none of which are FEMA-accredited. The Corte Madera Creek Levee Evaluation Project was created to

evaluate the feasibility of increasing the level of flood protection for residences and businesses within Corte Madera Creek's 100-year floodplain, and to work towards having the levees become FEMA accredited. A failure of the levees along Corte Madera creek, along the Sonoma-Marin Area Rail Transit (SMART) right of way, or around Marina Village during a high rain event could cause flooding into the several areas of Corte Madera, with property and infrastructure within the 100-year floodplain being most susceptible.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Corte Madera, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Corte Madera, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Corte Madera protected by its levees, particularly along Corte Madera Creek and around its marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.8 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting

California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called “storm surge.” The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Much of Corte Madera was built on fill and is at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in Corte Madera are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these neighborhoods continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017)

Numerous businesses, residential neighborhoods, schools, churches, community centers, roads, and other critical facilities lie in areas of Corte Madera susceptible to sea level rise. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that Corte Madera could anticipate impacts to nearly 40 percent of the residential parcels and 80 percent of the commercial parcels in a 100-year sea level rise scenario and including storm surge, with over $30 million in damages and $725 million in total losses to vulnerable buildings. Structures throughout the town can become damaged extensively with their foundations compromised over time. Of particular concern are those structures and infrastructure that have not been elevated to projected sea level rise heights over the next century, including Highway 101 which could become more isolated due to sea level rise flooding. Sea level rise in Corte Madera has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into adjacent neighborhoods. Sea level rise can also cause increased subsidence along Corte Madera’s shoreline, which may damage underground water and wastewater pipelines and disrupt services. Corte Madera’s marshland would eventually turn into open water as a result of sea level rise, eliminating a natural barrier that protects the town from increased storm surge. Corte Madera would begin to experience seasonal, king tide, and storm surge flooding more frequently in the future.

Figure 130: Town of Corte Madera Sea Level Rise Impact 1 Foot
Source: Marin County OEM

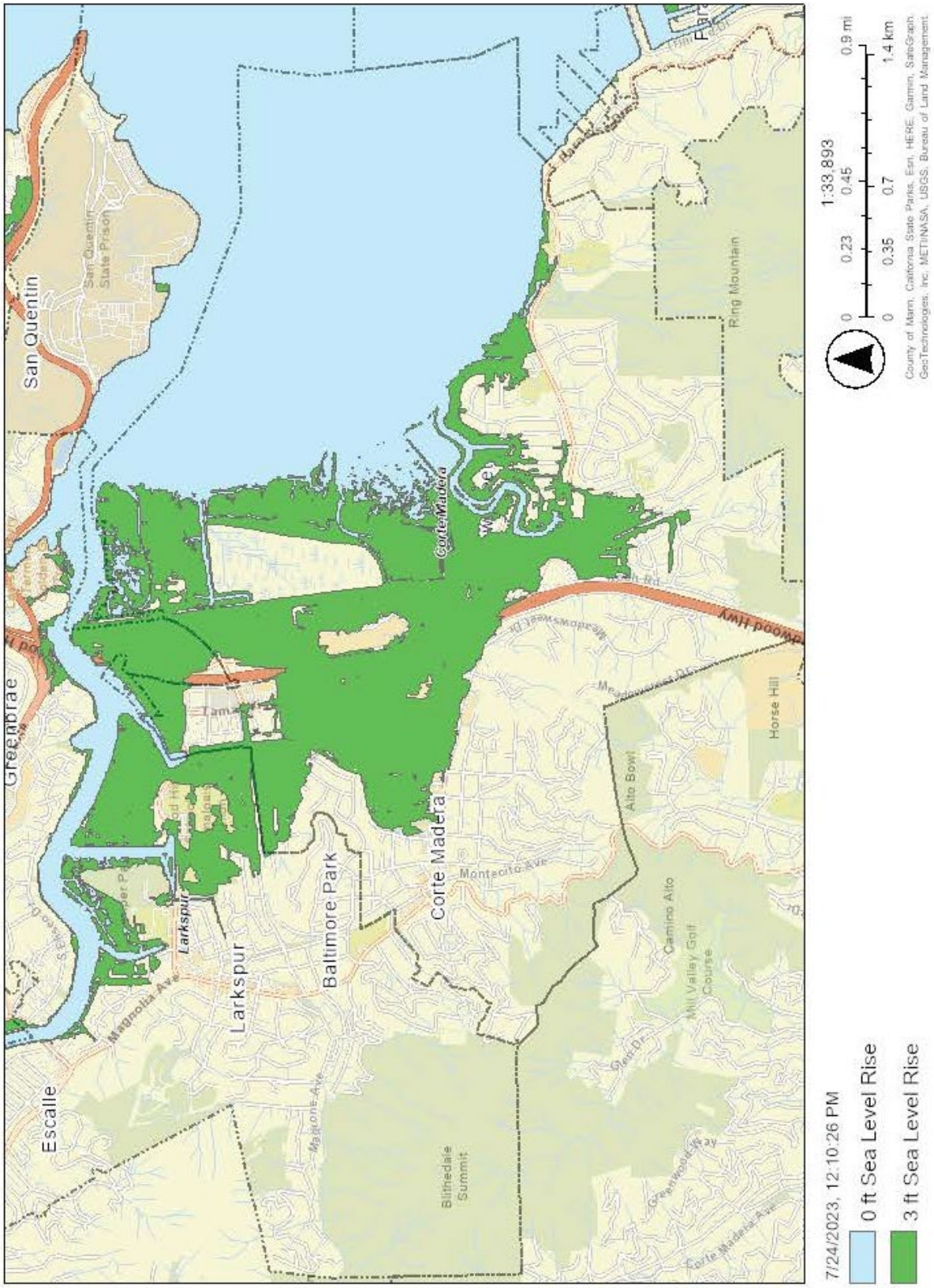


Figure 131: Town of Corte Madera Sea Level Rise Impact 3 Foot
Source: Marin County OEM

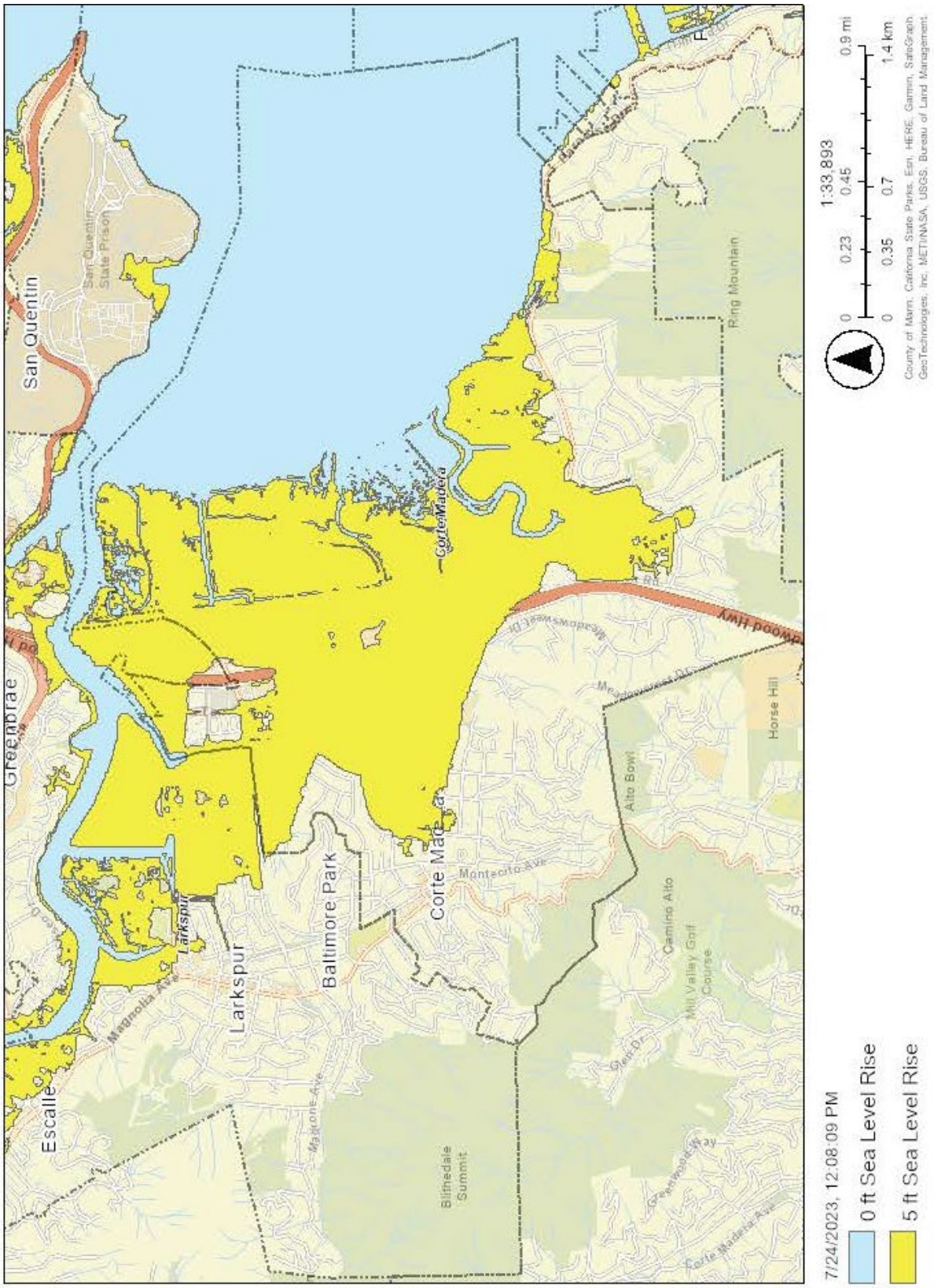


Figure 132: Town of Corte Madera Sea Level Rise Impact 5 Foot
Source: Marin County OEM

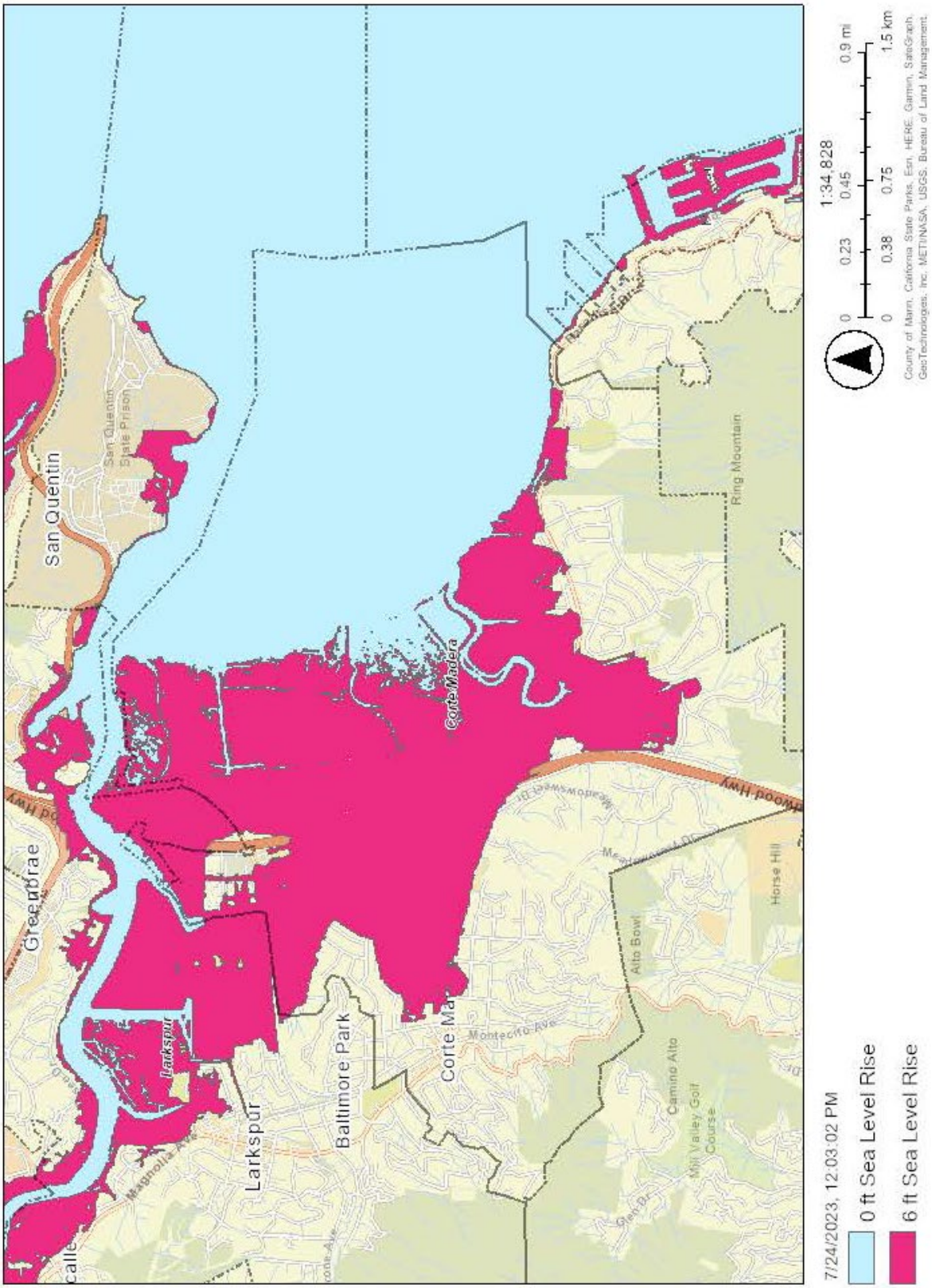


Figure 133: Town of Corte Madera Sea Level Rise Impact 6 Foot
Source: Marin County OEM

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

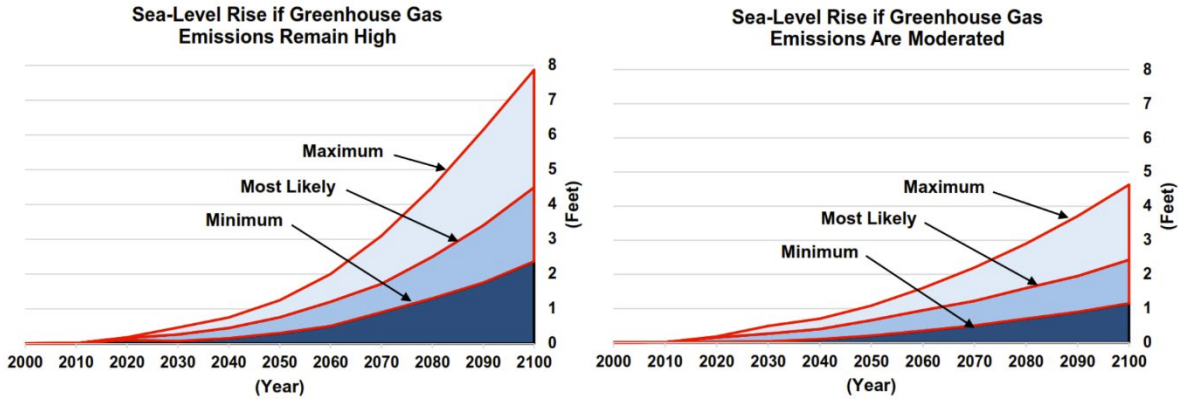


Figure 134: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Corte Madera already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Corte Madera with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Corte Madera will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Corte Madera will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across Corte Madera will continue to become inundated.

2.2.9 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 43):

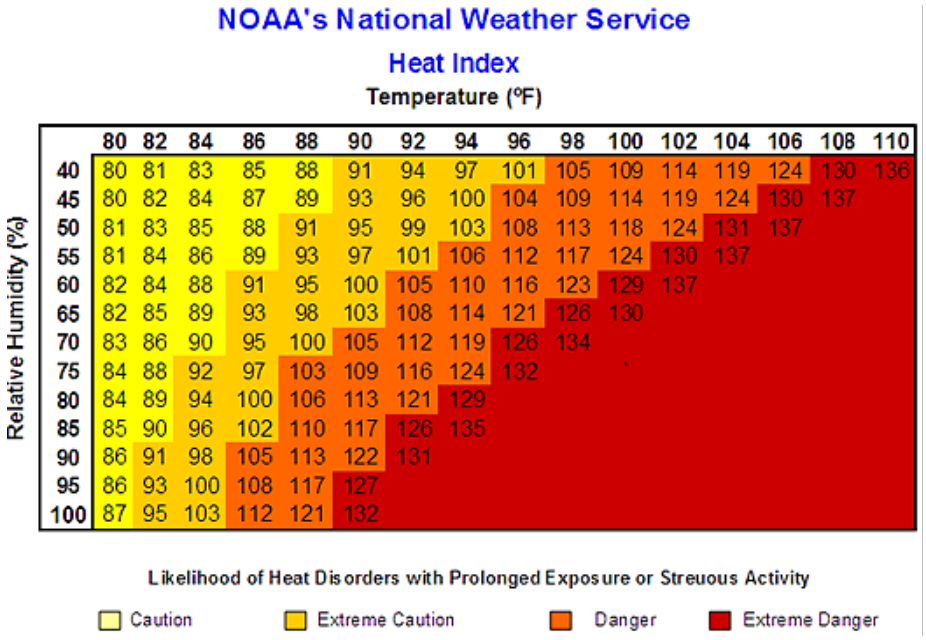


Figure 135: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Corte Madera and would be felt more at lower elevations in the central and eastern areas of the town. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

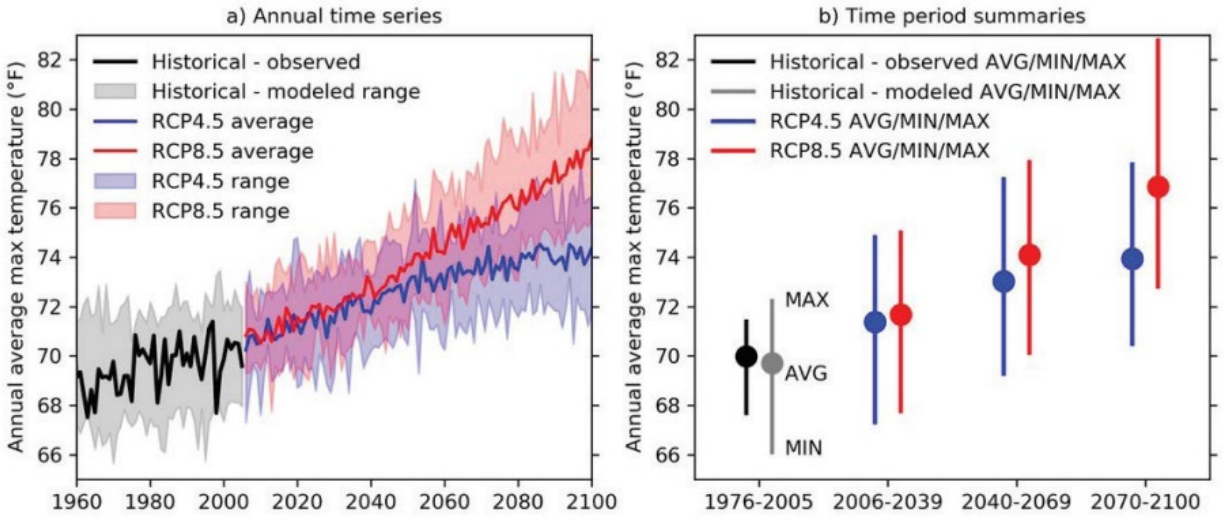


Figure 136: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Corte Madera. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Corte Madera where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Corte Madera could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Corte Madera as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of Corte Madera where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Corte Madera could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.10 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 45).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 137: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 46) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 138: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 139: Waterspout Formation
Source: MarineInsights

All of Corte Madera is susceptible to storms and damage from wind and tornadoes, though the mountainous areas on the western side of town have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind

event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes. On 12/23/2012, high wind blew down a large pine tree in Corte Madera, which crashed into a playground structure.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Corte Madera. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Corte Madera as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Corte Madera including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.11 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Corte Madera would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the town. Much of the central and eastern half of Corte Madera is at a lower elevation and lies in a tsunami hazard area. This includes the primary commercial area of town along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities that could experience flooding impacts from a tsunami. Communities that are particularly susceptible are those south of San Clemente Creek located directly on the shoreline of San Francisco Bay. A tsunami could also push water up Corte Madera Creek, impacting homes and businesses lying along the creek. Waves from a tsunami could reach about 10-15 feet by the time they reach bayside communities in Corte Madera.

Corte Madera has never experienced a tsunami however, given its proximity to the San Francisco Bay, it is within a Tsunami zone and could potentially experience the impacts of one.

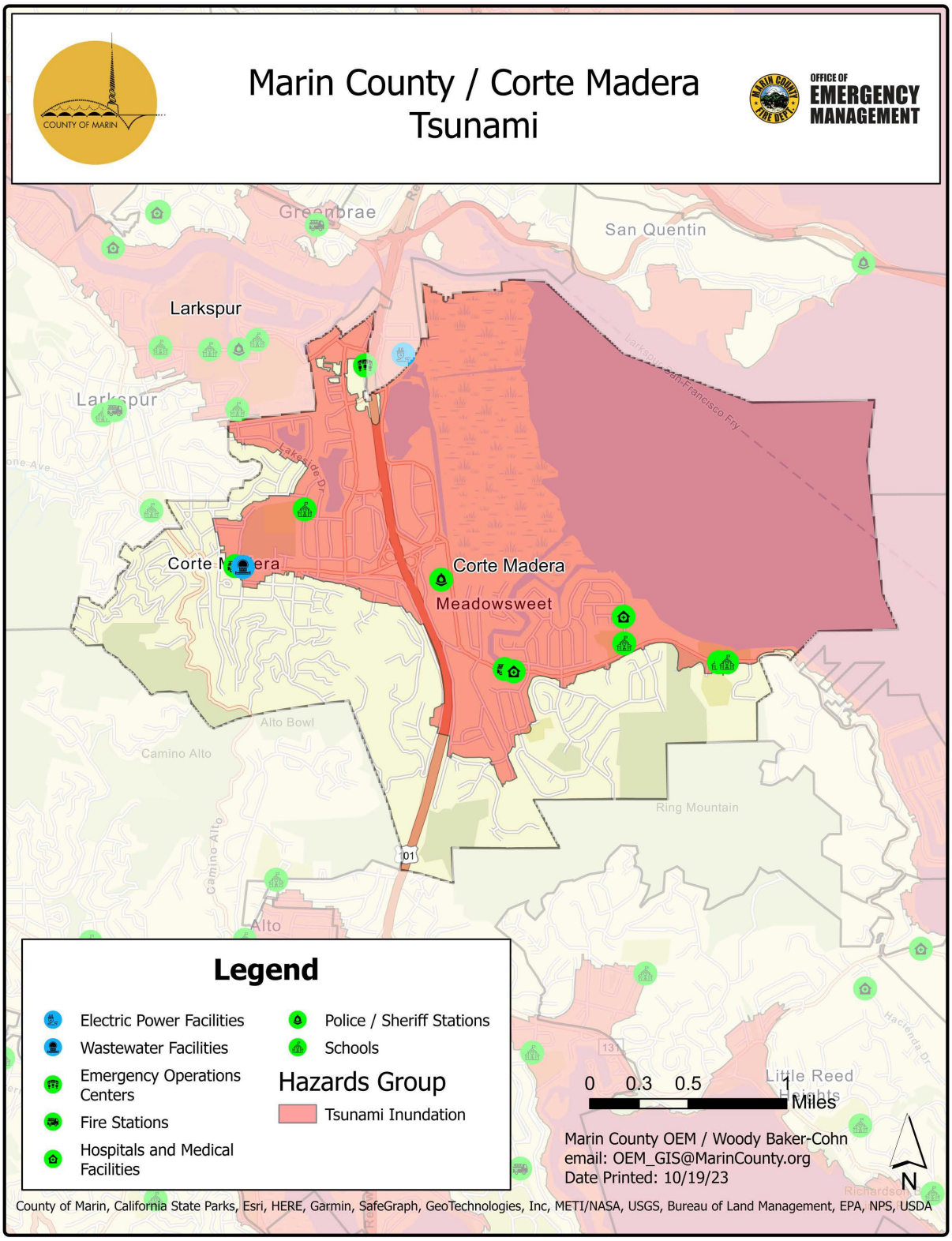


Figure 140: Town of Corte Madera Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Corte Madera, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Corte Madera. This is particularly true along Corte Madera Creek and around the marshland areas of Corte Madera where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Corte Madera would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Corte Madera Creek and along the shoreline of Corte Madera as a result of high wave heights associated with a more significant tsunami.

2.2.12 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new

development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA.. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 49 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

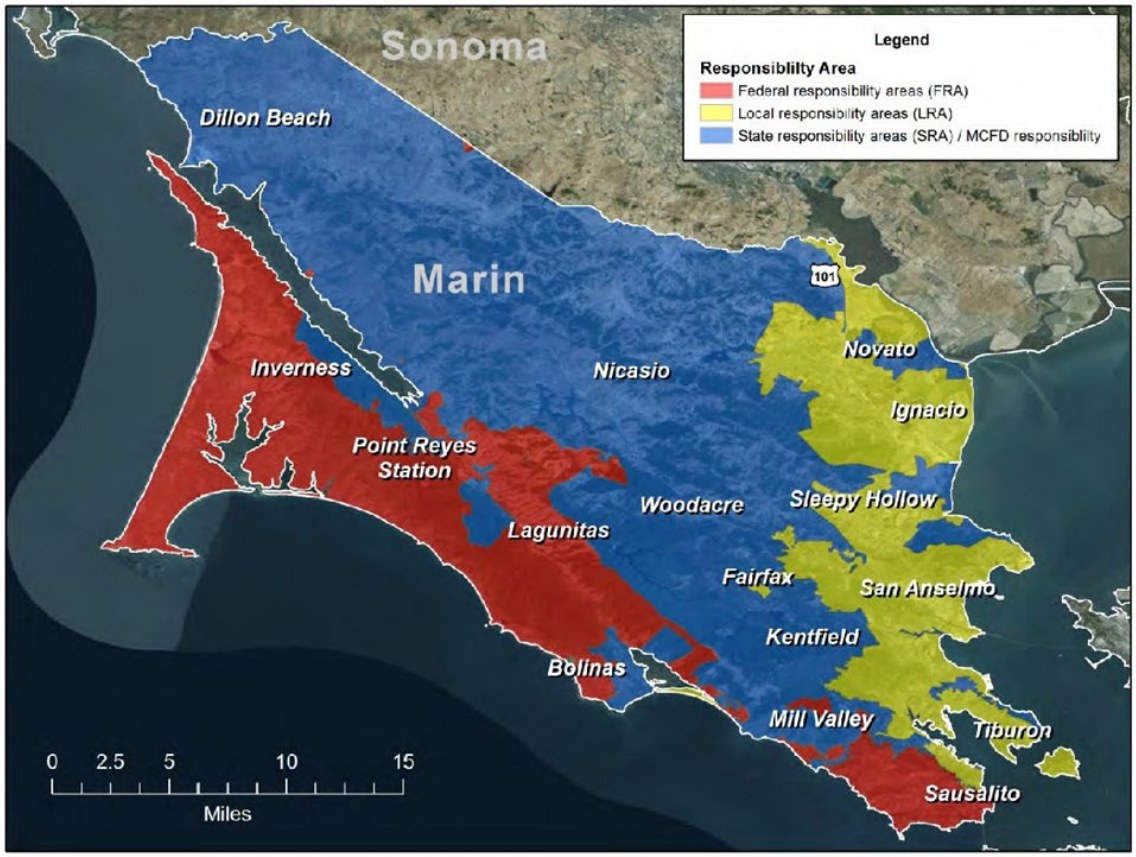


Figure 141: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan, 11/27/23

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern

Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios

due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

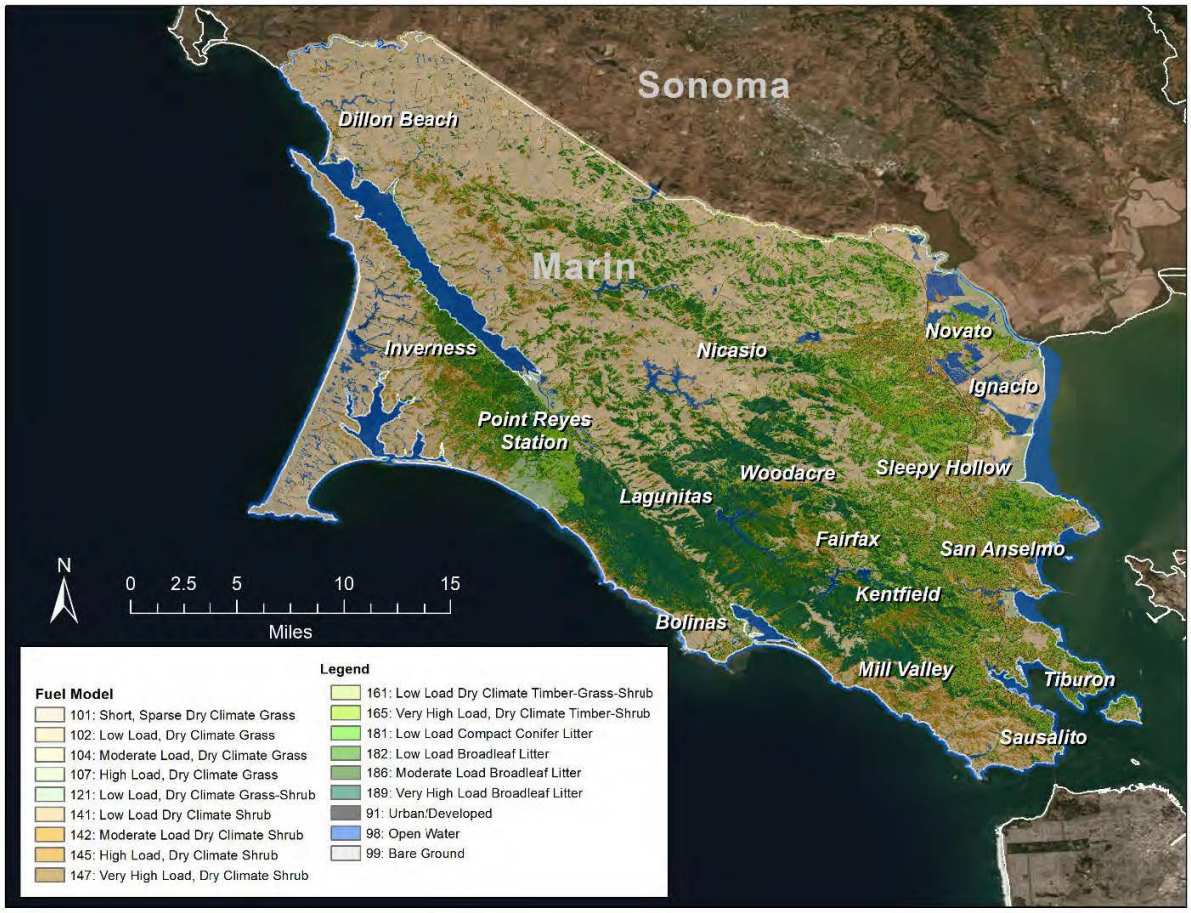


Figure 142: Fuel Model Map for the Marin County OA
Source: Marin CWPP, 11/27/23

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species) and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread

more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to 70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)

- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 Marin County and the Town of Corte Madera experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in Corte Madera would most likely occur on the southern side of the town where there is more forested terrain. This area of Corte Madera is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a wildfire. Many of the hillside neighborhoods are at risk of wildfires and have extremely limited ingress and egress for residents and emergency services.

Specific communities in Corte Madera at high risk of wildfire include Marin Estates, Chapman Park, Meadowsweet, Christmas Tree Hill, and Madera del Presidio. All of Corte Madera could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As wildland areas around Corte Madera become drier due to climate change, the risk of a wildfire occurring and impacting the town will continue to increase. Brush fires in the town may increase over time as marshlands, parks, and other open spaces experience drier conditions.

Corte Madera has never experienced a major wildfire, but brush fires have occurred in the town.

On 9/27/2022, a brush fire that grew to a half-acre triggered the closure of Corte Madera Avenue west of Tamalpais Drive in Corte Madera.

On 6/13/2020, an arsonist set several brush fires in Corte Madera marshland that were quickly extinguished.

On 10/10/2019, a brush fire broke out along Highway 101 amid reg flag weather conditions and PSP shutoffs. Firefighters were able to keep the fire from spreading across Casa Buena Drive.

On 9/14/2016, a brush fire started at a homeless camp in a marshland behind the Cost Plus Plaza off Redwood Highway and burned a half-acre of grass, threatening nearby grazing goats.

On 1/3/2014, a brush fire started near a homeless camp in Corte Madera and burned six acres of grassland near the Village Shopping Center.

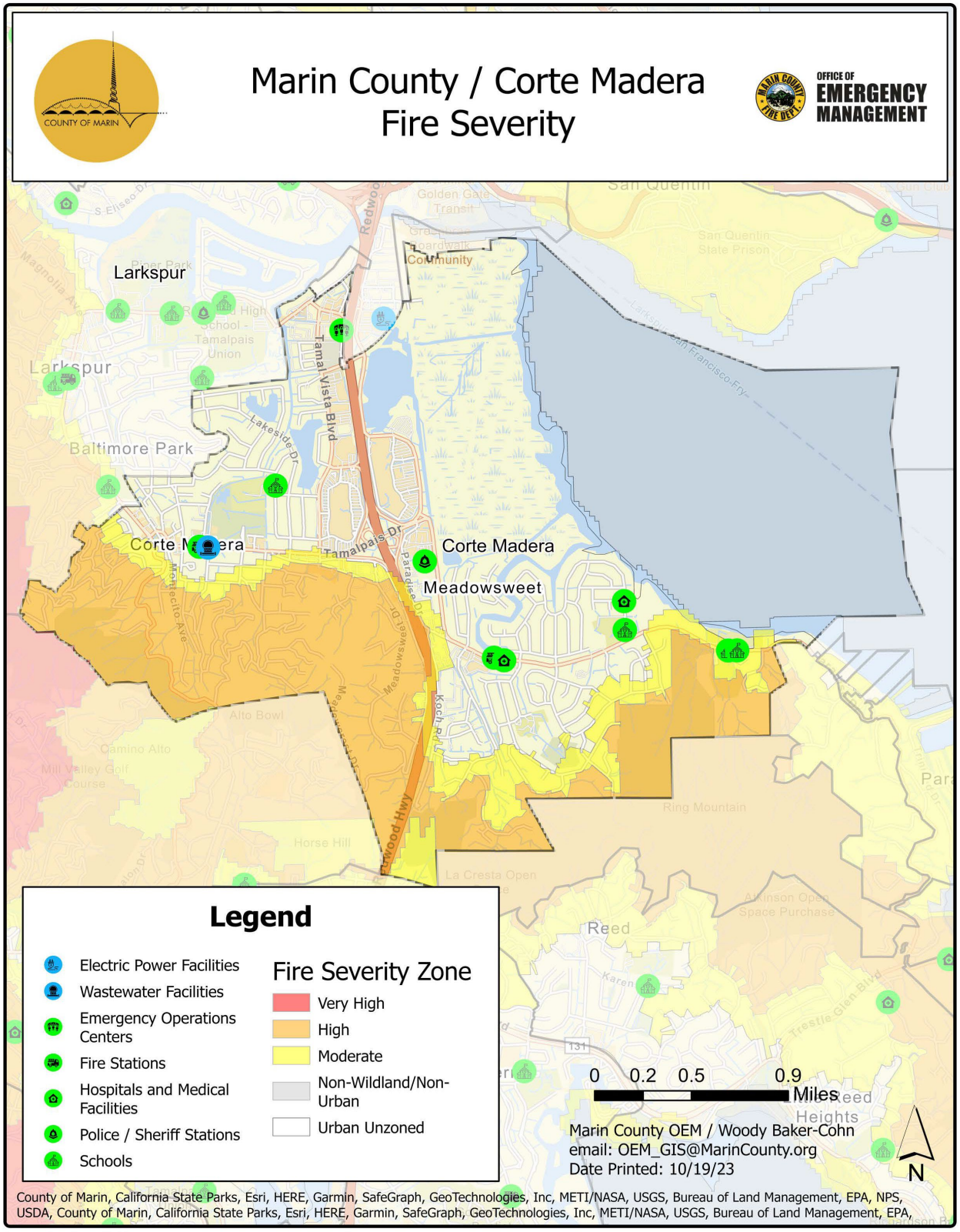


Figure 143: Town of Corte Madera Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

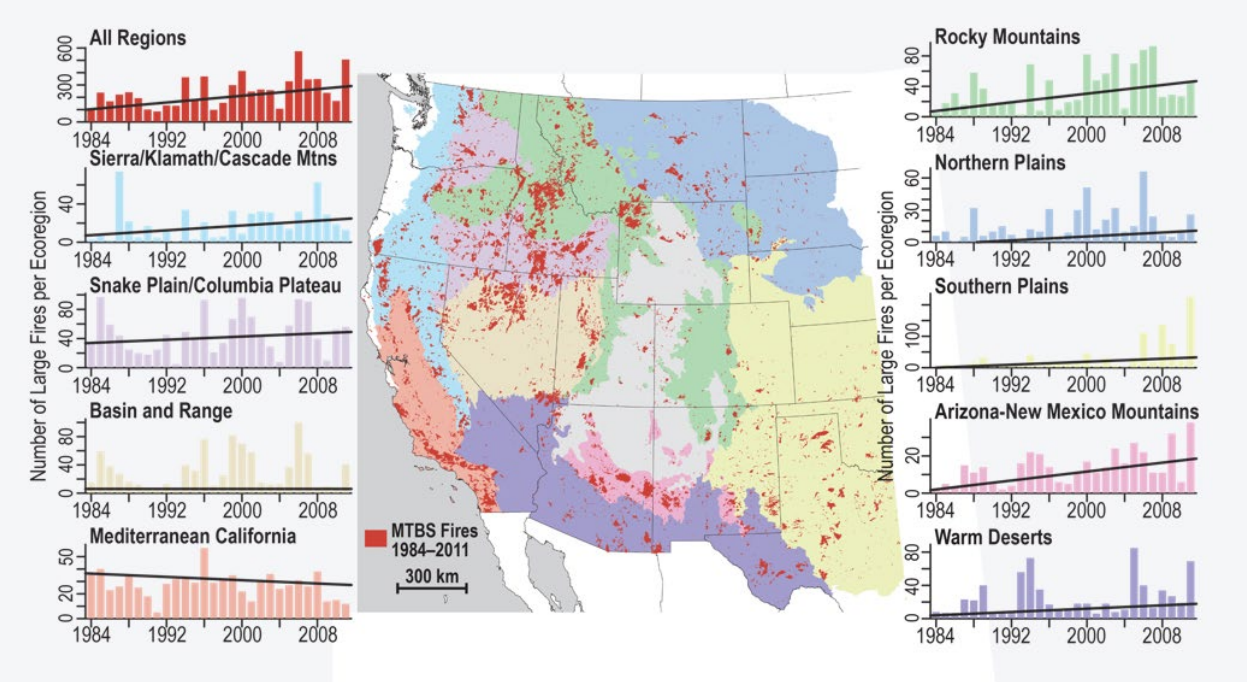


Figure 144: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Corte Madera is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around southern and western Corte Madera. Future development in the WUI throughout Corte Madera will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Corte Madera WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Corte Madera marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character. In 2023 the County of Marin updated the Housing Element of the General Plan, with input from the various jurisdictions within the county. Future large development in the County is not expected within the next 5 years, however, some managed development has been identified, approved, or submitted. In 2023, the Town of Corte Madera also updated the Housing Element of the General Plan.

There has not been a significant amount of development within the Town of Corte Madera since the last plan update in 2018. There has not been any increased risk to the town as a result of new development since the last plan update in 2018.

Future land use and growth management strategies in the Town of Corte Madera are consistent with priorities detailed in the 2018 Marin County MJHMP and aim to concentrate future development into and toward existing communities away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and to avoid conflicting uses.

Table 19: Town of Corte Madera Future Growth Areas

Development	# of Units	# of Parcels	Project Date[1]	Acres	Fire Severity Zone	Flood Zone
111 Lucky Drive	25	1	N/A	1.67	No	AE
5651 Paradise Drive	33	3	N/A	1.55	No	AE
41 Tamal Vista Blvd.	74	1	N/A	2.11	No	AE
400 & 500 Tamal Plaza	105	2	N/A	3	No	AE
2 Fifer Ave, 10 Fifer Ave, 110 Nellen & 150 Nellen	120	4	N/A	3.45	No	AE
5804 Paradise Drive	41	1	N/A	1.16	No	AE
5750 Paradise Drive	62	3	N/A	1.76	No	AE
100 Tamal Plaza	53	1	N/A	1.5	No	X
240 Tamal Vista	55	1	N/A	1.57	No	AE
Macy's (1400 Redwood Ave)	300	1	N/A	7.48	No	AE
Total	**868**	**19**				

1. **All sites rezoned on January 17, 2023 associated with the update to the Town of Corte Madera Housing Element Update (6th Cycle – 2023 – 2031)**

Table 60: Town of Corte Madera Future Growth Areas
Source: Town of Corte Madera

3.2 Capability Assessment

The overall priorities in the Town of Cote Madera have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall town priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the Town of Corte Madera General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the Town's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the Town of Corte Madera an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Local Emergency Operations Plan and Continuity of Operations Plan**: The Town would benefit from the development of our own emergency operations Plan and Continuity of Operations Plan. These Plans would allow the Town to develop response and contingency plans for the risk and vulnerability of the Town to the hazards identified in the Hazard Mitigation Plan.
- **Community Wildfire Protection Plan:** The Town plans to take an active role in mitigation actions to enhance wildfire protection.
- **Emergency Manager:** The Town will consider identifying staff to provide emergency management or disaster preparedness duties as a collateral role.
- **StormReady certification and Firewise Communities certification:** The town will consider participation in these programs.

Table 20: Legal and Regulatory Capabilities		
Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan/ Housing Element Safety Element	Y 2009/ 2023 2023	The General Plan outlines long-term direction for development and policy. The Town has a Safety Element in its General Plan that includes a discussion of fire, earthquake, flooding, and landslide hazards. This 2018 Local Hazard Mitigation Plan was adopted as an implementation appendix to the Safety Element. In addition, the Town enforces the requirements of the California Environmental Quality Act (CEQA), which, since 1988, requires mitigation for identified natural hazards. The Town has used these pre-existing programs as a basis for identifying gaps that may lead to disaster vulnerabilities in order to work on ways to address these risks through mitigation. As this plan gets updated there is potential to improve it with updated risk information and strategies. The Housing and Safety Elements of the Town General Plan were updated in 2023.
Strategic Plan	N	
Capital Improvements Plan	Y 2022	The Capital Improvement Plan (CIP) directs construction activities for Town owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure. As this plan gets updated there is potential to improve it with updated strategies.
Economic Development Plan	N	
Local Emergency Operations Plan	N	
Continuity of Operations Plan	N	
Flood Mitigation Plan (FMP)	Y 2011	This plan includes more specific information on Flood Mitigation, including listing additional resources, goals, strategies, and actions.
Engineering Studies for Streams	N	
Open Space Management Plan	N	
Regional Transportation Plan (RTP)	N	Regional transportation plan completed by Transportation Authority of Marin
Stormwater Management Plan/Program	Y 2022	Storm Drain Master Plan currently underway.
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate	Y 2021	Climate Adaptation Assessment

change adaptation)		
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	Yes. Projects are reviewed for compliance with building code standards. Building permit applications are routed to various departments for review (Building, Planning, Fire, and Public Works) as necessary to ensure compliance with applicable codes and standards.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Central Marin Fire Department has an ISO rating of 2.
Site plan review requirements	Y	Yes. Projects are reviewed for compliance with development standards, including required setbacks. The majority of building permit applications submitted to the Town are required to provide a site plan.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Muni Code includes several sections that address hazard mitigation including Title 6 Health and Sanitation, Title 15 Buildings and Construction, and Title 16 Protection of Flood Hazard Areas
Zoning ordinance	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision ordinance	Y	Title 17 (Subdivisions). In addition, Chapter 18.31A (Two-Unit Developments & Urban Lot Splits) establishes a ministerial review process and provide objective zoning standards for Two-Unit Developments and Urban Lot Splits.
Floodplain ordinance	Y	Chapter 16.10 (Flood Damage Prevention)
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N	
Flood insurance rate maps	Y	
Elevation Certificates	Y	
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Y	

Table 61: Town of Corte Madera Legal and Regulatory Capabilities
Source: Town of Corte Madera

Town of Corte Madera General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The Town of Corte Madera General Plan, adopted in April 2009, was prepared over a one year period that included an extensive public review process. The General Plan is the most important policy and planning document in the Town and is used by virtually every department. The General Plan is the Town's statement of its vision for the future. The General Plan contains policies covering every aspect of the Town: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety. The Housing, Land Use, and Safety Elements of the General Plan were updated in 2023.

Town of Corte Madera specific goals and policies related to mitigation of natural hazards are as follows:

Table 21: Town of Corte Madera General Plan

Goal/Policy/ Program	Explanation
Land Use Element	
Goal	A mix and distribution of land uses that enhances community character and serves the needs of existing and future Town residents. A variety of safe, pleasant, well-maintained and distinctive residential neighborhoods. Infill development that achieves a more livable, sustainable community. Strong and vibrant commercial and office centers that serve local and regional needs. A strong and vibrant local economy. An efficient and well-maintained network of public and institutional facilities and services that meet the health, education, and governmental needs of all citizens.
Policy	Lu-1.3. Provide high quality plan review and inspection services through the Town's Building division for all construction activities undertaken in the community.
Program	LU-1.3.a – Building Code Enforcement. Continue Building code plan checking and inspection services.
Policy	LU-2.3. Protect and conserve the existing housing stock and existing residential areas. Require owners to maintain their properties in good condition and appearance and to eliminate unsafe and unhealthy conditions. Protect residents and maintain the housing stock by enforcing the Zoning Ordinance and the building, housing, and fire codes for all types of residential units.
Program	LU-2.3.a: Code Enforcement. Continue zoning, building, and fire code enforcement to ensure compliance with development and maintenance regulations as well as health and safety standards.
Policy	LU-2.4. Ensure new residential development and upgrades to existing residential development are compatible with existing neighborhood character and structures.
Program	LU-2.4.a: Development compatibility. Require that new single-family, residential mixed-use, medium-density and high-density residential development and upgrades to residential developments are of high quality and in accordance with the Housing Chapter, Resource Conservation and Sustainability Chapter, and Community Design Chapter of the General Plan, and with Town adopted design guidelines.
Policy	LU-2.5. Encourage property owner reinvestment in upgrades to existing residences and related property improvements.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
Program	LU-2.5.a; Property Upgrades. Support upgrades to existing residential structures when consistent with the General Plan and Zoning Ordinance, the Town development standards and design review.
Policy	LU-6.2. Provide high-quality fire protection and paramedic services for residents and businesses in the community
Program	LU-6.2.a: Response Times. Maintain the existing target response time of five minutes or less for emergency Fire calls through adequate staffing and proper distribution of Fire stations and equipment.
Program	LU-6.2.b: Update Town Impact Fees. Through periodic updates to Town impact fees require all new development to contribute funding toward necessary Fire and paramedic facilities and equipment.
Program	LU-6.2.c: CERT Training. Use available staff resources to support community Emergency Response Team training classes.
Program	LU-6.2.d: Fire Department Review. Include Fire Department review and comments on proposed building plans to address safety concerns.
Program	LU-6.2.e: Upgrade Fire Facilities. Identify necessary upgrades to Fire and paramedic facilities and equipment during development project, environmental review and planning activities.
Policy	LU-6.3. Provide high-quality law enforcement services for residents and businesses in the community.
Program	LU-6.3.a: Target Response Time: Maintain the existing target response time of three minutes or less for urgent assistance calls.
Program	LU-6.3.b: Financing of Police Services. Through periodic updates to Town impact fees, require all new development to contribute fair-share funding toward necessary law enforcement facilities and equipment.
Program	LU-6.3.c: Promote Public Safety Programs. Regularly promote ongoing public safety programs, including Neighborhood Watch, Police Explorers, and other public education and crime prevention efforts.
Program	LU-6.3.d: Police Department Review. Include Police Department review and comments on proposed building plans to address safety concerns.
Program	LU-6.3.e: Law Enforcement Facilities. Identify and support necessary upgrades to law enforcement facilities and equipment. This should include improvements to the existing Twin Cities Police Department facility in Larkspur, coordinate with the City of Larkspur.
Policy	LU-6.9. Maintain existing infrastructure systems.
Program	LU-6.9.a: Infrastructure Maintenance. Continue to work with service agencies to ensure the maintenance of infrastructure systems in Corte Madera.
Conservation and Open Space Element	
Goal	An established vision for a sustainable Corte Madera. Reduced consumption of non-renewable energy sources in Corte Madera. Reduce existing and future levels of GHG emissions originating from within the community. Increased recycling participation by Town residents and businesses. An enhanced environment through conservation of valuable resources. Sustainable resources management. Biodiversity and sustainable habitat.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
	Long-term sustainability of wetlands. Protect, restore and enhance the quality of surface and groundwater resources to meet the needs of all beneficial uses. Attainment of Air Quality standards in the San Francisco Bay Air Basin. Preservation and enhancement of historic resources within the community.
Policy	RCS-2.2. Increase energy conservation and efficiency within Corte Madera
Program	RCS-2.2f: Heat Islands. Minimize heat islands and the resulting increase in energy use for cooling, by avoiding the use of materials such as some types of artificial turf that have excessive heat reflect characteristics, and by using cooling techniques such as landscape sharing where reasonable feasible.
Policy	RCS-3.1. Actively seek to reduce greenhouse gas emissions within the planning area.
Program	RCS-3.1.a: Implement California Air Resources Board Regulations. The Town shall implement regulations adopted by the California Air Resources Board or other applicable regulatory agencies to reduce greenhouse gas emissions.
Program	RCS-3.1.b: Support Marin County's Greenhouse Gas Reduction Plan. The Town shall support Marin County's greenhouse gas mitigation measures.
Program	RCS-3.1.c: Cities Climate Protection Campaign. Continue participation in the Cities for Climate Protection Campaign, administered by ICLEI (Local Governments for Sustainability), which includes conducting a greenhouse gas emissions audit and establishing a greenhouse gas emissions reduction target.
Policy	RCS-6.1. Protect natural values of open space and habitat areas while promoting recreational and related uses that are compatible with resource protection.
Program	RCS-6.1.a: Open Space Uses. Maintain open space areas in natural states, making open space recreational use secondary to protection of resources by implementing General Plan Land Use policies.
Program	RCS-6.1.b: Management of Open Space. Continue supporting the protection of existing environmental and open space preserves. Coordinate management actions of these areas with adjoining cities and Marin County Open Space District.
Policy	RCS-6.2. Protect wetlands, other waters of the United States, and essential habitat for special status species, including, but not limited to, other wetland habitat areas, habitat corridors, and sensitive natural communities.
Program	RCS.6.2.a: Resource Protection. Protect sensitive biological resources, including wetlands and other waters of the Unites States and other wetland habitat areas, and habitat corridors, and sensitive natural communities through environmental review of development applications in compliance with CEQA provision.
Program	RCS-6.2.b: Restoration Objectives. Where feasible restore lost or damaged habitat. Support restoration objectives for local habitat types identified by the California Department of Fish and Wildlife and in other regional planning documents.
Policy	RCS 6.3. Manage the development review process in compliance with CEQA provisions to promote resource conservation and sustainability.
Program	RCS-6.3.a: Environmental Review. Continue to require environmental review of development applications pursuant to CEQA to assess the impact of proposed development on species and habitat diversity, particularly special-status species, sensitive habitat areas, wetlands and other wetland habitats, and habitat connectivity. Require adequate mitigation measures for ensuring the protection of sensitive habitat acreage, value and functions. Require specific mitigation measures for wetlands and waters of the United States.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
Policy	RCS-6.7. Protect migratory corridors.
Program	RCS-6.7.a: Migratory Corridors. Condition approval of development proposals to assure that movement corridors for migratory fish and wildlife species are maintained. Coordinate with Marin County and adjoining jurisdictions, and federal and state agencies such as CalTrans, to assure regional connectivity of open space and wildlife corridors.
Policy	RCS-7.1. Conserve, restore and enhance areas containing important habitat, wetlands and special status species.
Program	RCS-7.1. Protect biodiversity. Protect areas known to support a high degree of biological diversity and that may contain species known to be rare or protected under the State or Federal Endangered Species Act. These include the Town's tidal wetlands, freshwater wetlands, and hillside oak woodlands.
Policy	RCS 7.2. Retain sensitive habitat areas and restore to their natural state, where feasible, and protect from inappropriate development and landscaping.
Program	RCS 7.2.c: Limit Impacts. As part of the development review process, restrict or modify proposed development in areas that contain essential habitat for special status species, sensitive habitat areas or wetlands as necessary to ensure the continued health and survival of these species and sensitive area.
Policy	RCS 7.4. Protect woodland and tree resources.
Program	RCS 7.4.a: Tree Protection. Protect large native trees, trees with historical importance, oak woodlands, and forest habitats, and prevent the untimely removal of trees through implementation of standards in the Town's Municipal Code. Evaluate tree protection standards as part of the project to develop Design Guidelines and update the Tree Ordinance accordingly.
Policy	RCS-7.8. Limit utility placement in open space.
Program	RCS-7.8.a: Utility Placement. Discourage placement of utilities in open space areas. Necessary utilities should be located and designed to minimize impacts to open space and habitat areas. Ensure that adequate tree canopy visually buffers utility facilities from lower vantages.
Policy	RCS-8.3. Use flood basins for seasonal habitat.
Program	RCS-8.3.a: Utilize natural or managed flood basins to provide seasonal habitat for waterfowl and shorebirds, and avoid development in these basins to protect habitat values.
Policy	RCS-8.4. Work towards integrated management of tidal areas and drainages within the Town limits.
Program	RCS8.4.b: Restore Waterway Function. Restore waterway's natural functions where possible. Keep drainageways open and daylight culverted drainageways wherever feasible.
Policy	RCS-9.1. Continue to comply with local, state, and federal standards for water quality.
Program	RCS-9.1.b. Stormwater Runoff Measures. Continue to incorporate measures for stormwater runoff control and management in construction sites.
Program	RCS-9.1.c: Water Quality Improvements in Waterways. Support water quality improvements in creeks and drainage in accordance with standards of the Regional Water Quality Control Board or any agencies with jurisdiction.
Policy	RCS-9.3. Establish development guidelines to protect areas that are particularly susceptible to erosion and sediment loss.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
Public Safety	
Goal	Reduced fire hazards Town-wide. Achieve high level of public safety for all Town residents and businesses. Emergency access availability in hillside areas. Minimized noise intrusion to commercial and office areas along the Highway 101 frontage. Town noise standards to provide protection from unsafe and undesirable noise levels. Projects that minimize noise impacts to sensitive receptors. Residential and structural protection from hazardous seismic and subsidence activity.
Policy	PSH -1.1. Require fire safe construction practices, such as fire preventive site design, landscaping, and building materials, and installation of sprinklers on new development and redevelopment projects.
Program	PSH-1.1.a: Non-Combustible Construction. Continue to implement requirements for non-combustible roofs and expand the Fire code to include non-combustible exterior siding.
Program	PSH 1.1.b: Development Review. Through the project review process, continue to ensure that landscaping, lighting, building siting and design, adequate water pressure and peak load storage capacity, and building construction materials reduce the opportunity for fire hazards.
Program	PSH 1.1c: Firefighting Access. Continue to require access for emergency vehicles and firefighting equipment on all new development and redevelopment projects. The Town shall also identify the feasibility of constructing additional emergency access improvements.
Program	PSH-1.1.d: Seismic Shutoff Program. Continue to operate the Seismic Shutoff Program by requiring emergency shutoff valves on natural gas lines as part of new construction and remodel projects as required by the Fire Code.
Policy	PSH-1.2. Encourage landscaping maintenance programs to reduce potential fire hazards in the hills, wildland areas and urban interface.
Program	PSH-1.2.a: Vegetation Management. Continue to aggressively enforce vegetation management as required by the Fire Code. The Town shall also identify the feasibility of other aggressive vegetation management options.
Program	PSH-1-2.b: Construction Materials. Continue to require use of construction materials that decrease fire hazards in new developments in hillside areas, including mandatory use of spark arresters on chimneys.
Program	PSH-1.2.c: Landscaping Requirements. Require the use of fire-safe planting materials in landscape plans for new development, including the use of non-prolific species. Include provisions in the Design Guidelines.
Program	PSH-1.2.d: Use Website for Fire Awareness. Provide information on methods for reducing fire hazards through the Town's website and newsletter, including clearing of plant debris and use fire-safe landscaping.
Policy	PSH-1.3. Reduce fire hazard risks in existing developments by ensuring that private property is maintained to minimize vulnerability.
Program	PSH-1.3.a: Structure Compliance. Conduct annual inspections to require property owners to maintain their structures in compliance with safety standards identified in adopted Codes.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
Program	PSH-1.3.b: Smoke Detector Requirements. Continue to promote smoke detector installation in existing structures. Require the installation of smoke detectors as a condition for granting a permit on any new development or redevelopment project.
Program	PSH-1.3:c: Fire Extinguisher Installation. Continue to promote fire extinguisher installation in existing structures through distribution of informational brochures and notices to Town residents and businesses.
Program	PSH-1.3.d: Wildland Urban Interface Ordinance. Continue to implement the Wildland Urban Interface Ordinance.
Policy	PSH-1.4. Adopt and regularly update Standards of Coverage for the Town.
Program	PSH-1.4.a: Standards of Coverage. The Fire Department shall complete its Standards of Coverage document addressing provisions of fire protection for the Town. Additionally, the Town Council will adopt and regularly update the Standards of Coverage report.
Policy	PSH-2.1. Establish and maintain an effective emergency response program that anticipates the potential for disaster.
Program	PSH-2.1.a: Implement Town Emergency Plan. Continue to implement consolidated emergency response programs and plans for fire, flooding, seismic and other potential hazard events contained in the Town Emergency Response Plan. The Plan shall be shared among Town departments, emergency response providers and support groups.
Program	PSH-2.1.b: Community-Based Disaster Plan. Continue to involve community-based disaster response planning that involves local businesses and neighborhoods.
Program	PSH-2.1.c: Emergency Response Plan. Regularly update and publicize the Town's Emergency Response Plan to include evacuation routes, emergency connectors, and emergency shelters in conformance with state guidelines through the Library, Town website, local radio and other community outreach sources.
Program	PSH-2.1.d: Emergency Drills. Hold regular (at least one per year) emergency preparedness drills and include the services of the Community Emergency Response Training (CERT), Marin OEM and related emergency services agencies and groups.
Program	PSH-2.1.e: Natural Hazards Awareness. Promote awareness and caution among residents regarding possible natural hazards, including landslides, earthquakes, flooding, fire hazards through a publicized disaster plan.
Policy	PSH-2.2. Provide public safety employee training to ensure team members' skills remain current.
Program	PSH-2.2.a: Training for Town Employees. Continue to train Town and public safety employees in emergency responsiveness. Include the Marin County Office of Emergency Management (OEM) in training exercises.
Policy	PSH-2.3. Maintain active involvement with Marin Emergency Radio Authority (MERA) and pursue installation and activation of the MERA radio system.
Program	PSH-2.3.a: MERA Radio System. Work with MERA to install and activate the MERA radio system in Corte Madera, consistent with Town emergency response plan needs.
Policy	PSH-2.4. Maintain active maps of fire hazards.
Program	PSH-2.4.a: Update Fire Hazard Maps. Periodically update maps identifying fire hazard areas in Corte Madera.
Policy	PSH-2.5. Continue to coordinate neighborhood disaster response preparedness planning efforts through fire programs and coordination with emergency response agencies.
Program	PSH-2.5.a: Neighborhood Safety Training. Organize neighborhood teams of CERT graduates and continue to support neighborhood training on how to maintain public safety.

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
Program	PSH-2.5.b: Special Needs Services. Work with social service community to ensure the safety of special needs population during times of disaster.
Policy	PSH-2.6. Utilize mutual aid agreements that provide public safety personnel in times of emergency.
Program	PSH-2.6.a: Mutual Aid Agreements. Continue to support mutual aid agreements with local agencies and jurisdictions that provide public safety personnel in times of emergency.
Policy	PSH-2.7. Explore ways to transport public safety employees from outlying areas when damaged infrastructure prevents them from driving to Corte Madera in emergency situations.
Program	PSH-2.7.a: Ingress/Egress Plans. Include a public safety "ingress" component to the Town's emergency preparedness plans.
Policy	PSH-2.8. Ensure that public safety facilities, apparatus, and equipment are designed and constructed adequately to efficiently operate paramedic, fire, and police services in times of disaster.
Program	PSH-2.8.a: Public Safety Audits. Conduct performance audits of public safety facilities and identify any needed corrective measures.
Policy	PSH-2.9. Establish or identify facilities and provide equipment that may be used by residents during the first days immediately after a major disaster.
Program	PSH-2.9.a: Identify Emergency Supplies. Identify needed emergency supplies to assist Town residents in the first days following an emergency or major disaster.
Program	PSH-2.9:b. CIP Funding for Emergencies. Use Capital Improvement Program or similar funding to establish a readily accessible supply of funds for use by the Town in times of an emergency or major disaster.
Policy	PSH-3.1. Encourage hillside residents to learn the trails and footpaths in their neighborhoods for use as alternative escape routes.
Program	PSH-3.1.a: Ingress and Egress Routes. Work with the Christmas Tree Hilldweller's Association and similar groups to identify emergency ingress and egress routes, including opportunities for construction of periodic vehicle pullouts.
Policy	PSH-3.2. Pursue the development of emergency route connectors to service roads in the hillside areas in a manner that resects the established semirural neighborhood character.
Program	PSH-3.2.a: Emergency Vehicle Access. Increase accessibility to emergency vehicles in hillside areas and improve evacuation routes through construction of vehicle pullouts and through exploration of road widening or construction in selected wildland fire hazard areas.
Policy	PSH-3.3. Maintain road conditions for improved emergency access.
Program	PSH-3.3.a: CIP Funding for Vehicle Access. Use Capital Improvement Program funding to maintain roadways and to improve vehicle emergency access.
Policy	PSH-8.1. All construction in Corte Madera shall comply with the California Building Code, including requirements for seismic design.
Program	PSH-8.1.a: Enforce California Building Codes. Enforce requirements of the California Building Code, including seismic design provisions, as part of the building permit issuance and inspection process.
Program	PSH-8.1.b: Adopt Updated CBC. Adopt updated versions of the California Building Code to address new technical and structural requirements that improve safety.
Policy	PSH-8.2. New development and redevelopment projects with the potential for geological hazards, such as slope failures or soil subsidence, shall be subject to geotechnical

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
	evaluation prior to approval.
Program	PSH-8.2.a: Geotechnical Reports. Require new development and redevelopment projects in hillside areas subject to the Hillside Land Capacity Overlay District regulations, on slopes of 30% or more, or on sites designated “3” or”4” on the map entitled “Interpretation of the Relative Stability of Upland Slopes on the Tiburon Peninsula, Sausalito, and Adjacent Areas, Marin County, California, 1976” or areas subject to subsidence to submit a geologic investigation and a report by a qualified engineering geologist with application materials. The reports shall address potential for slope failure, soil subsidence and related geologic events, and recommend measures to minimize hazards.
Program	PSh-8.2.b: Development Standards. In areas with identified geotechnical hazards, development shall conform to geotechnical report mitigation measures and/or project and site modifications to respond to site-specific hazards and constraints.
Program	PSH-8.2.c: Denial Condition. The Town may deny applications for development on excessively steep hillsides where slope stability mitigations are not deemed feasible by the Town Engineer and where a significant hazard to Town residents may result from construction of a proposed development.
Program	PSH-8.2:d: Drought Resistant Plants. Require the use of drought-tolerant plants in hillside areas to reduce excessive watering of hillsides.
Program	PSH-8.2.e: Site and Building Design. Include site planning and building design features that reduce potential impacts from geologic hazards in the Town’s Design Guidelines, including provisions to limit damage to structures caused by subsidence and accepted grading practices on hillsides.
Program	PSH-8.2.f: Subdivision Design. Condition subdivision and lot line adjustment approvals to assure that lots on hillsides are large enough to provide flexibility in finding a stable buildable site and driveway location.
Policy	PSH-8.3. Conduct landslide repair operations in conjunction with new development
Program	PSH-8.3.a: Landslide Mitigation. Where known landslide areas exist, require comprehensive landslide mitigation actions to improve slope stability. This can include, with affected property owner support, landslide repair extending beyond the boundaries of a proposed development project site. As part of the review and approval of development and public works projects, the planting of vegetation on unstable slopes to protect structures at lower elevations or other appropriate measures shall be incorporated into the project design. Native plans may be required for landscaping in areas with landslide potential to eliminate the need for supplemental water and to reduce the risk of landslide.
Policy	PSH-8.4. Maintain current information on seismic hazards and landscaping.
Program	PSH-8.4.a: Seismic and Landslide Hazards. Develop and periodically update Town maps and information on seismic and landslide hazards for use in evaluating development proposals.
Public Facilities Element	
Goal	Well-distributed and maintained system of park and recreational facilities. A range of recreation programs that offers opportunities to participate for all Town residents. Community trails system that will promote non-automotive, environmentally sound circulation. Adequate access to open space.
Policy	Policy PR-3.2. Identify linkages, corridors and other connectors to provide a

Table 21: Town of Corte Madera General Plan	
Goal/Policy/ Program	**Explanation**
	functional network of parks, open space areas, and bicycle paths through Town.
Program	Program PR3.2:b: Habitat Protection. Protect and retain existing natural habitats when planning a Town-wide trail system.
Policy	PR-4.1. Encourage the provision of access to open space areas in the design of adjacent development projects.
Program	PR-4.1.a: Subdivision Requirements. Identify access paths and parking areas as part of development approvals. Design access paths to avoid neighborhood and user disputes; minimize intrusion into sensitive wildfire habitat areas.
Program	PR-4.1.b: Marsh and Preserve Access. Coordinate access to and use of the Town's varied open spaces, canals and ecological preserves with policy and implementation actions in Chapter 3 (Resource Conservation).

Table 62: Town of Corte Madera General Plan
Source: **Town of Corte Madera** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the Town personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 22: Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Planning Commission	Y	The Planning Commission meetings on the second and fourth Tuesday of each month. The Commission holds public hearings and takes action on subdivision, design reviews, conditional use permits, and items that may be forwarded to or called up by the commission.
Administrative Services	Y	Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Hazard Mitigation Planning Committee	Y	The Town participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee that meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Public works maintenance staff regularly sweep streets and clean out/maintain the storm systems to keep them functional. The Town, Central Marin Fire Department, and PG&E all are involved in tree trimming around town.
Mutual aid agreements	Y	The Central Marin Fire Department utilizes mutual aid agreements with local agencies and jurisdictions that provide public safety personnel in times of emergency.

Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	N	
Grant writing	Y	The Town acquired a state grant to undertake the Climate Adaptation Assessment.
Hazus analysis	N	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	
Floodplain Administrator	Y	Director of Public Works is also the Floodplain Administrator.
Emergency Manager	N	
Community Planner	N	
Civil Engineer	Y/FT	
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Y/FT	Maintains and operates a wide range of local equipment and facilities as well as providing assistance to members of the public. These include providing reliable sewer services, street maintenance, storm drainage systems, street cleaning, streetlights and traffic signals.
GIS Coordinator	N	
Community Development Staff	Y/FT	Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan.
Town Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building related activities including issuing permits, conducting environmental review, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. Public Works Department is responsible for Town-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works

		Department.
Police Department Staff	Y/FT	The Central Marin Police Authority conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Protection District Staff	Y/FT	The Corte Madera Fire Department protects the town from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire.

Table 63: Town of Corte Madera Administrative and Technical Capabilities
Source: **Town of Corte Madera**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 23: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in the past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Water, gas, and electric utilities are managed by other agencies. Sanitary funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	Y	The Town does not collect a storm water utility fee, however it could be a source of revenue in the future.
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation but

		could possibly fund future mitigation activities.

Table 64: Town of Corte Madera Fiscal Capabilities
Source: **Town of Corte Madera**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Town of Corte Madera and the Town of Corte Madera partnerships utilized to promote those programs.

Table 24: Town of Corte Madera Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The Town produces a weekly digest of local issues in Town, which is an effective outreach tool. Additionally the Town website contains links to a wide variety of mitigation information and training opportunities. The Town has a Flood Control Board that advises on flood related issues. There is also a Climate Action Committee that advises the Town Council on climate related issues.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	The Town uses mailers and social media outreach to educate the public about flood, fire, and sanitary sewer related issues.
Natural disaster or safety related school programs	N	
StormReady certification	N	
Firewise Communities certification	N	
Community Rating System	Y	The Town is part of the CRS system and has a current rating of 6.
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 65: Town of Corte Madera Community Outreach
Source: **Town of Corte Madera**

3.2.5 Participation in the National Flood Insurance Program

Town of Corte Madera has participated in the Regular Phase of the NFIP since **12/15/1977**. Since then, the Town of Corte Madera has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. Town of Corte Madera has been in the CRS program since **10/01/03**. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, Town of Corte Madera is currently ranked Class 6 community, which gives a 20% premium discount to individuals in the Town of Corte Madera Special Flood Hazard Area (SFHA), and a 10% discount to policyholders outside the SFHA.

Repetitive Loss Structures

Repetitive Loss Residential Structures: 6
Repetitive Loss Non-Residential Structures: 3
Severe Repetitive Loss Residential Structures: 1
Severe Repetitive Loss Non-Residential Structures: 0

Presently, the Town of Corte Madera manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the Town's participation in the NFIP. As well, the Town's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the Town.

The Town of Corte Madera will continue to manage their floodplains in continued compliance with the NFIP. An overview of the Town's NFIP status and floodplain management program are discussed in Table 25: Town of Corte Madera NFIP Status. Additional information on the Town's CRS program follows.

The activities credited by the CRS program provide direct benefits to Marin County and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that Marin County implements and receives CRS credits include:

Corte Madera's CRS program as of January 12, 2023

Activity 310 – Construction Certificate Management: Credit is provided for having written construction certificate management procedures for all new and substantially improved/substantially damaged buildings. (38 points)

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community offering additional FIRM information, historical flood information, and natural floodplain functions. The service is publicized annually and records are maintained. (90 points)

Activity 330 – Outreach Projects: Credit is provided for general outreach projects and targeted outreach projects. These projects are disseminated annually. (50 points)

Activity 340 – Hazard Disclosure: Credit is provided for state regulations requiring disclosure of flood hazards. (15 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Corte Madera Library. Credit is also provided for floodplain information displayed on the community's website.

(73 points)

Activity 360 – Flood Protection Assistance: Credit is provided for offering one-on-one advice regarding property protection and making site visits before providing advice. The service is publicized annually and records are maintained. (55 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 55 percent of the Special Flood Hazard Area (SFHA) as open space, and preserving open space land in a natural state. (912 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new construction and substantial improvement, foundation protection, cumulative substantial improvement, and local drainage protection. Credit is also provided for the enforcement of building codes and Building Code Effectiveness Grading Schedule (BCEGS®) Classification. (181 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using additional map data in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study reports. (177 points)

Activity 450 – Stormwater Management: The community enforces regulations for soil and erosion control, and water quality. (31 points)

Section 502 – Repetitive Loss Category: Based on the updates made to the NFIP Report of Repetitive Losses as of October 3, 2022, the Town of Corte Madera, CA has 10 repetitive loss properties and is a Category B community for CRS purposes. All requirements for a Category B community have been met. (No credit points are applicable to this section)

Activity 510 – Floodplain Management Planning: Credit is provided for the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan, adopted on September 17, 2019. A progress report must be submitted on an annual basis. (171 points)

Activity 610 – Flood Warning and Response: Credit is provided for a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. A description of the flood exercise or After-Action Report from an actual flood event must be submitted on an annual basis. Warning information and safety measures must be publicized annually. (215 points)

Activity 630 – Dams: Credit is provided for a State Dam Safety Program. (37 points)

Table 25: Town of Corte Madera NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	384 NFIP policies in Town. Total premium is $456,952 and total coverage is $127,563,000.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	167 losses paid for a total of $1,413,723.30. Two substantial damage claims.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	Approximately 1204 structures within A-zones.
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	Floodplain management is a full-time function with the City of CM. Duties are performed on a daily basis.
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	The community is a CRS Class 6 with a floodplain management program that is exceeding the minimum standards of the NFIP. This includes the level of permit review, GIS capabilities, annual outreach program, inspection, and engineering staff and capabilities.
What are the barriers to running an effective NFIP program in the community, if any?	Staff time
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	The most recent Community Assistance Visit was on 9/14/2018.
Is a CAV or CAC scheduled or needed?	There are no CAV or CACs scheduled for Corte Madera. None are needed at this time.
Regulation	
When did the community enter the NFIP?	12/15/1977
Are the FIRMs digital or paper?	03/16/2016 Digital and historical paper copies of FIRMs are maintained in the office.
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Exceed the NFIP by State mandated building codes and adopted higher regulatory standards. Based on the credited CRS program:

	• State regulations for required disclosure of flood hazards • Current building code adoption and enforcement • Freeboard requirements for residential and non-residential development • Cumulative substantial improvement • Foundation protection requirements with required compaction reports • Positive drainage from foundation walls per building code
Provide an explanation of the permitting process.	When a permit application is received by the Building Department, if it is identified to be within the floodplain, the permit application and construction documents are provided to Public Works to complete the floodplain development review and identify requirements for inspections and/or elevation certificates.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	CRS Class 6
What categories and activities provide CRS points and how can the class be improved?	c310 38 — 38 c320 90 — 90 c330 50 — 50 c340 15 — 15 c350 73 — 73 c360 55 — 55 c370 — — c410 — x CGA — = — c420 894 x CGA 1.02 = 912 c430 177 x CGA 1.02 = 181 c440 174 x CGA 1.02 = 177 c450 30 x CGA 1.02 = 31 c510 171 — 171 c520 — — c530 — — c540 — — c610 215 — 215 c620 — — c630 37 — 37 **Community Classification Calculation:** cT = total of above — cT = 2045 Community Classification (from Table 110-1): — Class = 6 The score sheet referenced is from the 2022 CRS verification visit and accurately represents the community's level of effort and capabilities. An additional 500 points would need to be identified for a CRS Class 5 points baseline. This would include introducing and exploring new creditable CRS activities and verifying that the credit criteria would be met and qualify. Potential new credits may include: 330 OP 330 FRP 370 FIA 510 RLAA, SDMP 540 CDR, PSM, CIP1, CIP2, SDR
Does the plan include CRS planning requirements	The CRS Manual and CRS Addendum are referenced for all CRS credit criteria guidelines. The current hazard mitigation plan includes the CRS 10-steps for the planning requirements.

DRAFT

Table 66: Town of Corte Madera NFIP Status
Source: FEMA, Town of Corte Madera

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long‐term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 26 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 26: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Government Mitigation Strategies: As a member of the Marin Emergency Radio Authority (MERA), the Town participates in the decisions on management of the current county-wide, interagency emergency radio system. MERA, with the Town as participant, is also studying the replacement for the system as it reaches the end of its service life. Town employees have been offered CERT, Get Ready, and appropriate EOC training for their duties as disaster service workers. An updated General Plan was adopted which includes significant public safety components.		X			X
Economy Mitigation Strategies: The Town continues to review and adopt current California Building and Fire codes. The town also provides public disaster preparedness education to the business community to reduce the impact and aid the recovery of their economically-vital functions. We also work closely with the Chamber of Commerce in these endeavors.		X			X
Environmental Mitigation Strategies: The Town now requires Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas. This reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire. The Town also has been removing exotic, invasive, and hazardous species and replacing with native, safer vegetation.			X		X
Earthquake natural gas valves are required in new construction or during substantial remodel work		X			X
Continue to participate in FEMA's National Flood Insurance Program and Community Rating System (CRS)		X			X

Table 26: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
As new development occurs, roadways and driveways are required to be of minimal 12 to 20 foot width and with approved turnarounds and/or turnouts.		X			X
Implement projects identified in Capital Improvement Plan, such as maintaining & upgrading of flood control and sewer facilities.		X			X
Fire code amendments to reduce the damage to structures from earthquake, landslide and fire. Including automatic natural gas shut-off valves and fire sprinklers for new and substantially remodeled structures.		X			X

Table 67: Status of Previous Hazard Mitigation Actions
Source: Town of Corte Madera

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County MJHMP and Town of Corte Madera Annex were revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Town of Corte Madera based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires Town Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Marin County and Town of Corte Madera Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 27 lists the Current Hazard Mitigation Actions for the Town of Corte Madera and Sanitary District #2 .

Table 27: Town of Corte Madera Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
CM-1	Marin Emergency Radio Authority (MERA) Upgrades. MU-13 Protect Infrastructure and Critical Facilities	All Hazards/ 1, 2, 3, 4, 5	Marin County and Town of Corte Madera.	Existing (2018)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	Ongoing/ High	
CM-2	Town is studying replacement for the Marin Emergency Radio Authority (MERA) system as it reaches the end of its service life.	All Hazards/ 1, 2, 3, 4, 5	Marin County and Town of Corte Madera.	Existing (2018)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	Ongoing/ High	
CM-3	Update public safety components of the General Plan. MU-4 Adopt Development Regulations in Hazard Areas	All Hazards/ 1, 2, 4, 5	Town of Corte Madera, Community Development	Existing (2018)	Cost: General Funds	1 – 3 years/ High	An updated General Plan was adopted which includes significant public safety components.
CM-4	Review and adopt current California Building and Fire codes. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of Corte Madera, Central Marin FPD	Existing (2018)	Cost: General Funds	1 – 3 years/ High	The Town continues to review and adopt current California Building and Fire codes.
CM-5	Review and adopt current California Building codes for seismic, flood, fire and other disaster. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of Corte Madera	Existing (2018)	Cost: General Funds	3 - 5 years/ Medium	The Town continues to review and adopt current California Building codes.
CM-6	As new development occurs, roadways and driveways are required to be of minimal 12 to 20 foot width and with approved turnarounds and/or turnouts.	All Hazards/ 1, 2, 4, 5	Town of Corte Madera	Existing (2018)	Cost: General Funds	1 – 3 years/ High	
CM-7	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies.	Dam Failure 1, 2, 3, 4, 5,	Town of Corte Madera Marin County	New (2023)	Cost: General Funds	Ongoing/ Low	Continue to encourage residents to participate in Alert Marin with an emphasis on properties at risk from all hazards.
CM-8	Enhance and promote community and individual emergency preparedness. MU-15 Develop and Conduct a Household Disaster Preparedness Program. ET-2 Increase awareness of extreme temperatures risk and safety.	All Hazards/ 3, 4, 5	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Focus on signing residents up for Alert Marin and establish a personal evacuation kit and plan.

Table 27: Town of Corte Madera Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
CM-9	Enhance Community facilities to support the socially vulnerable population during extreme weather events. ET-3 Assist Vulnerable Population	All Severe Weather 1, 2, 4, 5	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1 - 2 years/ High	
CM-10	Fire code amendments to reduce the damage to structures from earthquake, landslide and fire. Including automatic natural gas shut-off valves and fire sprinklers for new and substantially remodeled structures.	Earthquake, Debris Flow, Wildfire, Land Subsidence/ 1, 2, 4, 5	Town of Corte Madera	Existing (2018)	Cost: General Funds	1 – 3 years/ High	
CM-11	Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas. WF-9 Implement a Fuels Management Program	Wildfire/ 1, 2, 4, 5,	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	This reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire.
CM-12	Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species and replacing them with native, safer vegetation. WF-9 Implement a Fuels Management Program, ET-1 Reduce Urban Heat.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire. Supports environmental restoration.
CM-13	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	
CM-14	Hillside neighborhoods adaptation projects to protect against wildfire risk including widening narrow roads and adding road pullouts, increasing number of emergency egress roads from neighborhoods, continue vegetation management in highest risk areas, and other projects listed in the assessment.	Wildfire/ 1, 2, 4, 5,	Town of Corte Madera, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Project aligned and identified in the Town's Climate Adaptation Assessment

Table 27: Town of Corte Madera Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
CM-15	Shoreline adaptation projects to protect against flooding and sea level rise including improved, replaced, or new levees, raising structures out of the flood zone, raising road elevations, and other projects listed in the assessment.	Flooding, Sea Level Rise, Levee Failure, Tsunami/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ Medium	Project aligned and identified in the Town's Climate Adaptation Assessment
CM-16	Central Corte Madera adaptation projects to protect against flooding including maintaining, replacing, or new flood control pump stations, maintaining and dredging existing lagoons and canals, maintain and improve storm drainage throughout neighborhoods, and other projects listed in the assessment.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Town of Corte Madera, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ Medium	Project aligned and identified in the Town's Climate Adaptation Assessment
CM-17	Updating or enhancing flood control pump stations, storm force mains, and gravity storm lines around town. This will also include maintaining and dredging existing flood control open channels, canals, and lagoons.	Flooding, Sea Level Rise, Levee Failure, Dam Failure, Tsunami/ 1, 2, 4, 5	Town of Corte Madera, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ Medium	Projects listed in the Storm Drain Master Plan which will be released in early 2024.
CM-18	Earthquake natural gas valves are required in new construction or during substantial remodel work.	Earthquake/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost TBD: HMGP, BRIC, CDAA	2 -5 Years/ High	
CM-19	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential Dam related emergencies or risk.	Dam Failure 1, 2, 3, 4, 5, 6	Town of Corte Madera, NMWD	New (2023)	Cost: General Funds	Ongoing/ Low	Continue to encourage residents to participate in Alert Marin with an emphasis on properties at risk from dam failure.
CM-20	Map and Assess Vulnerability to Landslides	Landslide/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	2-5 Years/ Low	Review landslides to date and geological data to determine areas at risk of future landslides.

Table 27: Town of Corte Madera Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
CM-21	Require Water Conservation During Drought Conditions and Enhance Landscaping and Design Measures	Drought 1, 2, 3, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	Ongoing/ Low	Follow MMWD and State guidelines on water conservation during droughts.
CM-22	Establish Local Funding Mechanisms for Flood Mitigation	Flooding/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	Ongoing/ High	Determine amount of funding needed for flood protection improvements and decide on a method to raise money.
CM-23	Elevate or Retrofit Structures and Utilities	Flooding/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: TBD, Grants-HMGP, FMA, BRIC, CDAA or privately funded	Ongoing/ High	Recommend and support property owners in raising their homes out of the flood zone.
CM-24	Protect and Restore Natural Buffers	Sea Level Rise/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: Grants-HMGP, FMA, BRIC, CDAA or General Funds	Ongoing/ High	Continue to protect wetlands along the bay and include ecotone slopes as possible protection measure where possible.
CM-25	Increase Awareness of Sea Level Rise	Sea Level Rise/ 1, 2, 3, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	1-3 Years/ High	Create a sea level rise webpage to provide data and links to information about sea level rise
CM-26	Reduce Urban Heat Island Effect	Severe Weather-Heat/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	5-10 Years/ Low	Implement green streets initiatives and plant street trees around Town.
CM-27	Map and Assess Vulnerability to Subsidence	Subsidence/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	2-5 Years/ Low	Monitor subsidence in low lying neighborhoods and estimate future subsidence.
CM-28	Increase height and retrofit existing levees in town	Levee Failure/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: TBD, grant funding- HMGP, FMA, BRIC, CDAA	5-20 Years/ High	Systematically retrofit existing levees based on risk of failure and increase height to FEMA standards where possible.
CM-29	Require or Encourage Fire-Resistant Construction Techniques	Wildfire/ 1, 2, 4, 5	Town of Corte Madera	New (2023)	Cost: General Funds	2-5 Years/ High	Encourage fire-resistant construction for new or major

Table 27: Town of Corte Madera Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
							remodels in hillside neighborhoods.
CM-30	Reduce flood control pump station reliance on fossil fuel generators by replacing with clean energy back up power facilities.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 3, 4, 5	Town of Corte Madera	New (2023)	Cost TBD: HMGP, FMA, CDAA	5-20 Years/ Low	
	Sanitary District #2						
SD-1	Updating or enhancing sanitary pump stations, force mains, and gravity storm lines around town.	Flooding, Sea Level Rise/ 1, 2, 3, 4, 5	Sanitary Dist. #2, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ High	Project listed in Sanitary Sewer Master Plan to be finalized in 2023.
SD-2	Install bypass force mains where none currently exist from the Paradise Pump Station to the joint force main connection on the north side of Corte Madera Creek.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 3, 4, 5	Sanitary Dist. #2, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ High	
SD-3	Improve the Paradise Pump Station wet well capacity to help prevent sewer overflows during storms.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 3, 4, 5	Sanitary Dist. #2, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	2 -5 Years/ High	
SD-4	Reduce sanitary pump station reliance on fossil fuel generators by replacing with clean energy back up power facilities.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 3, 4, 5	Sanitary Dist. #2, Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	5-20 Years/ Low	

Table 68: Town of Corte Madera & Sanitary District #2 Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Town of Corte Madera. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 26 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Town of Corte Madera identified and prioritized the mitigation actions as detailed in Table 27, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the Town of Corte Madera will maintain this plan and will serve as a lead staff for grant project applications on Town projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Town of Corte Madera will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Town of Corte Madera already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

Town General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the Town. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

Town Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the Town.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

7. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
8. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
9. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

The Town of Corte Madera is located in Marin County, approximately eight miles north of the Golden Gate Bridge. Incorporated in 1916, the Town of Corte Madera encompasses approximately 4.5 square miles in total. However, 1.25 square miles of this area is submerged under bay waters and 0.67 square mile is protected marshland, leaving a net land area of 2.55 square miles. Parks, open space, and flood control areas comprise 0.38 square mile of this net land area. Highway 101, the main freeway connecting San Francisco with the Marin communities and Sonoma County, bisects Corte Madera. The Town's most significant growth period was from 1940 to 1970 when the community's population increased from 1,098 to 8,464. The Town currently has a population of 10,029 according to the California Department of Finance.

Housing affordability in Marin County and in the Bay Area has become an increasingly important issue. Corte Madera's housing conditions are reflective of many area-wide and even nation-wide trends. Over the past several decades, housing costs have skyrocketed out of proportion to many people's ability to pay, with increasing construction and land costs contributing to the rise in housing prices. In the Bay Area, the high demand for housing pushes prices even higher. This mismatch in household incomes and housing costs has several implications: it becomes more difficult for employers to recruit and retain employees; new residents are pushed farther away from job centers where home prices are less expensive, leading to long traveling distances to work, higher greenhouse gas emissions from vehicles, and increasingly clogged highways; and many young families, longtime residents, their children, and other community members without high incomes relocate because they can no longer afford to live in the community.

The Town recognizes that it occupies the ancestral home of the Coast Miwok indigenous people. The Coast Miwok were displaced during Spanish colonization and the rise of missionaries, and were further excluded from their land during Mexican occupation and the ranching era. Today, there are few Native American people living in Corte Madera and Marin County.

Historical lending and zoning practices, including redlining and exclusionary covenants, have resulted in segregated living patterns in Marin and racially disparate housing outcomes. People of color have not benefited from the generational transfer of home equity and homes themselves, as some white people have, and rapidly escalating housing costs in more recent decades have made it extremely difficult for people of color to get a foothold in the housing market. Anti-development sentiment throughout Marin County has also restricted new housing development, helping maintain patterns of segregation. As a result, Marin is one of the most segregated counties in the Bay Area, with five of the ten most segregated Census tracts in the region. Providing more housing and a variety of housing types at different affordability levels will help to diversify the Corte Madera community and result in more balanced and integrated living patterns throughout the Bay Area. It will also bring fresh perspectives, lived experiences, skills, and expertise to Corte Madera, ensuring that the community is well equipped to face future challenges and opportunities.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Town of Corte Madera.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Town of Corte Madera Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Town of Corte Madera plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Town of Corte Madera is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Town of Corte Madera Public Works Director will monitor and update the Town of Corte Madera and Sanitary District #2 Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase

engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the Town of Corte Madera, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Town of Corte Madera, to evaluate the plan after each update meeting.

4.4 Plan Update

The Town of Corte Madera Public Works Director will monitor and update the Town of Corte Madera and Sanitary District #2 Annex to the Marin County OA MJHMP. During the five-year update cycle, the Town of Corte Madera and the Marin County Office of Emergency

Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP and Town of Corte Madera Website 3-19
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 3-20
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 3-21
Figure 4: Hazard Mitigation Plan Survey 3-23
Figure 5: Map of Town of Corte Madera in Marin County 3-25
Figure 6: Map of the Town of Corte Madera 3-26
Figure 7: The Town of Corte Madera Precipitation and Monthly Temperatures 3-29
Figure 8: Races in Corte Madera 3-31
Figure 9: Town of Corte Madera Land Use Map 3-32
Figure 10: Town of Corte Madera Social Vulnerability Map Census Tract 1212.00 3-35
Figure 11: Town of Corte Madera Social Vulnerability Map Census Tract 1211.00 3-36
Figure 12: Town of Corte Madera Risk Assessment – Planning Team Top Hazards 3-41
Figure 13: Hazard Risk Categorization 3-41
Figure 14: NASA Global Temperature Change CO2 Gas 3-45
Figure 15: NASA Global Temperature Change 1884 to 2022 3-45
Figure 16: NASA Global Temperature Change Sea Level 3-46
Figure 17: Annual Mean Sea Level Trends 3-48
Figure 18: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 3-49
Figure 19: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 3-49
Figure 20: Town of Corte Madera Dam Inundation Critical Facilities and Infrastructure 3-55
Figure 21: Town of Corte Madera Phoenix Lake Dam Inundation Impact 3-56
Figure 22: Landslide Susceptibility Classes 3-59
Figure 23: Mud Flow Areas 3-60
Figure 24: Town of Corte Madera Debris Flow Critical Facilities and Infrastructure 3-61
Figure 25: Modified Mercalli Intensity Scale 3-64
Figure 26: Mercalli Scale vs. Magnitude 3-65
Figure 27: Soil Types 3-65
Figure 28: Town of Corte Madera Earthquake Impact 3-67
Figure 29: Marin County Earthquake Impact and Fault Lines 3-68
Figure 30: Town of Corte Madera Earthquake Critical Facilities and Infrastructure 3-70
Figure 31: Diagram of an Atmospheric River Event 3-73
Figure 32: Town of Corte Madera Flooding Critical Facilities and Infrastructure 3-74
Figure 33: Flooding on Golden Hind Passage in Corte Madera, January 10, 2017 3-78
Figure 34: Dissolution Sinkhole Formation 3-79
Figure 35: Cover-Subsidence Sinkhole Formation 3-79
Figure 36: Cover-Collapse Sinkhole Formation 3-80
Figure 37: Levee Failure Mechanisms 3-81
Figure 38: Town of Corte Madera Sea Level Rise Impact 1 Foot 3-84
Figure 39: Town of Corte Madera Sea Level Rise Impact 3 Foot 3-85
Figure 40: Town of Corte Madera Sea Level Rise Impact 5 Foot 3-86
Figure 41: Town of Corte Madera Sea Level Rise Impact 6 Foot 3-87
Figure 42: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 3-88
Figure 43: Heat Index 3-89

Figure 44: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 3-90
Figure 45: Beaufort Wind Scale 3-91
Figure 46: Enhanced Fujita Scale 3-92
Figure 47: Waterspout Formation 3-92
Figure 48: Town of Corte Madera Tsunami Critical Facilities and Infrastructure 3-94
Figure 49: Federal, State and Local Responsibility Areas in the Marin County OA 3-97
Figure 50: Fuel Model Map for the Marin County OA 3-100
Figure 51: Town of Corte Madera Wildfire Critical Facilities and Infrastructure 3-105
Figure 52: Trends in the Annual Number of Large Wildfires in the United States 3-106

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 3-8
Table 2: 2023 MJHMP Planning Team Members 3-12
Table 3: Town of Corte Madera & Marin County MJHMP Planning Meetings 3-16
Table 4: Town of Corte Madera Estimated Jurisdictional Population 3-30
Table 5: Population Change of The Town of Corte Madera 3-30
Table 6: Languages Spoken in Corte Madera 3-30
Table 7: Marin County Jurisdictional Housing Stock 3-31
Table 8: NRI Hazards and Marin County MJHMP Hazards 3-33
Table 9: NRI Hazard Type Risk Index for Corte Madera Census Tract 1212.00 3-34
Table 10: NRI Hazard Type Risk Index for Corte Madera Census Tract 1211.00 3-35
Table 11: Household Income for The Town of Corte Madera as of 2019 3-38
Table 12: Town of Corte Madera Civilian Employed Population 16 years+ by Industry 3-39
Table 13: Town of Corte Madera Critical Facilities 3-39
Table 14: Select Hazards Magnitude/ Severity Scale or Index 3-42
Table 15: Town of Corte Madera Hazard Risk Assessment 3-51
Table 16: Hazard Risk Assessment 3-52
Table 17: Residential Structures in The Town of Corte Madera by Flood Zone 3-76
Table 18: Town of Corte Madera Critical Facilities in the Flood Zones 3-77
Table 19: Town of Corte Madera Future Growth Areas 3-107
Table 20: Town of Corte Madera Legal and Regulatory Capabilities 3-111
Table 21: Town of Corte Madera General Plan 3-119
Table 22: Town of Corte Madera Administrative and Technical Capabilities 3-121
Table 23: Town of Corte Madera Fiscal Capabilities 3-122
Table 24: Town of Corte Madera Community Outreach 3-122
Table 25: Town of Corte Madera NFIP Status 3-126
Table 26: Status of Previous Hazard Mitigation Actions 3-130
Table 27: Town of Corte Madera & Sanitary District #2 Current Hazard Mitigation Actions 3-136

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

4. Town of Fairfax Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Town of Fairfax and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the Town of Fairfax more disaster resistant and sustainable.

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TABLE OF CONTENTS

4. Town of Fairfax Community Profile 4-1
Acknowledgements 4-3
Table of Contents 4-5
Section 1.0: Introduction 4-7
1.1 Introduction 4-7
1.2 Planning Process 4-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 4-8
1.2.2 Steering Committee Planning Process 4-9
1.2.3 Coordination with Stakeholders and Agencies 4-9
1.2.4 Public Engagement 4-16
1.3 Overview and History 4-23
1.4 Government 4-27
1.5 Weather and Climate 4-27
1.6 Demographics 4-28
1.7 Social Vulnerability and Risk 4-32
1.8 Economy and Tax Base 4-35
1.9 Critical Facilities 4-36
1.10 Historical Properties 4-38
Section 2.0: Hazard Identification and Risk Assessment 4-39
2.1 Climate Change 4-41
2.2 Hazards 4-49
2.2.1 Debris Flows 4-50
2.2.2 Drought 4-56
2.2.3 Earthquake 4-58
2.2.4 Flooding 4-64
2.2.5 Land Subsidence/Sinkholes 4-69
2.2.6 Severe Weather – Extreme Heat 4-71
2.2.7 Severe Weather – High Wind & Tornado 4-73
2.2.8 Wildfire 4-77
Section 3.0: Mitigation Strategy 4-89
3.1 Changes in Development 4-89
3.2 Capability Assessment 4-90
3.2.1 Regulatory Capabilities 4-90

3.2.2 Administrative and Technical Capabilities 4-95
3.2.3 Fiscal Capabilities 4-97
3.2.4 Community Outreach 4-98
3.2.5 Participation in the National Flood Insurance Program 4-99
3.3 Mitigation Goals 4-103
3.4 Status of Previous Mitigation Actions 4-105
3.5 Hazard Mitigation Actions 4-106
3.6 Progress in Local Mitigation Efforts 4-110
3.7 Project Implementation 4-110
3.8 Future Development Trends 4-111
Section 4.0: Plan Review, Evaluation, and Implementation 4-113
4.1 Plan Adoption 4-113
4.2 Plan Monitoring 4-113
4.3 Plan Evaluation 4-113
4.4 Plan Update 4-114
Figures and Tables 4-115
Acronyms/Abbreviations 4-117

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Town of Fairfax, Community Profile has been prepared in conjunction with the Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Town of Fairfax.

1.2 PLANNING PROCESS

The majority of Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the Marin County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California counties in that the populated portion of the OA where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions San Anselmo, Ross, and Fairfax are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA MJHMP Steering Committee, the Town of Fairfax involved additional internal planning team members to support the broader planning process. The Town of Fairfax jurisdictional representatives for the

coordinated Marin County OA MJHMPs Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Loren Umbertis, Director of Public Works
Telephone: (415) 458-2370
E-mail address: lumbertis@townoffairfax.org

Alternate Point of Contact
Mark Lockaby, Building Official
Telephone: (415) 458-2370
E-mail address: mlockaby@townoffairfax.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Fairfax	Loren Umbertis	Public Works Director	415-453-0291	lumbertis@townoffairfax.org
Fairfax	Mark Lockaby	Building Official	415-458-2370	mlockaby@townoffairfax.org
Fairfax	Heather Abrams	Town Manager	415-453-1584	habrams@townoffairfax.org

Table 69: Local Hazard Mitigation Planning Team Members

This 2023 Marin County OA MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the Town of Fairfax. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.

- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Town of Fairfax Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Town of Fairfax communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology,

and other community services and needs.

As detailed in 1.2 PLANNING PROCESS, the planning process enjoyed a robust unity of effort. Early in the process the Steering Committee determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Assistant Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chief
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES, Sr. Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II/ Environmental & Occupational Emergency Preparedness Team
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 70: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Town of Fairfax's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their Town of Fairfax website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Town of Fairfax & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process

Table 3: Town of Fairfax & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input

Table 3: Town of Fairfax & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan	• Individual phone or conference calls with planning jurisdictions and districts to answer specific

Table 3: Town of Fairfax & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Development Sessions	questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 71: Town of Fairfax & Marin County OA MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and access to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook

account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 145: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County OA MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provided the URL link to the Survey Monkey website to complete the survey.

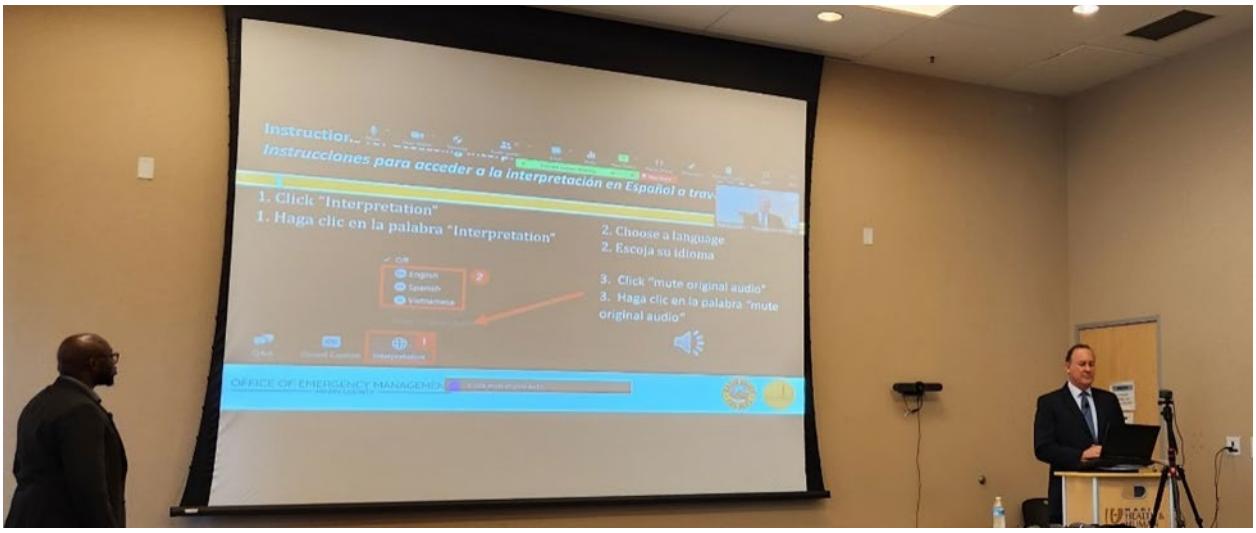


Figure 146: Marin County OA MJHMP Public Town Hall Meeting

SOCIAL MEDIA

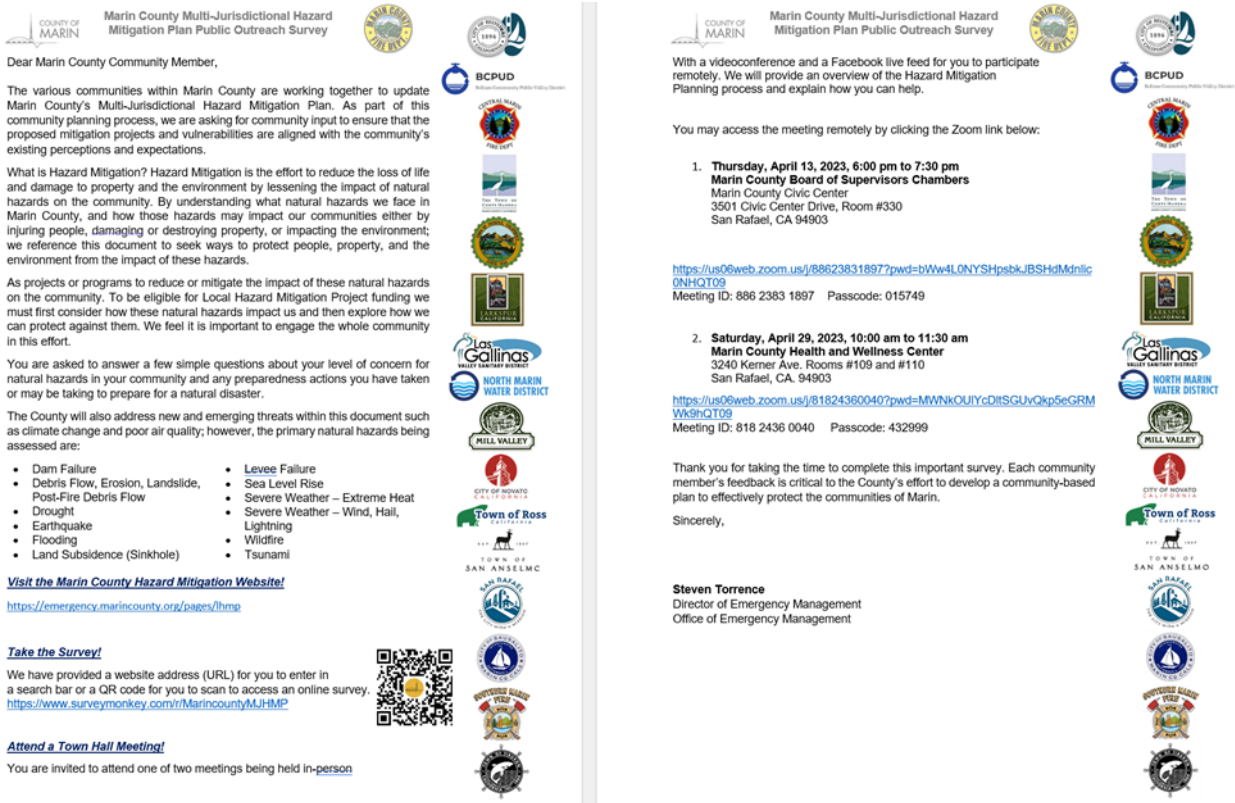
The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 147: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process over 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

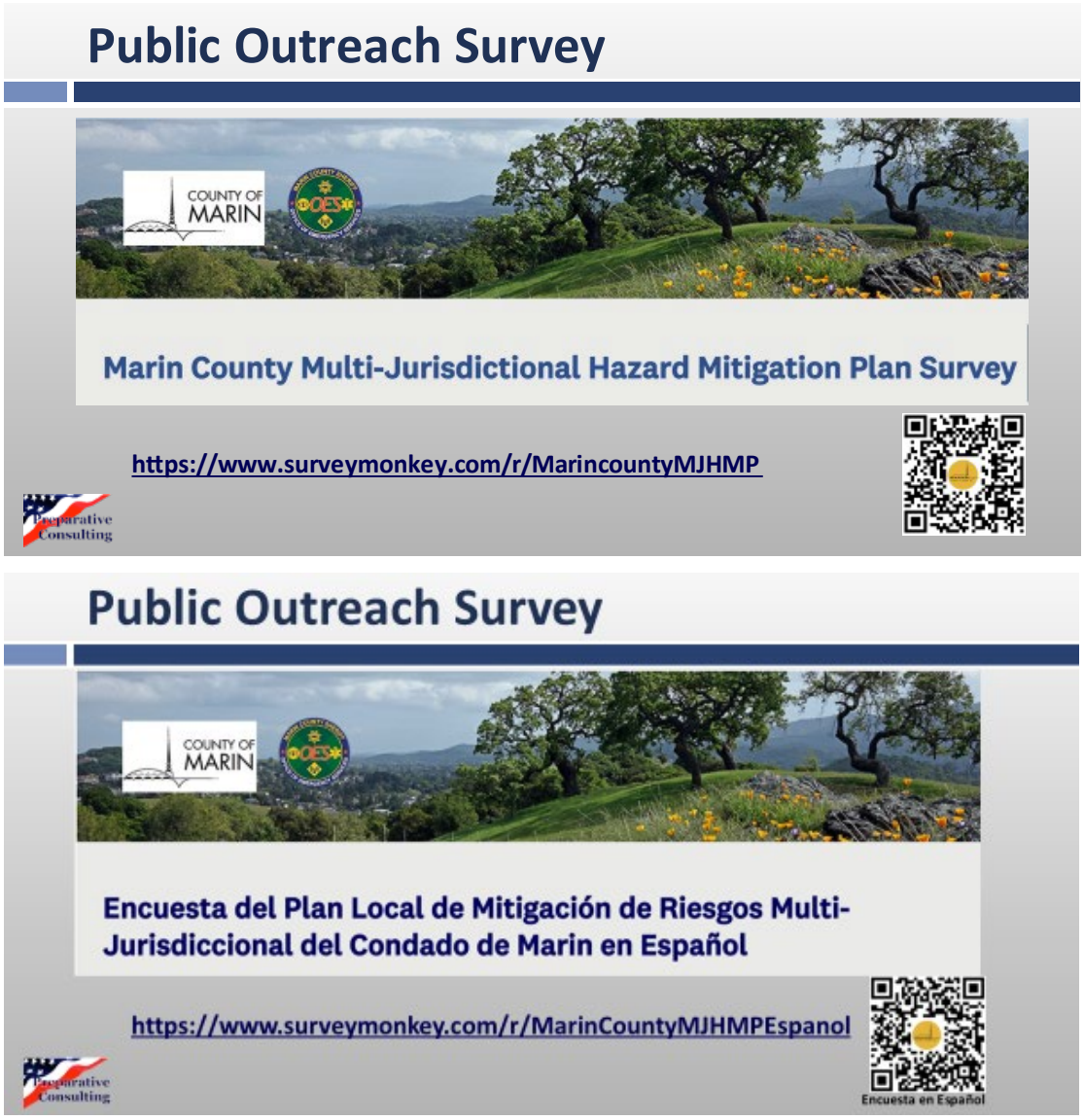


Figure 148: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community

who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The Town of Fairfax had an additional 14-day comment period for the Town of Fairfax Community Profile where their profile was posted on the Town website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of Corte Madera distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform

decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

The Coast Miwok Native Americans occupied stretches along local creeks, spring and seep areas; moreover, prehistoric habitations were usually chosen near permanent and seasonal drainages, typically along flat ridges and terraces.

Fairfax is a unique and very diverse community located in a spectacular setting in Upper Ross Valley. The Town was once part of the 6,558-acre Canada de Herrera land grant given to Domingo Sais on August 10, 1839, by the Mexican government as a reward for his military service. This grant covered all of Fairfax and part of San Anselmo. Sais occupied the land, with his wife and eleven children. Shortly before he died in 1853, Sais gifted the area that is now the site of the Fair-Anselm Shopping Center and the former Marin Town and Country Club to Dr. Alfred W. Taliaferro, formerly of Virginia, one of the first Europeans to settle in what is now the Marin County OA, becoming its first physician. In 1855, Dr. Taliaferro, in turn, transferred a 32 acre site to a fellow Virginian and boyhood friend, Charles Snowden Fairfax, as a wedding gift. Fairfax, the tenth Baron of Cameron, Scotland, had come to California in 1849 as part of the Gold Rush at the age of 20. Fairfax and his wife, Ada, named their home, the “Bird’s Nest Glen.”

In 1876, the Fairfax District was granted its own school district for the lands contained in the former Sais Rancho. The first school was built in Sleepy Hollow.

Charles and Adele Pastori leased the “Bird’s Nest Glen” in 1890 from Emma Woodward, opening a restaurant in 1893, and purchasing the property outright in 1905. The couple operated a high quality restaurant in the original Fairfax residence until 1911 when the building was destroyed in a fire. Charles also died in 1911.

The first post office was opened in Blagg’s Store in 1910 (now 1780-1788 Sir Francis Drake) and John Blagg became the Town’s first postmaster. The community began to grow rapidly when the Fairfax Tract at Pastori’s Station, Ridgeway and Deer Park was developed in 1907 and 1908. Additional development occurred as the Fairfax Improvement Company marketed the Pacheco Tract in 1910. Next, the Fairfax Development Company subdivided the Fairfax Manor Tract, and Henry Frustuck subdivided the Fairfax Park Tract, both of which occurred in 1911. By 1911, there were 100 homes in Fairfax, while in 1905 only five homes existed. The expansion of the community continued, as the Rocca Brothers developed Fairfax Heights in 1912, and the Bush Annex, Bothin Park, and the Manor Tracts became available for residential use in 1913.

The Cascades subdivision was developed in 1914, and later expanded in 1921 and 1926. St. Rita’s Church was built in 1916, the original building is still in place and now used as the Church Hall, the new church being built alongside in 1953. The area around the Town was used as the setting for western movie productions during the early years of the motion picture industry between 1910 and 1923. Essanay Film Manufacturing Company with Bronco Billy filmed several movies in Fairfax in 1911.

The demographics of the growing community changed significantly with the construction of Alpine Dam in 1917, which precipitated an influx of Italian laborers and caused the Willow Avenue portion of the Town to be known as “Little Italy” for many years after the dam was completed. The dam was dedicated in 1919.

In 1920 the Fairfax Volunteer Firemen purchased nine acres of the Fairfax Park Tract from Henry Frustuck for a park for the Town. The current Pavilion was constructed on the park site in 1921. A year later, part of the area reserved as a park was sold to the School District as the site for Central School, today’s School Street Plaza.

The Town was officially incorporated in February 1931, governed by a five-member council. Today, Fairfax is a small town located at the western edge of the Marin County OA’s city centered corridor that parallels U.S. Highway 101, with the agriculturally rich rural portion of the county just beyond to the west. The town’s natural setting encompasses a series of valleys, canyons, and forested hills with largely undeveloped ridgelines. Scenic and natural resources are key aspects of the community’s sense of place and contribute to the overall quality of life in Fairfax. In addition to the form of the land, mature trees and the extensive areas of protected open space in and around the Town help define the Town's identity as a community that values nature and environmental preservation. The architectural diversity of the neighborhoods and the compact, small scale Town Center area also make Fairfax a very special place for residents and visitors.

The residential development that occurred between 1907 and 1914, with winding streets and a wide range of lots sizes, set the stage for the future development of the community’s built environment. Much of the subsequent residential and commercial development of Fairfax prior to World War II was related to the town’s status as a summer resort for residents of San Francisco attracted by the warm, sunny weather of the Ross Valley. In recent years, rapidly rising housing prices have resulted in numerous proposals to significantly renovate existing residential structures. Any change to the existing fabric of the Town will not occur primarily as a result of subdivisions of land, but rather as infilling scattered undeveloped or underdeveloped sites, or through the replacement of one residential structure with another.

The Town of Fairfax was incorporated as a town in 1931. The Town of Fairfax had an estimated population of 7,605 in 2020, with 5,518 housing units in the Town. The Town has a total area of 2.677 square miles. The median income for a household in the Town is $111,290 and the per capita income for the Town is $87,951. Approximately 0 percent of families and 3.9 percent of the population is below the poverty line (2021 data, U.S. Census Bureau).

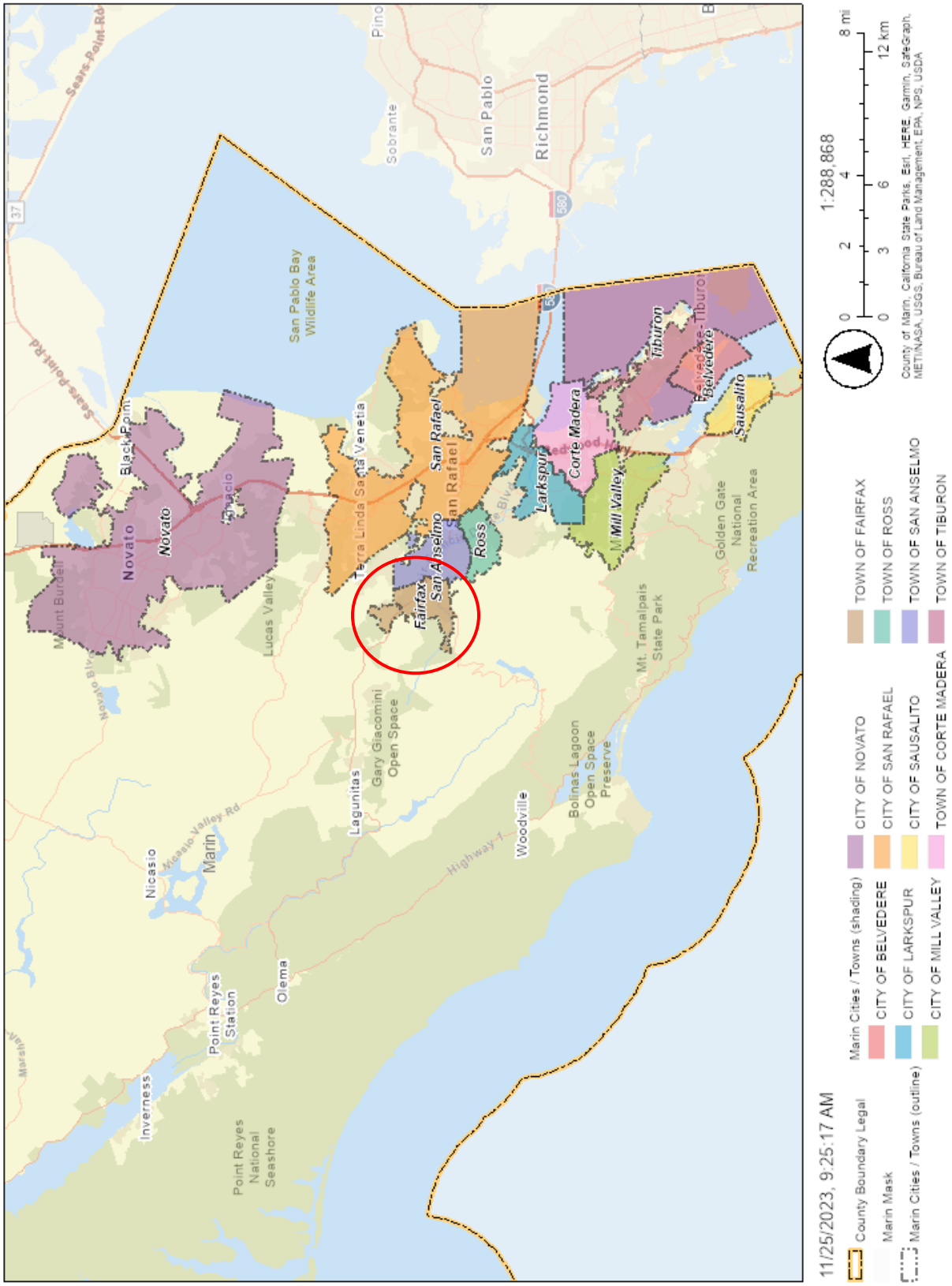


Figure 149: Location of the Town of Fairfax within the Marin County OA
Source: Marin County OEM

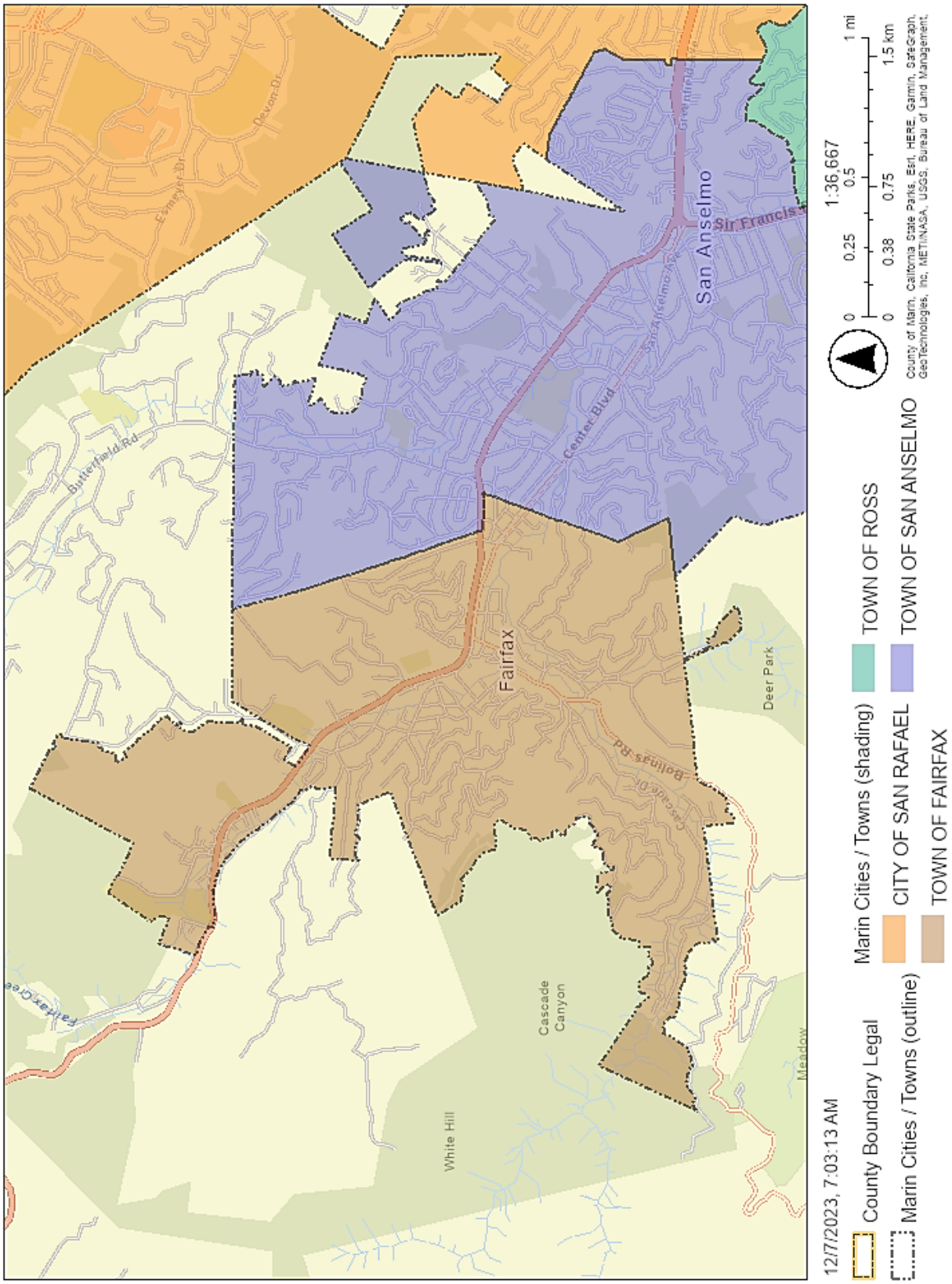


Figure 150: Map of the Town of Fairfax
Source: Marin County OEM

1.4 GOVERNMENT

The Town of Fairfax was incorporated as a town in 1931 and is governed by a five-person Town Council. Each year the Town Council elects one of its members to serve as Mayor, the executive head of the Town; and appoints a Town Manager, the administrative head of the Town. The Town consists of 9 departments: the Administration, Climate and Environment, Finance, Fire Department, Human Resources, Planning and Building, Police, Public Works, and Recreation and Community Services.

The Town Council assumes responsibility for the adoption of this plan; and the Town Manager will oversee its implementation.

The Ross Valley Fire Department provides Fire services to the Towns of Fairfax, San Anselmo, Ross and the Sleepy Hollow Fire Protection District In 2012, Ross Valley Fire Department's Board of Directors voted to consolidate fire services with the Town of Ross, incorporating the Town of Ross fire Station 18, and the 6 firefighters employed there, into the Ross Valley Fire Department.

The Fairfax Police Department is a full service Police department. Although the town did not incorporate until the early 1930s, in 1925 the state legislature allowed counties to appoint police chiefs for unincorporated areas and Fairfax appointed its first police officer. The Police Department is currently staffed at 12 officers.

1.5 WEATHER AND CLIMATE

The Town of Fairfax lies 115 ft (35 m) above sea level. In Fairfax, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 48°F to 62°F and is rarely below 42°F or above 72°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is 43 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (70%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.3 °C (48.7) °F	9.8 °C (49.7) °F	10.9 °C (51.6) °F	11.8 °C (53.2) °F	13.6 °C (56.5) °F	15.6 °C (60.2) °F	16 °C (60.8) °F	16.4 °C (61.4) °F	16.4 °C (61.5) °F	15 °C (58.9) °F	11.9 °C (53.5) °F	9.5 °C (49) °F
Min. Temperature °C (°F)	6.3 °C (43.4) °F	6.9 °C (44.4) °F	7.8 °C (46.1) °F	8.5 °C (47.4) °F	10.1 °C (50.2) °F	11.7 °C (53) °F	12.3 °C (54.2) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.5 °C (52.7) °F	8.9 °C (48) °F	6.8 °C (44.2) °F
Max. Temperature °C (°F)	13.3 °C (56) °F	13.9 °C (57) °F	15.1 °C (59.2) °F	16.2 °C (61.2) °F	18.3 °C (64.9) °F	20.9 °C (69.6) °F	21.2 °C (70.2) °F	21.5 °C (70.8) °F	21.9 °C (71.4) °F	20 °C (68.1) °F	16.2 °C (61.2) °F	13.1 °C (55.7) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	78%	72%	71%	70%	75%	76%	73%	72%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 151: The Town of Fairfax Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the Town of Fairfax since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The Town of Fairfax had an estimated population of 7,625 in the 2018 plan. 2020 U.S. Census Survey estimated the Town's population at 7,605. However, revised estimates for 2022 estimate the population to decrease to 7,418 population.

Table 4: Town of Fairfax Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
Town of Fairfax	7,418	7,605	7,625	-2.71%

Table 72: Town of Fairfax Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The Town of Fairfax is 7,605 as of 2020. Between 2018-2022, the City's growth rate decreased at an average annual rate of -2.71%, lower than the historic twenty-year average growth rate of 3.2%. Table 5 shows the population growth comparison of the State of California, The Marin County OA and the Town of Fairfax between 2010 - 2020.

Table 5: Population Change of The Town of Fairfax				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
Fairfax, town	7,441	7,605	164	2.2%

Table 73: Population Change of The Town of Fairfax
Source: Town of Fairfax Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the Town of Fairfax.

Table 6: Languages Spoken in Fairfax	
Primary Language Spoken	% of Population
English only	87.5%
Spanish	7.3%
Other Indo-European languages	2.8%
Asian and Pacific Islander languages	1.4%
Other languages	1.0%

Table 74: Languages Spoken in Fairfax
Source: US Census Bureau (2020)

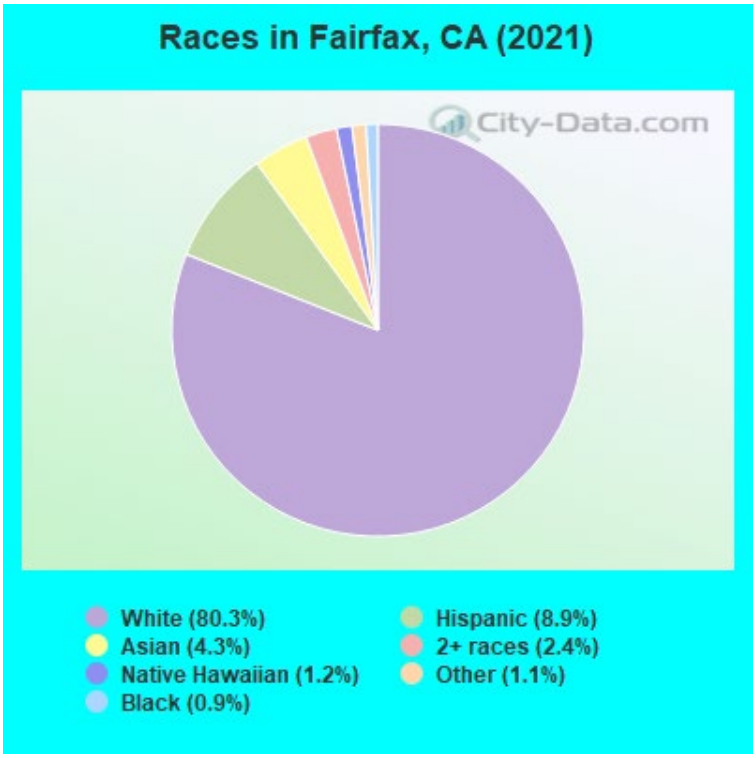


Figure 152: Races in Fairfax
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
Town of Fairfax							
2022	Number	3,486	2,185	338	499	451	13
	Percent	100.00%	62.68%	15.47%	147.63%	90.38%	2.88%
2018	Number	3,594	2,281	345	486	469	13
	Percent	100.00%	63.47%	15.12%	140.87%	96.50%	2.77%

Table 75: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

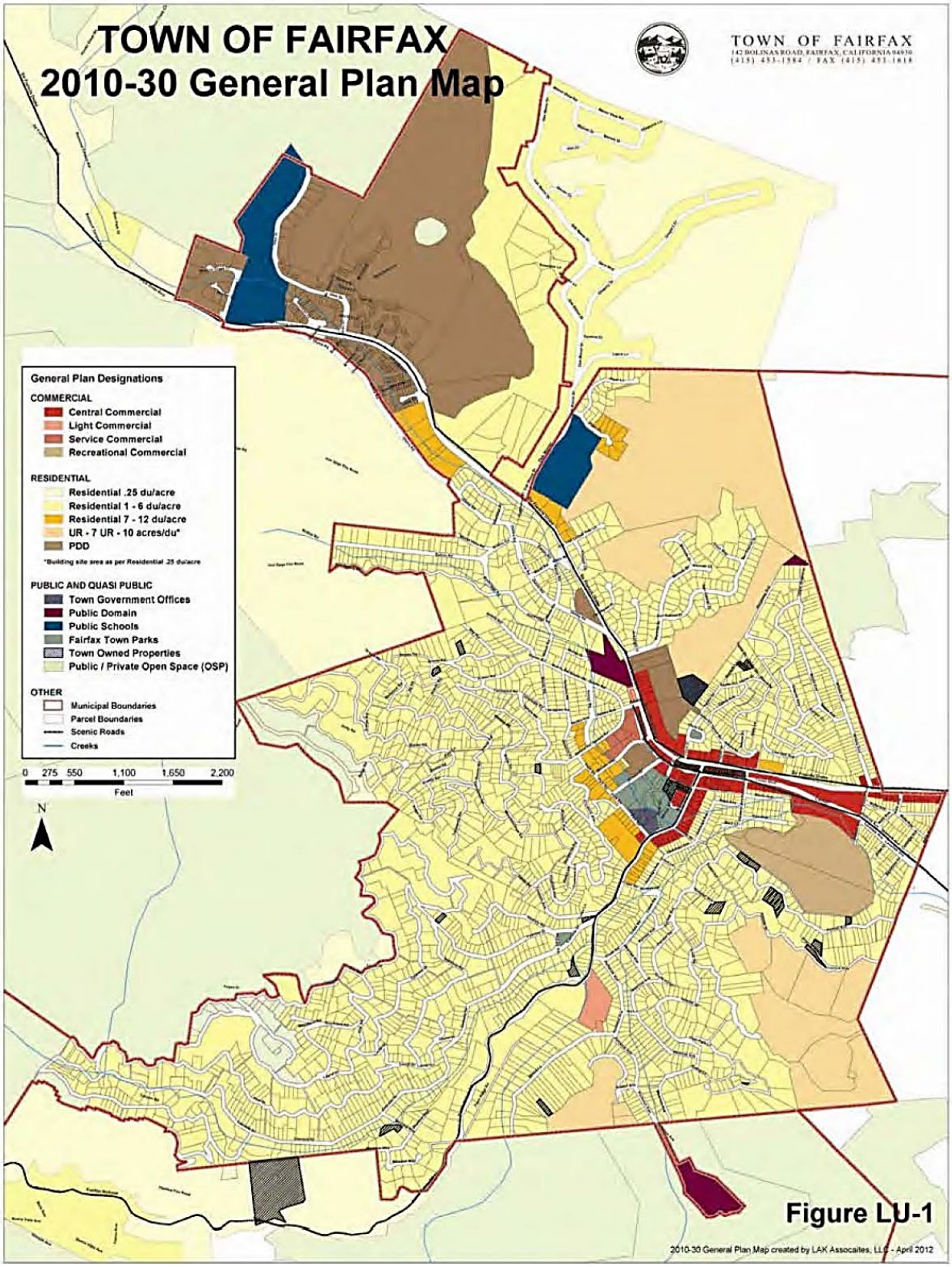


Figure 153: Town of Fairfax Land Use Map
Source: Town of Fairfax 2012 General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards	
NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 76: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Table 9 illustrates the NRI Hazard Type Risk Index for Fairfax Census Tract 1141.00.

Table 9: NRI Hazard Type Risk Index for Fairfax Census Tract 1141.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$882,375	Relatively Low	Very High	1.01	$894,568	90.4
Riverine Flooding	$400,764	Relatively Low	Very High	1.01	$406,302	95.6
Wildfire	$39,159	Relatively Low	Very High	1.01	$39,700	90.2
Landslide	$24,490	Relatively Low	Very High	1.01	$24,828	98.6
Heat Wave	$8,195	Relatively Low	Very High	1.01	$8,308	48.2
Tornado	$3,711	Relatively Low	Very High	1.01	$3,762	8.8
Strong Wind	$263	Relatively Low	Very High	1.01	$266	9.3
Coastal Flooding	$0	Relatively Low	Very High	1.01	$0	0
Drought	$0	Relatively Low	Very High	1.01	$0	0

Table 77: NRI Hazard Type Risk Index for Fairfax Census Tract 1141.00
Source: FEMA National Risk Index 2023

Social groups in Census tract 0604114100 have a Very Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

Figure 10 illustrates the Social Vulnerability Map for Fairfax Census Tract 1141.00. Social groups in Census tract 0604114100 have a Relatively Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

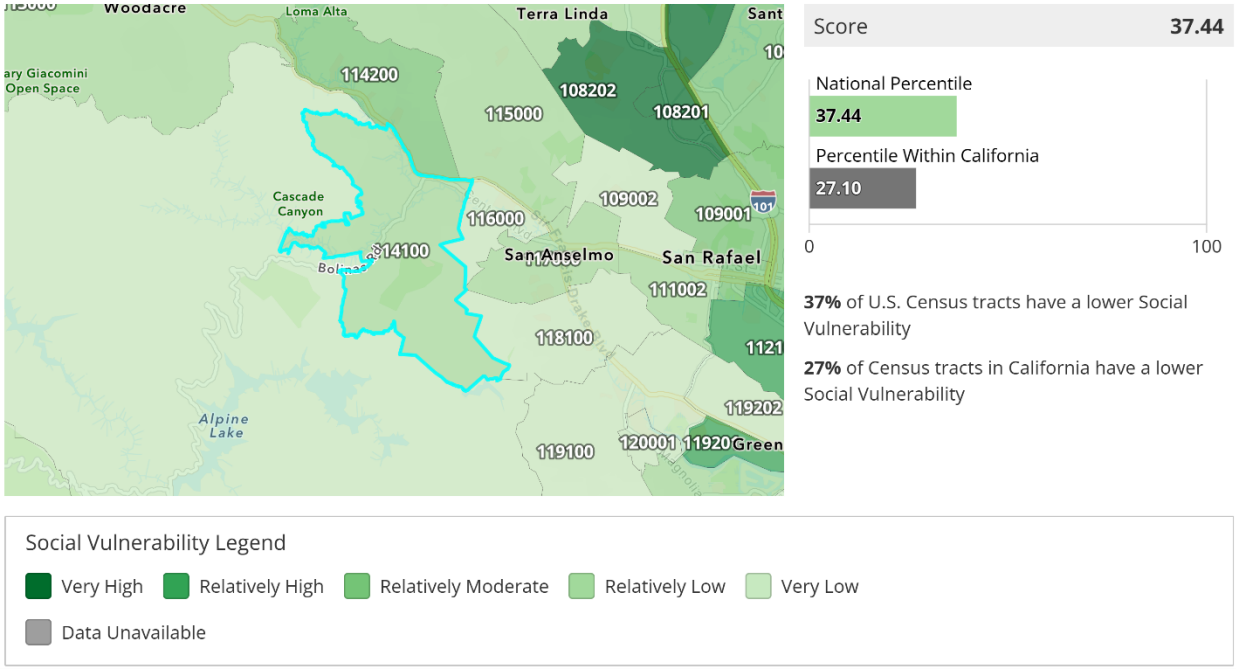


Figure 154: Town of Fairfax Social Vulnerability Map Census Tract 1141.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

The Town of Fairfax has a “Relatively Low” Social Vulnerability rating. The Town of Fairfax had an estimated population of 7,441 in 2020, with 3,479 housing units in the Town. The Town has a total area of 2.204 square miles. The median income for a household in the Town is $111,290 and the per capita income for the Town is $59,011. Approximately 0.3 percent of families and 10.1 percent of the population is below the poverty line (2020 data, U.S. Census Bureau).

1.8 ECONOMY AND TAX BASE

Table 10 shows income by household in The Town of Fairfax as of 2021.

Table 10: Household Income for the Town of Fairfax as of 2021		
Household Income	Number	Percent
Total Households	3410	-
Less than $10,000	222	6.5
$10,000 to $14,999	48	1.4
$15,000 to $24,999	211	6.2
$25,000 to $34,999	194	5.7
$35,000 to $49,999	303	8.9
$50,000 to $74,999	361	10.6
$75,000 to $99,999	239	7.0
$100,000 to $149,999	743	21.8
$150,000 to $199,999	426	12.5
$200,000 or more	668	19.6
Median household income (dollars)	$111,290	
Mean household income (dollars)	$131,887	

Table 78: Household Income for The Town of Fairfax as of 2021
Source: US Census Bureau American Community Survey 2021 Estimates

Table 11 shows the percentage of people in The Town of Fairfax over the age of 16 employed by industry.

Table 11: Town of Fairfax Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	4,096	-
Agriculture, forestry, fishing and hunting, and mining	47	1.15%
Construction	250	6.10%
Manufacturing	138	3.37%
Wholesale trade	131	3.20%
Retail trade	359	8.76%
Transportation and warehousing, and utilities	59	1.44%
Information	123	3.00%
Finance and insurance, and real estate and rental and leasing	274	6.69%
Professional, scientific, and management, and administrative and waste management services	893	21.80%
Educational services, and health care and social assistance	948	23.14%

Arts, entertainment, and recreation, and accommodation and food services	435	10.62%
Other services, except public administration	323	7.89%
Public administration	116	2.83%

Table 79: Town of Fairfax Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Town of Fairfax to fulfill the requirements of its mission during an emergency:

Table 12: Town of Fairfax Critical Facilities

	Category	Name	Address	Fire Severity Zone	Flood Zone
40.	Fire Station	Ross Valley Fire Station 21	10 Park Road, Fairfax 94930	High	AE
41.	Police Station	Fairfax Police Department	142 Bolinas Rd Fairfax	High	AE
42.	Town Hall/EOC	Fairfax Town Hall	142 Bolinas Rd, Fairfax	High	AE
43.	Corp Yard	Fairfax DPW Corp Yard	142 Bolinas Rd, Fairfax	High	AE
44.	Community Center/ Finance Dept	Finance Department for Town of Fairfax	16 Park Road, Fairfax	High	AE
45.	Community Center, Council Chambers	Woman's Club	46 Park Road, Fairfax, CA 94930	High	AE
46.	Community Center. Gymnasium, event center	The Pavilion	142 Bolinas Rd, Fairfax, CA 94930	High	AE But is well above the BFE

Table 80: Town of Fairfax Critical Facilities
Source: Town of Fairfax

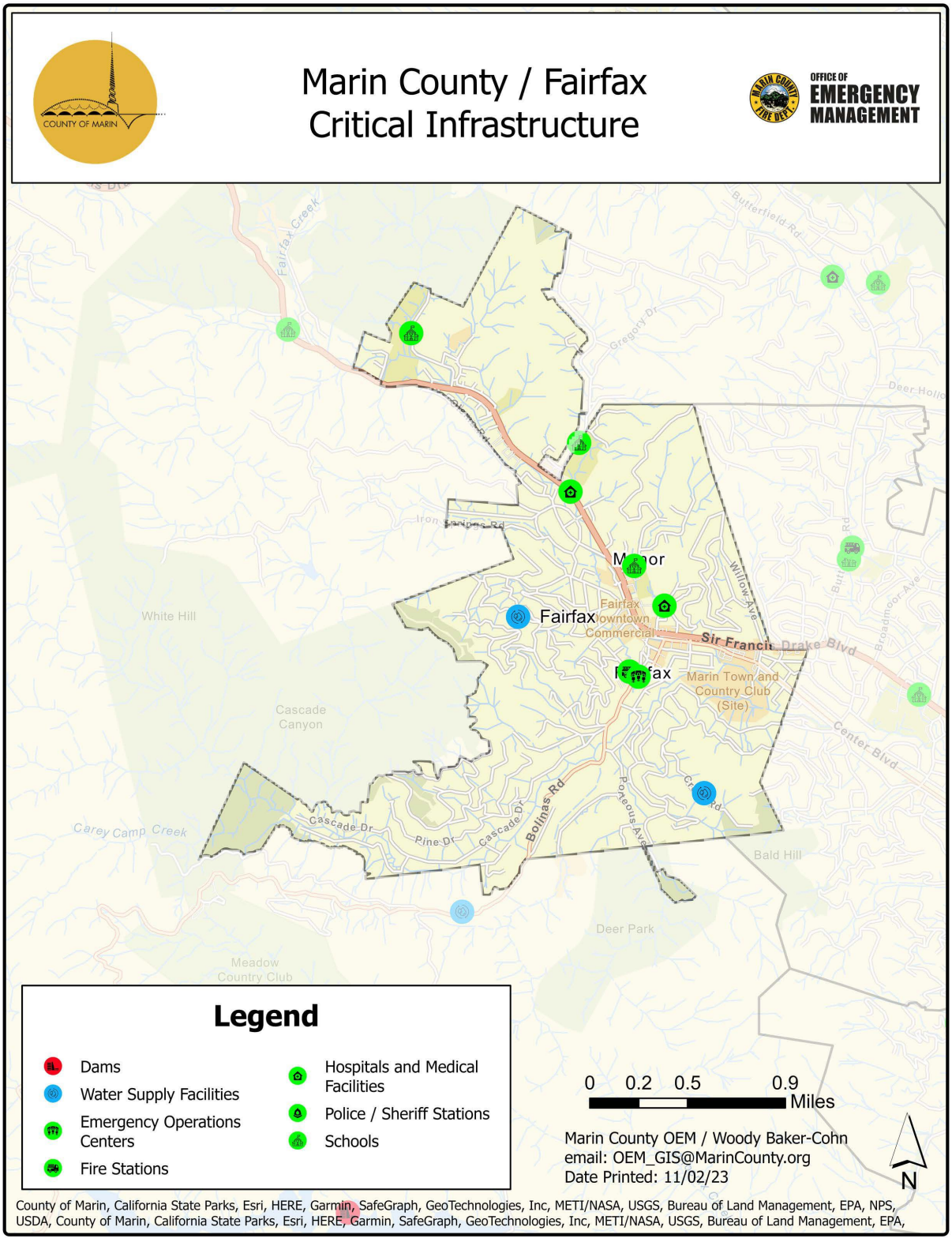


Figure 155: Town of Fairfax Critical Facilities and Infrastructure
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The Town of Fairfax has one registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- Town of Fairfax Chamber of Commerce.
- Town of Fairfax website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA).

Table 13: Historic Sites in Fairfax

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Lord Charles Snowden Fairfax Home (679)		X	X		Fairfax

Table 81: Historic Sites in The Town of Fairfax
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Town of Fairfax identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 12 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

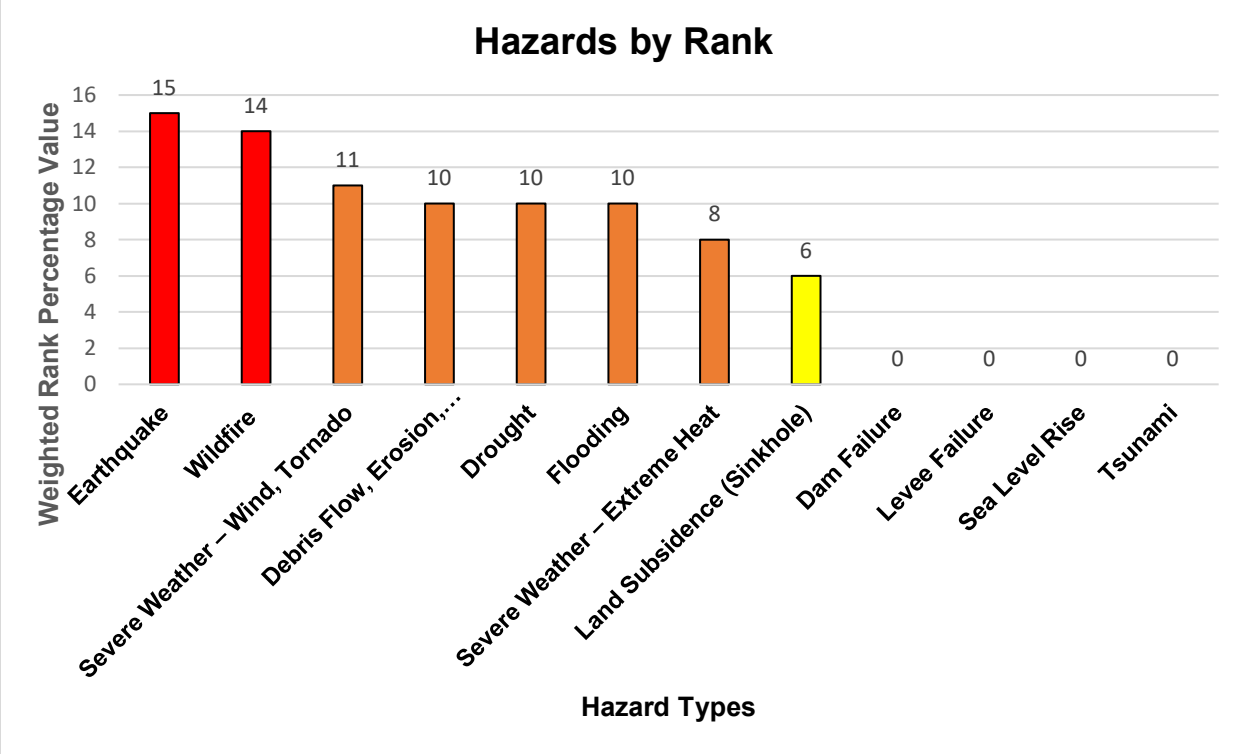


Figure 156: Town of Fairfax Risk Assessment – Planning Team Top Hazards

Figure 13: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 157: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed

the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 82: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS
Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS
Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

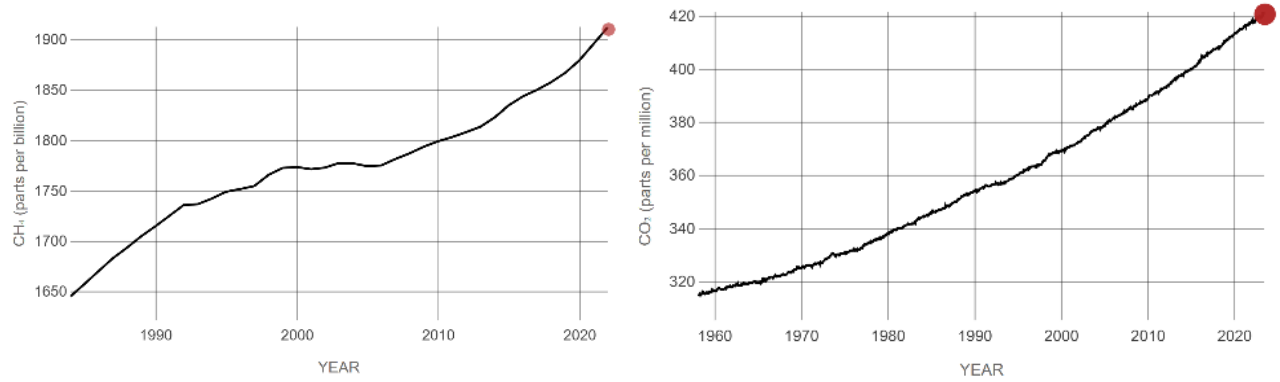


Figure 158: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

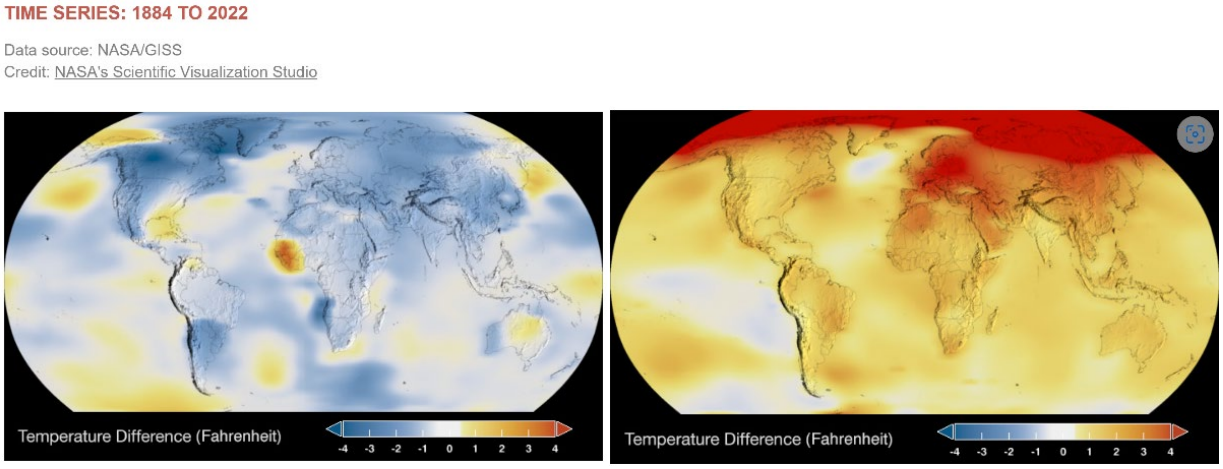


Figure 159: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

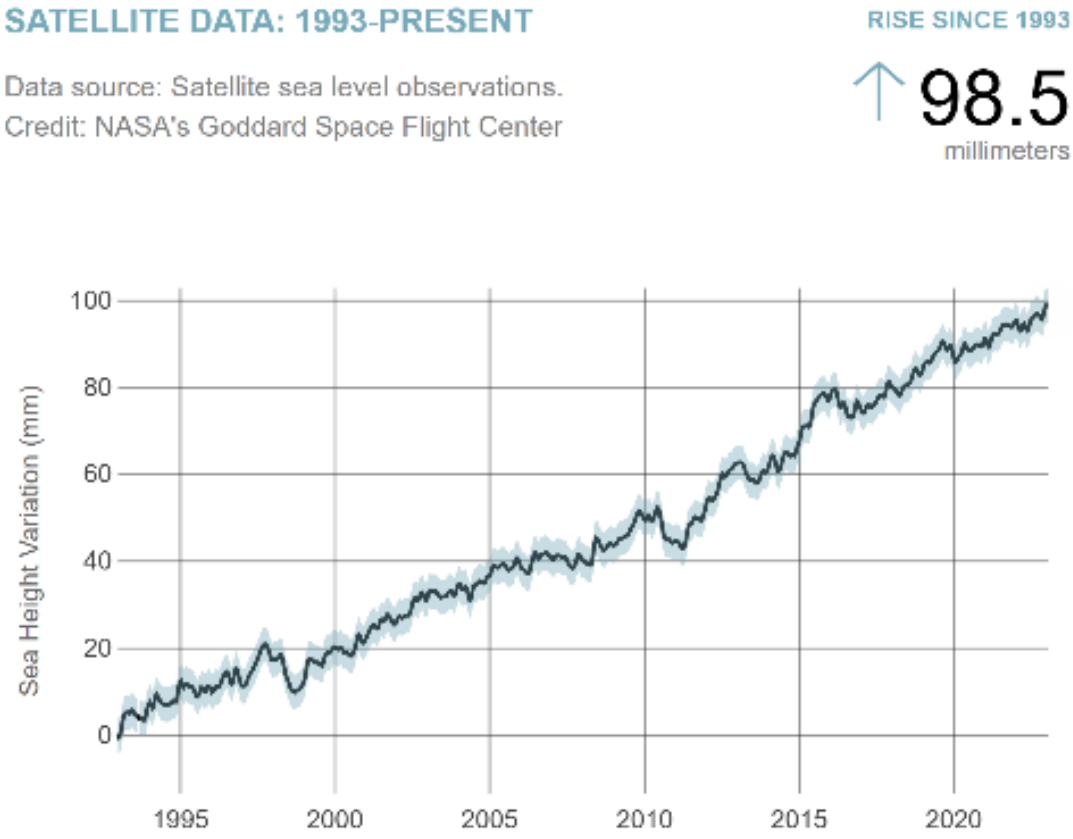


Figure 160: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.

- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.

- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

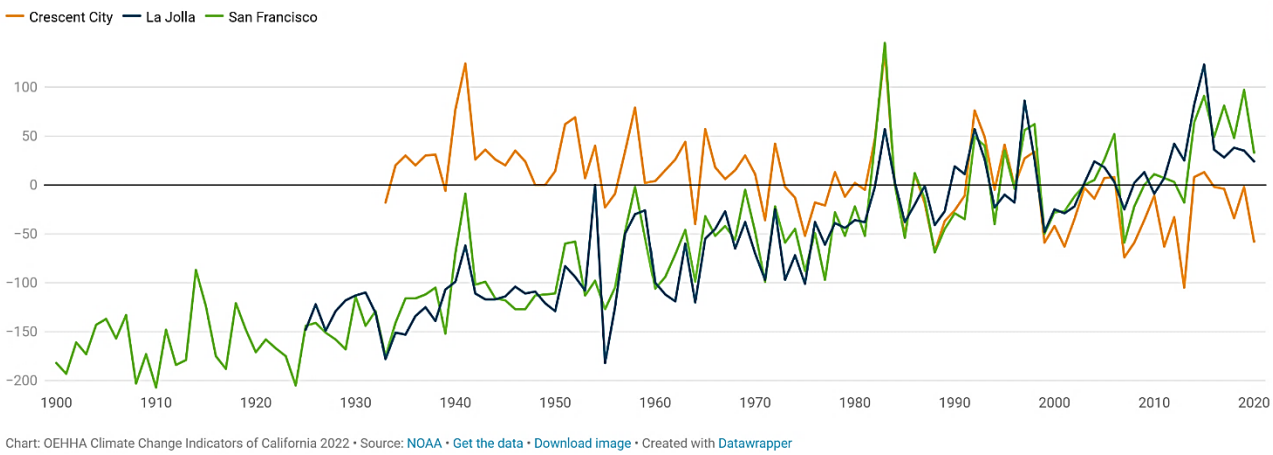


Figure 161: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable.

Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced. Marin Shoreline Sea Level Rise Vulnerability Assessment: https://www.marincounty.org/-/media/files/departments/cd/planning/slr/baywave/vulnerability-assessment-final/final_allpages_bvbconsulting_reduced.pdf?la=en

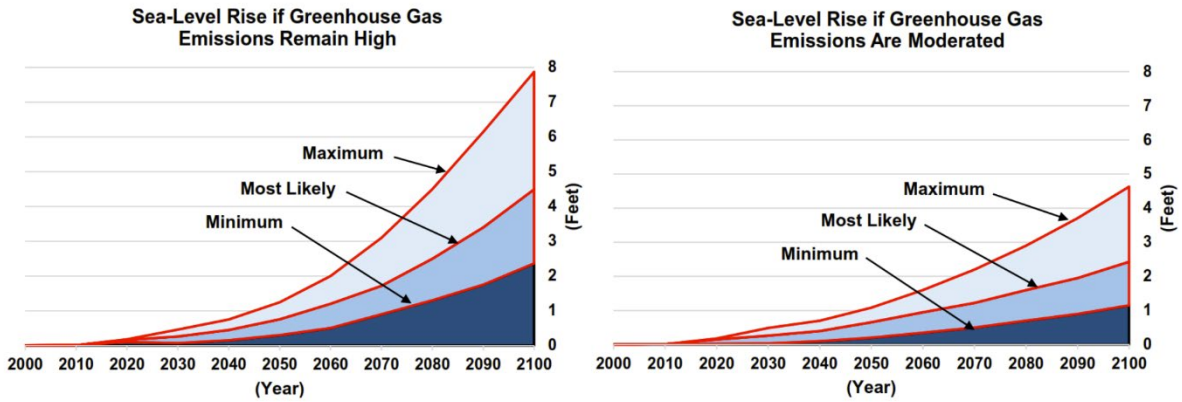


Figure 162: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

Climate Change in the Marin County Operational Area

Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the Town of Fairfax as per the planning team.

Table 15: Town of Fairfax Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Likely	Limited	Moderate	Medium	Low	**10.00**
Drought	Occasional	Extensive	Weak	Medium	Low	**10.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Land Subsidence	Occasional	Negligible	Weak	Low	Low	**6.00**
Severe Weather – Extreme Heat	Unlikely	Significant	Weak	Medium	Low	**8.00**
Severe Weather – High Wind/Tornado	Likely	Limited	Moderate	Medium	Medium	**11.00**
Wildfire	Highly Likely	Significant	Severe	Medium	Medium	**14.00**

Table 83: Town of Fairfax Hazard Risk Assessment
Source: Town of Fairfax

Omitted Hazards

The Town of Fairfax does not have risk exposure to Dam Failure, Levee Failure, Sea Level Rise, or Tsunamis. The Town is not in any dam inundation zone and does not lie near a coastline.

Table 16: Marin County OA Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 84: Marin County OA Hazard Risk Assessment
Source: County of Marin

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of

the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 19 shows landslide susceptibility classes.

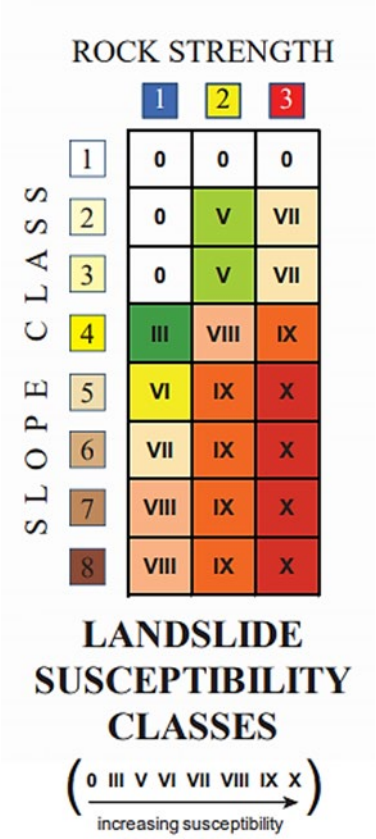


Figure 163: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 20 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

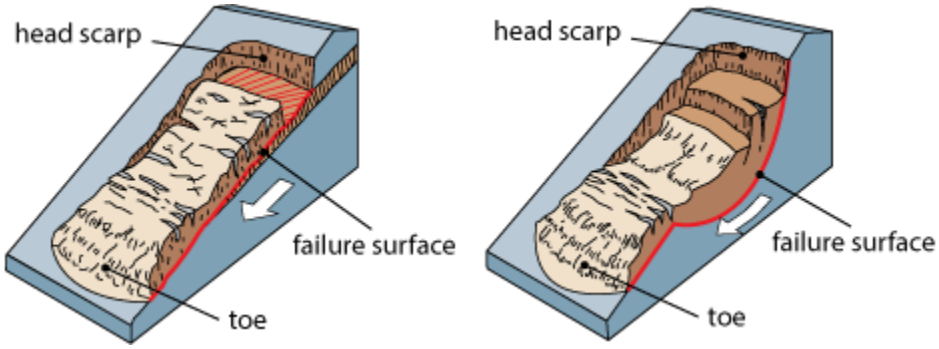


Figure 164: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in Fairfax would occur where the terrain is steeper and is more susceptible to movement of hill slope materials. This area includes most of Fairfax with the exception of the downtown area along Sir Francis Drake Boulevard adjacent to Fairfax Creek. The areas of Fairfax that are most susceptible to a landslide are residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. The Deer Park area of Fairfax is at the bottom of a canyon and is very landslide-prone. Road access into several residential areas of Fairfax, including along Cascade Drive and Bolinas Road and in communities north of Sir Francis Drake Boulevard, are minimal and a landslide on any of the major thoroughfares in these areas could limit ingress and egress for residents. There are hundreds of residences in these areas that could be susceptible to a landslide. All of the critical facilities in Fairfax, including the Town facilities, with the exception of two water tanks lie outside areas of high landslide susceptibility, but the Manor Elementary School and the Saint Ritas School lie in areas with some landslide susceptibility.

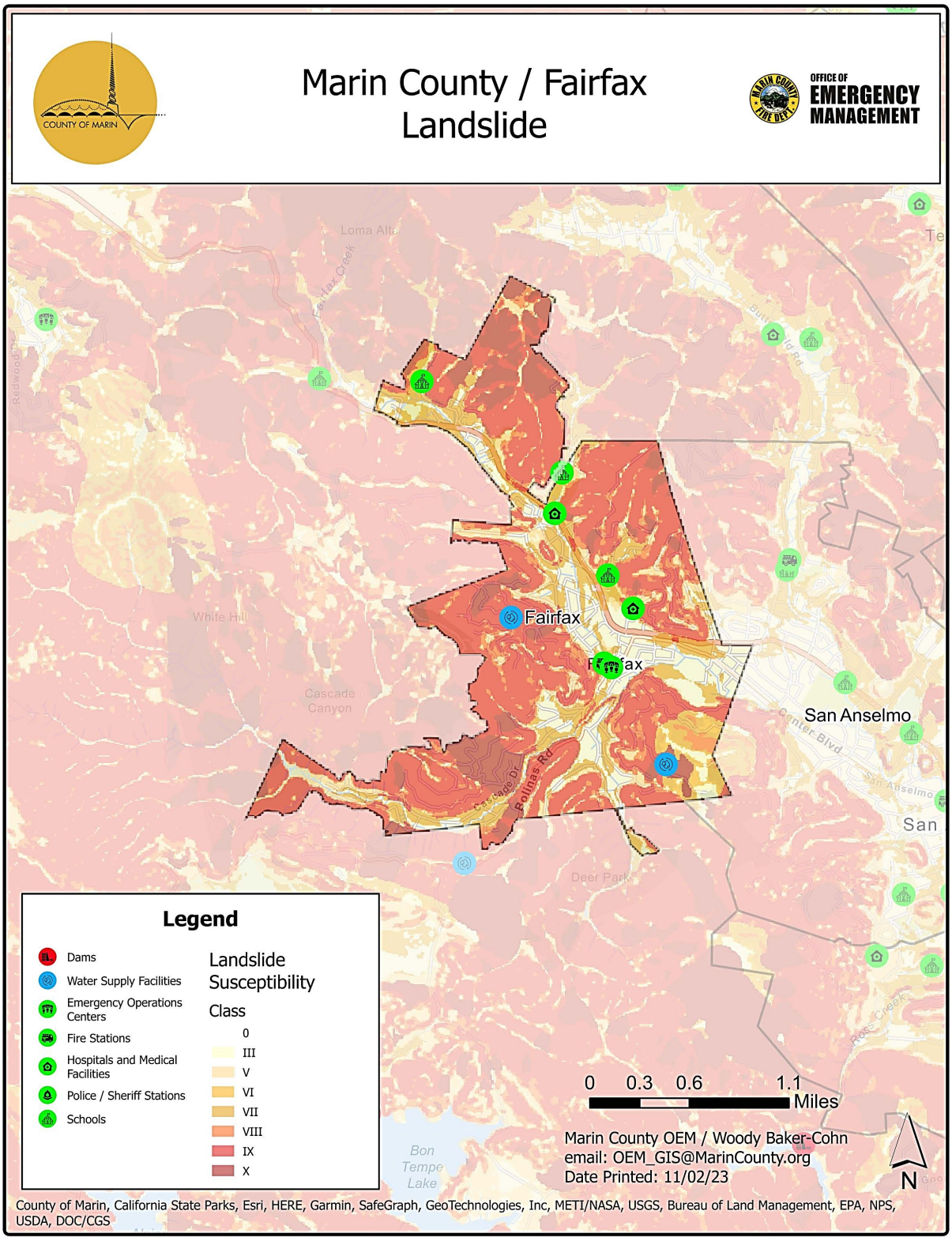


Figure 165: Town of Fairfax Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open space around Fairfax, including from Mount Tamalpais, the Cascade Canyon Preserve, the White Hill Open Space Preserve, the Hawthorne Canyon Open Space Preserve, and the Bald Hill Open Space Preserve could potentially contribute to debris flows in Fairfax. San Anselmo Creek flows from the Mount Tamalpais watershed through Fairfax and Fairfax Creek flows from near the White Hill Open Space Preserve through Fairfax. Both creeks could potentially contribute to a debris flow that could impact bridges, residences and other structures in the Town, affecting ingress and egress to residential areas.

On 1/13/2023, a storm caused a landslide in unincorporated Fairfax that damaged six apartments and displaced 19 residents at a complex on Olema Road. Mud and debris were sent through residences, breaking through walls, doors and windows. The damage was estimated at hundreds of thousands of dollars.

Figure 166: Mudslide in Fairfax – 1/13/2023
Source: The Marin Independent Journal

On 2/7/2017, a storm caused a landslide on Berry Trail in Fairfax, causing a woman and a son to have to escape through a bathroom window in their home. Olema Road was closed at Westbrae Drive because of mud, flooding and debris.

On 1/10/2017, after days of torrential rains and high winds, a hillside and trees at Sir Francis Drake Boulevard and Olema Road in Unincorperated Fairfax were sent tumbling down a hill, trapping two little girls and their grandparents in their home. A wall of mud came sliding down onto part of the home, smashing the carport and taking out the stairs.

On 12/21/2005-1/1/2006, a hillside along Wood Lane in the Deer Park area came crashing down on New Year's Eve in a storm, taking out a fence and much of a vacant house. The landslide took out the kitchen, carport, stairs and a large section of a concrete wall, and deposited a Honda parked in the carport on top of another vehicle across the street. Dozens of residences along the street had mud in their yards.

On 1/3–1/5/1982, a severe storm caused numerous landslides across the Town, isolating several areas and blocking access roads. Six houses were destroyed by mudslides and phone and electricity was out. Almost all businesses on Bolinas Road suffered damage. Total loss was estimated at $3 million.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[12], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Fairfax that have a higher landslide susceptibility, including the numerous open spaces around town will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Fairfax could be susceptible to post-fire debris flows. This includes areas around Deer Park Creek, San Anselmo Creek and Fairfax Creek, which flow through downtown. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.

[12] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.

Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Fairfax, though it's effects would be most felt in the mountainous areas around the Town where the risk of wildfire would increase. Dry trees in public spaces like the Cascade Canyon Preserve, the White Hill Open Space Preserve, the Hawthorne Canyon Open Space Preserve, and the Bald Hill Open Space Preserve can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Fairfax may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Fairfax, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Fairfax. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Fairfax where wildfires are more likely to occur. Future development in this area and in the mountainous areas of Fairfax could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Fairfax can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 23).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 167: Modified Mercalli Intensity Scale
Source: USGS

Figure 24 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 168: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 25). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 169: Soil Types
Source: USGS

An earthquake fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Fairfax due to the number of active faults within and near the Marin County OA.

Fairfax is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the Town. Areas in Town, primarily the low-lying areas adjacent to San Anselmo Creek and along Sir Francis Drake Boulevard have a "moderate" earthquake shaking potential and could be more susceptible to an earthquake. All of the Town's critical facilities, with the exception of its two water tanks, including its schools, Police Station and Emergency Operations Center, Ross Valley Fire Station #21 and the Fairfax Community Center Town Hall lie in an area of moderate vulnerability to shaking from an earthquake. Hundreds of homes and dozens of businesses, including the main commercial area of town, lie in this area. Hundreds more homes lie in an area of lower earthquake shaking susceptibility.

Earthquake Shake Intensity

The colors on Figures 26 and 27 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

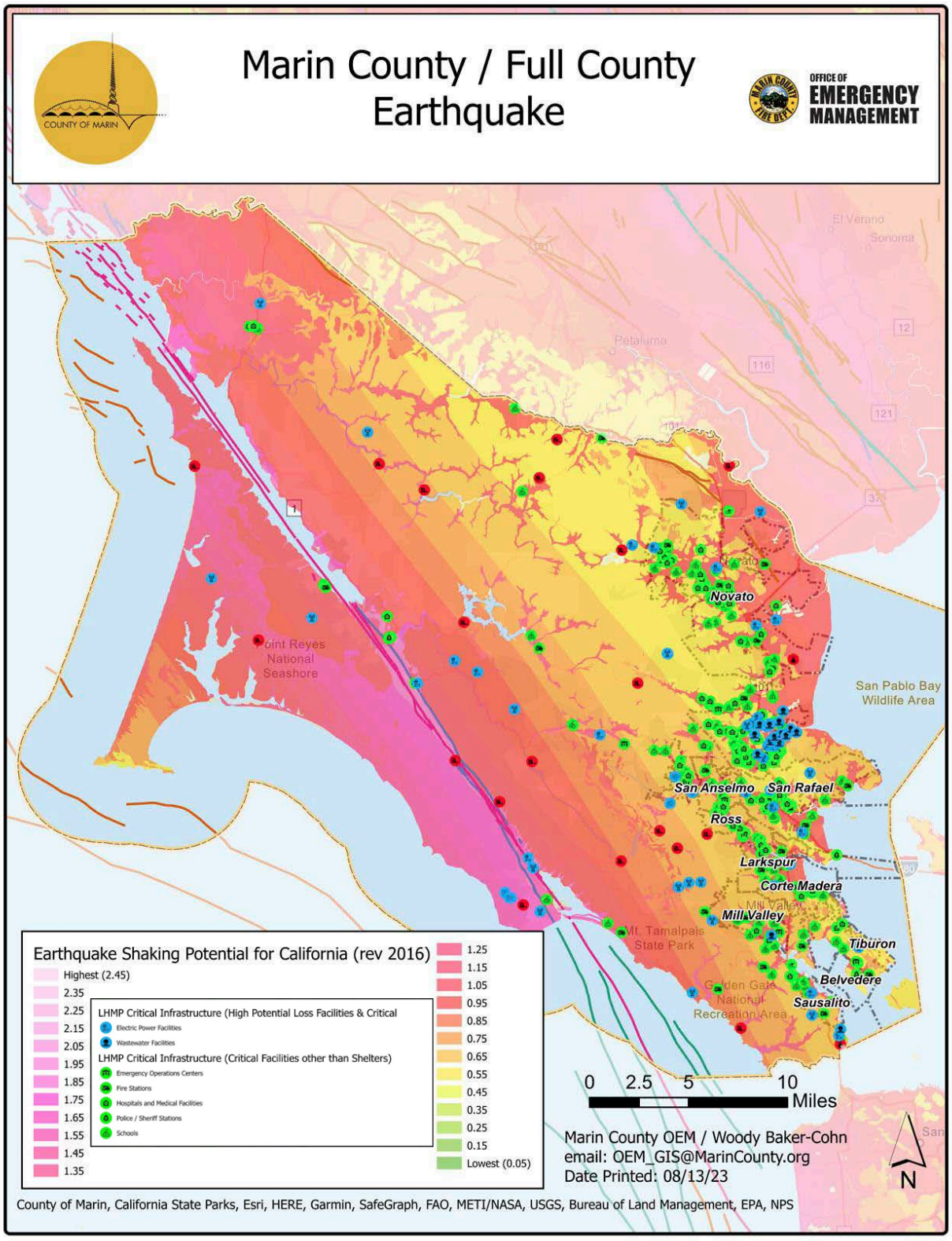


Figure 170: County of Marin Earthquake Impact and Fault Lines
Source: Marin County OEM

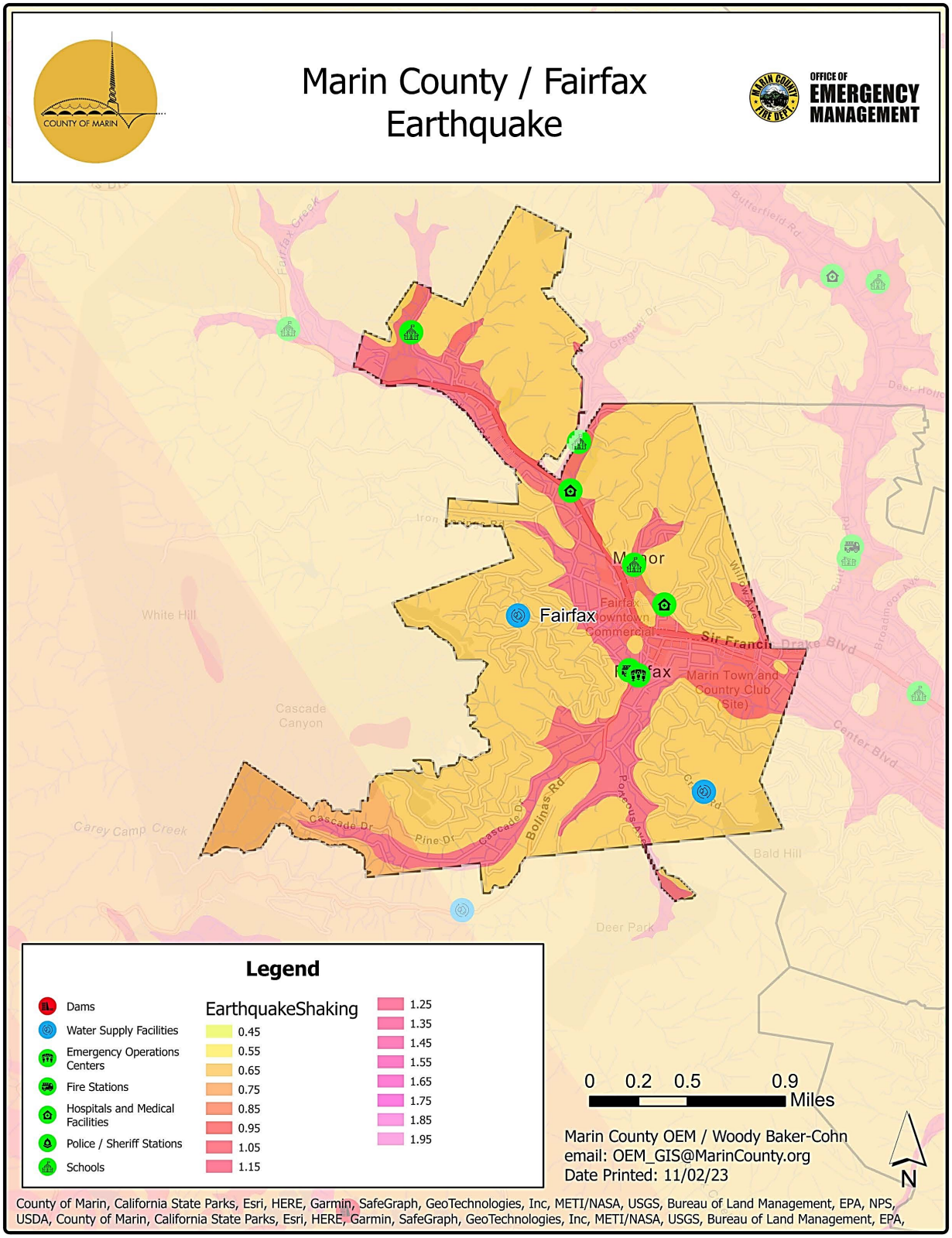


Figure 171: Town of Fairfax Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

A major earthquake event could result in deaths, injuries, property and environmental damage, and disruption of normal government and community services. Hospitals outside of the Town may be impacted by an earthquake. Telephone systems could be affected by system failure, overloads and loss of electrical power. Natural gas leaks pose a fire threat and breaks in the system could affect service to the Town. Water sources could be compromised due to damage to treatment plants, pump stations and/or the pipelines that distribute potable water. Liquefaction-related damage to water supply pipelines could impair fire suppression, leaving the Town vulnerable to a large fire. Sewage collection systems throughout the Marin County OA may sustain widespread damage if ground movement damages mains or pipelines. Electricity may be interrupted. Landslides may occur. Bridges and roads may be closed because of damage. An earthquake may also result in dam failure. Liquefaction of creeks during the winter storm season could exacerbate flood hazards. The Town may experience road closures from liquefaction, earthquake-triggered landslides, shaking damage to bridges as well as indirect causes of closures such as building damage, hazmat releases, and utility pipeline breaks and fallen trees. The Town of Fairfax will be affected by the regional impacts of regional transportation disruption, particularly closure of the Golden Gate Bridge. Earthquakes could also cause landslides in the areas around Fairfax with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Fairfax hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across Fairfax were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Fairfax.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Fairfax, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[13], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Fairfax. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Fairfax downtown and along its creek beds where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

[13] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 28.

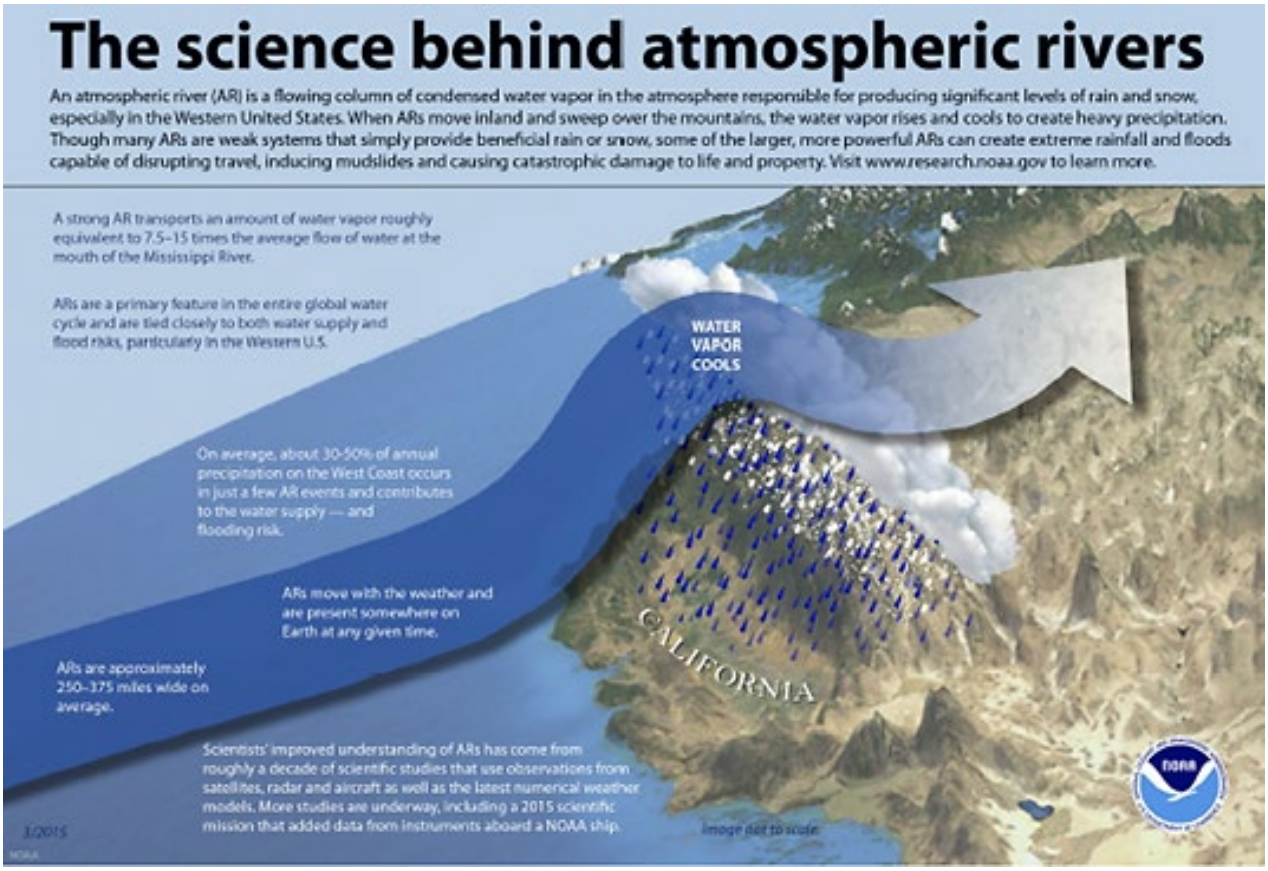


Figure 172: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any

area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the stormdrains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in Fairfax generally results from creek flooding. Fairfax is not located along the coast and would not experience coastal flooding. Fairfax is subject to periodic flooding from San Anselmo and Fairfax Creeks. Ross Valley, where Fairfax is located, is naturally prone to flooding by its location, geologic and geomorphic setting: rainfall can be intense, soils are shallow with limited absorption capacity, slopes are steep, stream channels are entrenched and in many places narrow with relatively little storage capacity. The watershed has been altered from its natural condition and many sections of creeks and streams have been placed in culverts and the natural pattern of runoff has been changed. During prolonged and heavy storms the watershed can become saturated. If rainfall is sufficiently intense, heavy runoff can result in high flows exceeding the capacity of the creek in places where conveyance is constrained. Floodwaters escape the creek capacity and breach the creek bank in downtown Fairfax. 'Localized' flooding also occurs in many places in Fairfax and is exacerbated where the storm water drainage network has inadequate capacity for peak flows or is blocked from sediment, debris, or vegetation. Localized flooding is characterized by excessive ponding in the street, and overflow onto lower-lying residential properties even during 5-year storm events. Localized flooding can occur within or outside of the FEMA designated floodplain. Severe winter storms can also be accompanied by hazards and destruction resulting from high winds. High winds knock down limbs or entire trees which subsequently damage power and utility lines, buildings, block streets, and even pose a direct risk to human safety.

Local flooding in Fairfax is exacerbated where the storm water drainage network has inadequate capacity for peak flows. The most flood-prone areas of Fairfax are downtown south of Broadway Boulevard and Center Boulevard. The 100-year floodplain extends primarily along Fairfax Creek, widening up to several hundred feet on either side from Azalea Avenue east through the downtown area to the Post Office. There are numerous homes and businesses in this area along with the Town's primary critical facilities including the Fairfax Police Station and Emergency Operations Center, the Ross Valley Fire Station #21 and the Fairfax Community Center that could be susceptible to flooding. The 100-year also floodplain also extends along San Anselmo Creek west of Bolinas Road and several hundred feet of Deer Park Creek where numerous homes could be susceptible to flooding. The 500-year floodplain occurs primarily along the 100-year floodplain fringe of Fairfax and San Anselmo Creeks, extending several hundred feet up Deer Park Creek, along Wood Lane, and along Bothin Road where there are dozens of homes. No other critical facilities in Fairfax lie within either the 100 or 500-year floodplain.

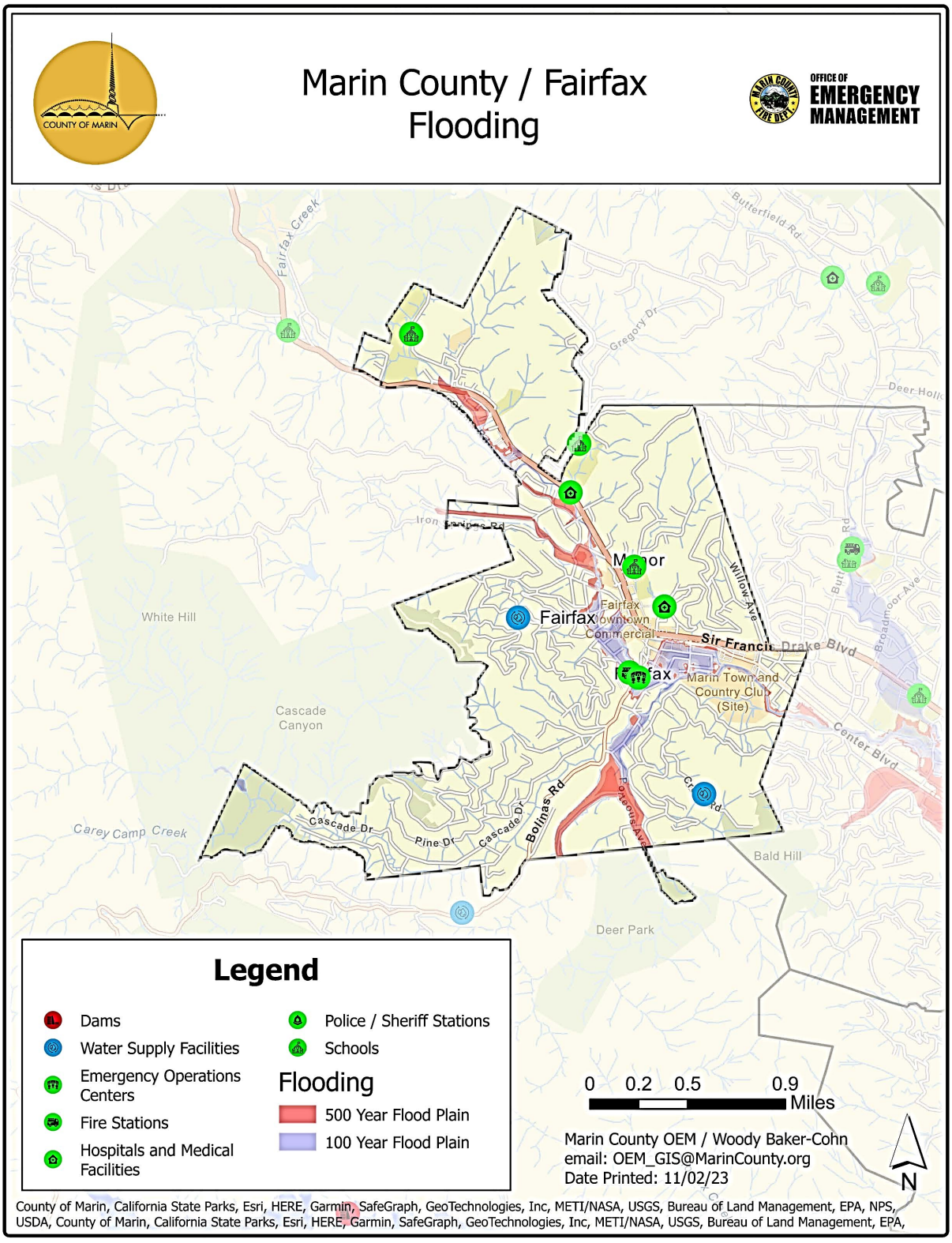


Figure 173: Town of Fairfax Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 17 shows the number of Fairfax critical facilities by flood zone.

Table 17: Town of Fairfax Critical Facilities by Flood Zone				
	Category	Name	Address	Flood Zone
1.	Fire Station	Ross Valley Fire Station 21	10 Park Road, Fairfax 94930	AE
2.	Police Station	Fairfax Police Department	142 Bolinas Rd Fairfax	AE
3.	Town Hall/EOC	Fairfax Town Hall	142 Bolinas Rd, Fairfax	AE
4.	Corp Yard	Fairfax DPW Corp Yard	142 Bolinas Rd, Fairfax	AE
5.	Community Center/ Finance Dept	Finance Department for Town of Fairfax	16 Park Road, Fairfax	AE
6.	Community Center, Council Chambers	Woman's Club	46 Park Road, Fairfax, CA 94930	AE
7.	Community Center. Gymnasium, event center	The Pavilion	142 Bolinas Rd, Fairfax, CA 94930	AE But is well above the BFE

Table 85: Town of Fairfax Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning.

On 2/7/2017, police closed Park Road because of flooding. Water also flooded most of Bolinas Road through downtown. Olema Road was closed at Westbrae Drive because of mud, flooding and debris. No major damage was reported.

On 12/11/2014, creeks in Fairfax turned into rivers after a storm that dropped over two inches of rain. Flooding was reported along Wood Lane and Porteus Avenue. Traffic on Sir Francis Drake Boulevard in west Fairfax was slowed by flooding. A tree fell on a home, but no major damage from flooding were reported.

On 1/1/2006 the town experienced major flooding with major damage to Police, Fire, and Town Hall buildings along with damage to many businesses, and residences.

On 1/3–1/5/1982, a severe storm damaged almost all businesses on Bolinas Road with flooding. Total loss was estimated at $3 million.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[14] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Fairfax. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Fairfax will likely experience more rain inundation events that lead to creek flooding and increase the potential threat of tree mortality and other potential hazards. Development along Deer Park Creek, San Anselmo Creek and Fairfax Creek, including the downtown area would expose more people, structures and infrastructure including major roads to creek flooding as a result of climate change.

2.2.5 LAND SUBSIDENCE/SINKHOLES

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 30 for a picture and description of how dissolution sinkholes form.

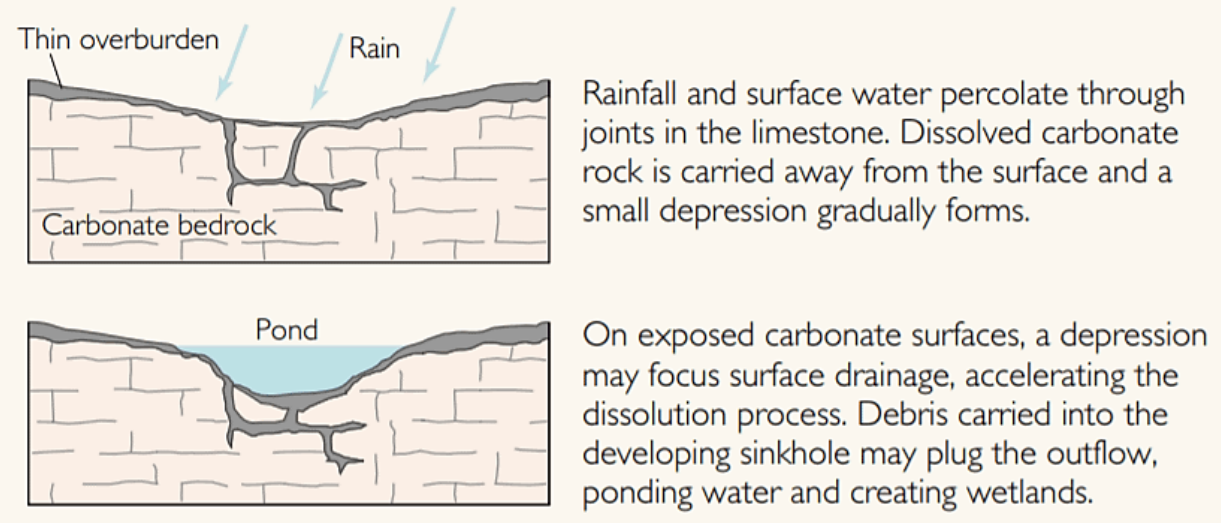


Figure 174: Dissolution Sinkhole Formation
Source: USGS

[14] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 31 for a picture and description of how cover-subsidence sinkholes form.

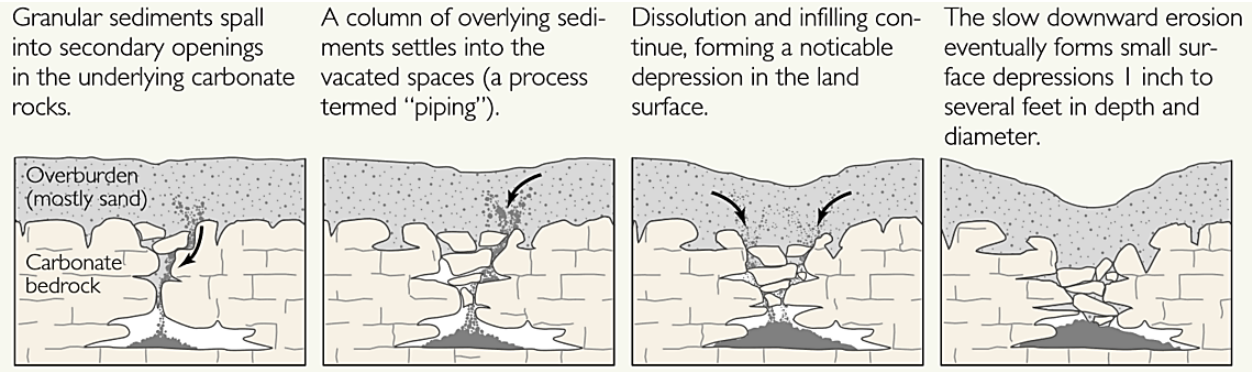


Figure 175: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 32 for a picture and description of how cover-collapse sinkholes form.

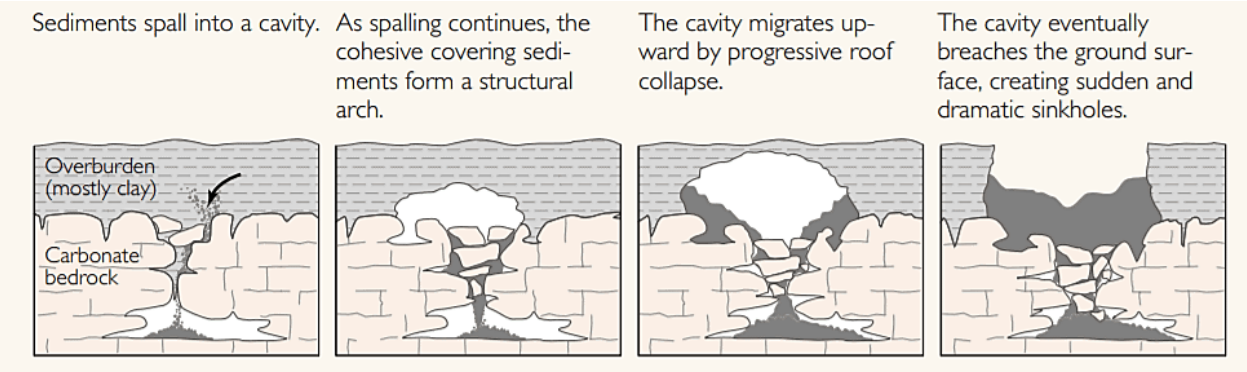


Figure 176: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new

sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central lowland areas of Fairfax along Fairfax and San Anselmo creeks where the ground is more porous. This includes the primary commercial area of town where there are numerous residences, businesses and critical facilities the Fairfax Police Station and Emergency Operations Center, the Ross Valley Fire Station #21 and the Fairfax Community Center. Land subsidence could have numerous impacts for Fairfax, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the Town.

On December 13, 2021 a sink hole was discovered under the sidewalk and part of the eastbound lane at the 2300 block of Sir Francis Drake. The sink hole appeared to be at least 15-feet deep.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Fairfax as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Fairfax could increase with future development in the lowland populated areas of the city, particularly the downtown area, where land subsidence is more likely to occur.

2.2.6 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 33):

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Figure 177: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat.

Extreme heat has the potential to impact all areas of Fairfax and would be felt more at lower elevations in the central areas of the Town. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the Town of Fairfax experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

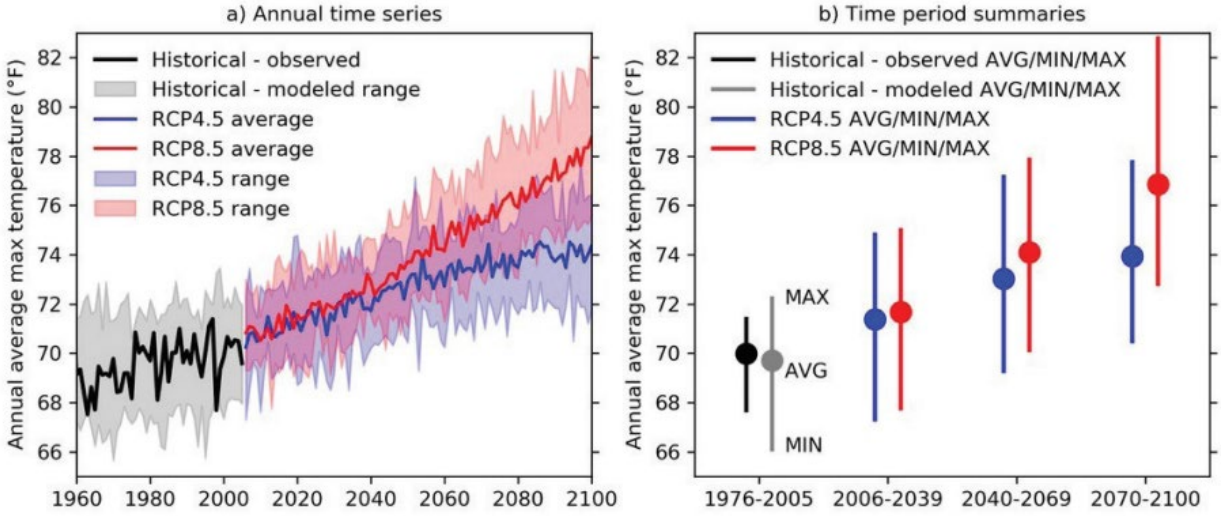


Figure 178: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Fairfax. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Fairfax where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Fairfax could exacerbate the impacts from heat related events, particularly

in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Fairfax as conditions become hotter and drier. These effects will primarily be felt in the open space areas of Fairfax where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Fairfax could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.7 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 35).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 179: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 36) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 180: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 181: Waterspout Formation
Source: MarineInsights

All of Fairfax is susceptible to storms and damage from wind and tornadoes, as most of the Town has tree cover. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

Fairfax has experienced winter storms that have caused damage.

On 3/14/2023, a wild storm ripped through Fairfax, causing a tree to fall on a fence at Manor Elementary School on Oak Manor Drive.

Figure 182: Wind Damage at Manor Elementary School – 2023 Storm
Source: Marin Independent Journal

On 1/8/2017, a storm with high winds caused 2,000 customers in Fairfax to lose power. Tree branches ensnared power lines on Spruce Road.

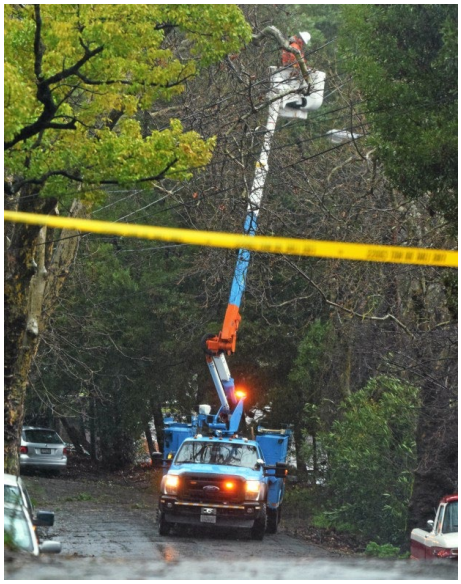


Figure 183: Wind Damage on Spruce Road – 2017 Storm
Source: Marin Independent Journal

On 11/30/2012, high winds knocked trees down onto power lines which sparked a fire that burned down a small cabin, resulting in a fatality.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Fairfax. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Fairfax as a result of increased storms due to climate change can lead to an increase in power outages.

Future development in any of the forested areas around Fairfax with high tree cover including in residential areas will increase the effects of severe wind events.

2.2.8 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion, or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes, and can reach speeds up to 15 miles per hour. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the

total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerous fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The County of Marin is one of six counties in the state who contract with CAL FIRE to protect SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 40 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

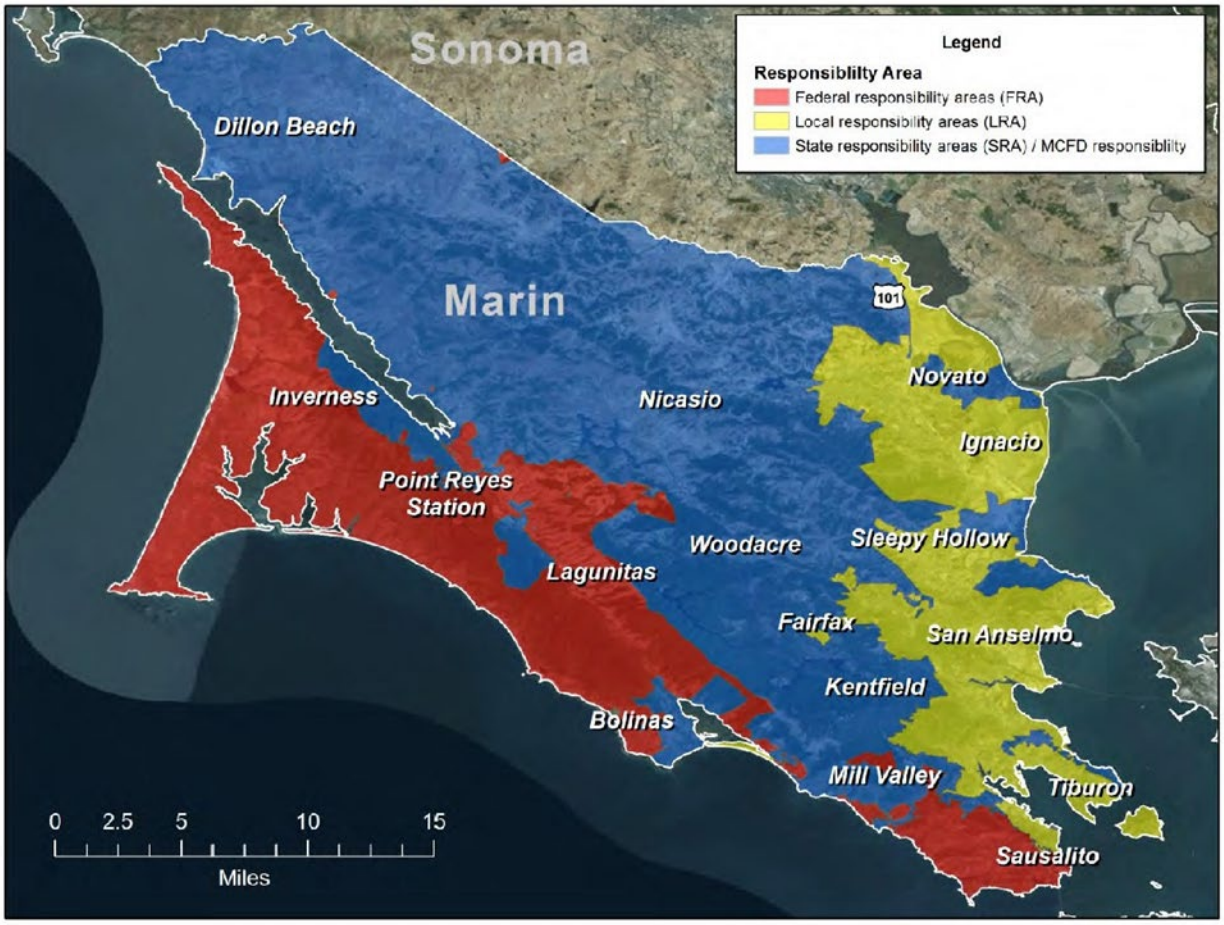


Figure 184: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay). The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/San Anselmo, Hicks, and Lucas Valleys. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Great Basin to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph) and gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires.

A few times per year in the summer and early fall, monsoonal flow from Mexico brings in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, the lightning can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the CWPP, an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

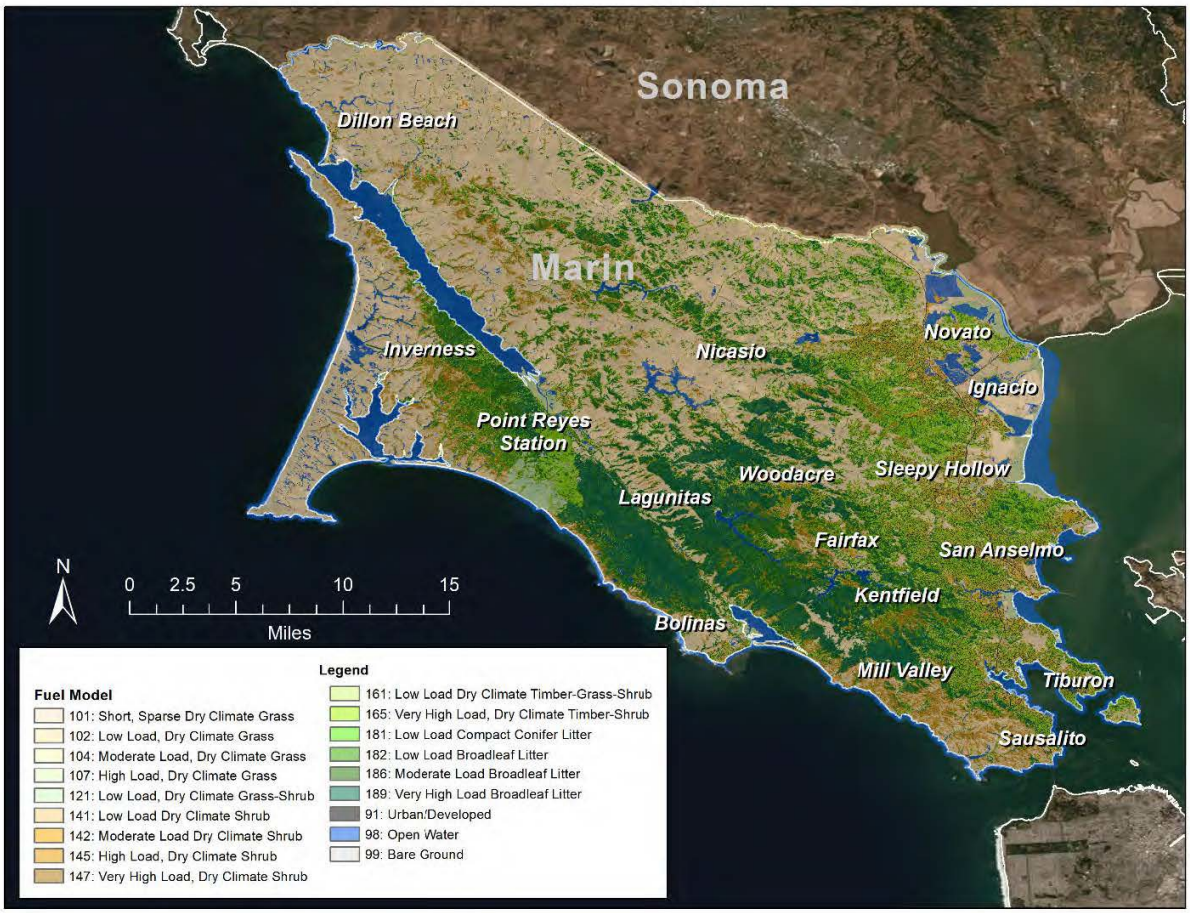


Figure 185: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to

widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt.

Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin County OA) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles

can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 the Marin County OA including the Town of Fairfax experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA.

The fire season generally lasts from five to six months, when there is little rain. Access to the adjacent open space areas and the hillside and canyon areas is limited by few access routes and narrow roads. Fairfax is within the Wildland-Urban Interface (WUI) and most of the town, including all of its critical facilities, is in a high FHSZ. Road access is minimal into several residential areas of Fairfax with winding narrow roads, including along Cascade Drive and Bolinas Road, and in communities north of Sir Francis Drake Boulevard. Evacuation of these areas due to wildfire could be challenging. The Town borders directly on the open space lands of Mount Tamalpais, the Cascade Canyon Preserve, the White Hill Open Space Preserve, the Hawthorne Canyon Open Space Preserve, and the Bald Hill Open Space Preserve. The hillsides and canyons carry the potential of high fire danger. The wildland fire hazard is caused by a combination of factors including hillside terrain, highly flammable vegetation and forest, long summers, and human activity. There are heavy fuel loads. Many homes have been built on steep slopes with vegetation in close proximity. The onset of Sudden Oak Death (SOD) has significantly increased the number of dead or weakened trees in the areas, which contributes to the fuel loads.

Wind is a predominant factor in the spread of fire.

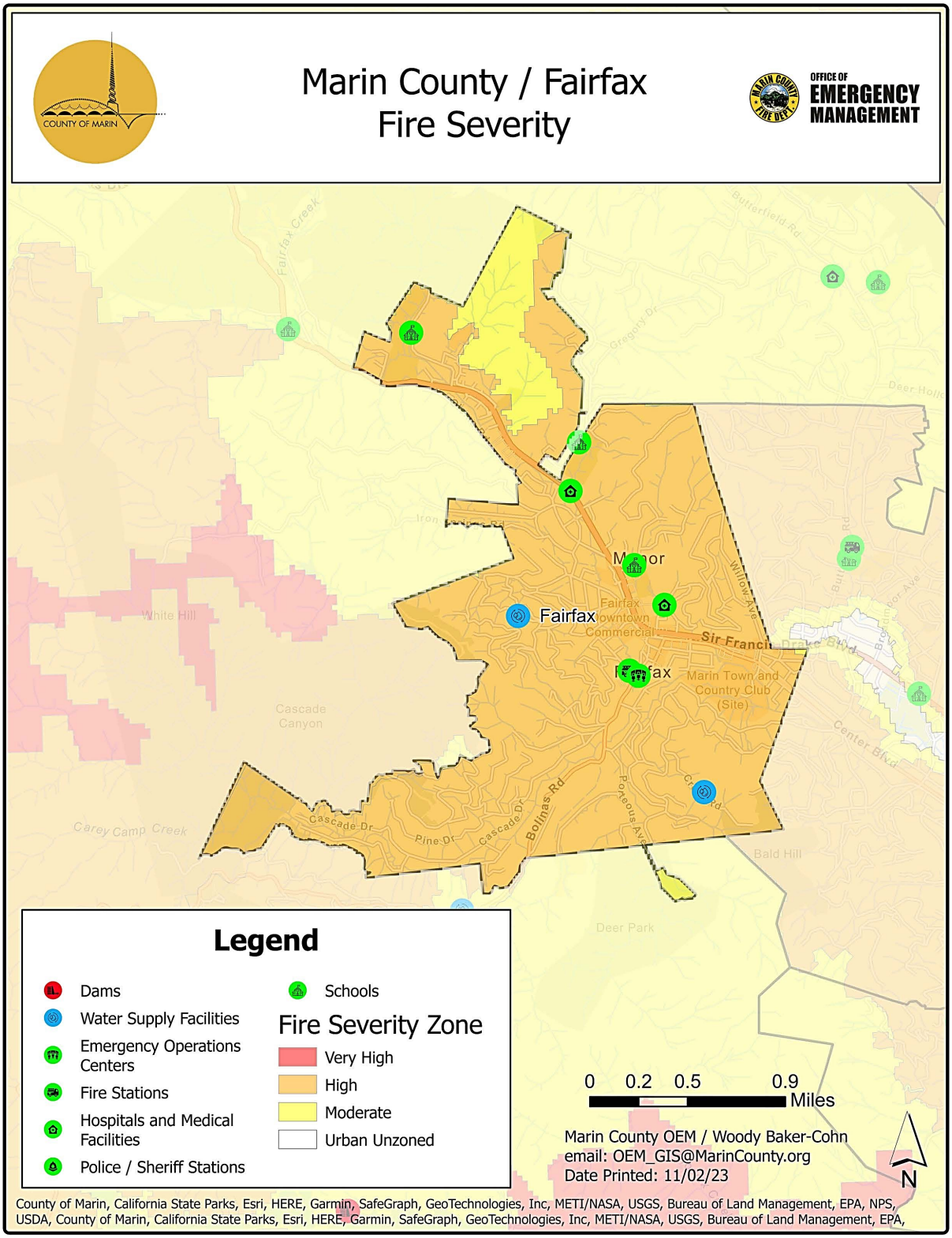


Figure 186: Town of Fairfax Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Wildfires can cause short-term and long-term disruption to Fairfax. Fires may result in deaths and injuries and can destroy buildings and infrastructure. Additional costs associated with the loss of homes to wildland fire include disruption of utilities, transportation, and other public services. Although the physical damages and casualties arising from wildfires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In large wildfire events, the economic impact of this loss of services may be comparable to the economic impact of physical damages to the Town. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Wildfires can also cause major damage to power lines needed to distribute electricity to operate facilities. High intensity wildfires can also have substantial effects on watersheds through loss of vegetation and soil erosion, which may impact the Town by changing runoff patterns and degrading water quality through sedimentation and contamination.

All of Fairfax could be impacted by a Power Safety Shutoff (PSP) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Fairfax become drier due to climate change, the risk of a wildfire occurring and impacting the Town will continue to increase. Brush fires in the Town may increase over time as parks and other open spaces experience drier conditions.

Fairfax has never experienced a major wildfire. The Town experiences small fires annually.

On 10/6/2023, a brush fire burned three acres in Fairfax off Bolinas Fairfax Road during a three-day period of unseasonable warmth in the Town. No injuries were reported and no structures were threatened.

Figure 187: Fairfax Brush Fire - 2023
Source: Marin Independent Journal

On 7/16/2019, a house fire on a ridge on Crest Road spread into wildlands. There was no wind and the fire was extinguished with no further damage.

On 9/18/2016, a wildfire burned ten acres of parched terrain about 1.5 miles northwest of Fairfax near Camp Tamarancho. Temperatures were above 90 degrees and conditions were extremely dry. No structures were damaged by the blaze.

On 1/18/2014, a wildfire burned an acre of remote hillside along the Bolinas-Fairfax ridgeline between Kent and Alpine Lake in the unincorporated County of Marin above Fairfax. No injuries were reported and no buildings were threatened.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

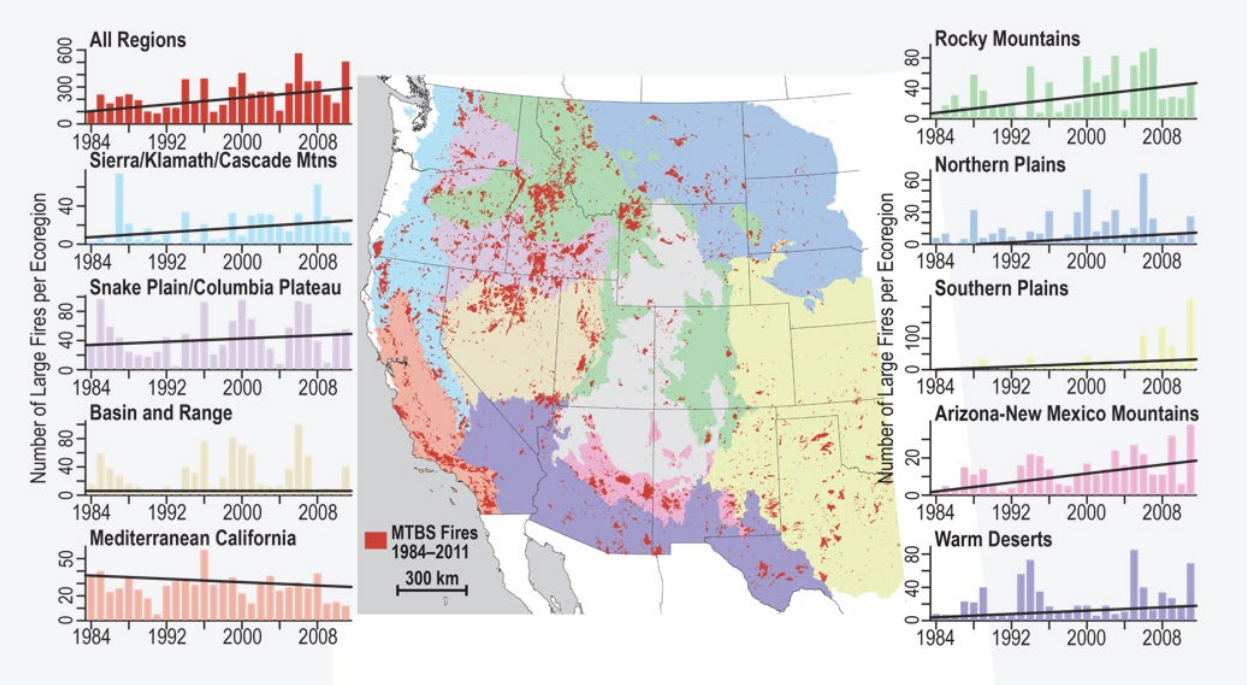


Figure 188: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Fairfax is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Fairfax. Post-fire debris flows could become more common in the areas of Fairfax around its creeks, including downtown. Future development in the WUI throughout Fairfax will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Fairfax WUI can increase risk to life, property and public health as a result of a wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The County of Marin is a county located in the northwestern San Francisco Bay Area. As of the 2020 census, the population was 262,231. Its county seat and largest city is San Rafael. The Marin County OA is across the Golden Gate Bridge from San Francisco and is included in the San Francisco–Oakland–Berkeley, CA Metropolitan Statistical Area.

The core of the Town of Fairfax is a classic example of “old urbanism,” where human-scale development was oriented around a transit station. Unfortunately, planning and development patterns since 1930 have often given preference to automobile travel over all other forms, minimizing or eliminating other transit options and human-scaled development. This shift is evidenced in the Marin County OA by ever expanding commercial districts and residential development, until one community abuts another and commercial areas become continuous strips, only accessible by car or sparse public transit service.

One can see this trend most strikingly in commercial areas adjacent to the historic core of Fairfax that are zoned Highway Commercial (CH). CH areas are typified by large monolithic structures surrounded by “parking lagoons”; for example, Fairfax Market to the west on Sir Francis Drake Boulevard and the Fair-Anselm and grocery store complex to the east on Center Boulevard.

Fortunately, residents of Fairfax over the past several decades have intuitively resisted these impacts and vigorously fought to save the Town from automotive-centric development patterns, seeking instead to preserve the Town's human-centric development pattern. Fairfax citizens have sought to secure open space for future generations, limit development not compatible with the original historic scale of the Town, and inhibit development that furthers grid-lock along the Sir Francis Drake Boulevard, the main arterial that runs through the entire Ross Valley corridor. For example, plans to create a freeway through the Ross Valley in the middle of the 20th century, and proposals to create massive residential development in the east end of town at the end of the 20th century, were defeated by citizen activism.

Fairfax development can be described in terms of well-defined urban planning principles. Below is an overview of relevant concepts that currently experience renewed interest throughout the country, in our efforts to address climate change, strive for social equity, and create economically viable communities with a sense of place.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Fairfax has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 18: Town of Fairfax Future Growth Areas

	Development	# of Units	# of Parcels	Project Date	Acres	Fire Severity Zone	Flood Zone
1	School Street Plaza	175	1	Est. 2029	2	High	X
2	Fairfax Market	8	1	Est. 2026	1	High	X
3	Underutilized commercial sites	159	17	unknown	varies	High	X
4	Accessory Dwelling Units (ADU's)	160	-	20 yrs.	All Residentially Zoned sites	High/ Very High	varies
	Total	**83**					

Table 86: Town of Fairfax Future Growth Areas
Source: Town of Fairfax

3.2 Capability Assessment

The overall priorities in the Town of Fairfax have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall town priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the Town of Fairfax General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the Town's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 19: Town of Fairfax Legal and Regulatory Capabilities		
Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y 2010	The General Plan outlines long-term direction for development and policy. The new Safety Element includes a discussion of fire, earthquake, flooding, and landslide hazards; and importantly includes a section on Community Preparedness. Consistent with the Plan Maintenance and Update Process section of the 2018 Local Hazard Mitigation Plan (LHMP) Annex, the General Plan Advisory Committee (GPAC) reviewed, refined, and incorporated selected mitigation strategies into the 2010 General Plan Safety Element. As this plan gets updated there is potential to improve it with updated risk information and strategies.
Strategic Plan	N	
Capital Improvements Plan	Y	The Capital Improvement Plan (CIP) directs construction activities for Town owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure. As this plan gets updated there is potential to improve it with updated strategies.
Economic Development Plan	N	
Local Emergency Operations Plan	Y 2006	The plan is due for an update. It was created with the technical assistance of the Marin County Sheriff's Office of Emergency Services.
Continuity of Operations Plan	n	
Flood Mitigation Plan (FMP)	Y	Information on flood mitigation included in the Fairfax 2018 Local Hazard Mitigation Plan
Engineering Studies for Streams	Y	The Ross Valley Flood Protection and Watershed Program
Open Space Management Plan	N	
Regional Transportation Plan (RTP)	N	Regional Transportation Plan completed by Transportation Authority of Marin
Stormwater Management Plan/Program	Y	Town Code Chapter 17.068, Floodplains adopted 1988
Engineering Studies for Streams	Y	The Ross Valley Flood Protection and Watershed Program
Community Wildfire Protection Plan	Y	Town coordinates with Marin Wildfire Protection Authority (MWPA) on activities and mitigation efforts including Firesafe Marin
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal	N	

zone management, climate change adaptation)		
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	Yes, state and local building codes are adequately enforced.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Ross Valley Fire Department has an ISO rating of 2. It is adequately enforced.
Site plan review requirements	Y	Site plans shall include: an outline of the lot showing the length and direction of all property lines; relevant property setbacks; all buildings, fences, retaining walls, walkways, and driveways. Clearly indicate the distances from any structure to the property lines. Show all structures presently on the site and those proposed; indicate paving material for the driveway and if the paving is new or existing; a north arrow; the edge of street pavement and name of any abutting street; if a curb and/or sidewalk exists; site drainage; contour lines for properties steeper than a one-foot drop over a seven-foot horizontal distance (15% grade).
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Municipal Code includes several sections that address hazard mitigation. The Town adopts the current California Building Code which applies to all construction activity within the Town boundaries. The California Building Code is comprised of 11 parts that incorporate public health, safety, energy, green building and access standards used in the design and construction of all buildings. The new code provisions will allow the Town to utilize the latest technologies, advances in construction standards and seismic design for the use in new residential and commercial construction and in remodels.
Zoning ordinance	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision ordinance	Y	Town Code Title 16
Floodplain ordinance	Y	Town Code Chapter 17.068

Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Hill Area Residential Development Ordinance, Town Code Chapter 17.072
Flood insurance rate maps	Y	Building and planning check all building and planning application using FEMA Flood Insurance Maps to determine if projects require inclusion of special conditions or building methods to comply with FEMA regulations
Elevation Certificates		
Acquisition of land for open space and public recreation uses	Y	Fairfax Open Space Committee is active in finding and acquiring Open Space parcels within the town limits
Erosion or sediment control program	Y	All planning and building applications are conditioned to comply Marin Countywide Stormwater Pollution Prevention Program.

Table 87: Town of Fairfax Legal and Regulatory Capabilities
Source: Town of Fairfax

Town of Fairfax General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The Town of Fairfax General Plan, April 4, 2012 included an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the Town's statement of its vision for the future. The General Plan contains policies covering every aspect of the Town: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

Town of Fairfax specific goals and policies related to mitigation of natural hazards are as follows:

Table 20: Town of Fairfax General Plan

Goal/Policy/ Program	Explanation
Land Use Element	
Goal	Preserve scenic and natural resources, restore natural habitats, minimize wildfire hazards, preserve human-centered scale, mixed use and sense of community while managing growth
Policy	New development outside of the Town's boundary shall be limited and of a scale that preserves the significant scenic and natural resources and rural character of the areas adjacent to the Town
Program	Identify and pre-zone and lands outside the Town's boundaries that are considered subject to development for the purposes of maintain land use practices that respect the Town's natural environment.
Program	Create inventory of undeveloped or underdeveloped lands with the Fairfax Planning Area
Program	Proposed development of any parcel in the inventory shall be reviewed by the Fairfax Open Space Committee
Conservation and Open Space Element	
Goal	Integrate reduction of the use of non-renewable energy resources and greenhouse gas (GHG) emissions into the planning process, reduce consumption of non-renewable energy resources and reduce GHG emission by the residents and the Town, Promote

	education and citizen involvement
Policy	Develop a Climate Action Plan, promote zooming to facilitate live/work units and minimize motorized transit, encourage green building techniques for new and remodel construction, participate in state and county efforts towards energy conservation, renewable energy and GHG reduction
Program	Establish Climate Action Committee, obtain resource usage information for town and create a climate action plan (CAP).
Program	Adopt planning policies and zoning that promotes mixture of residential and commercial usage in the same building/site to promote live/work and promote infill development.
Program	Adopt green building ordinance provide links on website to green building information and resources.
Program	Continue membership in Marin Energy Authority, support Marin County Greenhouse Gas Reduction Plan, require GHG emission analysis as part of any traffic study.
Program	Implement energy efficiency and use of sustainable energy resources by Town Government
Program	Create infrastructure to facilitate the use of plug-in electric vehicles.
Public Safety	
Goal	Minimize risks due to geologic hazards, floods and fire and foster Community Preparedness
Policy	Land use decision will be made using best available geotechnical information and make that information available to the public, encourage seismic retrofit, encourage retrofitting of public and private buildings that pose a risk, preserve existing building stock, collaborate with other agencies to maintain critical infrastructure during emergency events
Program	Archive past geotechnical studies for past development, document past landslides, evaluate Town-owned critical facilities, encourage building owners to seismically retrofit their properties, retrofit seismically deficient bridges, enforce relevant codes and construction standards.

Table 88: Town of Fairfax General Plan
Source: **Town of Fairfax** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the Town personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 21: Town of Fairfax Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Planning Commission		The Planning Commission meetings on the third Thursday of each month. The Commission holds public hearings and takes action on subdivision, design reviews, conditional use permits, and items that may be forwarded to or called up by the commission.
Hazard Mitigation Planning Committee	Y	The Town participates in the Marin County OA MJHMP Planning Committee that meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Town has a Maintenance Plan for trees in public parks and routinely prunes/maintains trees and removes hazardous trees; Town contracts with Marin Sanitary Service for regular street cleaning
Mutual aid agreements	Y	Public Safety Mutual Aid agreements.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911. Town has a warning siren for use when imminent flooding of creeks may occur
Hazard data and information	Y	Data has been used for the determination of floodplain areas. Different building code requirements are enforced based on the location of a structure in the floodplain to mitigate risk.
Grant writing	N	
Hazus analysis	N	
Staff/Personnel Resources	Yes/No Full Time/ Part Time	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	Yes

Flood Control and Water Conservation District Staff	Y	Currently administered by Building Official
Emergency Manager	N	
Community Planner	N	
Civil Engineer	Y	Town contracts for Town Engineer Services
GIS Coordinator	N	
Community Development Staff	N	Currently contracted out. Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan. Anticipates and acts on the need for new plans, policies, and Code changes. Applies the approved plans, policies, code provisions, and other regulations to proposed land uses.
Town Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building related activities including issuing permits, conducting environmental review, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. Public Works Department is responsible for Town-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department.
Police Department Staff	Y/FT	The Fairfax Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Department Staff	Y/FT	The Ross Valley Fire Department protects the town from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire.

Table 89: Town of Fairfax Administrative and Technical Capabilities
Source: **Town of Fairfax**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 22: Town of Fairfax Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in the past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Water, Gas, Electric and Sewer are administered and managed by other agencies
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	N	Storm Drainage is not considered a utility by Town of Fairfax
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.

Table 90: Town of Fairfax Fiscal Capabilities
Source: **Town of Fairfax**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Town of Fairfax and the Town of Fairfax partnerships utilized to promote those programs.

Table 23: Town of Fairfax Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Fairfax Volunteers supplement town staff in a variety of outreach and community activities related to hazard mitigation. This includes organizing neighborhood groups, creek and path stewardship and emergency preparedness coordination.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	In cooperation with other agencies including Marin Wildfire Prevention Authority, Marin Municipal Water District, Ross Valley Fire District and Town Newsletter, information is provided to community on a range of programs
Natural disaster or safety related school programs	N/A	Ross Valley School District is not affiliated specifically with Town of Fairfax and may have its own programs
StormReady certification	N	
Firewise Communities certification	Y	Town of Fairfax does have Firewise communities but program is not directly managed by Town of Fairfax
Community Rating System	Y	Yes, refer to section 3.2.5.
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 91: Town of Fairfax Community Outreach
Source: **Town of Fairfax**

3.2.5 PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

The Town of Fairfax has participated in the Regular Phase of the NFIP since 1/5/1978. Since then, the Town of Fairfax has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. The Town of Fairfax has been in the CRS program since 10/01/2017. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, The Town of Fairfax is currently ranked Class 9 community, which gives a 5 % premium discount to individuals in the Town of Fairfax Special Flood Hazard Area (SFHA), and a 5 % discount to policyholders outside the SFHA.

Presently, the Fairfax manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the Town's participation in the NFIP. as well. The Town's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the Town.

The Town of Fairfax will continue to manage their floodplains in continued compliance with the NFIP. An overview of the Town's NFIP status and floodplain management program are discussed in Table 24. Additional information on the Town's CRS program follows.

The activities credited by the CRS program provide direct benefits to the Marin County OA and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that the Town of Fairfax implements and receives CRS credits include:

Activity 310 - We maintain Elevation Certificates for new and substantially improved structures in SFHA.

There are occasions that homeowners submit their elevation certificates when they are not making any improvements to their property. We keep hard copies in the office in a binder.

Activity 320 - We provide basic flood information to inquirers. We also provide additional information like flood depth, Historical flood information and etc.

Activity 330 - Outreach program. We send a flyer to all the properties in the flood zone. In the flyer we have some language for the history of flooding, protection of their property, protection

and clean local creeks and stormdrains, build responsibly for flooding and City floodplain information services.

Activity 340 - This is Hazard Disclosure. We require a residential resale inspection for all properties prior to the sale. We are disclosing whether a property was or was not in the flood zone.

Activity 350 - Our Public Library maintains flood protection materials. Also, we conduct an annual review and update of the information and links on our flood protection website.

Activity 360 - We send a brochure to properties in the flood zone. We provide flood protection advice to inquirers. We provide on-site flood protection assistance to inquirers. We let them know that flooding is not covered by the standard insurance policies whether they are property owners or renters. We also let them know that if they live or work in the Marin County OA they can register and get an alert notification during an emergency situation. We also let them know that they have to have an emergency plan and also how they can protect their property from flooding by cleaning the gutters and downspouts and area drains and making sure if they have a sump pump, the sump pump is working.

Activity 420 - This activity is preserving our open space in the floodplain.

Activity 430 - We enforce the floodplain management provisions of our zoning, subdivision and building code ordinances. Examples of this activity are requiring the lowest finished floor elevation of residences to be 1 foot higher than the base flood elevation. If the cost of improvements or repairs are more than 50% of the building's value, the owner needs to bring the building to compliance. Also, requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings.

Activity 440- We use and update our flood data maintenance system on an annual basis as needed, because we want to make the community floodplain data more accessible, current and useful.

1. We implement digital mapping or paper mapping systems that improve access and quality.
2. We maintain our historical Flood Hazard Boundary Map, FIRMs and Flood Insurance Studies.
3. We maintain benchmarks so surveyors can request obtain them from the Town.

Activity 450 - This activity is about stormwater management.

We regulate development on a case-by-case basis to ensure we treat runoff before it leaves the site and also ensure that the peak flow of stormwater runoff from each site will not exceed the pre-development. There are instances that the post-development peak flow rates for the developed area have been slightly increased from pre-development conditions however, onsite bio-retention areas or other treatment facilities have been provided to mitigate the increase in flow rate. We enforce regulations to minimize erosion from land disturbance due to construction.

Activity 502 - This is about repetitive loss Category- Properties that have had losses and reported to FEMA for these losses. We are in Category B. Category B means we are a community with at least one, but fewer than 50 repetitive loss properties that have not been mitigated. We have a map of the areas. We send a notice every year to those properties letting them know about flood

prevention and insurance information. We have 6 repetitive loss properties however we send notices to 41 properties in several repetitive loss areas.

Activity 510- Floodplain Management Planning- The Town of Fairfax has adopted the County of Marin Multi-Jurisdictional Hazard Mitigation Plan which has flood related sections like Dam Failure, Severe Storm, Flooding, Repetitive Loss Properties and Safety Warning/Evacuation Systems.

Table 24: Town of Fairfax NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	137 Policies $178,108 Premiums $44,273,000 coverage
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	118 Paid losses $1,886,056.82 Paid losses 2 Substantial damage claims
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	Per our GIS Consultant who queries GIS for building footprints against the SFHA boundary, there are 2000 buildings in SFHA.
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Review permit plans for FEMA regulation compliances. Use GIS to find out if the property is in a Flood Zone. Outreach brochure mailed to all properties in SFHA. Inspection is performed as needed.
What are the barriers to running an effective NFIP program in the community, if any?	We currently only have one staff member who manages the program. In order to run it effectively we hire consultants and obtain advice/help from County staff.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	9-1-2021
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	1/5/1978
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Yes. This is through development limitations, free board requirement, foundation protection, cumulative substantial improvements. We also have adopted and enforced the International Building Code. We do maintain drainage systems all year around to prevent

	flooding in different neighborhoods.
Provide an explanation of the permitting process.	Single-family residential projects require public hearings and discretionary decisions before the Planning and Building staff can process building permit applications for development. In Fairfax, residential projects are also subject to this two-step public hearing process with discretionary decisions made at each step. A "discretionary decision" by definition can either be for approval or denial of a project. If a project is denied at a Planning Commission or Design Review Board hearing, the decision can be appealed to the Fairfax Town Council.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	Class 9
What categories and activities provide CRS points and how can the class be improved?	All the activities that are performed/accomplished are described above. To improve the class to a higher classification the City needs to expand and do more work towards activities.
Does the plan include CRS planning requirements	Yes

Table 92: Town of Fairfax NFIP Status
Source: FEMA, Town of Fairfax

NFIP Insurance Coverage Details

Town of Fairfax joined the NFIP on 1-5-1978. The Town of Fairfax does participate in the Community Rating System. NFIP insurance data provided by DWR indicates that as of 9-13-2023, there were 136 policies in force in the Town of Fairfax with $175,355 in premiums, resulting in $36,668,000.00 of insurance in force. There have been 118 closed paid losses totaling $1,886,056.00 2 of the claims were considered substantial damage losses. Of these losses, 35 parcels were in AE zones, 29 parcels were in AO zone. Of the 118 claims, 0 claims were associated with pre-FIRM structures and 118 with post-FIRM structures. There were 16 repetitive loss structures in the Town of Fairfax. 14 were in A zones, and 2 were in B, C, or X zones. These repetitive loss structures account for $454,927.00 of the total losses in the Town of Fairfax. There were not any severe repetitive loss properties in the Town of Fairfax.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 16
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0
- Repetitive Loss Residential Structures: 16
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 0
- Severe Repetitive Loss Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA, including each of its jurisdictions, as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 STATUS OF PREVIOUS MITIGATION ACTIONS

Table 25 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 25: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Seismically retrofit and renovate Town Pavilion			X	X	Yes
Seismically retrofit/Renovate Town owned Women's Club (Council Chambers)			X	X	Yes
Conduct Periodic Testing of emergency sirens and early warning systems including Nixle		X		X	Yes
Mitigate flooding impacts to Town Facilities such as Town Hall		X		X	Yes
Incorporate FEMA guidelines and suggested activities into local government plans and procedures for managing flood hazards		X		X	Yes
Seek Grant Funding for vegetation removal along roadways and roadside collection/chipping of hazardous vegetation within the Wildlife Urban Interface (WUI)		X		X	Yes

Table 93: Status of Previous Hazard Mitigation Actions
Source: Town of Fairfax

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Town of Fairfax based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

A cost benefit review process will be completed for each project that will be submitted during a given fiscal year. The general priorities of the cost benefit risk analysis will focus on projects that are lifesaving, life safety, property protection and lastly environmental protection. A ratio of at least one dollar of benefit for each dollar invested will be considered the minimum cost benefit ratio for any projects submitted within the Town of Fairfax.

The Town of Fairfax maintains project worksheets with detailed descriptions of each project. A summary of each project is found in the table below.

Table 26 lists the Current Hazard Mitigation Actions for the Town of Fairfax.

Table 26: Town of Fairfax Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
F-1	Marin Emergency Radio Authority (MERA) Upgrades. MU-13 Protect Infrastructure and Critical Facilities	All Hazards/ 1, 2, 3, 4, 5	County of Marin and the Town of Fairfax	Existing (2018)	Cost TBD; State and/or Federal Homeland Security grants.	1-3 years High	Town as a participant, is also studying replacement for the system as it reaches the end of its service life.
F-2	Implement the Goals, Policies, and Actions listed in Table 20 of the General Plan Safety Element.	All Hazards/ 1, 2, 4, 5	Town of Fairfax	New (2023)	Cost: General Funds	1-3 years High	A new General Plan Safety Element was adopted which includes significant public safety components.
F-3	Review and adopt current California Building and Fire codes. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of Fairfax	Existing (2018)	Cost: General Funds	1 – 3 years/ High	The Town continues to review and adopt current California Building and Fire codes.
F-4	Review and adopt current California Building codes for seismic, flood, fire, and other disaster. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of Fairfax	Existing (2022)	Cost: General Funds	3 - 5 years/ Medium	The Town continues to review and adopt current California Building codes.
F-5	Fairfax Creek Flood Plain/trash capture	Flooding/ 1, 2, 4, 5	Town of Fairfax	New (2023)	$1,000,000, Coastal Conservancy, Marin County Storm Water Protection	1-2 years High	Expansion of flood plain and trash capture area easily accessible and maintained by staff to protect critical town facilities. ARPA Funds, stormwater master plan
F-6	Creek Retaining Walls Evaluation and Repair	Debris Flow, Land Subsidence / 1, 2, 4, 5	Town of Fairfax	Existing (2018)	1,000,000 Coastal Conservancy, BRIC, Marin County Flood District	1-3 years High	Evaluate condition of retaining walls supporting roadways along creeks and streams;
F-7	Bolinas Road Repaving and Restabilization	Debris Flow/ 1, 2, 4, 5	Fairfax and County of Marin	New (2023)	$5,000,000 TAM, Fed. Hwy Admin. (FHWA), SR1.	2-3 years Medium	Re-pave section of Bolinas Road, evaluate and repair failing walls; SB1 and gas tax, possible TAM funding
F-8	Sir Francis Drake Repaving and Restabilization	Sinkholes, Landslide / 1, 2, 4, 5	Town of Fairfax	New (2023)	2.500,000 TAM, FHWA, SB1 gast tax	1-3 years High	Re-pave section of Sir Francis Drake, evaluate

Table 26: Town of Fairfax Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
							subsurface; SB1 and Gas Tax, possible TAM funding
F-9	Resiliency Hub at Town Facilities	All Hazards/ 1, 2, 4, 5	Town of Fairfax	New (2023)	$500,000 Town funding, BAAQMD, PGE	1-3 years High	Add PV panels, battery storage and back-up, bi-directional power supply; BAAQMD, PGE rebates, Town funding
F-10	Seismic Retrofit of Pavilion Facility	Earthquake/ 1, 2, 4, 5	Town of Fairfax	Existing (2018)	$3,000,000 BRIC, Town Funding	2-4 years Medium	Seismically retrofit facility, improve ADA access, roof replacement,
F-11	Conduct Periodic Testing of emergency sirens and early warning systems including Nixle	Flooding/ 1, 2, 4, 5	Fairfax, Ross Valley Fire Protection District	Existing (2018)	Neglible cost to Town of Fairfax	1-3 years High	System is regularly tested and pre-season meetings held to discuss use and operations at least annually
F-12	Seismically retrofit/Renovate Town owned Women's Club (Council Chambers)	Earthquake/ 1, 2, 4, 5	Town of Fairfax	Existing (2018)	$350,000 BRIC, Town Funding	2-4 years Medium	Identified as a need, no design efforts completed to date
F-13	Seek Grant Funding for vegetation removal along roadways and roadside collection/chipping of hazardous vegetation within the Wildlife Urban Interface (WUI)	Wildfire/ 1, 2, 4, 5	Fairfax, Ross Valley Fire Protection District, Marin Wildfire Prevention Authority	Existing (2018)	$100,000 Marin Wildfire Protection Authority (MWPA)	1-3 years High	MWPA offers grants to locals and Town regularly engages with RVFD on projects on Town owned/managed parcels
F-14	Prepare GIS storm water map of the watershed to determine the water flow and design a culvert system appropriate to the volume and flow of peak runoff. Complete the identification of existing culverts and the need for new ones.	Flooding/ 1, 2, 4, 5	Town of Fairfax	New (2023)	$300,000 for design; $2.5 Million for improvements ARPA, Town funding, Marin County Storm Water Pollution Protection	1-6 years Medium	Currently in progress on multiple projects on design and evaluation
F-15	Enhance Community facilities to support the socially vulnerable population during extreme weather events.	Severe Weather - Heat 1, 2, 4, 5	Town of Fairfax , Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1 - 2 years/ High	

Table 26: Town of Fairfax Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
F-16	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	Town of Fairfax , Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	

Table 94: Town of Fairfax Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Town of Fairfax. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 25 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Town of Fairfax identified and prioritized the mitigation actions as detailed in Table 26, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this MJHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Project Implementation

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the Town of Fairfax will maintain this plan and will serve as a lead staff for grant project applications on Town projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Town of Fairfax will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Town of Fairfax already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

Town General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the Town. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

Town Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the Town.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

1) As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
2) Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
3) Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

In the Marin County OA, new housing construction continues to exacerbate the high proportion of detached, single-family housing. In 2020, 96 percent of construction permits issued countywide were for single-family units. In 2020, 61 percent of existing residential buildings are single-family detached units in the Marin County OA. In 2015 and 2017, 100 percent of construction permits issued were for single-family homes, making the 2020 figure of 96 percent the third highest in proportion of single-family unit construction permits issued in the last seven years, but the greatest number of permits in a year is consistently issued for the construction of this type of housing.

Historic development patterns in Fairfax created a town with a distinct center, providing a good public transit hub within walking and bicycling distance of most of the town's inhabitants. Fairfax has retained a village-like quality, with distinct neighborhoods, and large areas of surrounding visible open space.

The Town's General Plan seeks to preserve these qualities by providing policies and programs to guide future development. Interestingly, modern humanistic trends in urban development support many of the planning choices made by the Town over the last hundred years. The

current town center creates a lively mixture of businesses and residences and supports a wide variety of transportation choices.

The Land Use Element conveys a sense of the uniqueness of Fairfax; the Town's robust, villagelike land use characteristics, as seen in the small businesses, quaint neighborhoods and busy streets where many residents bicycle and walk. Framing and dominating the town is its natural setting – a perceived vast open space of oak-studded hills to the north and west, and the forested shoulders of the Coastal Range to the south. Fairfax is a special place, loved by residents as well as visitors.

One of the greatest problems facing the Marin County OA relates to population growth. Traditional solutions to that problem can be seen on the land in the form of compromise, if not complete loss, of natural areas; it can be seen in skies that are not as blue in the day and have fewer stars in the night; and it can be heard in the increase in traffic sounds and the decrease of natural sounds or the distance that sound travels. Where and how growth is accommodated in Fairfax is of paramount importance in crafting the Land Use Element.

In addition to the economic pressures of development in desirable Marin and Bay Area, the pressures to develop Fairfax for housing human growth are tremendous. Fairfax is required by the State to provide affordable housing (108 units required as of July 2010) as its share of California's population growth. The other end of the scale could be something so personal as a parent's hope of seeing their children live out their lives here, or a homeowner who wants to add a second unit to house a relative or offset rising costs. How Fairfax will address these demands is guided by the Land Use Element.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Town of Fairfax.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Town of Fairfax Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP and the Town of Fairfax Community Profile. Within the lifespan of these documents (five years), local government along with community-based organizations will ensure that the mitigation goals and strategies identified are monitored, that plan administration will continue under a collaborative and cooperative umbrella, and that the document itself will be properly maintained.

The Marin County OEM, as lead coordination agency for hazard mitigation planning within the Marin County OA and will assist and support the ongoing collaborative efforts of the Town of Fairfax, through the established hazard mitigation Steering Committee. Specific plan maintenance activities by the Marin County OEM and the Town of Fairfax may include:

- Distribution of the MJHMP and Community Profile to all interested parties, including both written and digital formats
- Monitoring of the Town of Fairfax mitigation project activities and dissemination of status reports
- Generation of reports relative to plan status, project management, and revision updates to executive leadership
- Preparations for plan eventual revision and updating

4.3 PLAN EVALUATION

Upon approval and adoption by the Town of Fairfax, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only, and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County OA to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County OEM will meet with the hazard mitigation Steering Committee, including the Town of Fairfax, to evaluate the plan after each update meeting.

4.4 PLAN UPDATE

During the five-year update cycle, the Marin County OEM will hold tri-annual update meetings with the hazard mitigation Steering Committee, including the Town of Fairfax, and local stakeholders to discuss revisions to the plan. The Marin County OEM and the Town of Fairfax will continue to hold public meetings after the first and third update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 4-18
Figure 2: Marin County OA MJHMP Public Town Hall Meeting 4-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 4-20
Figure 4: Hazard Mitigation Plan Survey 4-21
Figure 5: Location of the Town of Fairfax within the Marin County OA 4-25
Figure 6: Map of the Town of Fairfax 4-26
Figure 7: The Town of Fairfax Precipitation and Monthly Temperatures 4-28
Figure 8: Races in Fairfax 4-29
Figure 9: Town of Fairfax Land Use Map 4-31
Figure 10: Town of Fairfax Social Vulnerability Map Census Tract 1141.00 4-34
Figure 11: Town of Fairfax Critical Facilities and Infrastructure 4-37
Figure 12: Town of Fairfax Risk Assessment – Planning Team Top Hazards 4-39
Figure 13: Hazard Risk Categorization 4-39
Figure 14: NASA Global Temperature Change CO2 Gas 4-43
Figure 15: NASA Global Temperature Change 1884 to 2022 4-43
Figure 16: NASA Global Temperature Change Sea Level 4-44
Figure 17: Annual Mean Sea Level Trends 4-46
Figure 18: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 4-47
Figure 19: Landslide Susceptibility Classes 4-52
Figure 20: Mud Flow Areas 4-53
Figure 21: Town of Fairfax Debris Flow Critical Facilities and Infrastructure 4-54
Figure 22: Mudslide in Fairfax – 1/13/2023 4-55
Figure 23: Modified Mercalli Intensity Scale 4-58
Figure 24: Mercalli Scale vs. Magnitude 4-59
Figure 25: Soil Types 4-59
Figure 26: County of Marin Earthquake Impact and Fault Lines 4-61
Figure 27: Town of Fairfax Earthquake Critical Facilities and Infrastructure 4-62
Figure 28: Diagram of an Atmospheric River Event 4-65
Figure 29: Town of Fairfax Flooding Critical Facilities and Infrastructure 4-67
Figure 30: Dissolution Sinkhole Formation 4-69
Figure 31: Cover-Subsidence Sinkhole Formation 4-70
Figure 32: Cover-Collapse Sinkhole Formation 4-70
Figure 33: Heat Index 4-72
Figure 34: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 4-72
Figure 35: Beaufort Wind Scale 4-74
Figure 36: Enhanced Fujita Scale 4-75
Figure 37: Waterspout Formation 4-75
Figure 38: Wind Damage at Manor Elementary School – 2023 Storm 4-76
Figure 39: Wind Damage on Spruce Road – 2017 Storm 4-76
Figure 40: Federal, State and Local Responsibility Areas in the Marin County OA 4-79
Figure 41: Fuel Model Map for the Marin County OA 4-82
Figure 42: Town of Fairfax Wildfire Critical Facilities and Infrastructure 4-86
Figure 43: Fairfax Brush Fire - 2023 4-87

Figure 44: Trends in the Annual Number of Large Wildfires in the United States 4-88

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 4-8
Table 2: 2023 MJHMP Planning Team Members 4-12
Table 3: Town of Fairfax & Marin County OA MJHMP Planning Meetings 4-16
Table 4: Town of Fairfax Estimated Jurisdictional Population 4-28
Table 5: Population Change of The Town of Fairfax 4-29
Table 6: Languages Spoken in Fairfax 4-29
Table 7: Marin County OA Jurisdictional Housing Stock 4-30
Table 8: NRI Hazards and Marin County OA MJHMP Hazards 4-32
Table 9: NRI Hazard Type Risk Index for Fairfax Census Tract 1141.00 4-33
Table 10: Household Income for The Town of Fairfax as of 2021 4-35
Table 11: Town of Fairfax Civilian Employed Population 16 years+ by Industry 4-36
Table 12: Town of Fairfax Critical Facilities 4-36
Table 13: Historic Sites in The Town of Fairfax 4-38
Table 14: Select Hazards Magnitude/ Severity Scale or Index 4-40
Table 15: Town of Fairfax Hazard Risk Assessment 4-49
Table 16: Marin County OA Hazard Risk Assessment 4-50
Table 17: Town of Fairfax Critical Facilities in the Flood Zones 4-68
Table 18: Town of Fairfax Future Growth Areas 4-90
Table 19: Town of Fairfax Legal and Regulatory Capabilities 4-93
Table 20: Town of Fairfax General Plan 4-94
Table 21: Town of Fairfax Administrative and Technical Capabilities 4-96
Table 22: Town of Fairfax Fiscal Capabilities 4-97
Table 23: Town of Fairfax Community Outreach 4-98
Table 24: Town of Fairfax NFIP Status 4-102
Table 25: Status of Previous Hazard Mitigation Actions 4-105
Table 26: Town of Fairfax Current Hazard Mitigation Actions 4-109

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

5. City of Larkspur Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The City of Larkspur would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of Larkspur more disaster resistant and sustainable.

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TABLE OF CONTENTS

5. City of Larkspur Community Profile 5-1
Acknowledgements 5-3
Table of Contents 5-5
Section 1.0: Introduction 5-7
1.1 Introduction 5-7
1.2 Planning Process 5-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 5-8
1.2.2 Steering Committee Planning Process 5-9
1.2.3 Coordination with Stakeholders and Agencies 5-9
1.2.4 Public Engagement 5-16
1.3 Overview and History 5-23
1.4 Government 5-26
1.5 Weather and Climate 5-26
1.6 Demographics 5-27
1.7 Social Vulnerability and Risk 5-31
1.8 Economy and Tax Base 5-35
1.9 Critical Facilities 5-37
1.10 Historical Properties 5-40
Section 2.0: Hazard Identification and Risk Assessment 5-41
2.1 Climate Change 5-43
2.2 Hazards 5-50
2.2.1 Dam Failure 5-51
2.2.2 Debris Flows 5-57
2.2.3 Drought 5-63
2.2.4 Earthquake 5-64
2.2.5 Flooding 5-70
2.2.6 Land Subsidence 5-79
2.2.7 Levee Failure 5-81
2.2.8 Sea Level Rise 5-84
2.2.9 Severe Weather – Extreme Heat 5-89
2.2.10 Severe Weather – High Wind & Tornado 5-90
2.2.11 Tsunami 5-94

2.2.12 Wildfire 5-97
Section 3.0: Mitigation Strategy 5-109
3.1 Changes in Development 5-109
3.2 Capability Assessment 5-110
3.2.1 Regulatory Capabilities 5-110
3.2.2 Administrative and Technical Capabilities 5-115
3.2.3 Fiscal Capabilities 5-117
3.2.4 Community Outreach 5-118
3.2.5 Participation in the National Flood Insurance Program 5-119
3.3 Mitigation Goals 5-121
3.4 Status of Previous Mitigation Actions 5-123
3.5 Hazard Mitigation Actions 5-123
3.6 Progress in Local Mitigation Efforts 5-128
3.7 Plan Integration 5-128
3.8 Future Development Trends 5-129
Section 4.0: Plan Review, Evaluation, and Implementation 5-130
4.1 Plan Adoption 5-130
4.2 Plan Monitoring 5-130
4.3 Plan Evaluation 5-131
4.4 Plan Update 5-131
Figures and Tables 5-133
Acronyms/Abbreviations 5-135

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of Larkspur, Community Profile has been prepared in conjunction with the Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of Larkspur.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population, both incorporated and unincorporated, is concentrated in the Eastern portion of the county. There are a total of 11 incorporated jurisdictions within Marin County. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA MJHMP Steering Committee, the City of Larkspur involved additional internal planning team members to support the broader planning process. The City of Larkspur jurisdictional representatives for the

coordinated Marin County OA MJHMP Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Julian Skinner, Public Works Director
Telephone: 415-927-5017
E-mail: jskinner@cityoflarkspur.org

Alternate Point of Contact
Alex Othon, Senior Planner
Telephone: 415-927-5026
E-mail: aothon@cityoflarkspur.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: City of Larkspur Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Larkspur	Dan Schwarz	City Manager	415-927-5110	dschwarz@cityoflarkspur.org
Larkspur	Julian Skinner	Public Works Director/ City Engineer	415-927-5017	jskinner@cityoflarkspur.org
Larkspur	Robert Quinn	Public Works Superintendent	415-927-5028	rquinn@cityoflarkspur.org
Larkspur	Alex Othon	Senior Planner	415-927-5026	aothon@cityoflarkspur.org
Larkspur	Elise Semonian	Community Development Director	415-927-6713	ESemonian@cityoflarkspur.org
Central Marin Fire District	Matt Cobb	Battalion Chief/Fire	415-927-5077	mcobb@centralmarinfire.org
Central Marin Fire District	Ezra Colman	Battalion Chief/Fire	415-927-5077	ecolman@centralmarinfire.org

Table 95: City of Larkspur Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of the unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the City of Larkspur. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.

- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of Larkspur Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite

them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of Larkspur communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of Larkspur Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of Larkspur and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 96: 2023 MJHMP Local Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Larkspur's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of Larkspur & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process

Table 3: City of Larkspur & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach CITY Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input

Table 3: City of Larkspur & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan	• Individual phone or conference calls with planning jurisdictions and districts to answer specific

Table 3: City of Larkspur & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Development Sessions	questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 97: City of Larkspur & Marin County OA MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual

broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan

development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Larkspur provided a link on the city's website https://www.ci.larkspur.ca.us/158/Other-Citywide-Plans. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 189: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County OAMJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting

on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

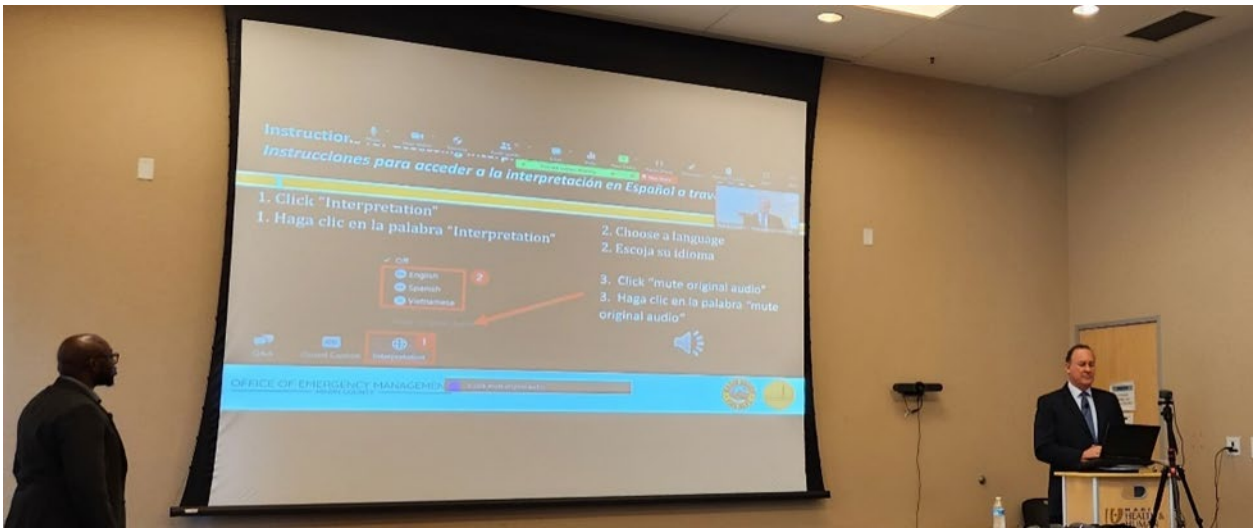


Figure 190: Marin County OA MJHMP Public Town Hall Meeting

SOCIAL MEDIA

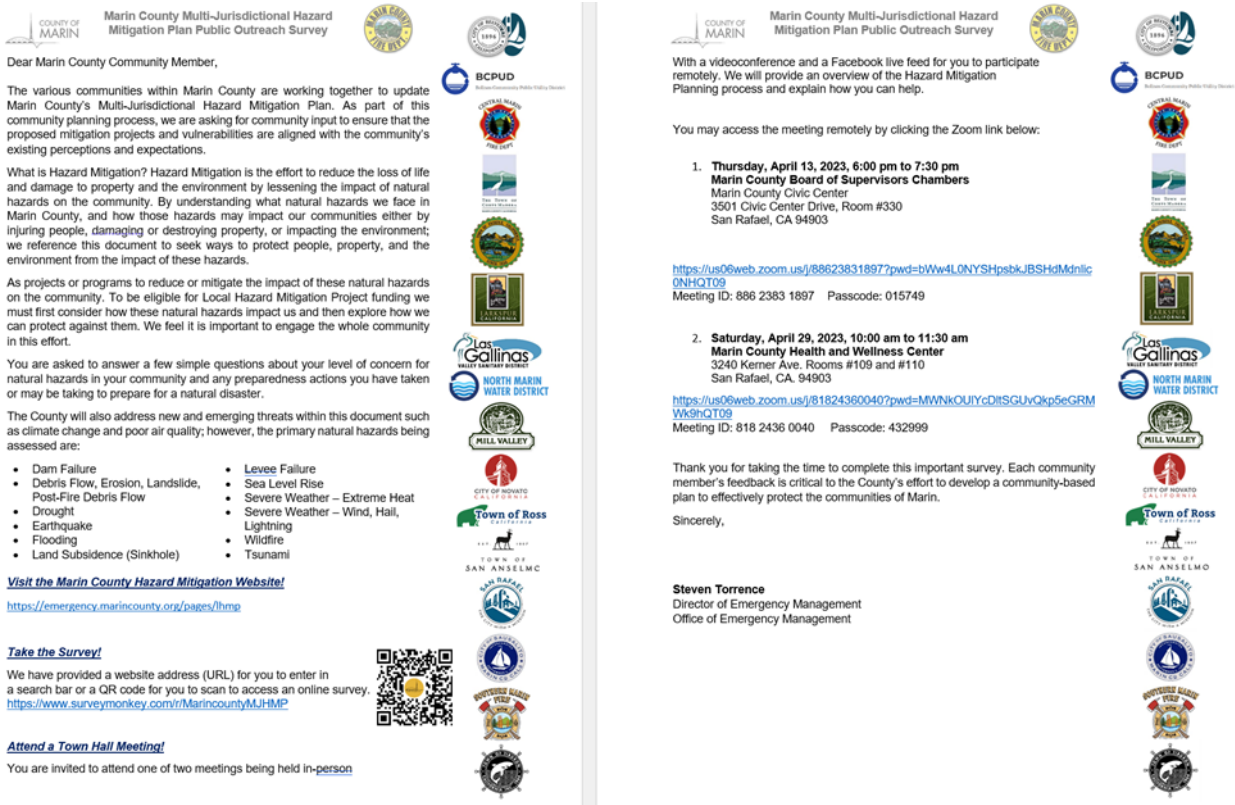
The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 191: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.

- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

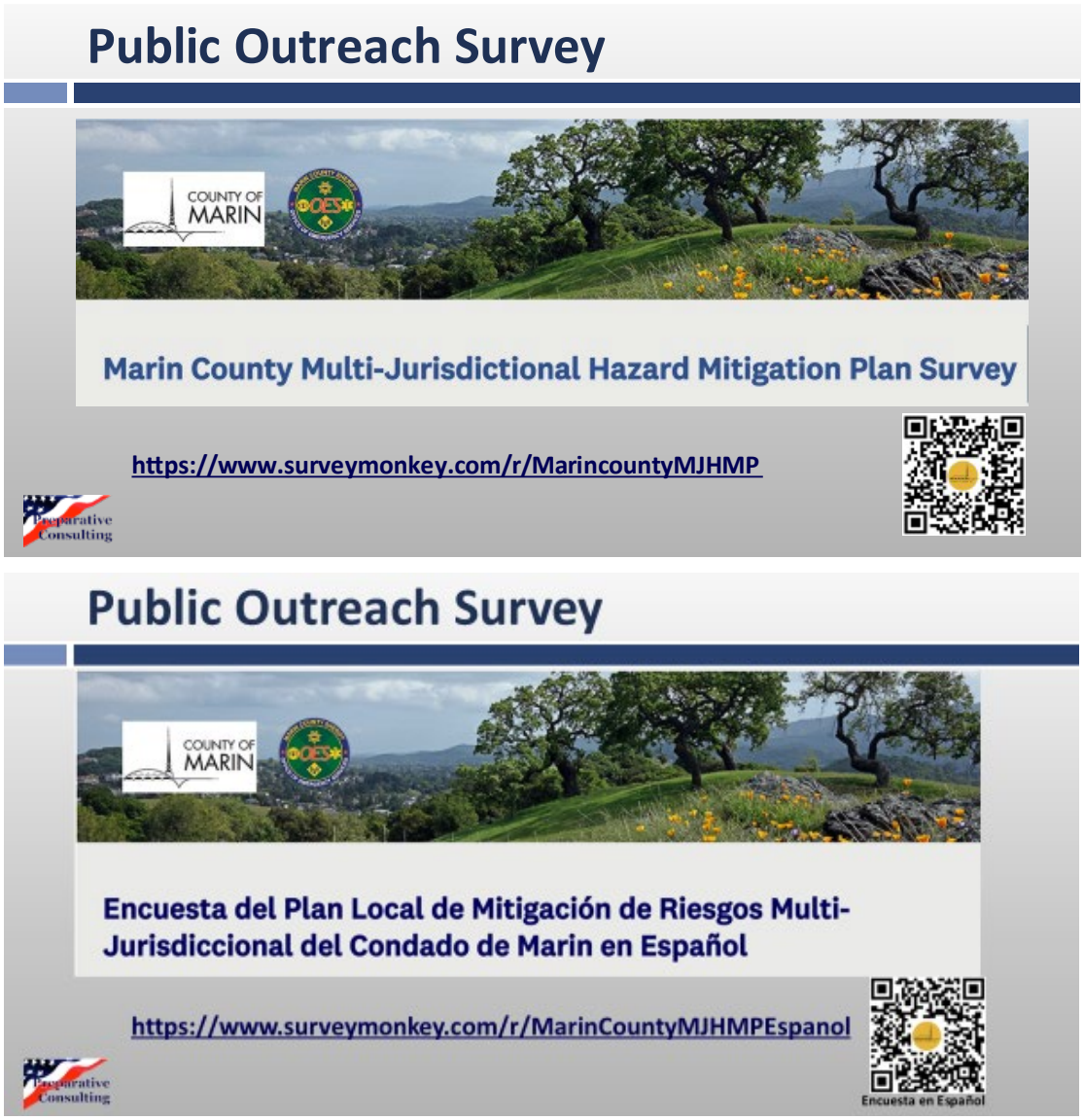


Figure 192: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of Larkspur had an additional 14-day comment period for the City of Larkspur Community Profile where their profile was posted on the City website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The City of Larkspur

distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

Larkspur is on the ancestral lands of the Coast Miwok People, including the Coast Miwok Tribal Council of Marin and the Federated Indians of Graton Rancheria. For more than 10,000 years, Coast Miwok people have lived along the shorelines of Marin County and continue to live in the county and beyond today. Stewards of the land, they managed the local watershed where creek and ocean resources were most abundant. The Miwok lost their land, first to the Mexican Californios and subsequently the American settlers who followed the “rush” for gold and the establishment of the state in 1850. An 1834 Mexican land grant to Irish immigrant John Reed included the area of Larkspur. Much of the area of Larkspur was logged in the 1840’s to supply lumber to San Francisco and the building of Presidio. Two sawmills were built to float logs down Corte Madera Creek to San Francisco Bay. Further growth was spurred by the formation of the North Pacific Coast Railroad Company railroad, with a railroad station being built in Larkspur. C.W. Wright and his American Land and Trust Company purchased much of present-day Larkspur in 1896, subdividing the land and piping in water. Wright’s wife Georgina named the City of Larkspur after she mistakenly identified the native lupine as Larkspur. C.W. Wright laid out the city in 1887 and the first post office opened in 1891. Larkspur quickly became a weekend destination for visitors from San Francisco, and a hotel, bathhouse, grocery store, and several retail shops were built. The City of Larkspur was officially incorporated on March 1st, 1908. Larkspur's Downtown Historic District, known also as Old Downtown Larkspur, was listed on the National Register of Historic Places in 1982. The city currently has a total area of 3.2 square miles and lies just inland of San Francisco Bay with hilly terrain on the southwest side.

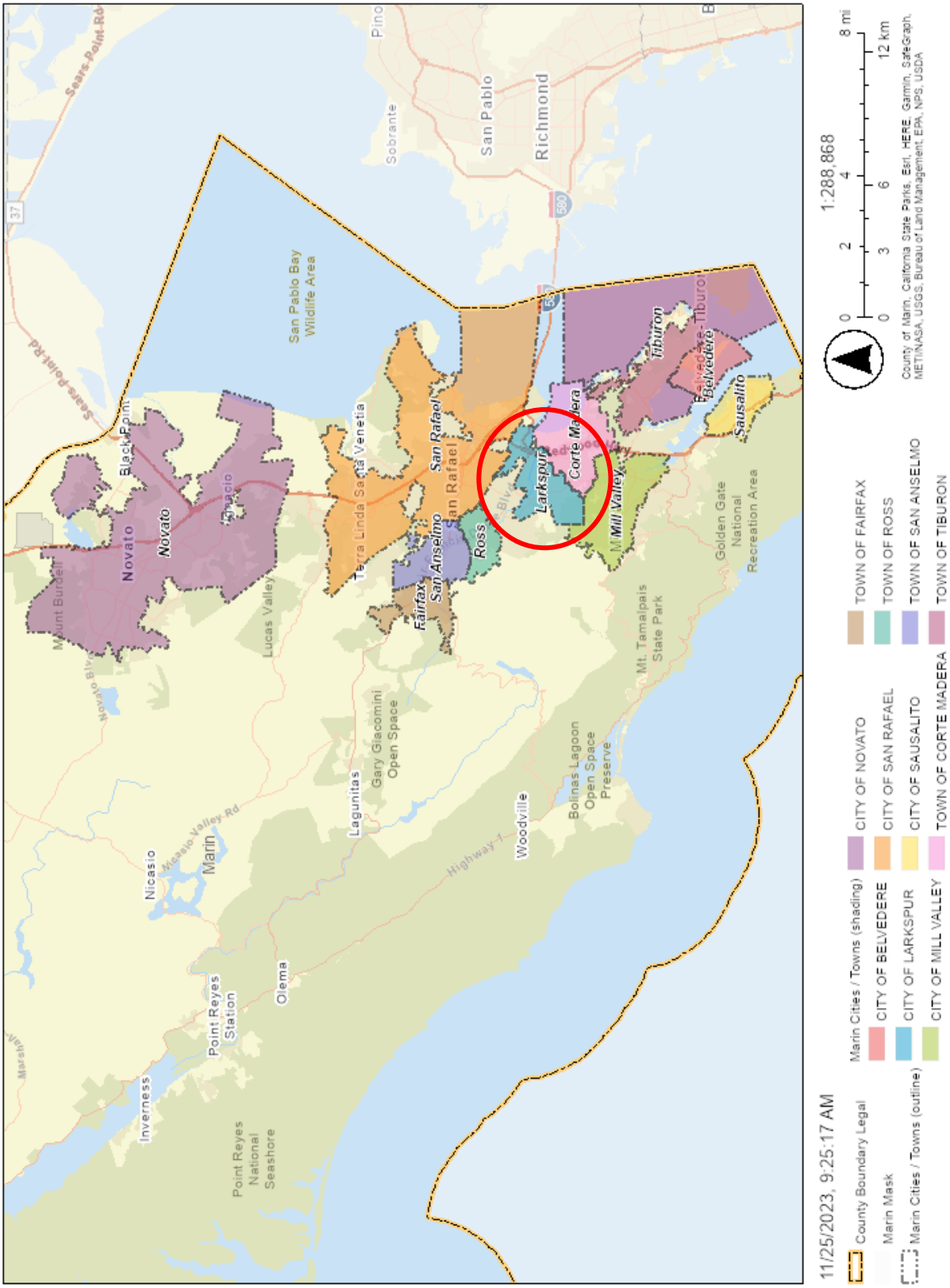


Figure 193: Map of City of Larkspur in Marin County
Source: Marin County OEM

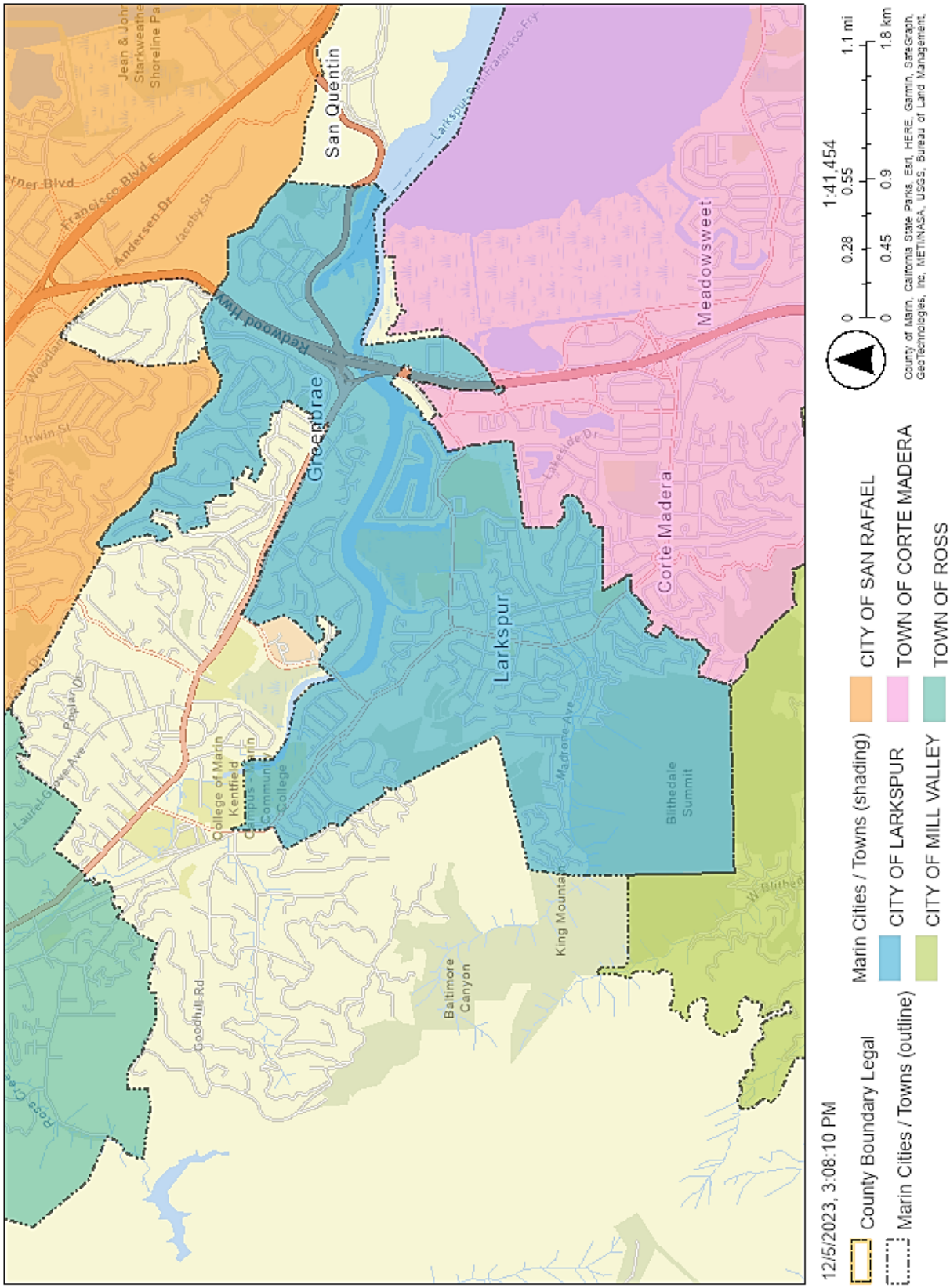


Figure 194: Map of the City of Larkspur
Source: Marin County OEM

1.4 GOVERNMENT

The City of Larkspur is governed by an elected five-person City Council responsible for passing local ordinances, approving the city budget, and setting strategic priorities for the city. The city council elects a mayor and vice mayor each year from its membership, the executive head of the city; and appoints a City Manager, the administrative head of the city. The city consists of 6 departments: Administration, Community Development (Building and Planning), Finance, Library, Public Works, and Recreation.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

In 2018, the City of Larkspur and the Town of Corte Madera formed the Central Marin Fire Department, a Joint Powers Authority to provide fire protection.

In 1980 the city merged its police department with the neighboring town of Corte Madera to become the Twin Cities Police Authority, which subsequently merged in 2013 with the police department of San Anselmo to form the Central Marin Police Authority. The Central Marin Police Authority has 50 full-time employees (42 sworn) and provides police services to approximately 35,000 residents.

1.5 WEATHER AND CLIMATE

The City of Larkspur is approximately 43 feet (13 m) above sea level. In the City of Larkspur, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 48.9°F to 61.3°F and is rarely below 43°F or above 73.1°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is 43 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 195: The City of Larkspur Precipitation and Monthly Temperatures
Source: ClimateData.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the City of Larkspur since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The City of Larkspur had an estimated population of 12,396 in 2018. 2020 U.S. Census Survey estimated the City's population at 13,064. However, revised estimates for 2022 estimated the population to decrease to 12,797 population.

Table 4: City of Larkspur Estimated Jurisdictional Population				
Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
City of Larkspur	12,797	13,064	12,396	3.13%

Table 98: City of Larkspur Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of the City of Larkspur is 13,064 as of 2020.

Table 5 shows the population growth comparison of the State of California, County of Marin and the City of Larkspur between 2010 – 2020.

Table 5: Population Change of The City of Larkspur				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
Larkspur, City	12,396	13,064	668	3.13%

Table 99: Population Change of The City of Larkspur
Source: City of Larkspur Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the City of Larkspur.

Table 6: Languages Spoken in Larkspur	
Primary Language Spoken	% of Population
English only	81.2%
Spanish	6.9%
Other Indo-European languages	7.9%
Asian and Pacific Islander languages	3.0%
Other languages	1.1%

Table 100: Languages Spoken in Larkspur
Source: US Census Bureau (2020)

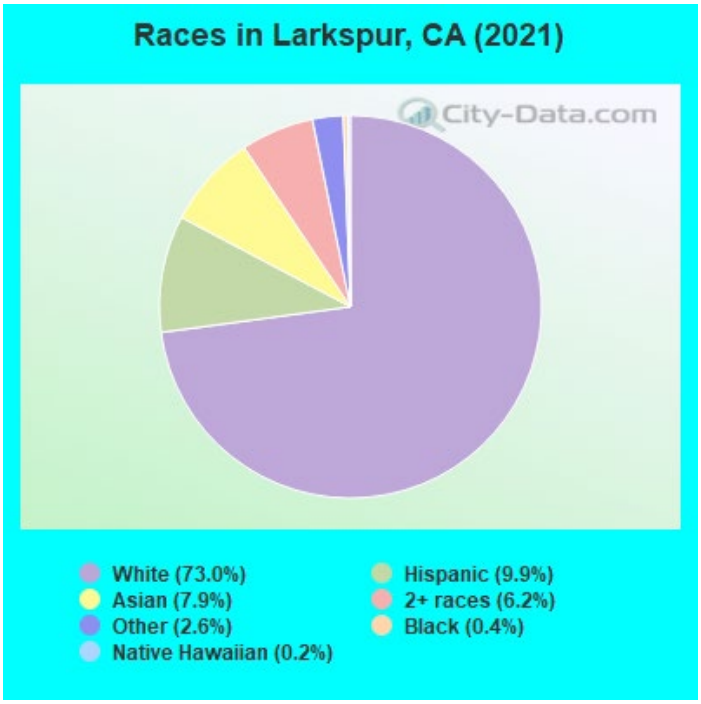


Figure 196: Races in Larkspur
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of Larkspur							
2022	Number	6,460	2,653	439	479	2,614	275
	Percent	100.00%	41.07%	6.80%	7.41%	40.46%	4.26%
2018	Number	6,479	2,650	427	488	2,625	289
	Percent	100.00%	40.90%	6.59%	7.53%	40.52%	4.46%

Table 101: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

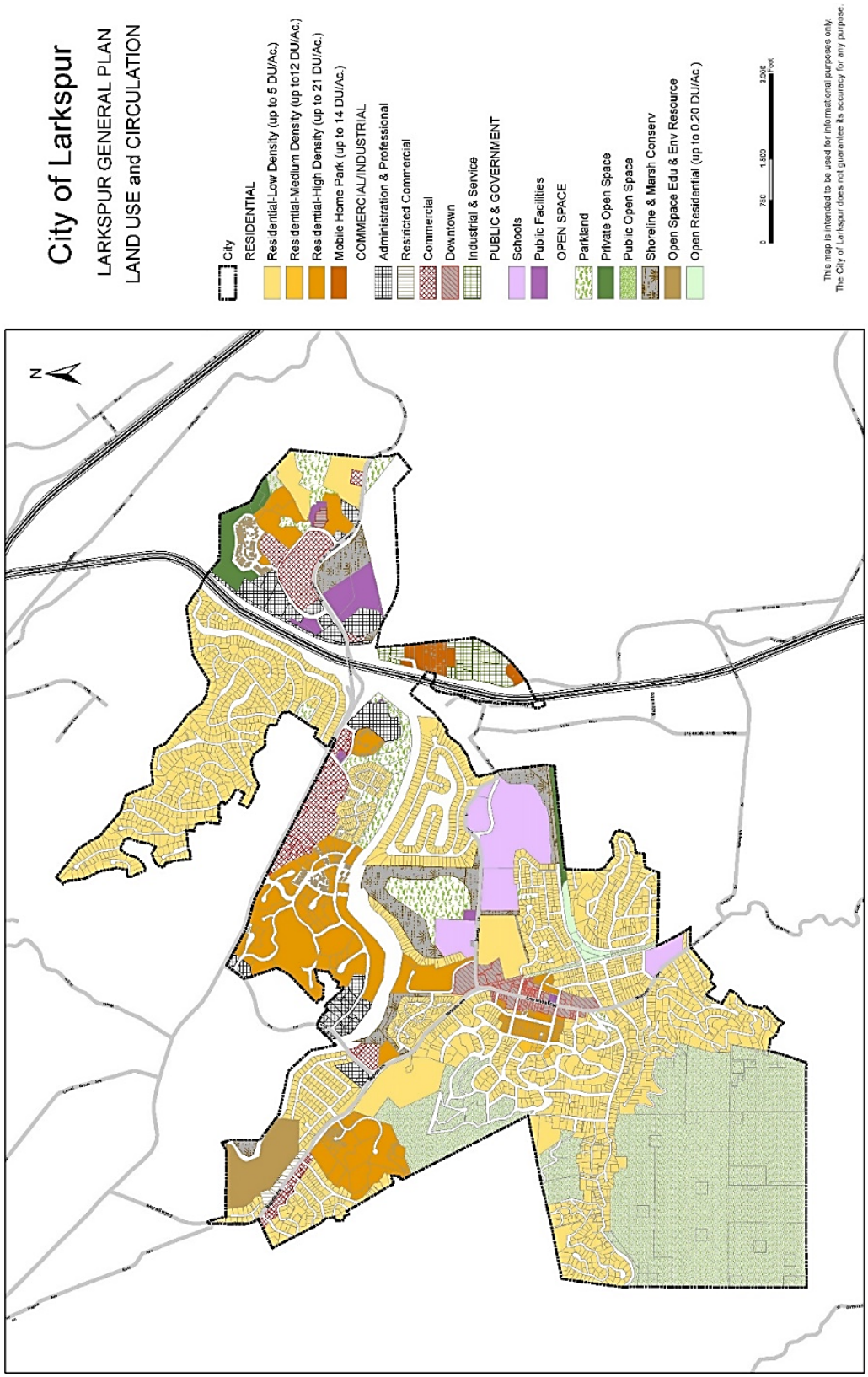


Figure 197: City of Larkspur Land Use Map
Source: City of Larkspur General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards	
NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 102: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

Table 9 illustrates the NRI Hazard Type Risk Index for Larkspur Census Tract 1200.02.

Table 9: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.02

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,068,514	Relatively Low	Very High	0.95	$1,975,315	96.1
Riverine Flooding	$640,184	Relatively Low	Very High	0.95	$611,340	97.2
Coastal Flooding	$80,651	Relatively Low	Very High	0.95	$77,017	95.7
Wildfire	$16,532	Relatively Low	Very High	0.95	$15,787	86
Heat Wave	$8,089	Relatively Low	Very High	0.95	$7,724	47
Tornado	$4,118	Relatively Low	Very High	0.95	$3,932	9.2
Landslide	$3,827	Relatively Low	Very High	0.95	$3,655	85.8
Drought	$2,285	Relatively Low	Very High	0.95	$2,182	86.6
Tsunami	$1,027	Relatively Low	Very High	0.95	$980	96.3
Strong Wind	$268	Relatively Low	Very High	0.95	$256	

Table 103: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.02
Source: FEMA National Risk Index 2023

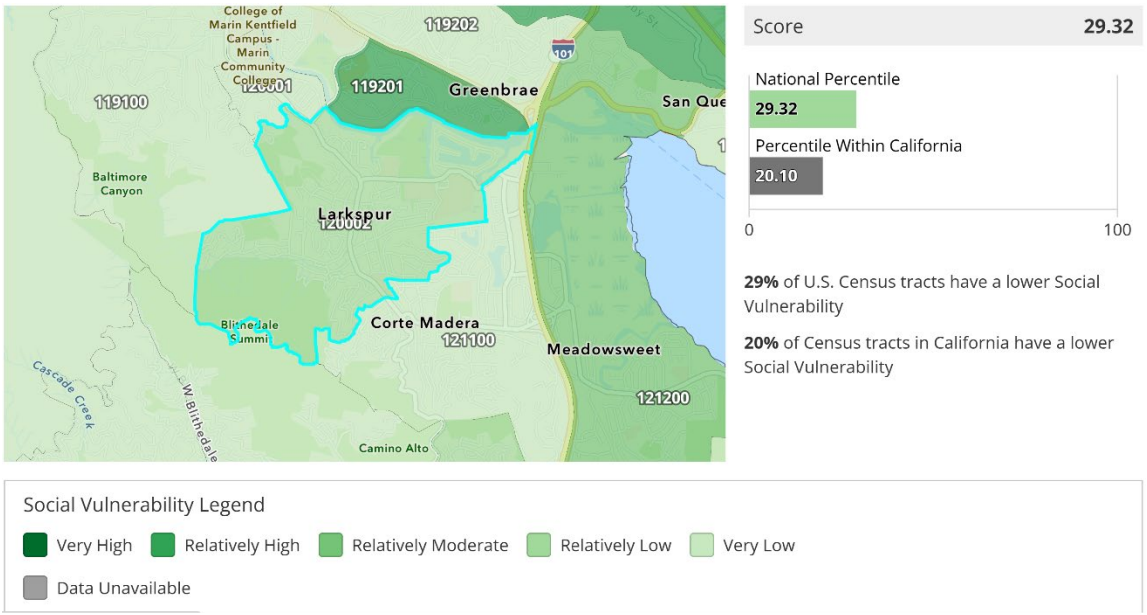


Figure 198: City of Larkspur Social Vulnerability Map Census Tract 1200.02
Source: FEMA National Risk Index 2023

Table 10 illustrates the NRI Hazard Type Risk Index for Larkspur Census Tract 1200.01.

Table 10: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$523,028	Very Low	Very High	0.65	$338,353	84.5
Riverine Flooding	$77,116	Very Low	Very High	0.65	$49,887	76.5
Heat Wave	$2,147	Very Low	Very High	0.65	$1,389	24.4
Tornado	$1,073	Very Low	Very High	0.65	$694	2.3
Landslide	$1,049	Very Low	Very High	0.65	$679	59.2
Coastal Flooding	$891	Very Low	Very High	0.65	$576	79.1
Wildfire	$140	Very Low	Very High	0.65	$91	35.3
Strong Wind	$71	Very Low	Very High	0.65	$46	2.4
Tsunami	$54	Very Low	Very High	0.65	$35	91.1
Drought	$0	Very Low	Very High	0.65	$0	0

Table 104: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.01
Source: FEMA National Risk Index 2023

Figure 11 illustrates the Social Vulnerability Map for Larkspur Census Tract 1200.01.

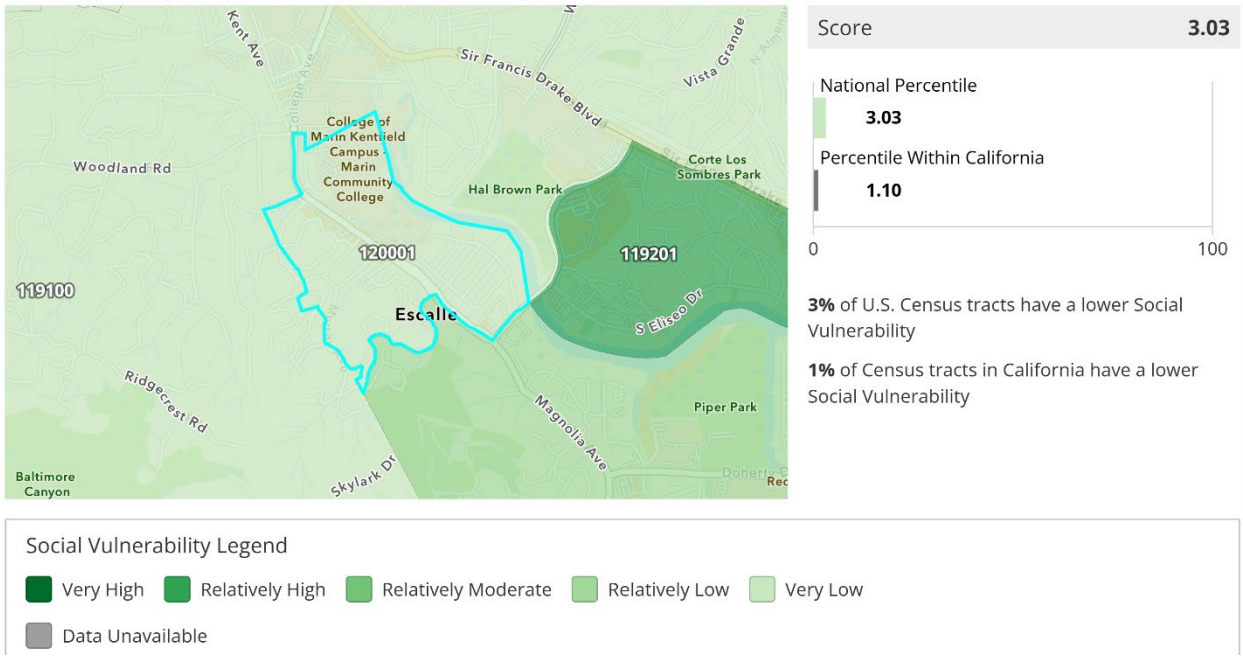


Figure 199: City of Larkspur Social Vulnerability Map Census Tract 1200.01
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for Larkspur Census Tract 1192.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$2,377,736	Relatively High	Very High	1.27	$3,016,845	98
Riverine Flooding	$59,479	Relatively High	Very High	1.27	$75,466	81.8
Heat Wave	$5,694	Relatively High	Very High	1.27	$7,224	45.8
Coastal Flooding	$3,939	Relatively High	Very High	1.27	$4,997	87
Tornado	$3,410	Relatively High	Very High	1.27	$4,326	10.1
Landslide	$2,812	Relatively High	Very High	1.27	$3,568	85.4
Tsunami	$287	Relatively High	Very High	1.27	$364	94.5
Strong Wind	$199	Relatively High	Very High	1.27	$253	8.9
Drought	$0	Relatively High	Very High	1.27	$0	0
Wildfire	$0	Relatively High	Very High	1.27	$0	

Table 105: NRI Hazard Type Risk Index for Larkspur Census Tract 1192.01
Source: FEMA National Risk Index 2023

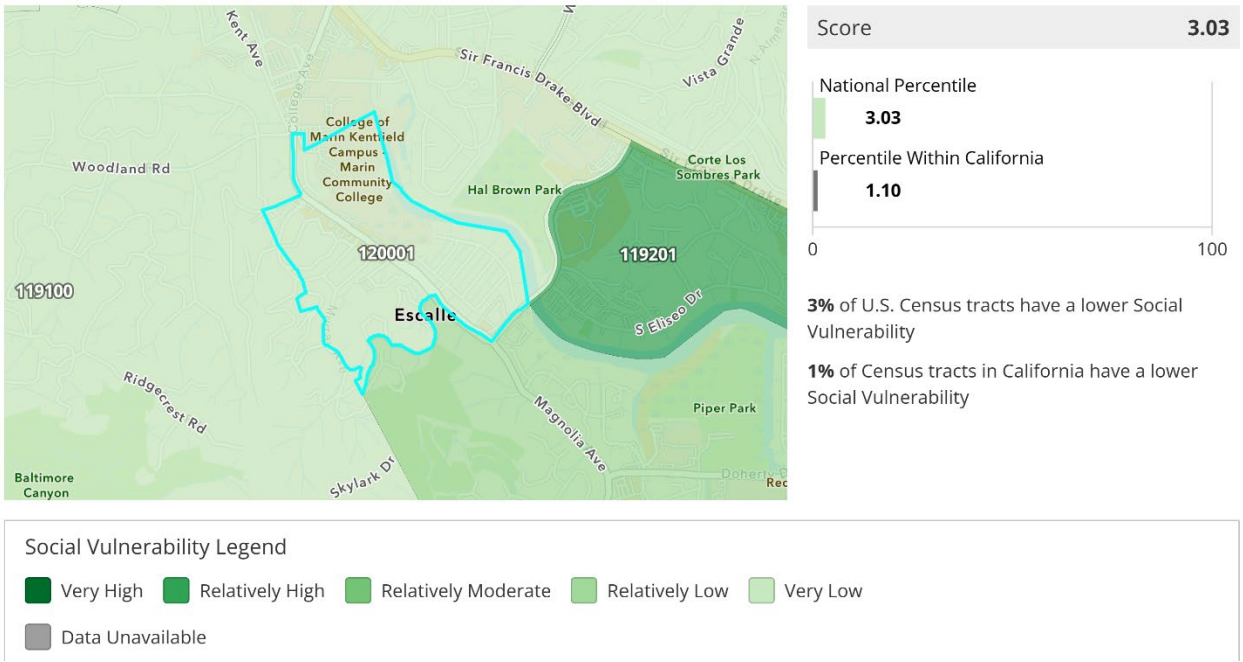


Figure 200: City of Larkspur Social Vulnerability Map Census Tract 1192.01
Source: FEMA National Risk Index 2023

Social Vulnerability in Larkspur and the Marin County OA

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

The median income for a household in the City was $135,260 and the per capita income for the City was $94,909. Approximately 1.5 percent of families and 7.7 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). While one of the three census tracts reflect a Relatively High Social Vulnerability Index in the City, the other two reflect a Very Low and Relatively Low Social Vulnerability Index. The area of the Relatively High Social Vulnerability Index is the 0.3 square mile area in Greenbrae known as the Bon Air Hill neighborhood. It is developed with primarily multi-family apartment buildings, condominium units, 297-unit senior living facility, one nursing home facility, shopping center and office and other commercial uses. There are 2,023 housing units in the area and 3,812 residents. The median age is 56.8, which is 10% higher than Larkspur and 20% higher than Marin County. The area is 65% White, 12% Asian and 14% Hispanic. The median and per capita income in this tract are lower than other areas of Larkspur ($85,739 and $69,672), with a 9.8% poverty rate.

1.8 Economy and Tax Base

Table 12 shows income by household in The City of Larkspur as of 2019.

Table 12: Household Income for The City of Larkspur as of 2021

Household Income	Number	Percent
Total Households	6,213	-
Less than $10,000	261	4.2
$10,000 to $14,999	87	1.4
$15,000 to $24,999	261	4.2
$25,000 to $34,999	360	5.8
$35,000 to $49,999	522	8.4

$50,000 to $74,999	603	9.7
$75,000 to $99,999	466	7.5
$100,000 to $149,999	888	14.3
$150,000 to $199,999	559	9.0
$200,000 or more	2,199	35.4
Median household income (dollars)	$135,260	
Mean household income (dollars)	$197,818	

Table 106: Household Income for The City of Larkspur as of 2019
Source: US Census Bureau American Community Survey 2021 Estimates

Table 13 shows the percentage of people in The City of Larkspur over the age of 16 employed by industry.

Table 13: City of Larkspur Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	6,841	-
Agriculture, forestry, fishing and hunting, and mining	0	0%
Construction	357	5.22%
Manufacturing	311	4.55%
Wholesale trade	106	1.55%
Retail trade	583	8.52%
Transportation and warehousing, and utilities	280	4.09%
Information	278	4.06%
Finance and insurance, and real estate and rental and leasing	524	7.66%
Professional, scientific, and management, and administrative and waste management services	1404	20.52%
Educational services, and health care and social assistance	1818	26.58%
Arts, entertainment, and recreation, and accommodation and food services	620	9.06%
Other services, except public administration	452	6.61%
Public administration	108	1.58%

Table 107 City of Larkspur Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the City of Larkspur to fulfill the requirements of its mission during an emergency:

Table 14: City of Larkspur Critical Facilities

Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire Stations	Central Marin Fire Department / Station 15	420 Magnolia Avenue Larkspur, CA 94939	N/A	X
Fire Stations	Central Marin Fire Department / Station 16	15 Barry Way Greenbrae, CA 94904	N/A	X
Police Stations	Central Marin Police Authority	250 Doherty Dr, Larkspur, CA 94939	N/A	AE
Emergency Operations Center	Marin County Emergency Operations Center	1600 Los Gamos Drive San Rafael, CA 94903	High	X
Local Government	Public Works Corporation Yard	325 Doherty Drive Larkspur, CA 94939	N/A	AE
Local Government	Larkspur City Hall	400 Magnolia Avenue Larkspur, CA 94939	N/A	X
Local Government	Larkspur Public Library	400 Magnolia Avenue	N/A	X
Hospitals and Medical Facilities	Tamalpais of Marin Greenbrae – Skilled Nursing Facility	501 Via Casitas Greenbrae	N/A	X
Hospitals and Medical Facilities	South Marin Health & Wellness Center	1220 S Eliseo Dr. Greenbrae	N/A	X
Schools and Educational Facilities	Redwood High School	395 Doherty Drive Larkspur, CA 94939	N/A	AE
Schools and Educational Facilities	Tamiscal High School	325 Doherty Drive Larkspur, CA 94939	N/A	AE
Schools and Educational Facilities	San Andreas High	599 William Avenue	N/A	AE
Schools and Educational Facilities	Hall Middle School	230 Doherty Drive Larkspur, CA 94939	N/A	X
Schools and Educational Facilities	St. Patrick School and Gymnasium	120 King Street	N/A	X
Schools and Educational Facilities	Marin Primary and Middle School	20 Magnolia Avenue	Moderate	X
Schools and Educational Facilities	Childrens Cottage Coop	2900 Larkspur Landing Circle	N/A	X
Medical	MarinHealth Facilities	1350 S. Eliseo Drive Greenbrae	N/A	X
Medical	MarinHealth Facilities	2 Bon Air Rd. #100	High	X

Community Space	Mt. Tam Raquet Club	1 Larkspur Plaza Drive	Moderate	X/AE
Community Space	Masonic Temple	1122 Magnolia Avenue	N/A	X
Community Space	American Legion	500 Magnolia Avenue	N/A	X
High Potential Loss Facilities				
Dams	Tubb Lake Dam		Moderate	X
Critical Infrastructure				
Transportation	Larkspur SMART Station		N/A	X
Transportation	Larkspur Ferry Terminal		N/A	X
Transportation	Bon Air Bridge		Moderate	AE
Transportation	Doherty Drive Bridge		N/A	X
Transportation	Alexander Avenue Bridge		N/A	X
Transportation	Bridge Street Bridge		High	X
Transportation	Cane Street Box Culvert		N/A	X
Transportation	King Street Box Culvert		Moderate	X
Transportation	Magnolia Avenue Bridge		Moderate	X
Transportation	Meadowood Drive Bridge		N/A	X
Transportation	Sir Francis Drake Bike/Pedestrian Bridge/Highway 101		N/A	AE
Transportation	Sir Francis Drake Pedestrian Overcrossing		N/A	AE
Transportation	Ward Street Bike Path		N/A	X
Cistern and Gates	Larkspur Marina	North inlet cistern Outfall cistern South inlet cistern	N/A	AE
Utility	Ross Valley Sanitary District Pump Station 10	Larkspur Landing	N/A	X
Utility	Ross Valley Sanitary District Pump Station 12	Bon Air	N/A	X
Utility	Ross Valley Sanitary District Pump Station 13	Greenbrae	N/A	X
Utility	Ross Valley Sanitary District Pump Station 14	Doherty Drive	N/A	X

Table 108: City of Larkspur Critical Facilities
Source: City of Larkspur

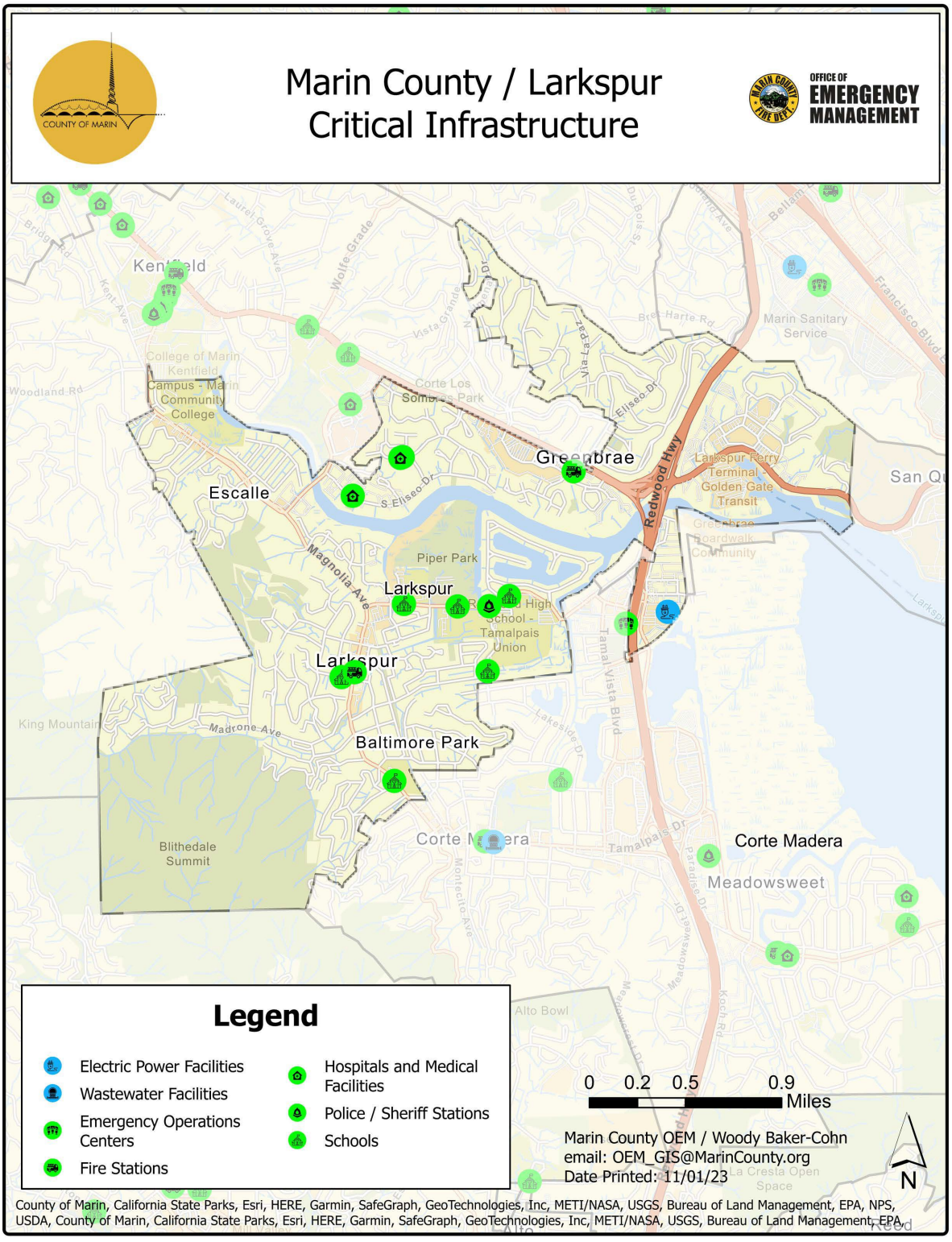


Figure 201: City of Larkspur Critical Facilities & Infrastructure
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The City of Larkspur has approximately one hundred and thirty listed historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of Larkspur Chamber of Commerce.
- City of Larkspur website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

The city maintains the list of locally historic structures on its website https://www.ci.larkspur.ca.us/DocumentCenter/View/411/Historic-Resources-Inventory?bidId= .

Table 15: Historic Sites In The City of Larkspur Listed on State or National Registry

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Alexander-Acacia Bridge	X			1/5/1984	Larkspur
Dolliver House	X			5/22/1978	Larkspur
Green Brae Brick Kiln Yard (917)	X	X	X	3/24/1978	Larkspur
Larkspur Downtown Historic District	X			10/7/1982	Larkspur

Table 109: Historic Sites In The City of Larkspur Listed on a State or Federal Registry
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of Larkspur identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 14 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

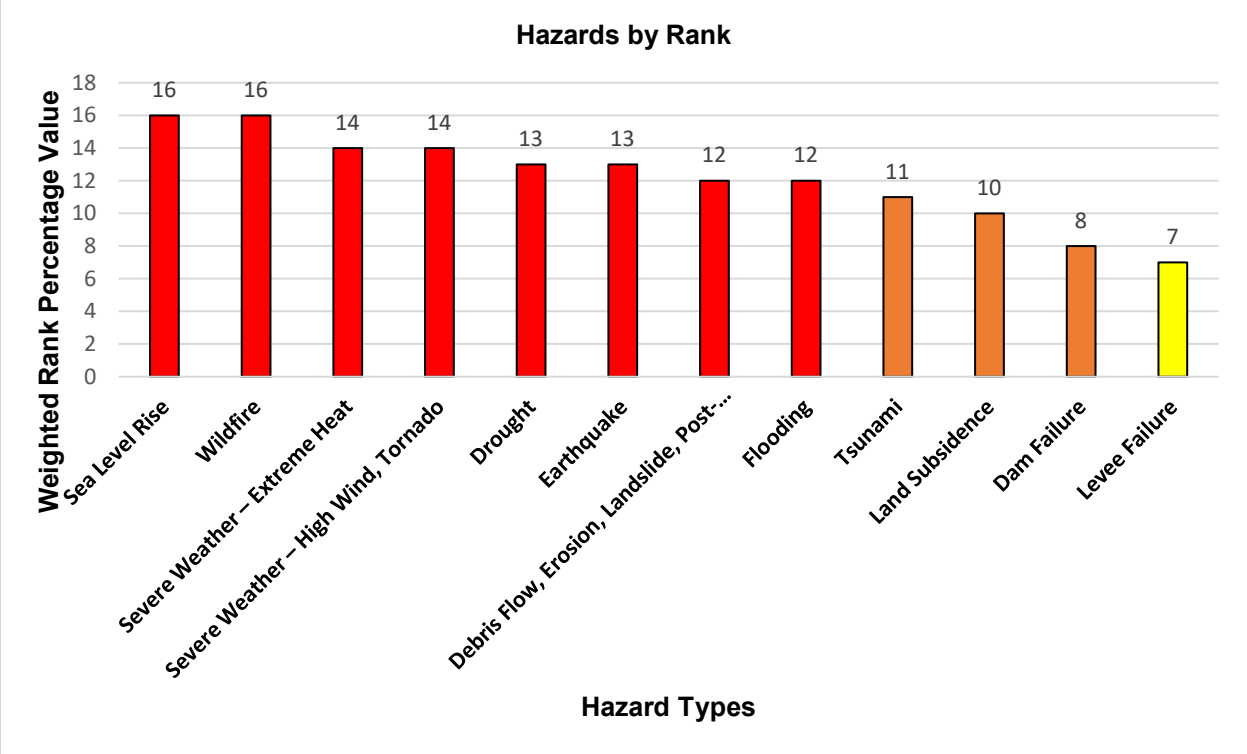


Figure 202: City of Larkspur Risk Assessment – Planning Team Top Hazards

Figure 15: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 203: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 16: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 110: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

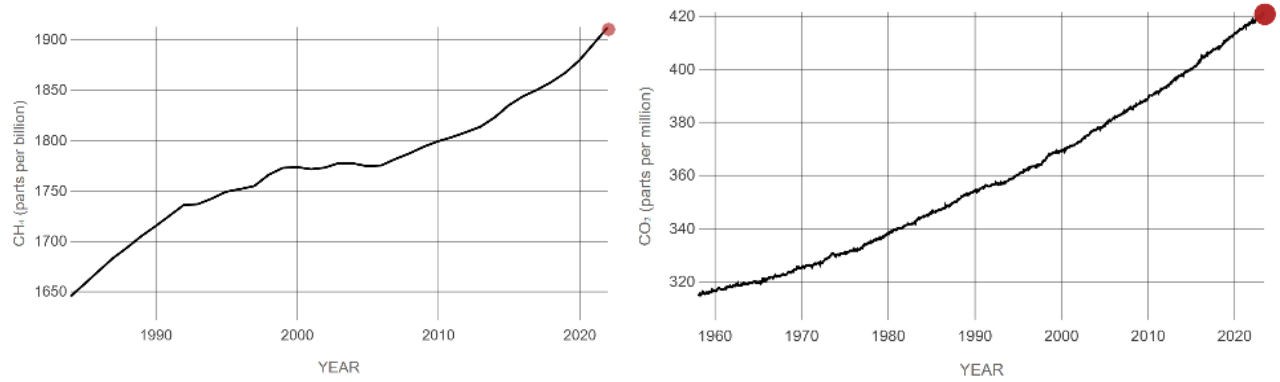


Figure 204: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

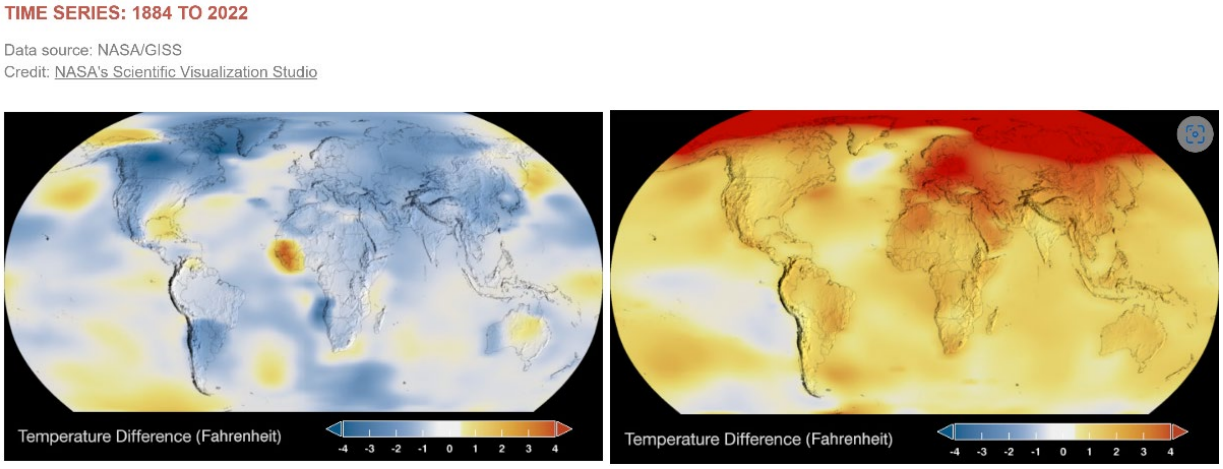


Figure 205: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

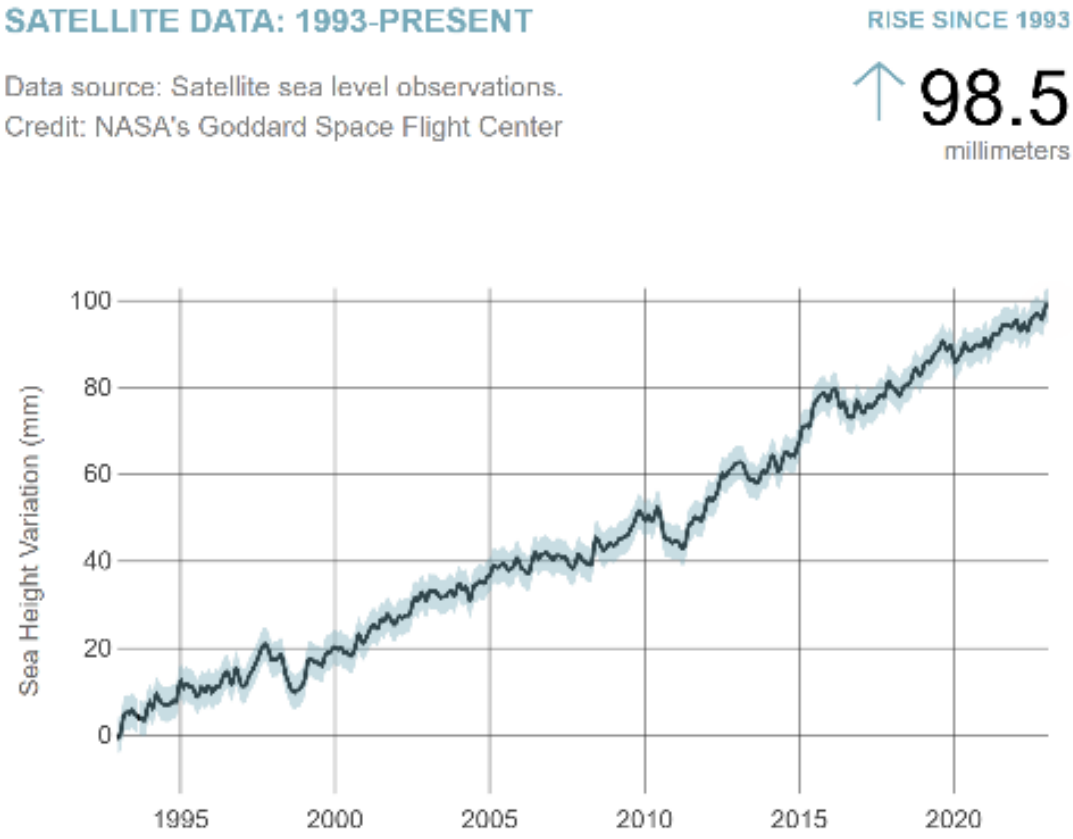


Figure 206: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.

- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, increased intensity of rain fall may occur and may become more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.

- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

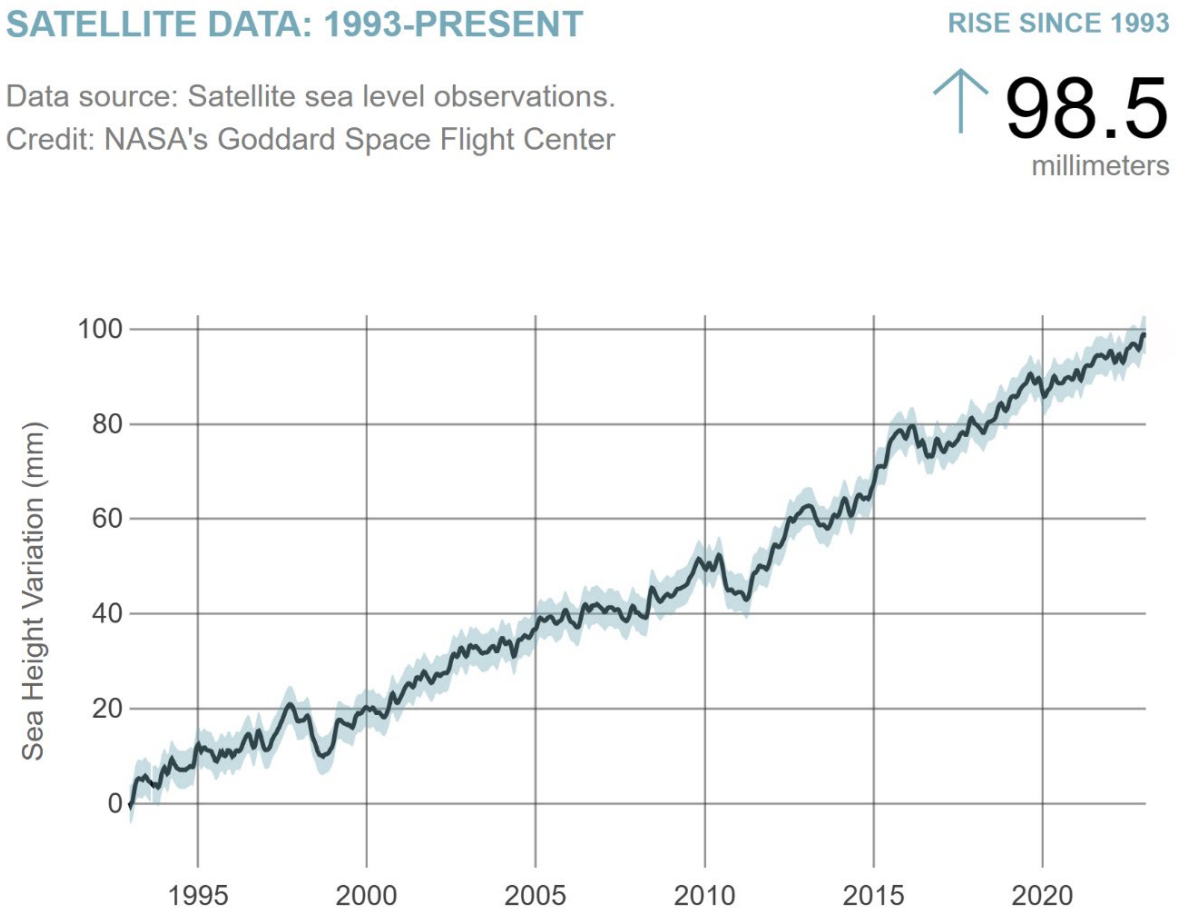


Figure 207: Satellite Sea Level Observations
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the City of Larkspur published the Greenhouse Gas Inventory for Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the City of Larkspur as per the planning team.

Table 17: Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Limited	Severe	Low	Low	**8.00**
Debris Flow	Likely	Limited	Severe	Medium	Medium	**12.00**
Drought	Occasional	Extensive	Moderate	High	Medium	**13.00**
Earthquake	Occasional	Extensive	Extreme	None	High	**13.00**
Flooding	Occasional	Limited	Severe	High	Medium	**12.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	Low	**7.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Likely	Extensive	Moderate	High	Medium	**14.00**
Severe Weather – Wind, Tornado	Likely	Extensive	Moderate	High	Medium	**14.00**
Tsunami	Occasional	Limited	Extreme	None	High	**11.00**
Wildfire	Likely	Significant	Extreme	High	High	**16.00**

Table 111: City of Larkspur Hazard Risk Assessment
Source: City of Larkspur

Table 18: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 112: County of Marin Hazard Risk Assessment
Source: County of Marin

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity

- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

There is one dam located in Larkspur at Tubb Lake. The City could be impacted by a failure of this dam or the Phoenix Lake Dam in the unincorporated County of Marin. The Phoenix Lake Dam and Phoenix Lake are located directly adjacent to the western border of the Town of Ross (see Figure 20). The dam has storage of 612-acre feet of water that could be released down Ross Creek and into Corte Madera Creek through Larkspur in the event of a full sunny-day dam failure. Where Corte Madera Creek opens up at the College of Marin along Larkspur's boundary with Kentfield, water could extend out to College Avenue with a depth of five feet in some areas of the College campus making it susceptible to flooding. While floodwaters would mostly stay confined to Corte Madera Creek as it traverses through Larkspur, floodwaters could extend up several tributaries of the creek on its south side around Piper Park and Riviera Circle along lower Larkspur Creek and the High Canal. Homes along Boardwalk One are susceptible to flooding and could be inundated in several feet of water approximately 35 minutes after the dam fails. After Corte Madera Creek passes Highway 101, homes on the south side of Corte Madera Creek are susceptible to flooding and could be inundated with floodwaters up to several feet approximately 40 minutes after the dam fails. Dozens of homes along Corte Madera Creek and its tributaries including Larkspur Creek have docks which could be damaged or destroyed in the event of a dam failure, depending on flood velocity. None of the critical facilities in Larkspur with the exception of the College of Marin are at risk of flooding from a dam failure.

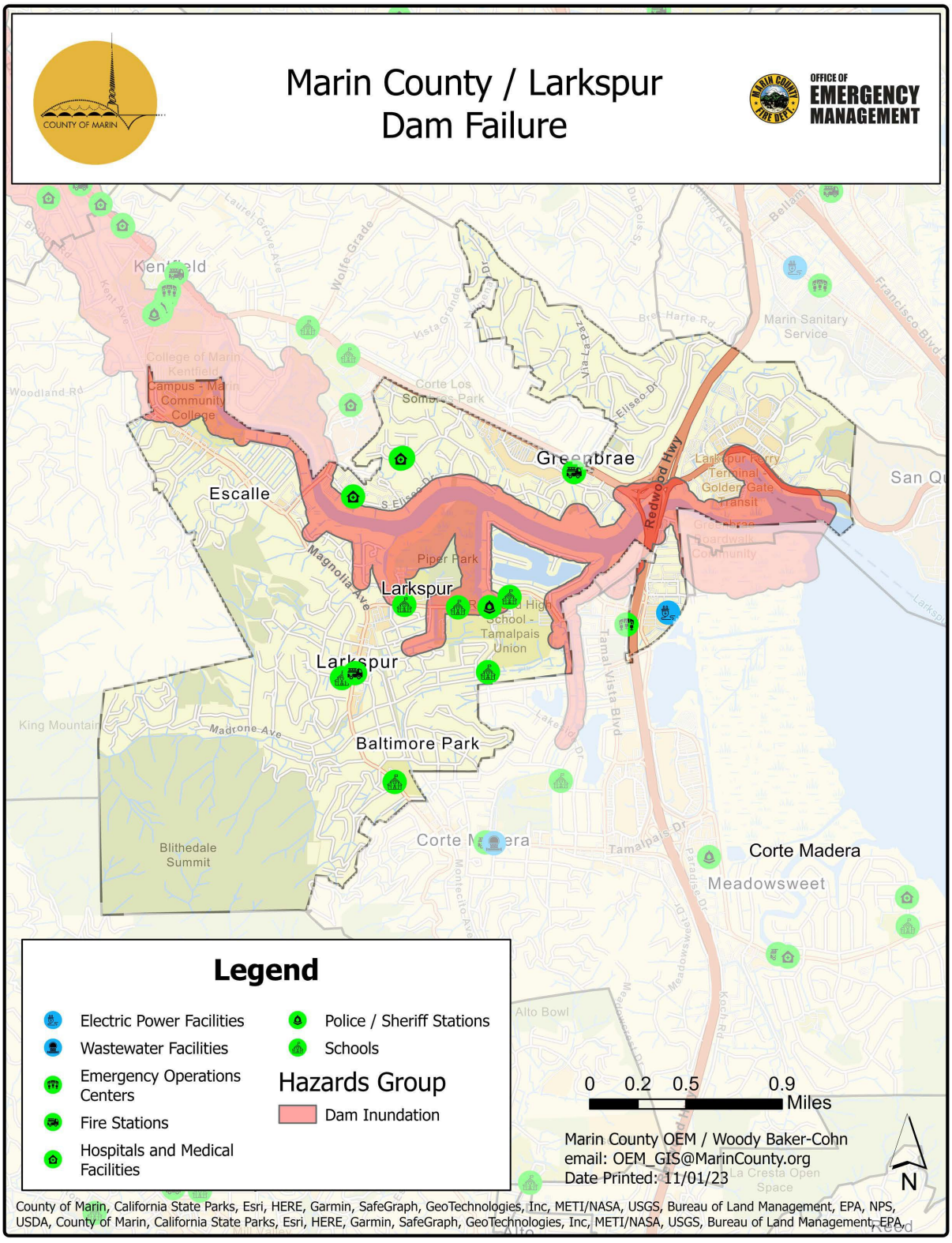


Figure 208: City of Larkspur Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

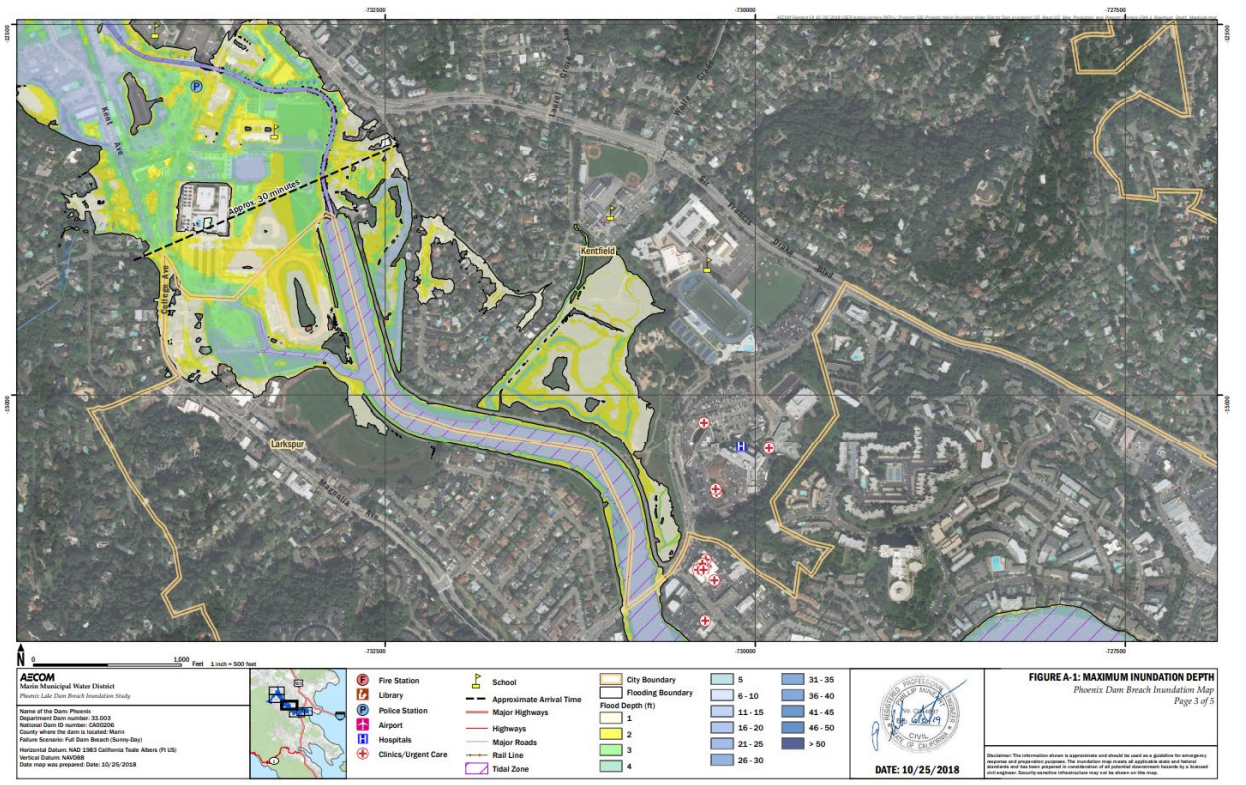


Figure 209: Phoenix Lake Dam Inundation Area – Larkspur West
Source: California Department of Water Resources

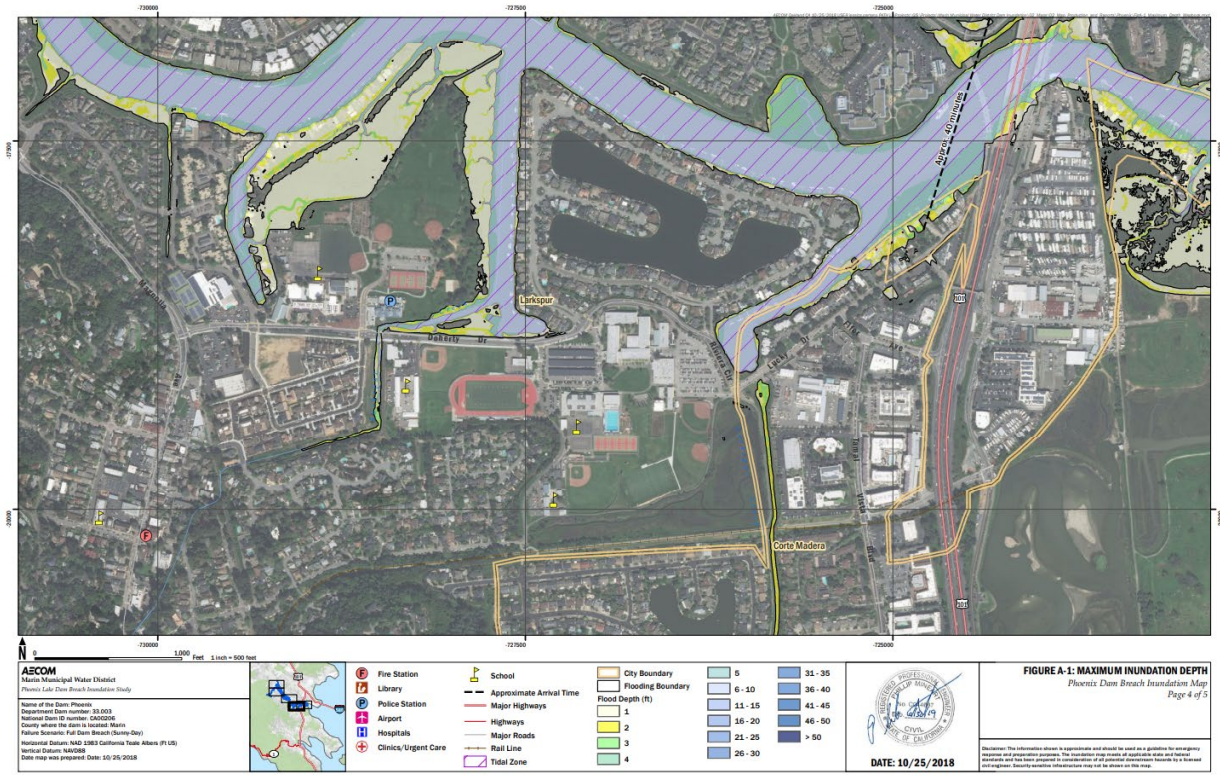


Figure 210: Phoenix Lake Dam Inundation Area – Larkspur Central
Source: California Department of Water Resources

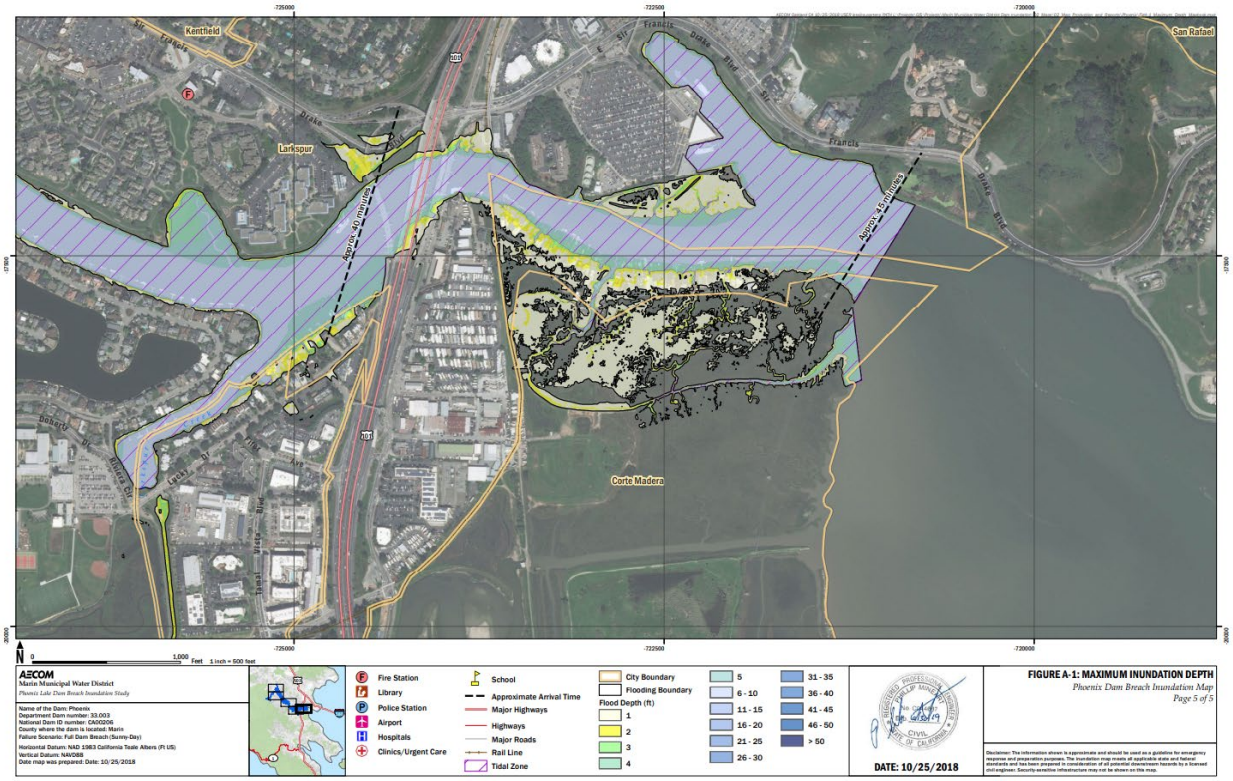


Figure 211: Phoenix Lake Dam Inundation Area – Larkspur East
Source: California Department of Water Resources

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Phoenix Lake Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of Larkspur. Future development along Corte Madera Creek, lower Larkspur Creek and the High Canal could expose additional people and structures to risk of a dam failure.

2.2.2 DEBRIS FLOWS

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff

or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 24 shows landslide susceptibility classes.

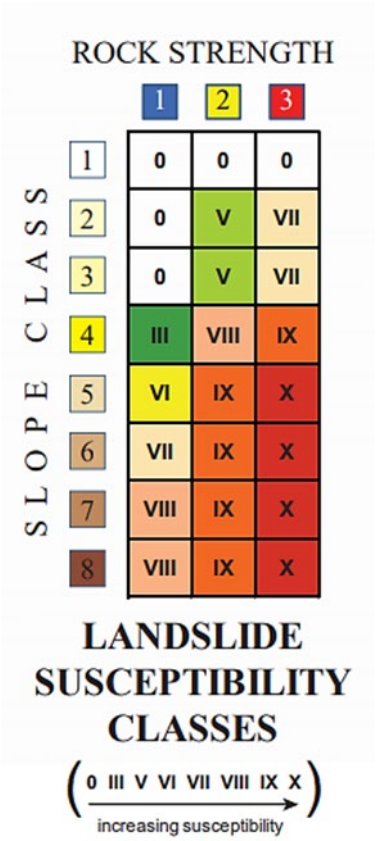


Figure 212: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a

movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 25 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

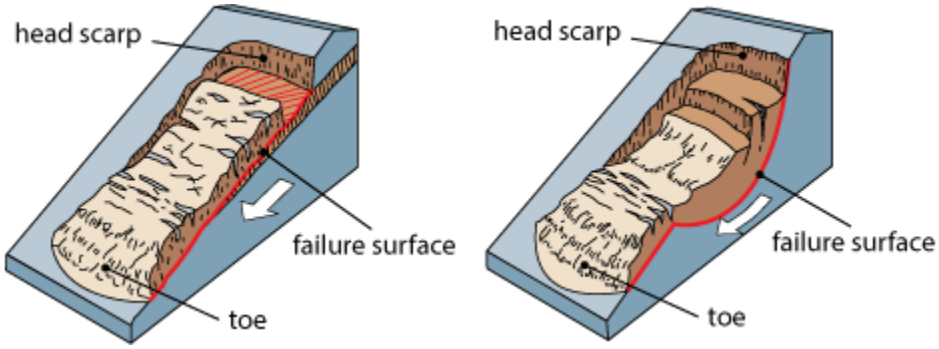


Figure 213: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

Three major groups of geologic materials underlie Larkspur. Sedimentary rock of the Franciscan Formation is the bedrock beneath the ridges and slopes forming Larkspur's northern and southern boundaries and Bon Air Hill. A large part of the Franciscan Formation underlying Larkspur is Franciscan melange, a mix of rock types embedded in crushed rock materials. Melange has highly erratic slope stability characteristics. Most of Larkspur west of Magnolia Avenue; north of Corte Madera Creek and Highway 101; and around Baltimore Park is extremely susceptible to landslides due to the steepness of the terrain. A landslide in Larkspur could occur anywhere in the city where the terrain may be susceptible to soil movement. These areas primarily consist of numerous winding and dead end streets and hundreds of hillside homes that may sustain damage from soil movement. Most of the downtown and commercial

area of Larkspur around Magnolia Avenue lies in an area of low to no landslide susceptibility. Most of the critical facilities in Larkspur lie outside a landslide susceptibility area but part of the Redwood High School and the Tamalpais of Marin Greenbrae skilled nursing facility lie areas of moderate to high landslide susceptibility. The commercial area north of Sir Francis Drake Boulevard across from the Larkspur Ferry Terminal lies in an area of moderate to high landslide susceptibility. Part of Highway 101 north of Sir Francis Drake Boulevard lies in an area of high landslide susceptibility and is protected by a retaining wall on the west side. A landslide closing the highway could cause traffic challenges in Larkspur.

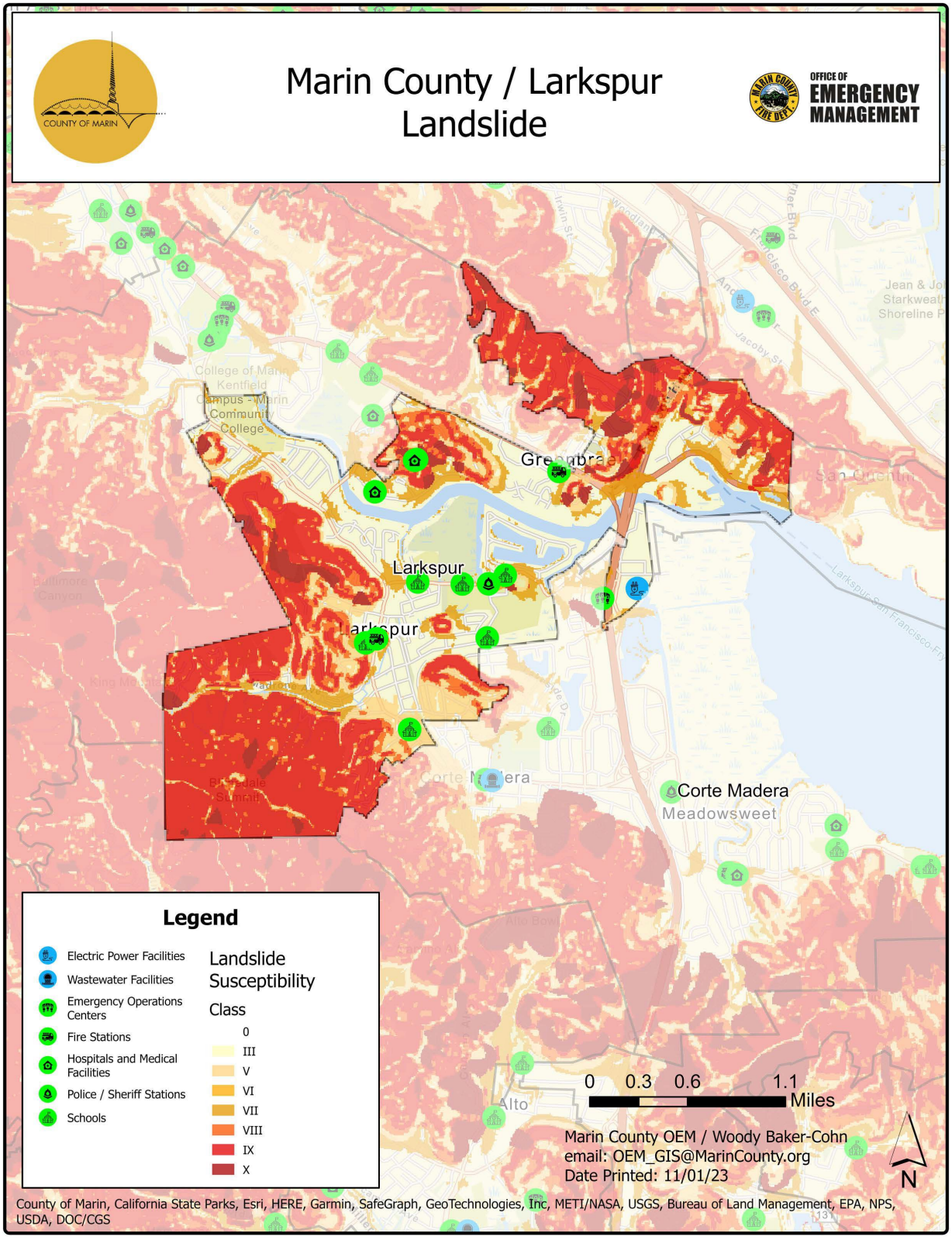


Figure 214: City of Larkspur Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

Transportation challenges may be of particular concern with a landslide in the City, particularly in the hilly and mountainous residential areas around the city west of Magnolia Avenue. Ingress and egress into these areas may be impacted by a landslide.

Earthquakes also have the potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Blithedale Summit Open Space Preserve, the King Mountain Open Space Preserve and any of the open space above Larkspur may contribute to soil instabilities and pose a risk to properties and infrastructure in the city. Erosion from the watersheds that drain into Corte Madera Creek and Larkspur Creek can add to soil instability and could contribute to debris flows down the creeks, destroying bridges and other road infrastructure and spreading out in the alluvial fan where Corte Madera and Larkspur Creeks converge near Highway 101. Homes and businesses along the creeks, including along Madrone Avenue and Magnolia Avenue, are particularly susceptible to debris flow. Fingers of alluvial stream deposits (clay, sand, silt, and gravel) extend down the hillsides in swales and creek beds to gently sloping alluvial fans and floodplains. These soils were eroded from the steep slopes and transported by flooding streams. The older area of Larkspur downtown and the nearby residential neighborhoods lie in a wide flat alluvial valley. Occasional erosion-resistant hills or knolls such as Palm Hill and some of its small neighbors protrude above the otherwise flat plain. Bay Mud lies in a broad band between Magnolia Avenue on the south and Sir Francis Drake Boulevard on the north (excluding Bon Air Hill). The older Bay mud reaches a thickness of 40 feet at the mouth of Corte Madera Creek. Bay mud is an unconsolidated jelly-like material that is both highly compressible, and subject to lateral flow when loads are placed on it. Landslides in Larkspur as a result of an earthquake may cause damage to homes and roads as a result of shifting soils, effecting ingress and egress in the hilly and mountainous residential areas of the city where there are numerous windy and dead-end roads. Many hillsides in Larkspur are unstable in their natural state, and even minor changes in the shape of the land surface could create major landslide problems.

On 1/22/1995, a rocky hillside in Larkspur weakened by a series of rainstorms gave way, burying two cars and damaging five others. No one was injured. The hillside was behind an apartment complex that sits on a former rock quarry site. City workers estimated that 400 to 1,000 cubic feet of mud slid into the building's parking lot.

During the winter storms of 1982, landslides (debris avalanches) in Larkspur produced over 10,000 cubic yards of soil, rock, and debris. Slope movements resulted in several million dollars in damage to homes, roads, and other improvements. On 1/3–1/5/1982 a severe storm caused a mudslide in the Madrone Canyon neighborhood, damaging or destroying four or more homes.

There have been no recorded debris flows in Larkspur since the last plan update.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022

study by the American Geophysical Union (AGU)[15], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of southern and western Larkspur that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in southern and western Larkspur could be susceptible to post-fire debris flows. This includes areas around Larkspur Creek. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on their effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

[15] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

Drought can occur in all areas of Larkspur and Marin, though its effects would be most felt in the hillside and mountainous areas where the risk of wildfire may increase. Dry trees throughout the City may become a safety hazard to the public due to falling trees or its limbs.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Larkspur may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Larkspur, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Larkspur. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Larkspur where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along Corte Madera Creek and its tributaries and along the shoreline of Larkspur, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of Larkspur could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Larkspur can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 27).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 215: Modified Mercalli Intensity Scale
Source: USGS

Figure 28 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 216: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 29). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 217: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning, there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. An earthquake could occur anywhere in and around Larkspur due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity

The colors on Figures 30 and 31 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

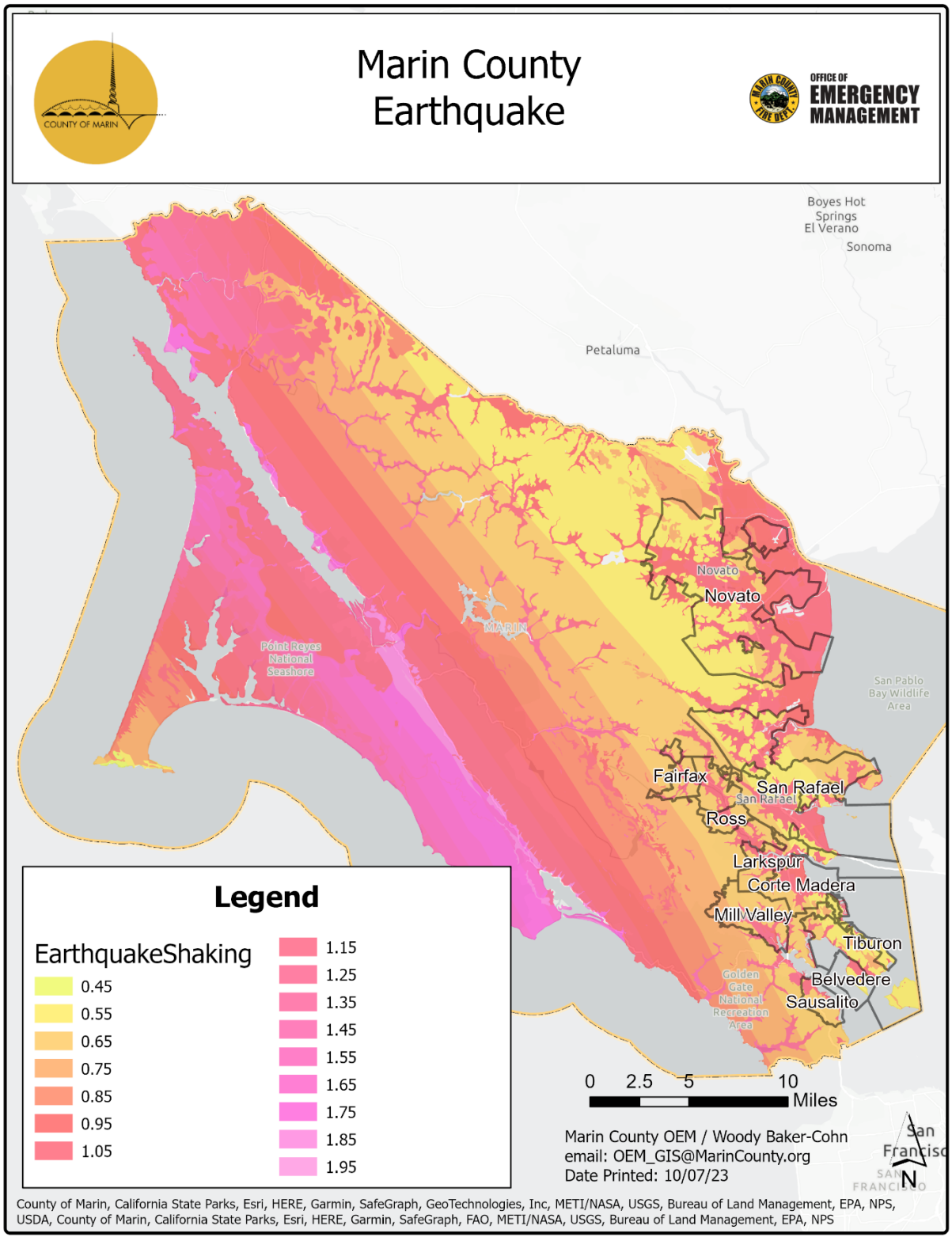


Figure 218: Marin County OA Earthquake Impact and Fault Lines
Source: Marin County OEM

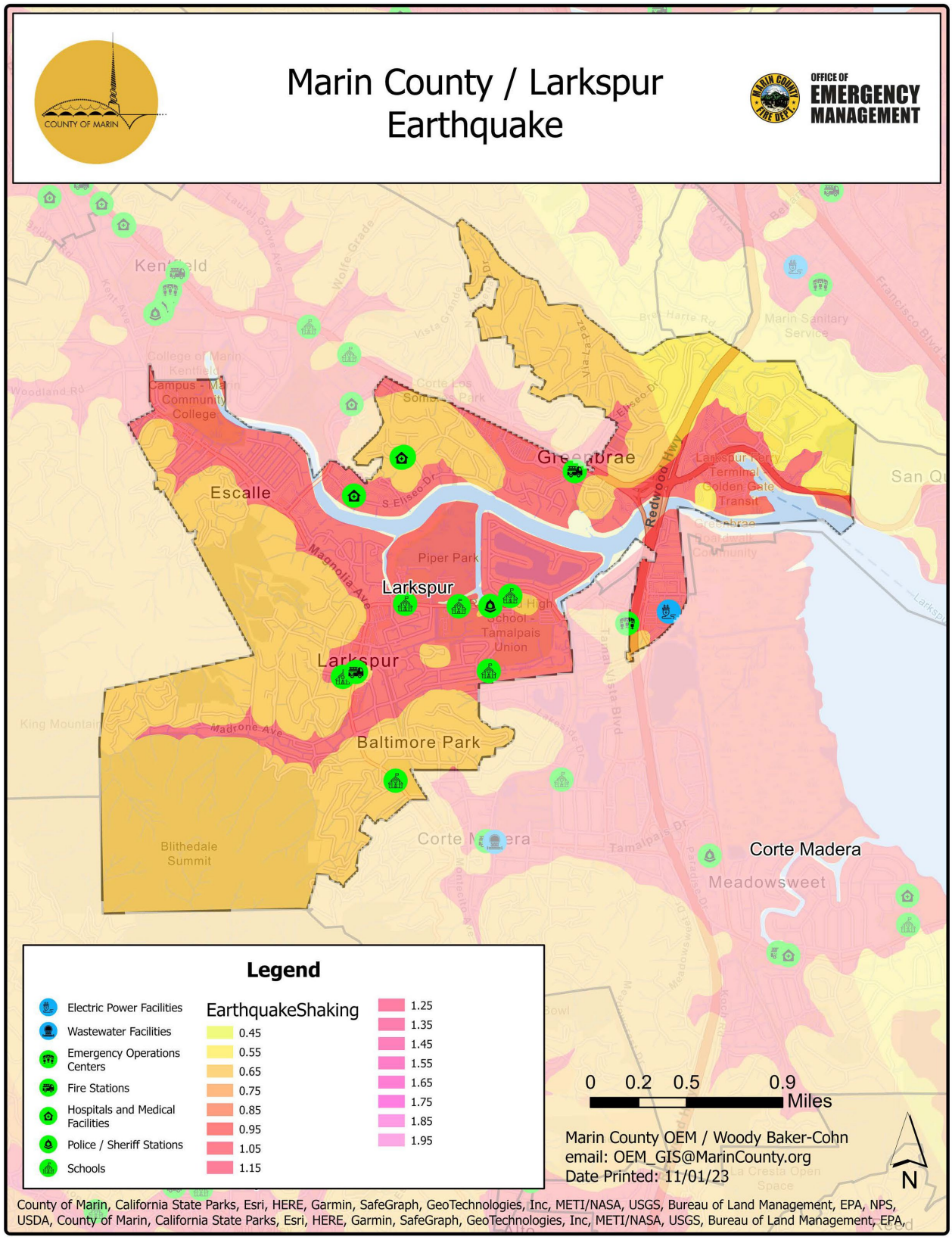


Figure 219: City of Larkspur Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Larkspur is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region may have major impacts to the City. There is increased risk of earthquake shaking and liquefaction in certain parts of Larkspur, particularly in the area of the city along Larkspur Creek and Corte Madera Creek, including around Highway 101 where Corte Madera Creek empties into San Francisco Bay and where superficial deposits and fill are more prevalent. This area has greater development density and includes hundreds of residences, part of downtown, and most of the primary commercial areas of the city including the major shopping centers north of Sir Francis Drake Boulevard. All of the City's critical facilities, with the exception of the Larkspur City Hall, Larkspur Fire Station #15 and the Tamalpais of Marin Greenbrae skilled nursing facility lie areas of moderate earthquake shaking susceptibility. Unreinforced masonry buildings in the downtown area could suffer moderate to severe damage from an earthquake. Larkspur has identified 15 unreinforced masonry buildings scattered through the area south of Corte Madera Creek. Although several are located downtown, most downtown buildings, including City Hall, are wood frame. Falling debris could endanger those in the vicinity of these older buildings. "Pancaking" of these older structures during business hours may entrap many people. The City's densely settled alluvial lowlands south of Corte Madera Creek have a potential for heavy damage. According to a scenario developed under the Earthquake Preparedness Program of the California Division of Mines and Geology, a major earthquake (8.3 magnitude on either the San Andreas or Hayward Fault), in addition to damaging buildings, can be expected to topple the Highway 101 freeway overpass at Sir Francis Drake Boulevard and buckle pavement on Highway 101 and Magnolia Avenue through Larkspur. The earthquake could set off landslides along Sir Francis Drake Boulevard leaving Greenbrae separated from the rest of Larkspur for up to 24 hours. Bon Air Road and Doherty Drive could also collapse from liquefaction and settlement. Utility lines carrying water, gas, and sewage could be ruptured by landslides and sudden settlement. If fires break out, emergency response teams could encounter serious difficulties in fighting them if water lines are broken and landslides block access roads.

Larkspur hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Larkspur.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Larkspur, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[16], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Larkspur. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands

[16] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

of Larkspur downtown and along its creek beds and marshlands where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its “bank-full” capacity, generally resulting from prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require

immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the “Atmospheric River” contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the “Pineapple Express” because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 32.

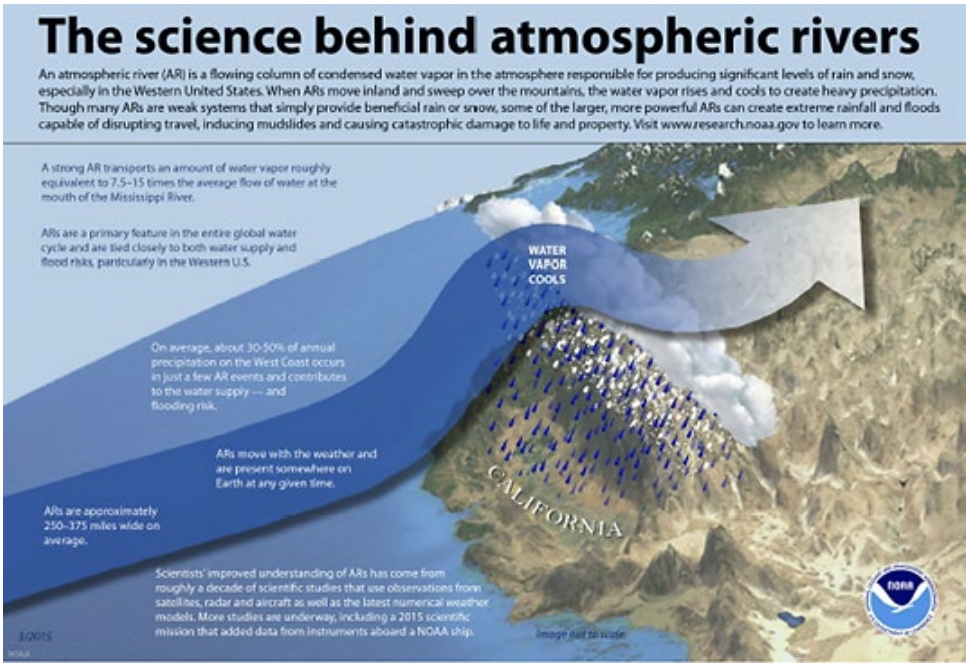


Figure 220: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Many developed and undeveloped Larkspur lands are subject to flooding due to a combination of factors, including periodic heavy winter rainfalls, tidal fluctuations, and potential for tsunami due to seismic activity. Larkspur has numerous drainage basins which lead to major creeks that drain to San Francisco Bay. Flooding in Larkspur generally results from a combination of creek flooding along Corte Madera Creek and Larkspur Creek as well as from high tides and storm runoff in low-lying areas along San Francisco Bay. Both sides of Corte Madera Creek and the lowland areas, particularly the alluvial fan area where Corte Madera and Larkspur Creek converge near Highway 101, are in the 100-year floodplain and could be susceptible to flooding. Historically, most of Larkspur's flooding has occurred in this area south of Corte Madera Creek and west of Highway 101. This area includes hundreds of homes, most of the College of Marin, Tamiscal High School, the Central Marin Police Authority, part of Redwood High School, San Andreas High School and the PG&E Greenbrae Substation. Part of Highway 101, Lucky Drive and Doherty Drive lie in the 100-year floodplain and could be susceptible to flooding. The Madrone Canyon and downtown areas along Larkspur Creek and several areas along Magnolia Avenue and Sir Francis Drake Boulevard near Corte Madera Creek are in 500-year floodplain and could be susceptible to flooding. This area includes hundreds of homes, most of downtown, several commercial shopping centers, the Larskpur City Hall and Fire Stations #15

and #16, the St. Patricks School, the South Marin Rehabilitation Center and part of Redwood High School. Most of the main thoroughfares in Larkspur, including Magnolia Avenue, Sir Francis Frak Boulevard and Highway 101 lie in the 500-year floodplain and could be susceptible to flooding. A major flooding event in Larkspur could cause significant transportation challenges for the city.

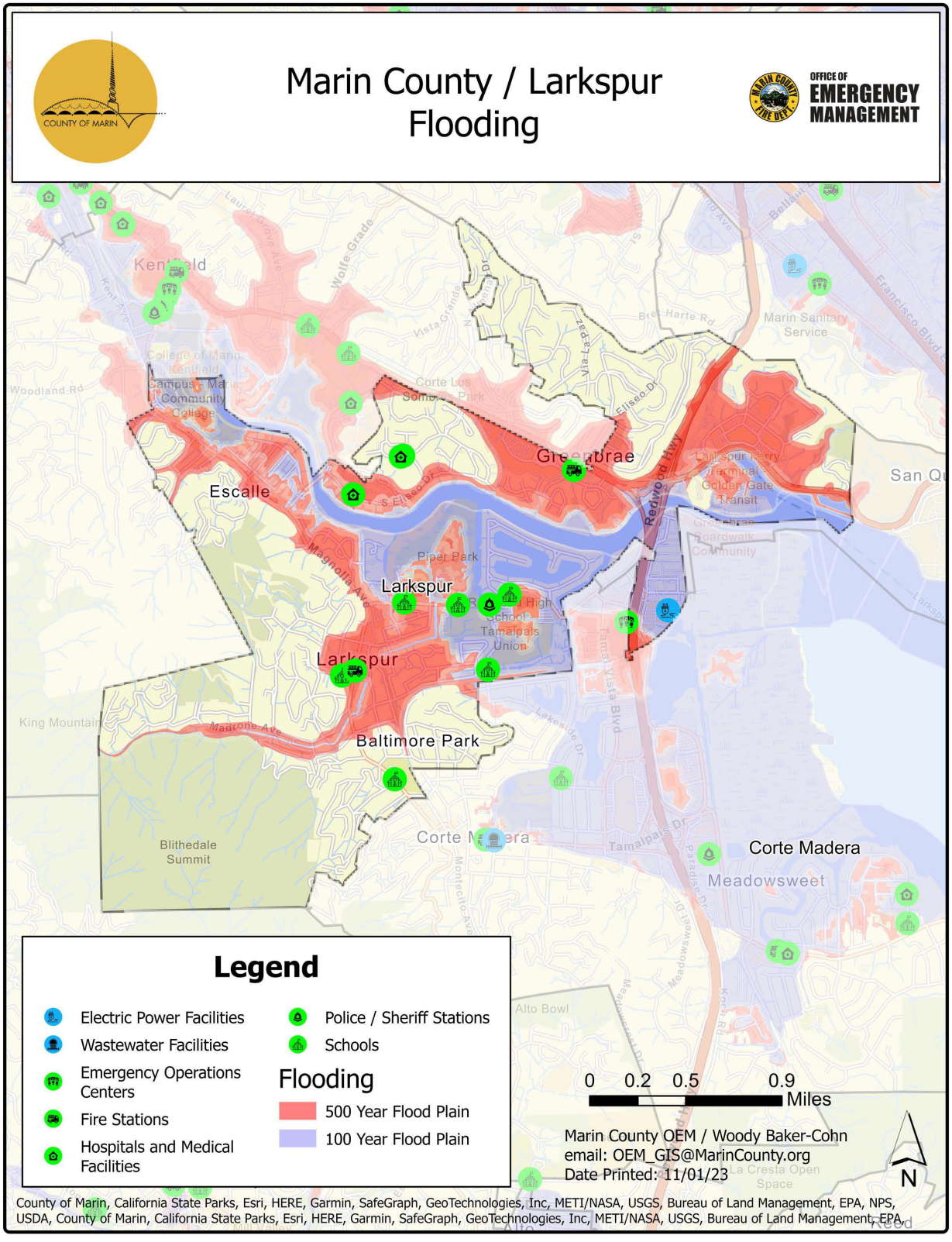


Figure 221: City of Larkspur Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 19 shows the number of City of Larkspur critical facilities by flood zone.

Table 19: City of Larkspur Critical Facilities by Flood Zone

Category	Name	Address	Flood Zone
Critical Facilities			
Fire Stations	Central Marin Fire Department / Station 15	420 Magnolia Avenue Larkspur, CA 94939	X
Fire Stations	Central Marin Fire Department / Station 16	15 Barry Way Greenbrae, CA 94904	X
Police Stations	Central Marin Police Authority	250 Doherty Dr, Larkspur, CA 94939	AE
Emergency Operations Center	Marin County Emergency Operations Center	1600 Los Gamos Drive San Rafael, CA 94903	X
Local Government	Public Works Corporation Yard	325 Doherty Drive Larkspur, CA 94939	AE
Local Government	Larkspur City Hall	400 Magnolia Avenue Larkspur, CA –94939	X
Local Government	Larkspur Public Library	400 Magnolia Avenue	X
Hospitals and Medical Facilities	Tamalpais of Marin Greenbrae – Skilled Nursing Facility	501 Via Casitas Greenbrae ~~94904~~	X
Hospitals and Medical Facilities	South Marin Health & Wellness Center	1220 S Eliseo Dr. Greenbrae	X
Schools and Educational Facilities	Redwood High School	395 Doherty Drive Larkspur, CA 94939	AE
Schools and Educational Facilities	Tamiscal High School	325 Doherty Drive Larkspur, CA 94939	AE
Schools and Educational Facilities	San Andreas High	599 William Avenue	AE
Schools and Educational Facilities	Hall Middle School	230 Doherty Drive Larkspur, CA 94939	X
Schools and Educational Facilities	St. Patrick School and Gymnasium	120 King Street	X
Schools and Educational Facilities	Marin Primary and Middle School	20 Magnolia Avenue	X

Schools and Educational Facilities	Childrens Cottage Coop	2900 Larkspur Landing Circle	X
Medical	MarinHealth Facilities	1350 S. Eliseo Drive Greenbrae	X
Medical	MarinHealth Facilities	2 Bon Air Rd. #100	X
Community Space	Mt. Tam Raquet Club	1 Larkspur Plaza Drive	X/AE
Community Space	Masonic Temple	1122 Magnolia Avenue	X
Community Space	American Legion	500 Magnolia Avenue	X
High Potential Loss Facilities			
Dams	Tubb Lake Dam		X
Critical Infrastructure			
Transportation	Larkspur Ferry Terminal (incl Ferry Landing, Fuel Storage)	101 East Sir Francis Drake Blvd, Larkspur, CA 94939	X
Transportation	Larkspur SMART Station		X
Transportation	Larkspur Ferry Terminal		X
Transportation	Bon Air Bridge		AE
Transportation	Doherty Drive Bridge		X
Transportation	Alexander Avenue Bridge		X
Transportation	Bridge Street Bridge		X
Transportation	Cane Street Box Culvert		X
Transportation	King Street Box Culvert		X
Transportation	Magnolia Avenue Bridge		X
Transportation	Meadowood Drive Bridge		X
Transportation	Sir Francis Drake Bike/Pedestrian Bridge/Highway 101		AE
Transportation	Sir Francis Drake Pedestrian Overcrossing		AE
Transportation	Ward Street Bike Path		X

Table 113: City of Larkspur Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within San Francisco Bay have the potential to

significantly impact the Larkspur storm drain system. Larkspur already sees flooding from king tides in San Francisco Bay and this is only expected to increase with sea level rise and climate change. Larkspur areas subject to frequent tidal flooding in the past are predominantly former marshlands (Bay Mud areas) that have previously been filled for urban expansion purposes.

On 11/8/2022, a storm caused flooding on Highway 101 near Larkspur, affecting travel.

On 2/13/2019, an atmospheric river event caused flooding in Larkspur. Major flooding occurred at the Lucky Drive exit on Highway 101.

On 2/8/2017, an atmospheric river event contributed to flooding in Larkspur, inundating roads and parking lots. Flooding was reported on Sir Francis Drake Boulevard at the Bon Air Shopping Center and on Bon Air Road at Magnolia Avenue. Residential flooding was reported along West Baltimore Avenue in the Madrone Canyon area. The Larkspur-Corte Madera, school district canceled classes as did the North Bridge Academy and St. Patrick School.

Figure 222: 2017 Larkspur Flooding at the BonAir Shopping Center
Source: ABC 7

On 12/14/2012, rainfall caused Corte Madera Creek to overflow its bank in some places. Residents at the Larkspur Marina neighborhood and Larkspur Plaza Drive both had to negotiate ponds in front of their homes. King tides contributed to the flooding.

Significant flood damage occurred in 1955, 1958, 1973, and 1982. The flood of late December 1955 caused serious damage in the Heather Gardens neighborhood where many families had to be evacuated by rowboat. Torrential rainfall in April 1958, and two back-to-back storms in January 1973, also caused severe flooding in Larkspur. The January 1982 storm was the worst in the state since 1955. In Marin County, 12 inches of rain fell in 36 hours. Unlike the earlier floods in Larkspur, the greatest loss of property was due to mudslides. Four homes, two in Madrone Canyon and two in the Murray Park area, were destroyed, as well as eight apartments at Skylark. Public and private damage was estimated at $3 million.

Figure 223: 1973 Flooding on Highway 101 in Larkspur
Source: County of Marin Public Works

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[17] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Larkspur. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Larkspur will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of Larkspur. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of Larkspur would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along Corte Madera Creek, Larkspur Creek and the High Canal would expose more people, structures and infrastructure including major roads to creek flooding and storm surge from Corte Madera Creek as a result of climate change.

[17] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

2.2.6 LAND SUBSIDENCE

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 36 for a picture and description of how dissolution sinkholes form.

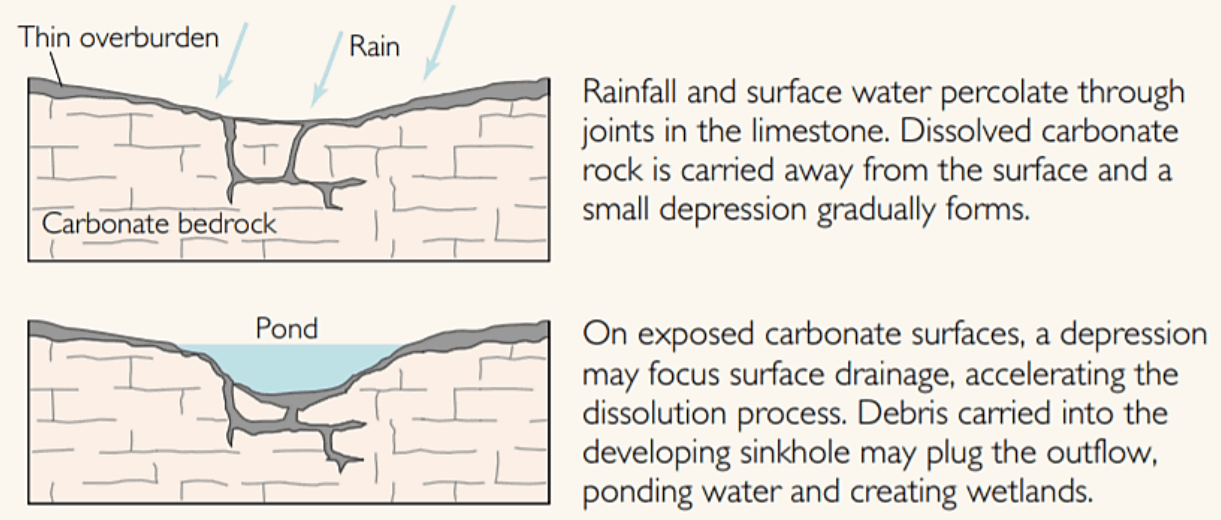


Figure 224: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 37 for a picture and description of how cover-subsidence sinkholes form.

Subsidence can also occur in bay mud areas which are prevalent around San Francisco Bay. Bay Mud, which has very little strength, can move and shift over long periods of time and is also affected by other natural events such as earthquakes, storm activities, water pressure and composition. Older construction of buildings placed on fill material on Bay Mud are susceptible to differential settlement which affects the service life of the structures as well as utilities, roadways and other infrastructure that supports these areas. The Marinship area and other low elevation areas built on bay mud have experienced significant differential settlement over time.

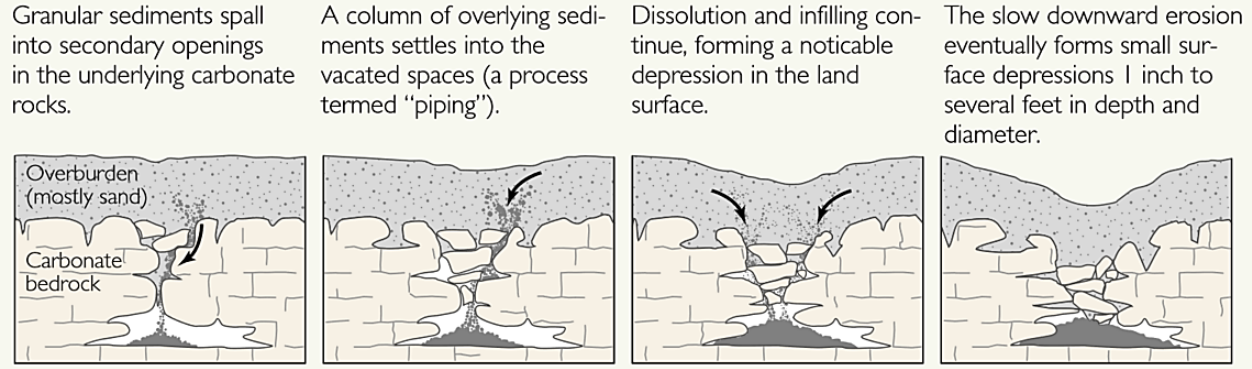


Figure 225: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 38 for a picture and description of how cover-collapse sinkholes form.

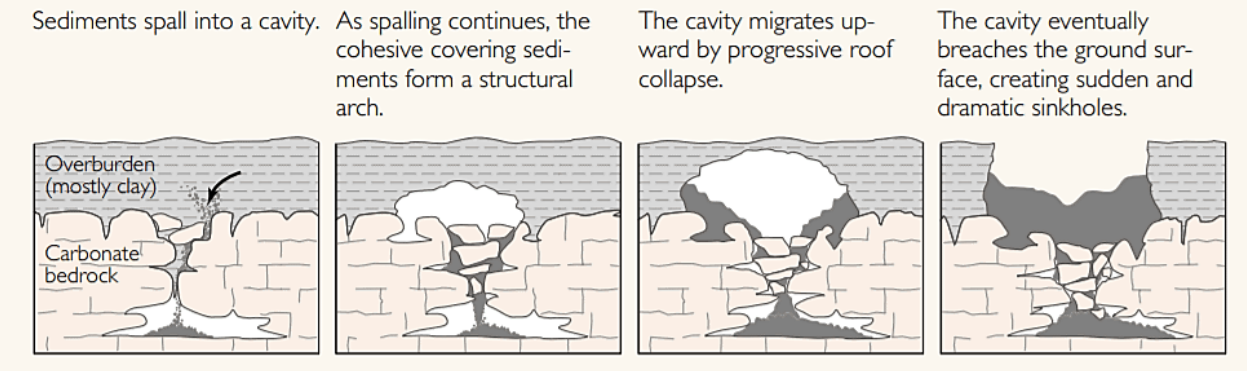


Figure 226: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Larkspur is at risk from land subsidence, in the form of liquefaction and settlement, Areas susceptible to liquefaction and settlement in Larkspur are those underlain by saturated, loosely compacted granular materials such as old stream beds (alluvium). Large areas of former bay

mud marshlands in Larkspur have been artificially filled over the years. Land subsidence and sinkholes would most likely occur in the lowland areas of Larkspur along San Francisco Bay where superficial deposits and fill are more prevalent. This includes the marshland area along both sides of Corte Madera Creek, the area east of the Marin Municipal Water District Facilities near Redwood High School and the area around the Larkspur Ferry Terminal north of the mouth of Corte Madera Creek. There are dozens of residences, several schools and numerous commercial buildings in areas of increased land subsidence susceptibility. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for Larkspur, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

Subsidence and differential settlement have occurred in Larkspur near Corte Madera Creek. Differential (or uneven) settlement may occur in poorly consolidated soils during earthquake shaking or over time.

There have been no major sinkholes recorded in Larkspur, though Larkspur's 75-100 year old storm drains are aging and deteriorating rapidly. Many have not been repaired in over 25 years and are starting to create sinkholes.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Larkspur, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Larkspur as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Larkspur could increase with future development in the lowland populated areas of the city where land subsidence is more likely to occur.

2.2.7 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 39 shows a levee and the multiple ways it can fail.

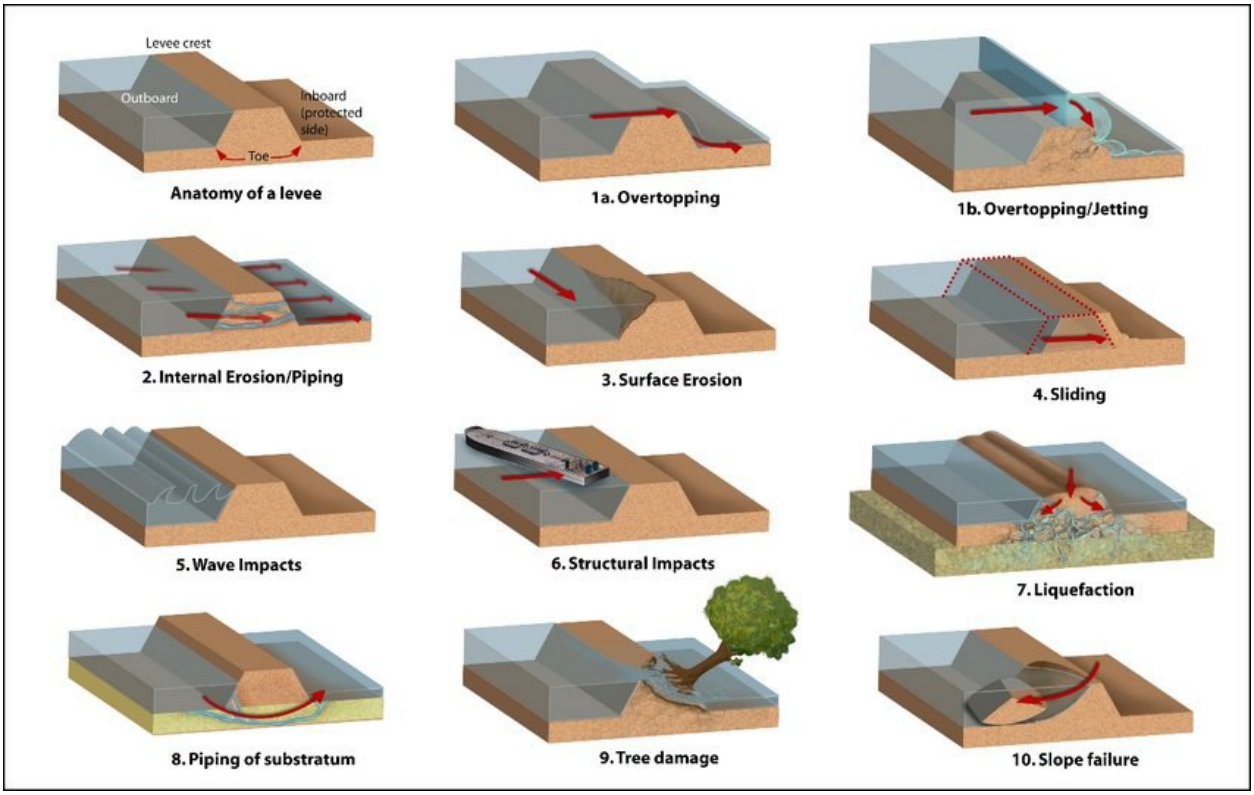


Figure 227: Levee Failure Mechanisms
Source: University of California

The City of Larkspur has three levees. The Corte Madera Creek levee is 0.67 miles long with an undocumented height and protects dozens of residences between Magnolia Avenue and Corte Madera Creek north of Bon Air Road. Around 304 people and 107 buildings with an estimated property value of $68.5 million are at risk from failure of the Corte Madera Creek levee. Marin County Levee 11 is 0.19 miles long with an undocumented height and protects numerous residences near Redwood High School from flooding. Around 131 people and 20 buildings with an estimated property value of $15.1 million are at risk from failure of the Marin County Levee 11. Marin County Levee 32 is 0.15 miles long with an undocumented heigh an it protects Remillard Park between the mouth of Corte Madera Creek and Sir Francis Drake Boulevard. There are no people or buildings at risk from a failure of the Marin County Levee 32.

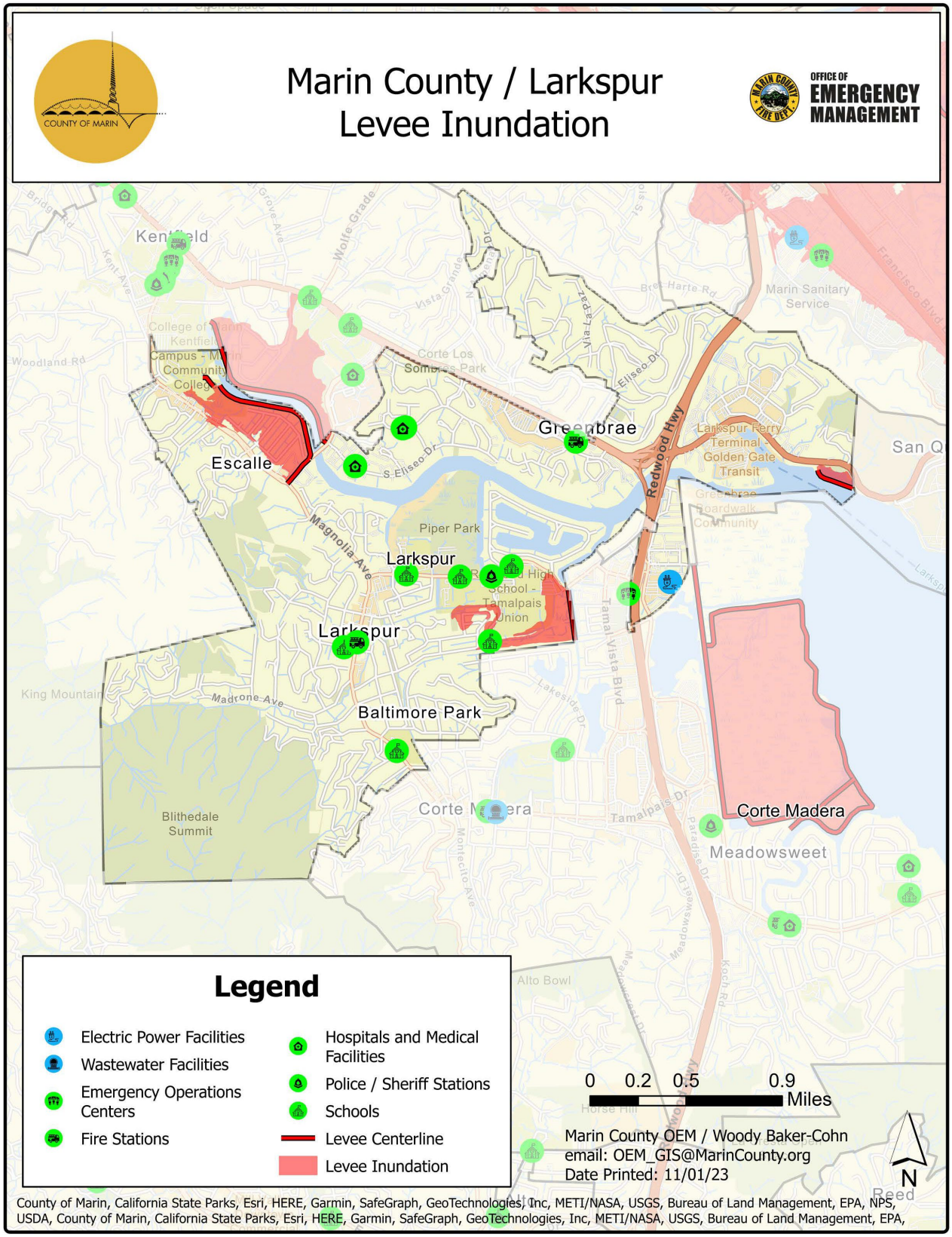


Figure 228: City of Larkspur Levee failure Critical Facilities and Infrastructure
Source: Marin County OEM

There have been no failures of any of the levees in Larkspur.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Larkspur, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Larkspur, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Larkspur protected by its levees, particularly along Corte Madera Creek and around its marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.8 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In

addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called “storm surge.” The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Most of Larkspur that lies in the 100-year floodplain is at risk of sea level rise, including along Corte Madera Creek and in the lowland areas at the convergence of Corte Madera Creek and Larkspur Creek near Highway 101. These areas may experience between one and six feet of inundation based on the latest predictions of sea level rise in the next 100 years. Numerous commercial areas, hundreds of residences, the Redwood High School, the Tamiscal High School, the San Andreas High School, the Central Marin Police Authority, the South Marin Rehabilitation Center and the PG&E Greenbrae substation lie in areas of Larkspur susceptible to sea level rise. Several main thoroughfares including Highway 101 and Sir Francis Drake Boulevard also lie in this area and already experience tidal flooding. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that Larkspur could anticipate impacts to over 12,000 people and over 1,200 living units with $2 billion in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, 132 acres of the city could be exposed to sea level rise. In the long-term, 379 acres of the city could be exposed to sea level rise; and 544 acres could be exposed with an additional 100-year storm surge. This third of the area of Larkspur is essential to accessing Larkspur, schooling, recreation, and emergency services. The Golden Gate Bridge District’s (GGBHTD) Larkspur site and hydraulic ferry facility may not be able to withstand near-term high tides. The several hundred thousand gallons of reserve fuel at the Larkspur Ferry Terminal could be vulnerable in the long-term. Housing along Corte Madera Creek canals, sloughs, and lagoons could be vulnerable in the near- to medium-terms. This includes, Boardwalk One, multi-family on Larkspur Plaza, the southern portion of Heatherwood Gardens, and housing west of S. Eliseo Drive. The elevated over marsh homes on Boardwalk One may be more adaptable than homes on solid foundations elsewhere. Industrial and commercial sites east of Highway 101 could be vulnerable in the near term with a storm surge, and to high tides in the medium-term along Redwood Highway. Floodwaters could move up Corte Madera Creek and could reach into neighborhoods, impacting streets in low elevation areas at Bon Air Road and west of the creek. Bon Air road is a critical route to area hospitals and has experienced flooding as recent as 2017 with up to one and one half feet of water at the Bon Air Bridge. These roads enable commuters,

school children, and emergency vehicles to travel to, from, and within the community. Riviera Circle homes could be vulnerable to sea level rise in the long-term, and storm surges and subsidence sooner. The Hillview neighborhood, while already vulnerable to stormwater back-ups, is vulnerable to sea level rise during a 100-year storm surge in the long-term, as is the Edgewater complex and buildings extending up Magnolia Avenue towards Kentfield. The Corte Madera/Larkspur Pathway could be compromised along Corte Madera Creek. Several schools along Doherty Drive could be vulnerable in the medium- to long-term. Stormwater infrastructure along the Corte Madera Creek, and its tributaries, could be burdened in the medium- to long-term. Access to and from Larkspur using Highway 101 already floods during storms. The route is vulnerable to tidal flooding in the long-term. The Central Marin Police Department could be surrounded by flood waters. Piper Park, a historic land fill and current community sports facility and marsh habitat could be vulnerable in the long-term to sea level rise and 100-year storm surge. Larkspur's most vulnerable assets interface with Corte Madera Creek and its tributaries as they enter San Francisco Bay. Some buildings on the creek already suffer from subsidence and have undergone repairs. The low-lying area along Doherty Drive could be vulnerable by the long-term and is highly susceptible to bay surges and stormwater flows. Much of Larkspur developed flat lands were marshy before the water was channeled and land filled. This area is vulnerable to flooding and subsidence. Larkspur Landing, a critical center for commuting and commerce, could also flood. Industrial parcels east of Highway 101 on the shoreline already flood seasonally and could continue to suffer from storms over the next fifteen years. Residential development along Corte Madera Creek could experience tidal flooding in the near- and medium terms. In the long-term, tidal flooding could impact fifteen percent of residential parcels in Larkspur. Multi-family parcels could also see flooding on Larkspur Plaza Drive. Fifty mobile homes, some of the County of Marin's limited affordable housing, could flood tidally at Mean Higher High Water Mark in the long-term and face storm flooding in the medium-term. Larkspur contains a high number of potentially vulnerable buildings relative to other communities in the study area.

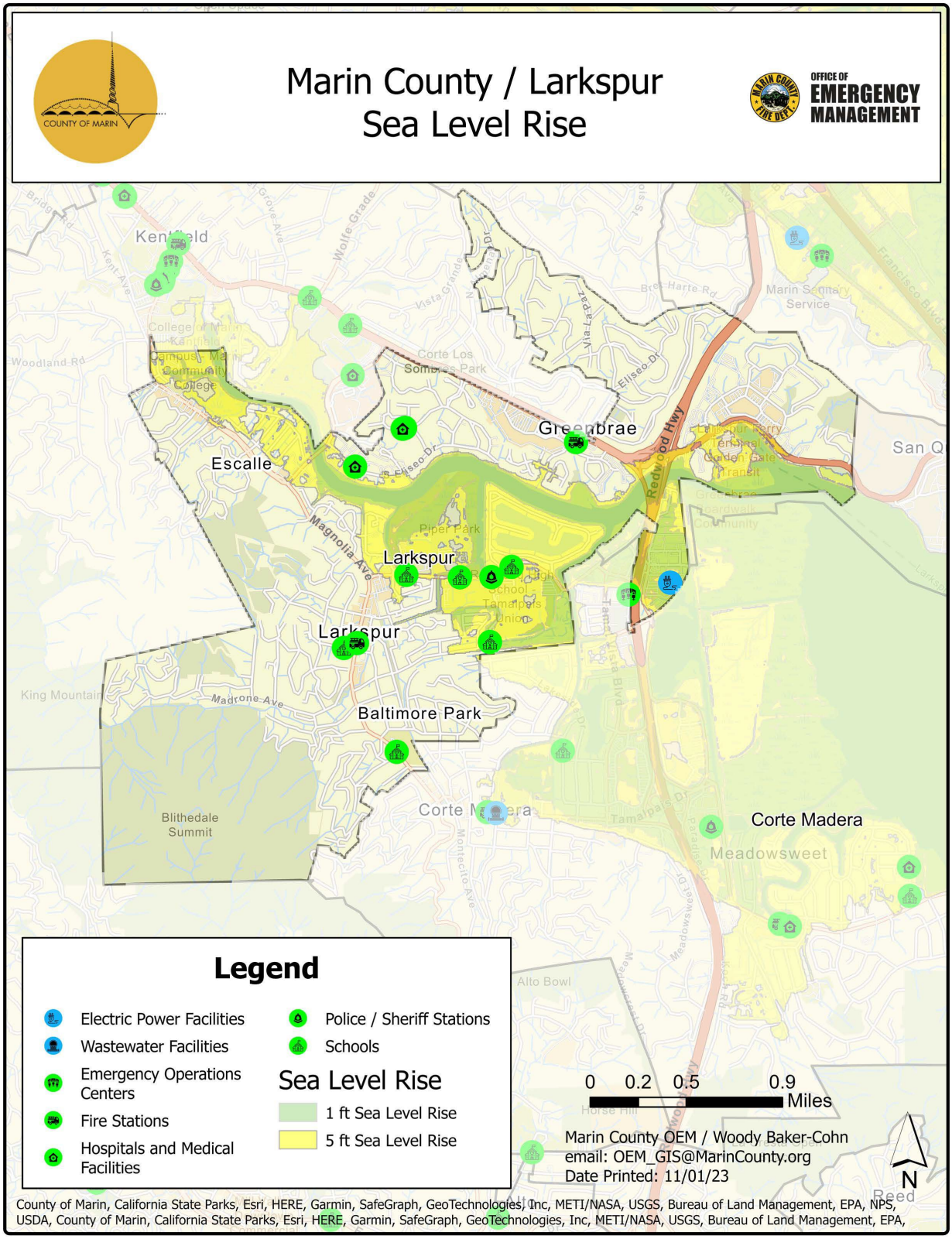


Figure 229: City of Larkspur Sea Level Rise Impact
Source: Marin County OEM

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

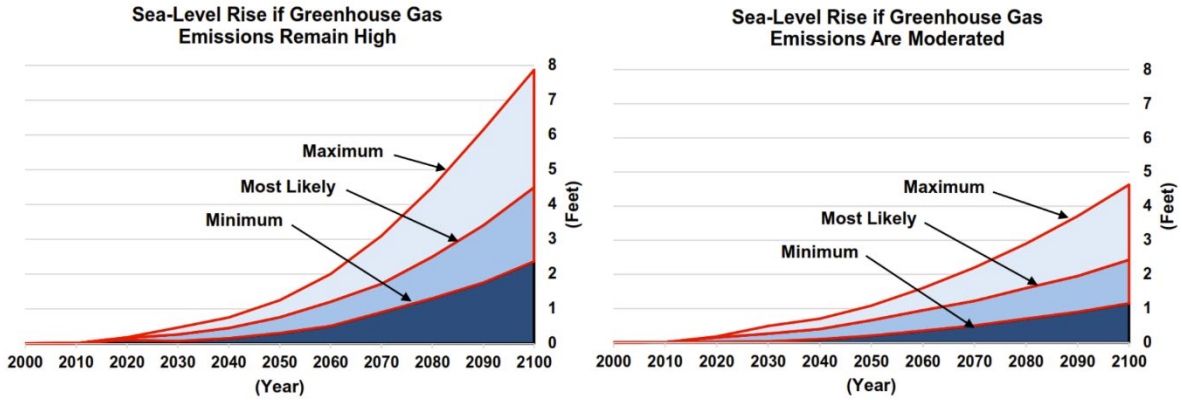


Figure 230: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Larkspur already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Larkspur with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Larkspur will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Larkspur will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across Larkspur will continue to become inundated.

2.2.9 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 43):

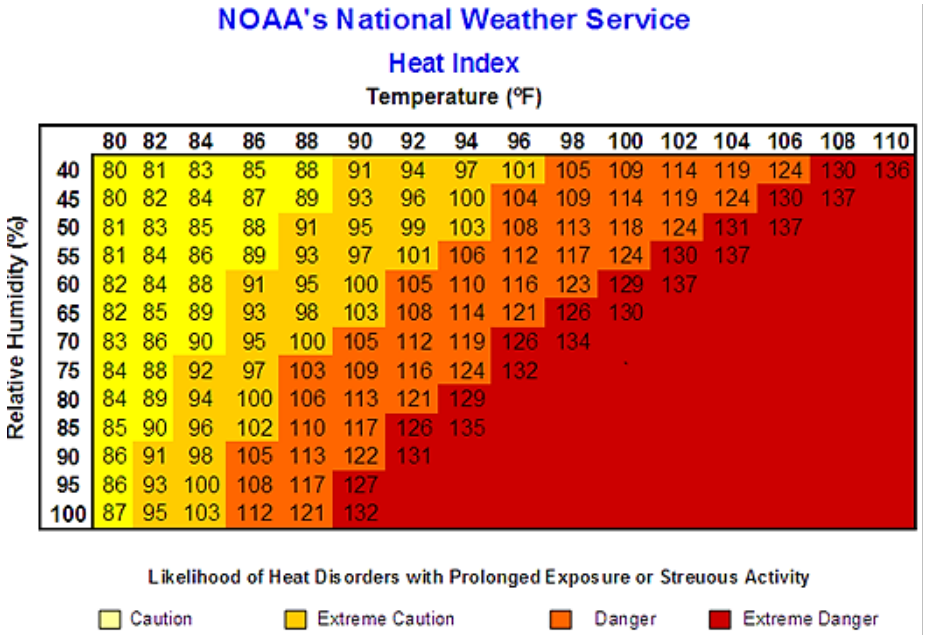


Figure 231: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Larkspur and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city along Magnolia Avenue and Sir Francis Drake Boulevard. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the City of Larkspur experienced an Extreme Heat Event with temperatures exceeding 107 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

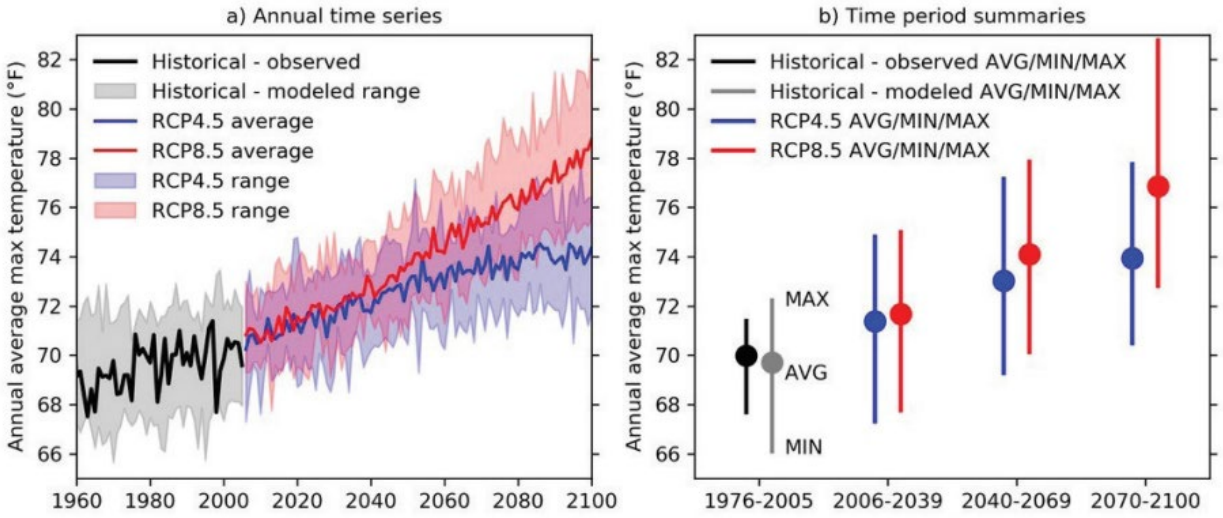


Figure 232: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Larkspur. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Larkspur where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Larkspur could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Larkspur as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of Larkspur where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Larkspur could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.10 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 45).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 233: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Larkspur is susceptible to high winds during summer months when high temperatures in the central valley tend to pull in colder temperature air from the Pacific Ocean in the form of fog and winds. Some areas of Larkspur have the are named “Hurricane Gultch” which are areas where the wind associated with the marine layer rolls over the upper hillsides and proceeds to impact properties, trees and infrastructure in the city.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a

thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 46) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 234: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 235: Waterspout Formation
Source: MarineInsights

All of Larkspur is susceptible to storms and damage from wind, though the hilly and mountainous areas around the City have increased susceptibility due to a higher presence of trees. There are numerous windy and dead-end roads in these areas where a downed tree could hinder access. Larkspur is unlikely to experience a tornado due to its terrain but it could experience a waterspout originating from San Francisco Bay. Drought coupled with high winds which frequently occur may increase the susceptibility of trees toppling and falling branch damages to property. Fallen trees may damage homes and other facilities. Power lines may be impacted by fallen trees and wind, causing power outages.

On 3/14/2023, a wild storm ripped through Larspur knocking down multiple trees.

On 10/21/2021, an atmospheric river event with strong winds caused power outages to more than 2,500 people in Larkspur.

On 1/17/2019, winds toppled a massive ginko tree in Larkspur. Nobody was injured.

On 1/14/2013, a redwood tree around 120-foot tall and about 5 feet in diameter at the base fell across West Baltimore Avenue and onto a home near Magnolia Avenue. The tree broke through the roof of the two-story home and pressed down onto the first story, bending walls. The tree also knocked down electrical lines that serve 70 homes in the neighborhood, 30 of

which remained without power by late afternoon. The base of the tree may have been rotted out.

Figure 236: Fallen Tree from 2013 Storm in Larkspur
Source: SF Gate

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Larkspur. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Larkspur as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Larkspur with high tree cover including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.11 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Larkspur would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the City. A tsunami would be expected to reach approximately 10 feet in San Francisco Bay near Larkspur. The wave run-up would generally be confined to the area east of the railroad crossing on Corte

Madera Creek. Tideland areas and filled ground near or below sea level could be inundated. The lowland area of Larkspur along Corte Madera Creek and around the convergence of Corte Madera Creek and Larkspur Creek near Highway 101 lie in a tsunami hazard area. Numerous commercial areas, hundreds of residences, the Redwood High School, the Tamiscal High School, the San Andreas High School, the Central Marin Police Authority, the South Marin Rehabilitation Center and the PG&E Greenbrae substation lie in areas of Larkspur susceptible to a tsunami. Sections of Magnolia Avenue, Sir Francis Drake Boulevard and Highway 101 lie in a tsunami hazard area. Flooding of any of these major throughfares in a tsunami event could cause major transportation challenges in the City.

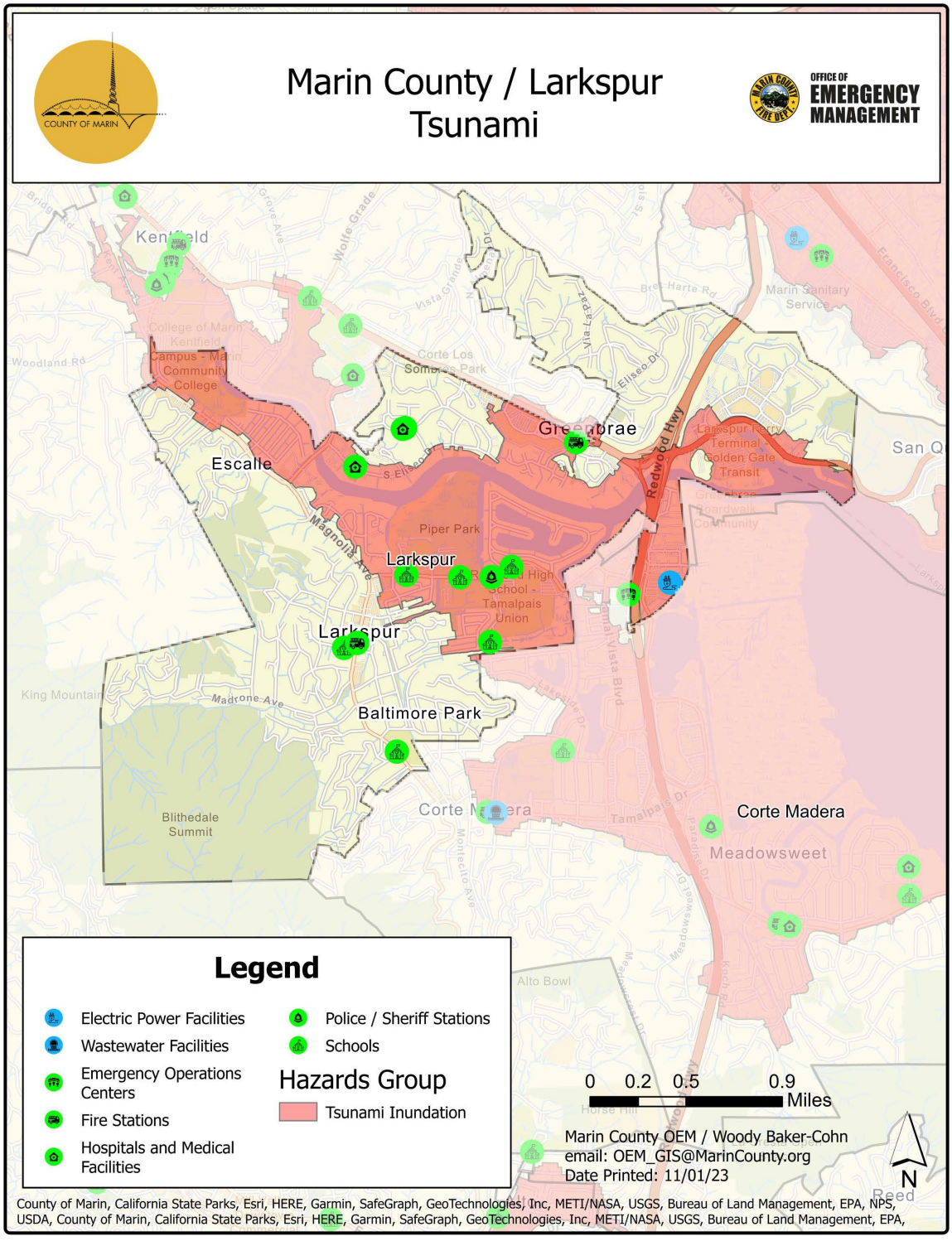


Figure 237: City of Larkspur Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Larkspur has experienced minor tsunamis in the past. Nevertheless, major tsunamis may occur in Larkspur. Flooding from a tsunami may be similar to king tide flooding already experienced by the City with the exception that a tsunami occurs in a shorter time frame and may impact the

City's bayside systems. Roadways and city infrastructure may become inundated with salt water, causing transportation issues and utility disruptions.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Larkspur, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Larkspur. This is particularly true along Corte Madera Creek and its tributaries and around the marshland areas of Larkspur where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Larkspur would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Corte Madera Creek and along the shoreline of Larkspur as a result of high wave heights associated with a more significant tsunami.

2.2.12 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 50 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

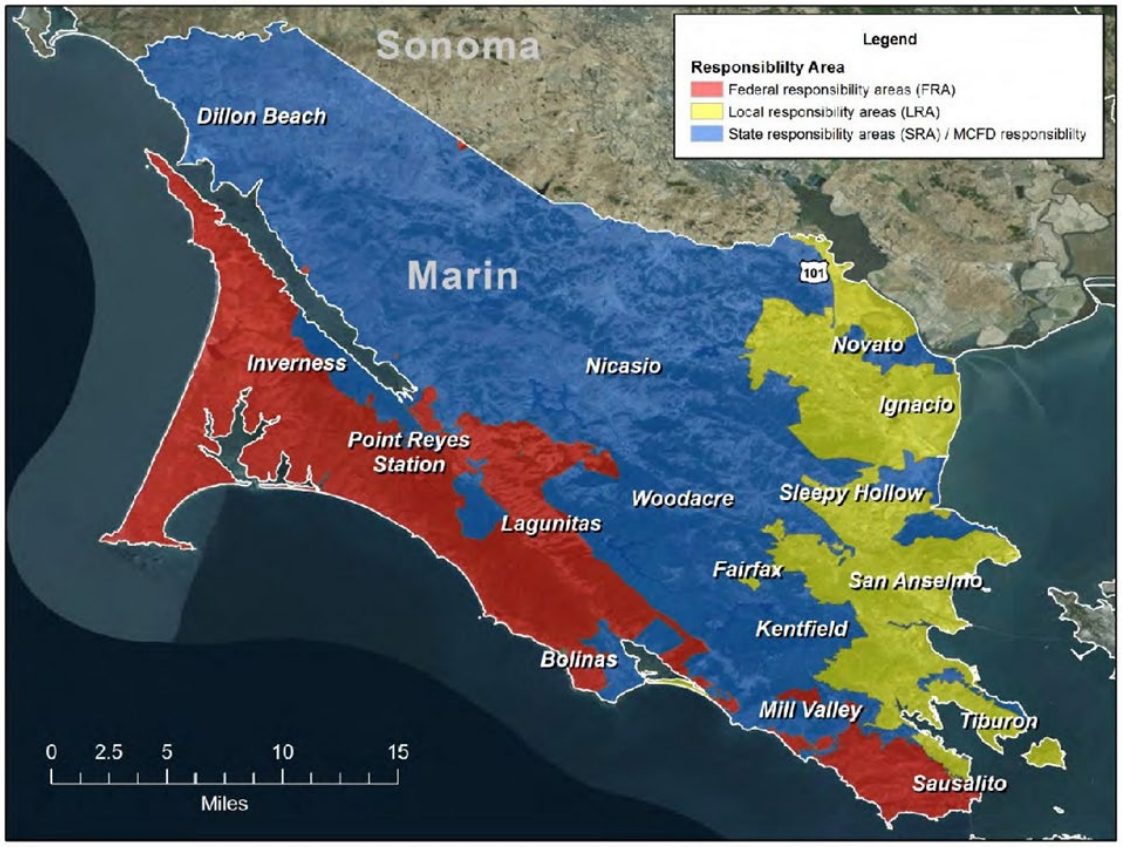


Figure 238: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late

December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to

have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

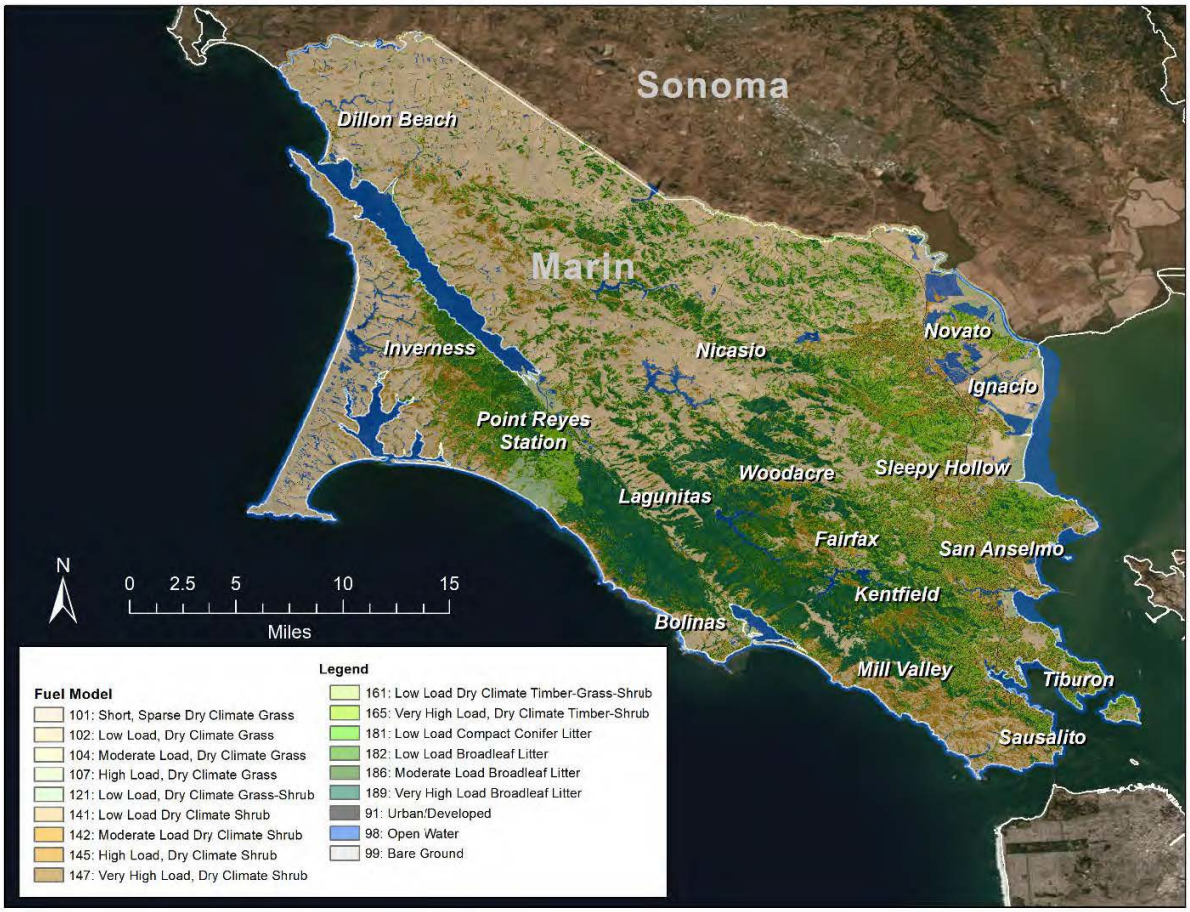


Figure 239: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is a concern since this specific disease can impact vegetation through Marin including the WUI; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular, appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects

receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher, and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

About 50 percent of the land area in Larkspur is at risk from wildland fires. Significant portions of the city are in a designated wildland-urban interface WUI zone bordering the Blithedale Summit Open Space Preserve and the King Mountain Open SpacePreserve. Some of the land is open space, but developed hillsides are also at risk. Like the rest of Marin County, Larkspur's periodically arid climate, combined with extensive areas of grass and brush-covered open space and variable topography, create an ever-present threat of wildland fire. Many homes located in high-risk fire areas were built of combustible building materials or with stilt and pole construction. The latter allows suspended floor areas to trap heat, increasing opportunities to ignite the homes.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin County OA) to help prevent the start of future wildfires. PG&E will, and have, initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass-through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District

at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A PSPS event has occurred in Larkspur and other areas of Marin in years past. While PG&E continues to address safety issues with their systems by installing equipment that can segregate their system in order to continue to provide power to their customers wildfires from overhead electrical systems. While wildfires can start anywhere, the high fuels high winds and high abundance of fuels above the jurisdictional boundary of Larkspur may be the most likely location for a wildfire to occur.

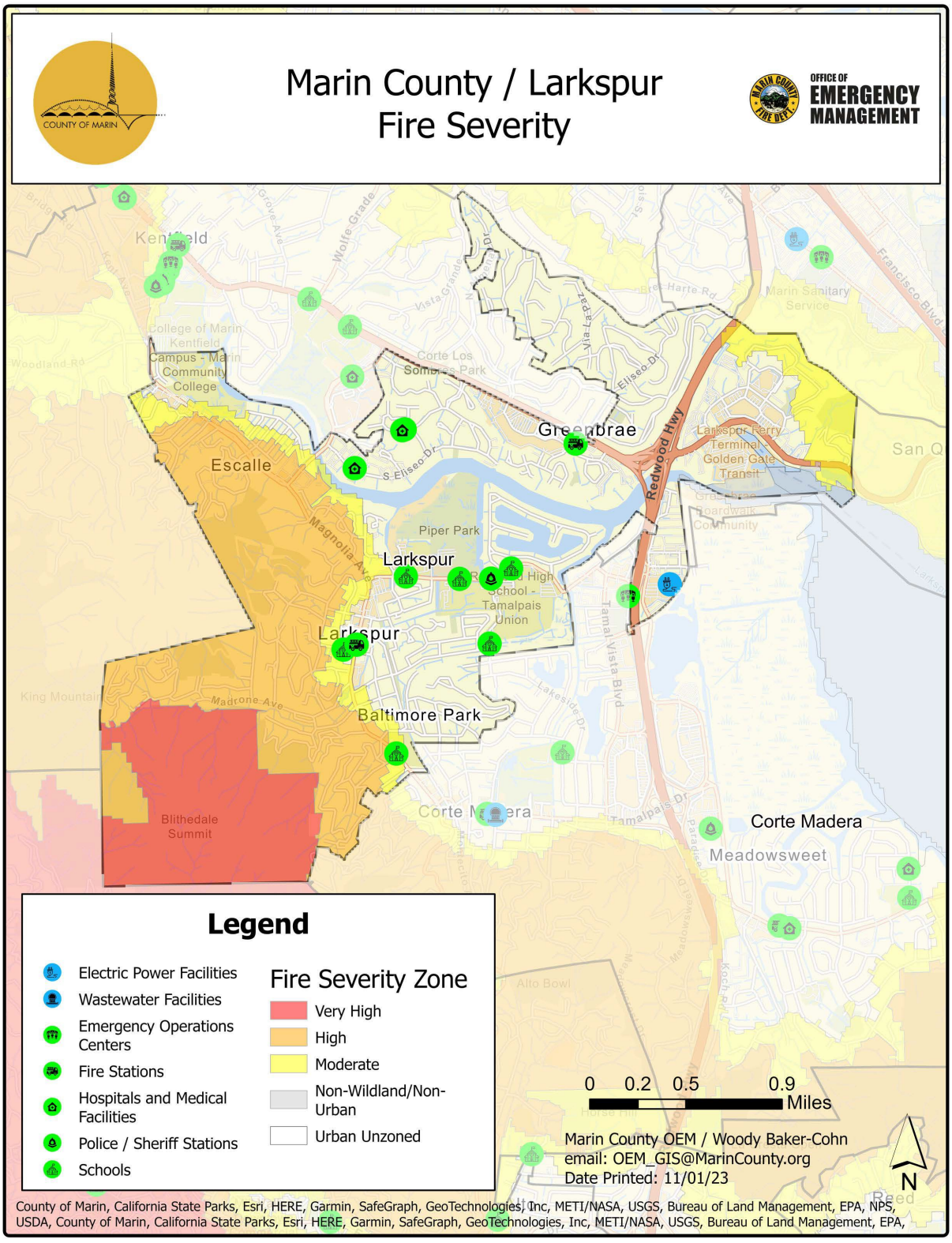


Figure 240: City of Larkspur Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

A handful of homes in Larkspur on the northern edge of the Blithedale Summit Open Space Preserve are the only structures in Larkspur in a Very High FHSZ and are at a higher risk of wildfire. The mountainous areas around the Blithedale Summit Open Space Preserve and the King Mountain Open Space Preserve extending primarily to Magnolia Avenue lie in a High FHSZ. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access. There are no critical facilities in this area. A fringe of moderate FHSZ borders the high FHSZ. There are dozens of homes, numerous businesses and the Marin Primary and Middle School that lie in this area and could be susceptible to wildfire. Most of downtown Larkspur does not lie in a FHSZ but borders a moderate FHSZ. A section of Larkspur north of Sir Francis Drake Boulevard near Larkspur Miwok Park lies in a moderate FHSZ. All of Larkspur could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Larkspur become drier due to climate change, the risk of a wildfire occurring and impacting the city may continue to increase. Brush fires in the city may increase over time as parks, and other open spaces including marshlands experience drier conditions.

On 6/13/2020, an arsonist set six brush fires in Larkspur and Corte Madera that were quickly contained. One fire sparked off Citron Fire Road in Larkspur's Blue Rock neighborhood, burning half an acre and spurring authorities to evacuation 20 nearby homes on Cedar Avenue and Opal Street. A short time later, two more brush fires broke out, on Larkspur Plaza Drive and on Rose Lane. No injuries were reported and no structures were damaged by the fires

Figure 241: 2020 City of Larkspur Arson Fires
Source: Central Marin Fire

In 1909, Larkspur was threated by a raging wildfire emanating from the slopes of Mt. Tamalpais and burning in Madrone Canyon. The cause of the fire was unknown, but the common belief is that it was due to the carelessness of campers.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

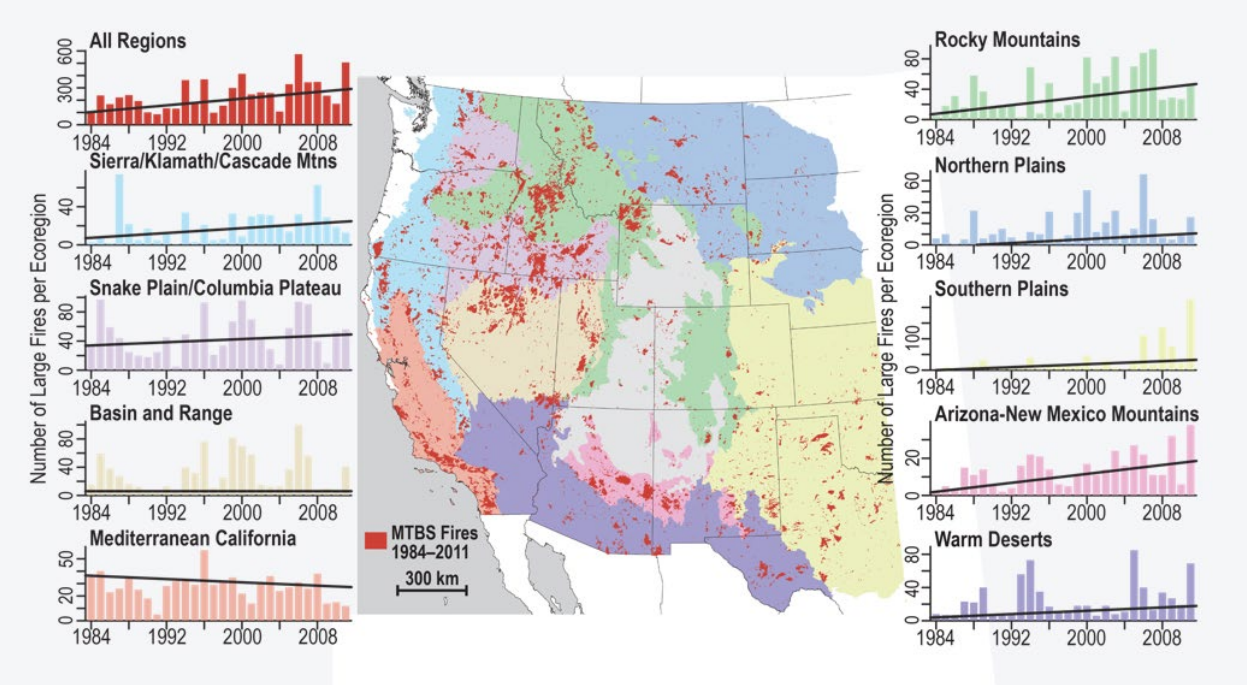


Figure 242: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Larkspur is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Larkspur. Future development in the WUI throughout Larkspur will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Larkspur WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Larkspur marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

Larkspur is a community with a high quality of life, a healthy environment, and a renowned school system. Larkspur neighborhoods grew as a post-war working-class suburb following early development as a summer resort surrounded by steep hills and water. According to the California Department of Finance, the City of Larkspur had 6,469 housing units in 2023. The 2020 housing stock was made up of 40.8 percent detached Single-Family Homes, 6.6 percent attached Single-Family Homes, 7.6 percent Multifamily Housing of Two to Four Units, 40.5 percent Multifamily Housing of Five-Plus Units, and 4.5 percent Mobile Homes. Generally, in Larkspur, the share of the housing stock that is detached single family homes is below that of other jurisdictions in the region.

Larkspur's layout and infrastructure date largely from the late 1800s through the 1960s. It faces formidable infrastructure challenges including, $20-$30 million dollars to repair storm drains, $12-$18 million to repair or rebuild the City Hall, and $12-$14 million to repair and restore its fire station. Climate change has evolved assets such as forests, hills, and shorefront locations into environmental liabilities.

Since 2000, Larkspur's population has increased by approximately 2 percent, which is below the rate for the Bay Area region as a whole, at 14.8 percent. From 1990 to 2000, the population increased by 8.5 percent. During the first decade of the 2000s the population decreased by 0.7 percent. In the most recent decade, the population increased by 2.7 percent.

The Plan Bay Area 2050 Final Blueprint forecasts that the nine-county Bay Area will add 1.4 million new households between 2015 and 2050. For the eight-year time frame covered by the 2023-2031 General Plan Housing Element Update, the Department of Housing and Community Development (HCD) has identified the region's housing need as 441,176 units. On January 12, 2022, the Association of Bay Area Government's adopted allocated 979 housing units to Larkspur, including 291 units for very low-income households, 168 units for low-income households, 145 units for moderate-income households, and 375 units for above moderate-income households. The City of Larkspur is planning for household growth in four general areas of the City to accommodate the City's share of the Regional Housing Need. As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Ross has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 20: City of Larkspur Projected Growth Areas

Area	# of Units	# of Parcels	Project Date	Acres	Fire Severity Zone	Flood Zone
Greenbrae	50	2	2023-2031	1.66	Low	X
Larkspur Landing	576	7	2023-2031	20.93	Low	X
Central and Downtown Larkspur	266	11	2023-2031	8.85	Moderate and low	X and AE
Cost Plus Plaza Area	196	1	2023-2031	5.45	Low	AE
Total	**1,221**	**21**		**36.9**		

Table 114: City of Larkspur Future Growth Areas
Source: City of Larkspur

3.2 CAPABILITY ASSESSMENT

The overall priorities in the City of Larkspur have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 21: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/ Master Plan	Y 1990	Larkspur is in process of finalizing an update to its General Plan, which is scheduled for adoption in 2023. The General Plan outlines the City's long-term strategic goals, policies and programs that affect the City's growth and development such as land use, transportation, streets and sidewalks, utilities & infrastructure, parks, housing and neighborhoods, recreation and community facilities, commercial services and products, the environment, public health and safety, and flooding. Chapter 7, Community Health and Safety, addresses many of the hazards addressed in this plan.
Strategic Plan	N	
Capital Improvements Plan	Y 2023	Every year, City staff develops a Five-Year Capital Improvement Program (CIP) for council consideration, which serves as a multi-year planning tool to coordinate the financing and scheduling of major projects to improve and maintain its infrastructure. The CIP directs construction activities for City owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure.
Economic Development Plan	N	

Local Emergency Operations Plan		These plans inform priority mitigation actions and programs.
Continuity of Operations Plan	Y	
Flood Mitigation Plan (FMP)	Y 1993	The city of Larkspur enforces floodplain management regulations in special flood hazards identified by the Federal Insurance Administration, through the Federal Emergency Management Agency. These regulations address the construction, location, extension, conversion or alteration of structures or land in special flood hazard zones, including both new development and modifications to existing uses and structures. The ordinance regulates and restricts development in flood-prone areas to promote the public health, safety and general welfare, to minimize public and private losses due to flood conditions in specific areas, and to minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public.
Engineering Studies for Streams	Y	The City's 100-year flood mitigation plan with the County of Marin includes mitigation strategies and actions.
Open Space Management Plan	N	
Regional Transportation Plan (RTP)	Y 2021	Plan Bay Area 2050
Stormwater Management Plan/Program	Y 2015	The City enforces regulations for best management practices during development as well as permanent and ongoing erosion control measures to minimize off-site stormwater flow and buildup of sedimentation and other obstacles in drainage ways. The city identifies drainage ways and watercourses as public easements and provides standards for the protection, maintenance, enhancement and restoration of streams and waterways in a manner which preserves the conveyance of stormwater run-off and enhances their ecological integrity and resource functions and value.
Community Wildfire Protection Plan	Y	The City is part of the Marin County Wildfire Protection Plan, which includes mitigation strategies and actions.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y 2022	The City has a Climate Action Plan.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	The City adopted the most recent State of California approved Uniform Building Code, including the Residential Building Code and Wildland-Urban Interface (WUI) standards to safeguard life, health, property, and public welfare by providing enhanced fire resistance for exterior treatments and new roof coverings in high fire hazard zones. The Seismic Safety Code contains

		structural requirements to insure structural integrity during seismic and other hazardous events and prevent personal injury, loss of life and substantial structural damage. The City requires the undergrounding of utilities in the case of new construction and major remodels. The City has also adopted the International Property Maintenance Code to provide for the abatement of unsafe and/or uninhabitable buildings.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Central Marin Fire Department has an ISO rating of 2. It is adequately enforced.
Site plan review requirements		
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Municipal Code includes several sections that address hazard mitigation. The city adopts the current California Building Code which applies to all construction activity within the City boundaries. The California Building Code is comprised of 11parts that incorporate public health, safety, energy, green building and access standards used in the design and construction of all buildings. The new code provisions will allow the City to utilize the latest technologies, advances in construction standards and seismic design for the use in new residential and commercial construction and in remodels.
Zoning ordinance	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision Regulations; Municipal Code Chapter 17	Y	The city's subdivision ordinance establishes standards to regulate the division of land and also establishes standards to restrict the creation of building sites in areas where flooding, lack of adequate access or services, or other conditions may create hazards to life or property. The regulations promote public health, safety and general welfare and minimize public and private losses due to hazardous conditions in specific areas and insure that reasonable caution is taken to preclude loss or damage to life and property.
Slope & Hillside Ordinance; Municipal Code Chapter 18.34	Y	The slope and hillside ordinance reduces densities and impervious construction in steep hillside areas. The ordinance provides a higher standard of review at the planning phase to address potential for hazards and environmental degradation related to slope failure, increased erosion, sedimentation, storm water run-off, fire hazards, loss of vegetation, excessive grading, visual intrusion of structures, and potential for traffic hazards.

		The ordinance serves to protect public health, safety and general welfare and minimize public expense for long-term maintenance of slope areas resulting from over-development in hillside areas.
Floodplain ordinance	Y	The City has adopted FEMA regulations in Chapter 15.18 of the Municipal Code
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Urban Runoff Pollution Prevention Ordinance Chapter 9.11 Grading Permits Chapter 15.20 Weed Abatement Chapter 9.26
Flood insurance rate maps	Y	Yes
Elevation Certificates	Y	Yes
Acquisition of land for open space and public recreation uses	Y	Yes
Erosion or sediment control program	Y	Yes

Table 115: City of Larkspur Legal and Regulatory Capabilities
Source: City of Larkspur

City of Larkspur General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of Larkspur General Plan was adopted in 1990. The City is currently preparing an update of the plan that was prepared over a 13-year period that included an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

City of Larkspur specific goals and policies related to mitigation of natural hazards are as follows:

Table 22: City of Larkspur General Plan	
Goal/Policy/ Program	**Explanation**
Land Use Element	
Goal	LU-14: Protection of persons and property from environmental hazards such as wildland fires and flooding due to sea level rise
Policy	Policy LU-14.1: Limit the exposure of existing and proposed development to environmental hazards.
Program	Action Program LU-14.1.a: Maintain updated Seismic Hazards, Slope Stability, Fire Hazard, Noise Exposure, and Floodplain maps. Consult hazard maps to determine whether a proposed project is located in a high-risk area. Action Program LU-14.1.b: Provide environmental hazard information to property owners at City Hall and on the City's website. Action Program LU-14.1.c: Provide information for property owners at City Hall and on the City's website regarding best practices for reducing risk of exposure to environmental

Table 22: City of Larkspur General Plan	
Goal/Policy/ Program	**Explanation**
	hazards. Action Program LU-14.1.d: During project review, require use of building materials that reduce exposure to environmental hazards (e.g., fire-resistant roofing material). Action Program LU-14.1.e: Continue to review projects for compliance with seismic safety building standards established in the International Building Code, or any subsequent code adopted by the City.
Conservation and Open Space Element	
Goal	Goal ENV-4: Sufficient open space to meet the health and safety needs of Larkspur residents
Policy	Policy ENV-4.1: Avoid developing open space that contains hazards, including earthquake fault zones, unstable slopes or soils, flood plains, sea level rise, and areas required for the protection and enhancement of air quality.
Program	Action Program ENV-4.1.a: Implement the policies and action programs addressing environmental hazards listed under Goals SAF-3 (natural hazards), SAF-4 (flood hazards), SAF-5 (seismic and geologic hazards), and SAF-6 (fire hazards).
Public Safety	
Goal	PREPAREDNESS SAF-1: A community fully informed about natural hazards and the methods to avoid or mitigate the effects of these hazards SAF-2: Planned, coordinated response to all disasters SAF-3: No new development in areas prone to natural hazards without adequate mitigation FLOOD HAZARDS SAF-4: Protection of life and property of Larkspur residents from the risk of flood damage SEISMIC AND GEOLOGIC HAZARDS SAF-5: Reduced risks of personal injury and property damage associated with seismic activity and geologic hazards FIRE HAZARDS SAF-6: Protection of Larkspur residents and property from fire hazards SAF-7: Adequate suppression response to wildfires and structural fires HAZARDOUS MATERIALS SAF-8: Protection from exposure to hazardous materials
Policy	Numerous policies
Program	Numerous programs
Public Facilities Element	
Goal	FAC-6: Public buildings that meet current and future demands for safety and public use
Policy	Policy FAC-6.1: Renovate public buildings to conform to seismic safety requirements, space needs, and use of new technology, while respecting the historic value and integrity of existing historic structures.
Program	Action Program FAC-6.1.a: Rehabilitate City Hall and Fire Station #15 to comply with seismic safety standards and capacity improvement needs. Action Program FAC-6.1.b: Explore the decommissioning and re-use of Fire Station #15 pursuant to consolidation of the Larkspur and Corte Madera Fire Departments and regionalization of fire services in the Ross Valley.

Table 116: City of Larkspur General Plan
Source: City of Larkspur General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the city personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 23: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Planning Commission	Y	Planning Commission reviews most new structures and major improvements to existing structures.
Hazard Mitigation Planning Committee	Y	The City participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee that meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Central Marin Fire Department fire hazard reduction program
Mutual aid agreements	Y	
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	N	
Grant writing	N	
Hazus analysis	N	
Staff/Personnel Resources	Yes/No Full Time/ Part Time	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	Yes
Floodplain Administrator	Y/FT	Yes
Emergency Manager	N	
Community Planner	N	
Civil Engineer	N	

GIS Coordinator	N	
Community Development Staff	Y/FT	Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan.
City Planning, Building, and	Y/FT	• Conducts comprehensive planning activities, including preparation of the General Plan. • Develops and enforces zoning regulations. • Prepares CEQA documents. • Verifies compliance with Uniform Building Code through checking plans, issuing permits, and inspections. • Oversee flood plain management program, including flood elevation determinations and flood-proof construction. • Coordinates development review with public works, fire, polices, and outside agencies. • Conducts site inspections to enforce permit and code compliance. Leads damage assessments and documentation during emergency.
Public Works Staff	Y/FT	Public Works Department is responsible for City-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department
Police Department Staff	Y/FT	The Central Marin Police Authority conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Department Staff	Y/FT	Larkspur Fire Department protects the city and portions of unincorporated Greenbrae from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire. Larkspur also has a volunteer fire department and manages its vegetation management program

Table 117: City of Larkspur Administrative and Technical Capabilities
Source: **City of Larkspur**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 24: City of Larkspur Fiscal Capabilities		
Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	There is no standalone 'Capital Improvement Project' funding – the City receives grants and other funding as listed below and allocates these funds to the CIP for large projects
Authority to levy taxes for specific purposes	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	N	The city does not own or manage these utilities
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	N	The City has a minimal runoff fee that is used for cleanwater activities only. The City does not have a storm water utility fee. The ability to charge a storm water utility fee is relatively new. The City anticipates that if other jurisdictions are successful in establishing and defending the legality of such fees then the CIty may consider in the future.
Incur debt through general obligation bonds and/or special tax bonds	Y	Bond funding has been used in the past but not for mitigation projects. This could possibly be explored to fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	The City has received federal funding in the past but not for mitigation. This could possibly be a funding source for future mitigation activities.
State funding programs	Y	The City has received state funding in the past but not for mitigation. This could possibly be a funding source for future mitigation activities.

Table 118: City of Larkspur Fiscal Capabilities
Source: **City of Larkspur**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of Larkspur and the City of Larkspur partnerships utilized to promote those programs.

Table 25: City of Larkspur Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Yes
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	Yes
Natural disaster or safety related school programs	Yes	Yes
StormReady certification	No	
Firewise Communities certification	No	
Community Rating System	No	
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 119: City of Larkspur Community Outreach
Source: **City of Larkspur**

3.2.5 Participation in the National Flood Insurance Program

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Detailed below is a description of Larkspur's flood management program to ensure continued compliance with the NFIP.

Larkspur has participated in the Regular Phase of the NFIP since 1974. Since then, the City has administered floodplain management regulations that meet or exceed the minimum requirements of the NFIP. The Community Rating System (CRS) is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. Larkspur is not currently a CRS participant.

Table 26: City of Larkspur NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	462 Total Coverage $127,418,000 Total Written Premium + Federal Policy Fee $434,694
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	127 claims for $1,620,025.03. No claims were for substantial damage.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	534
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	No
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	The City reviews all development within the floodplain, has GIS maps, provides information to the public
What are the barriers to running an effective NFIP program in the community, if any?	None
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	02/24/2010

Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	1974
Are the FIRMs digital or paper?	Paper and digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Exceed by requiring one foot of freeboard
Provide an explanation of the permitting process.	Floodplain permits are reviewed by the building department. City requests appraisals or elevation certificates prior to issuing permits, as required.
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
What categories and activities provide CRS points and how can the class be improved?	N/A
Does the plan include CRS planning requirements	N/A

Table 120: City of Larkspur NFIP Status
Source: FEMA, City of Larkspur

NFIP Insurance Coverage Details

The City of Larkspur joined the NFIP on June 14, 1974. NFIP insurance data provided by a National Flood Insurance Program Insurance Specialist indicates that as of October 2, 2023, there were 462 policies in force in the City of Larkspur with $434,694 in premiums, resulting in $127,418,000 of insurance in force. There have been 127 closed paid losses totaling $1,620,025. Nine of the claims were considered substantial damage losses. Of these losses, 31 sites area in A01-30 and AE Zones, 15 were in A Zones, and 24 were in B, C and X Zones. Of the 70 Closed Paid Loss sites, 66 were associated with pre-FIRM structures and 7 with post-FIRM structures. There were 20 repetitive loss structures in the City. 17 were in A zones, and 3 were in B, C, or X zones. These repetitive loss structures account for $550,125 of the total losses in the City of Larkspur. There were no severe repetitive loss properties in the City.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 20
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0
- Repetitive Loss (RL) Residential Structures: 20
- Repetitive Loss (RL) Non-Residential Structures: 0
- Severe Repetitive Loss (SRL) Residential Structures: 0
- Severe Repetitive Loss (SRL) Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 27 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 27: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
City Hall Seismic Upgrade EQ-1				X	X
Fire Station Seismic Upgrade Eq2, WF-1				X	X
Fire Station Expansion EQ-3, WF-2				X	X
Upgrade Storm Drain System FL-1, SW-1		X		X	X
Trash Pumps FL-5, FL-6, FL-7		X		X	X
Flood Mitigation Plan FL-9				X	X
High Fire Zone Assessment Program WF-2		X		X	X

Table 121: Status of Previous Hazard Mitigation Actions
Source: City of Larkspur

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 Hazard Mitigation Actions

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the City of Larkspur based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

A cost benefit review process will be completed for each project that will be submitted during a given fiscal year. The general priorities of the cost benefit risk analysis will focus on projects that are lifesaving, life safety, property protection and lastly environmental protection. A ratio of at least one dollar of benefit for each dollar invested will be considered the minimum cost benefit ratio for any projects submitted within the City of Larkspur.

The City of Larkspur maintains project worksheets with detailed descriptions of each project. A summary of each project is found in the table below.

Table 28 lists the Current Hazard Mitigation Actions for the City of Larkspur.

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Table 28: City of Larkspur Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
L-1	Marin Emergency Radio Authority (MERA) Upgrades. MU-13 Protect Infrastructure and Critical Facilities	All Hazards/ 1, 2, 3, 4, 5	Marin County and City of Larkspur.	Existing (2018)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	Ongoing - 1-2 years/ High	
L-2	Update public safety components of the General Plan. MU-4 Adopt Development Regulations in Hazard Areas	All Hazards/ 1, 2, 4, 5	City of Larkspur, Community Development	Existing (2018)	Cost: General Funds	1 – 3 years/ High	An updated General Plan is under consideration for adoption.
L-3	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies.	All Hazards, Dam Failure 1, 2, 3, 4, 5,	City of Larkspur Marin County	New (2023)	Cost: General Funds	Ongoing/ Low	Continue to encourage residents to participate in Alert Marin with an emphasis on properties at risk from all hazards.
L-4	Regularly review and update the City's Emergency Management Plan	All Hazards/ 3, 4, 5	City of Larkspur, Marin County, Fire Districts	New (2023)	Cost TBD: General Funds, HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Action Program SAF-2.1.a: Regularly review and update, as necessary, the City's Emergency Management Plan to coordinate with emergency plans of other governmental agencies and respond to changing conditions. Incorporate the likelihood of sea level rise and extreme heat and storm events.
L-5	Enhance and promote community and individual emergency preparedness.	All Hazards/ 3, 4, 5	City of Larkspur, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Action Program SAF-1.1.a: Implement, promote, and support the expansion of the Community Emergency Response, Training (CERT), the GET Ready, and the Neighborhood Response Group (NRG) programs (and any successor programs), for City staff, residents, businesses, schools, and neighborhood groups that

Table 28: City of Larkspur Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
							address emergency response protocols and procedures, disaster risk education, and self–sufficiency.
L-6	Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species and replacing them with native, safer vegetation. WF-9 Implement a Fuels Management Program, ET-1 Reduce Urban Heat.	Wildfire, Debris Flow, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	City of Larkspur, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Reduces the chance of a wildland fire igniting a structure(s). Supports environmental restoration by using native plants resistant to fire, debris flow, drought, and wind.
L-7	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	City of Larkspur,, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	
L-8	City Hall Seismic Upgrade EQ-1	Earthquake/ 1, 2, 4, 5	City of Larkspur,	Existing (2018)	Cost TBD: HMGP, BRIC, General Fund	Ongoing - 1-2 years/ High	
L-9	Fire Station Seismic Upgrade Eq2, WF-1	Earthquake/ 1, 2, 4, 5	City of Larkspur,	Existing (2018)	Cost TBD: HMGP, BRIC, General Fund	Ongoing - 1-2 years/ High	
L-10	Fire Station Expansion EQ-3, WF-2	Earthquake/ 1, 2, 4, 5	City of Larkspur,	Existing (2018)	Cost TBD: HMGP, BRIC, General Fund	Ongoing - 1-2 years/ High	
L-11	Upgrade Storm Drain System FL-1, SW-1	Flooding, Tsunami, Sea Level Rise, Levee, Dam Failure 1,2,4, 5, 6	City of Larkspur,	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA, FMA, General Fund	Ongoing - 1-2 years/ High	
L-12	Flood Mitigation Plan FL-9	Flooding, Tsunami,	City of Larkspur,	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA,	Ongoing	

Table 28: City of Larkspur Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
		Sea Level Rise, Levee, Dam Failure 1,2,4, 5, 6			FMA, General Fund	Ongoing - 1-2 years/ High	
L-13	High Fire Zone Assessment Program WF-2	Wildfire/ 1, 2, 4, 5	City of Larkspur, Marin County, Central Marin Fire District	Existing (2018)	Cost TBD: HMGP, BRIC, Fire Safe Marin, General Fund	Ongoing - 1-2 years/ High	
L-14	Assess Vulnerability to Landslides and Land Subsidence	Debris Flow, Land Subsidence/ 1, 2, 4, 5	City of Larkspur	Existing	Cost: TBD General Funds	Ongoing - 1-5 years/ Low	Review landslides and Land subsidence to date and geological data to determine areas at risk of future landslides or land subsidence.

Table 122: City of Larkspur Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the City of Larkspur. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 27 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the City of Larkspur identified and prioritized the mitigation actions as detailed in Table 28, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the City of Larkspur will maintain this plan and will serve as a lead staff for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into city plans and mechanisms. Where possible the City of Larkspur will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of Larkspur already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the City. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

City Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the City.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

10. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
11. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
12. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

The overall aim is to preserve and enhance Larkspur's unique physical and natural setting, and its largely residential character, while accommodating suitable new development. This includes protecting Larkspur's hillsides and creeks, and the vegetation, views, and general peacefulness associated with these natural characteristics. This City also seeks to enhance the attractiveness and viability of existing commercial areas, while encouraging neighborhood serving businesses and protecting the integrity of the existing commercial areas, particularly the historic Downtown. It also includes the protection of existing and future development from natural hazards, such as wildfires, landslides, and sea level rise and associated flooding.

One of the community's most valued features in Larkspur is its beautiful natural setting, which includes creek and marsh habitats, protected open space areas, and vistas of Mount Tamalpais. Future development should not impact Larkspur's sensitive environmental resources. Conversely, the City recognizes the safety risks posed by environmental hazards, such as flooding, earthquakes, and sea level rise, which may affect existing and proposed residential and commercial development in the next twenty years. The City aims to avoid or minimize impacts of development on the environment, as well as impacts of the environment on development to the greatest extent possible. The Land Use goals, policies, and programs seek to address these issues, as well as any unforeseen impacts on the physical development of the City over the next twenty years.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of Larkspur.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of Larkspur Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of Larkspur plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of Larkspur is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of Larkspur Public Works Director will monitor and update the City of Larkspur Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of Larkspur, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of Larkspur, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of Larkspur Public Works Director will monitor and update the City of Larkspur Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of Larkspur and the Marin County Office of Emergency Management will hold quarterly update meetings with the

Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 5-18
Figure 2: Marin County OA MJHMP Public Town Hall Meeting 5-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 5-20
Figure 4: Hazard Mitigation Plan Survey 5-21
Figure 5: Map of City of Larkspur in Marin County 5-24
Figure 6: Map of the City of Larkspur 5-25
Figure 7: The City of Larkspur Precipitation and Monthly Temperatures 5-27
Figure 8: Races in Larkspur 5-28
Figure 9: City of Larkspur Land Use Map 5-30
Figure 10: City of Larkspur Social Vulnerability Map Census Tract 1200.02 5-32
Figure 11: City of Larkspur Social Vulnerability Map Census Tract 1200.01 5-33
Figure 12: City of Larkspur Social Vulnerability Map Census Tract 1192.01 5-34
Figure 13: City of Larkspur Critical Facilities & Infrastructure 5-39
Figure 14: City of Larkspur Risk Assessment – Planning Team Top Hazards 5-41
Figure 15: Hazard Risk Categorization 5-41
Figure 16: NASA Global Temperature Change CO2 Gas 5-45
Figure 17: NASA Global Temperature Change 1884 to 2022 5-45
Figure 18: NASA Global Temperature Change Sea Level 5-46
Figure 19: Satellite Sea Level Observations 5-48
Figure 20: City of Larkspur Dam Inundation Critical Facilities and Infrastructure 5-54
Figure 21: Phoenix Lake Dam Inundation Area – Larkspur West 5-55
Figure 22: Phoenix Lake Dam Inundation Area – Larkspur Central 5-55
Figure 23: Phoenix Lake Dam Inundation Area – Larkspur East 5-56
Figure 24: Landslide Susceptibility Classes 5-58
Figure 25: Mud Flow Areas 5-59
Figure 26: City of Larkspur Debris Flow Critical Facilities and Infrastructure 5-61
Figure 27: Modified Mercalli Intensity Scale 5-65
Figure 28: Mercalli Scale vs. Magnitude 5-65
Figure 29: Soil Types 5-66
Figure 30: Marin County OA Earthquake Impact and Fault Lines 5-67
Figure 31: City of Larkspur Earthquake Critical Facilities and Infrastructure 5-68
Figure 32: Diagram of an Atmospheric River Event 5-72
Figure 33: City of Larkspur Flooding Critical Facilities and Infrastructure 5-74
Figure 34: 2017 Larkspur Flooding at the BonAir Shopping Center 5-77
Figure 35: 1973 Flooding on Highway 101 in Larkspur 5-78
Figure 36: Dissolution Sinkhole Formation 5-79
Figure 37: Cover-Subsidence Sinkhole Formation 5-80
Figure 38: Cover-Collapse Sinkhole Formation 5-80
Figure 39: Levee Failure Mechanisms 5-82
Figure 40: City of Larkspur Levee failure Critical Facilities and Infrastructure 5-83
Figure 41: City of Larkspur Sea Level Rise Impact 5-87
Figure 42: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 5-88
Figure 43: Heat Index 5-89

Figure 44: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 5-90
Figure 45: Beaufort Wind Scale 5-91
Figure 46: Enhanced Fujita Scale 5-92
Figure 47: Waterspout Formation 5-93
Figure 48: Fallen Tree from 2013 Storm in Larkspur 5-94
Figure 49: City of Larkspur Tsunami Critical Facilities and Infrastructure 5-96
Figure 50: Federal, State and Local Responsibility Areas in the Marin County OA 5-99
Figure 51: Fuel Model Map for the Marin County OA 5-103
Figure 52: City of Larkspur Wildfire Critical Facilities and Infrastructure 5-106
Figure 53: 2020 City of Larkspur Arson Fires 5-107
Figure 54: Trends in the Annual Number of Large Wildfires in the United States 5-108

List of Tables

Table 1: City of Larkspur Local Hazard Mitigation Planning Team Members 5-8
Table 2: 2023 MJHMP Local Planning Team Members 5-12
Table 3: City of Larkspur & Marin County OA MJHMP Planning Meetings 5-16
Table 4: City of Larkspur Estimated Jurisdictional Population 5-27
Table 5: Population Change of The City of Larkspur 5-28
Table 6: Languages Spoken in Larkspur 5-28
Table 7: Marin County OA Jurisdictional Housing Stock 5-29
Table 8: NRI Hazards and Marin County OA MJHMP Hazards 5-31
Table 9: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.02 5-32
Table 10: NRI Hazard Type Risk Index for Larkspur Census Tract 1200.01 5-33
Table 11: NRI Hazard Type Risk Index for Larkspur Census Tract 1192.01 5-34
Table 12: Household Income for The City of Larkspur as of 2019 5-36
Table 13 City of Larkspur Civilian Employed Population 16 years+ by Industry 5-36
Table 14: City of Larkspur Critical Facilities 5-38
Table 15: Historic Sites In The City of Larkspur Listed on a State or Federal Registry 5-40
Table 16: Select Hazards Magnitude/ Severity Scale or Index 5-42
Table 17: City of Larkspur Hazard Risk Assessment 5-50
Table 18: County of Marin Hazard Risk Assessment 5-51
Table 19: City of Larkspur Critical Facilities in the Flood Zones 5-76
Table 20: City of Larkspur Future Growth Areas 5-109
Table 21: City of Larkspur Legal and Regulatory Capabilities 5-113
Table 22: City of Larkspur General Plan 5-114
Table 23: City of Larkspur Administrative and Technical Capabilities 5-116
Table 24: City of Larkspur Fiscal Capabilities 5-117
Table 25: City of Larkspur Community Outreach 5-118
Table 26: City of Larkspur NFIP Status 5-120
Table 27: Status of Previous Hazard Mitigation Actions 5-123
Table 28: City of Larkspur Current Hazard Mitigation Actions 5-127

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

6. Las Gallinas Valley Sanitary District Profile

Las Gallinas VALLEY SANITARY DISTRICT

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Las Gallinas Valley Sanitary District and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities and district of the Las Gallinas Valley Sanitary District more disaster resistant and sustainable.

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TABLE OF CONTENTS

LAS GALLINAS VALLEY SANITARY DISTRICT PROFILE 6-1
Acknowledgements 6-3
Table of Contents 6-5
Section 1.0: Introduction 6-7
1.1 Introduction 6-7
1.2 Planning Process 6-7
1.2.1 Steering Committee Members (District Representatives) 6-8
1.2.2 Steering Committee Planning Process 6-8
1.2.3 Coordination with Stakeholders and Agencies 6-9
1.2.4 Public Engagement 6-16
1.3 Overview and History 6-23
1.4 Service Area 6-24
1.5 Administration 6-26
1.6 Financing 6-27
1.7 Weather and Climate 6-27
1.8 Social Vulnerability and Risk 6-28
1.9 Critical Facilities 6-38
Section 2.0: Hazard Identification and Risk Assessment 6-42
2.1 Climate Change 6-44
2.2 Hazards 6-51
2.2.1 Debris Flows 6-52
2.2.2 Drought 6-57
2.2.3 Earthquake 6-59
2.2.4 Flooding 6-65
2.2.5 Land Subsidence 6-71
2.2.6 Levee Failure 6-74
2.2.7 Sea Level Rise 6-80
2.2.8 Severe Weather – Extreme Heat 6-85
2.2.9 Severe Weather – High Wind & Tornado 6-87
2.2.10 Tsunami 6-90
2.2.11 Wildfire 6-93
Section 3.0: Mitigation Strategy 6-104
3.1 Changes in Development 6-104

3.2 Capability Assessment 6-104
3.2.1 Regulatory Capabilities 6-104
3.2.2 Administrative and Technical Capabilities 6-107
3.2.3 Fiscal Capabilities 6-108
3.2.4 Community Outreach 6-109
3.2.5 Participation in the National Flood Insurance Program 6-110
3.3 Mitigation Goals 6-111
3.4 Status of Previous Mitigation Actions 6-113
3.5 Hazard Mitigation Actions 6-113
3.6 Progress in Local Mitigation Efforts 6-117
3.7 Plan Integration 6-117
3.8 Future Development Trends 6-118
Section 4.0: Plan Review, Evaluation, and Implementation 6-119
4.1 Plan Adoption 6-119
4.2 Plan Monitoring 6-119
4.3 Plan Evaluation 6-120
4.4 Plan Update 6-120
Figures and Tables 6-122
Acronyms/Abbreviations 6-124

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Las Gallinas Valley Sanitary District Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Las Gallinas Valley Sanitary District.

1.2 PLANNING PROCESS

The majority of Marin County is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the Las Gallinas Valley Sanitary District involved additional internal planning team members to support the broader planning process. The Las Gallinas Valley Sanitary District jurisdictional representatives for the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (District Representatives)

Primary Point of Contact	Alternate Point of Contact
Dale McDonald, Administrative Services Mgr.	Greg Pease, Safety Manager
Telephone: 415-526-1519	Telephone: 415-526-1513
E-mail Address: dmcdonald@lgvsd.org	E-mail Address: gpease@lgvsd.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1.

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the Las Gallinas Valley Sanitary District. All participating jurisdictions and districts are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

Beginning in late 2022, members of the Steering Committee agreed to a monthly meeting schedule to identify hazard priorities and review local hazard mitigation strategy recommendations. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and LGVSD Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the LGVSD communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and LGVSD Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the LGVSD and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 1.

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Daisy Allen	Senior Planner
35	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
36	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
37	North Marin Water District	Eric Miller	Asst. General Manager
38	North Marin Water District	Tim Fuette	Senior Engineer
39	Novato	David Dammuller	Engineering Services Mgr.
40	Novato	Dave Jeffries	Consultant/JPSC
41	Ross	Richard Simonitch	Public Works Director
42	San Anselmo	Sean Condry	Public Works & Building Director

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
43	San Anselmo	Erica Freeman	Building Official
44	San Anselmo	Scott Schneider	Asst. PW Director
45	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
46	San Rafael	Cory Bytof	Sustainability
47	San Rafael	Joanna Kwok	Senior Civil Engineer
48	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
49	Sausalito	Andrew Davidson	Senior Engineer/ DPW
50	Sausalito	Kevin McGowan	Director of Public Works
51	Sausalito	Brandon Phipps	Planning Director
52	Tiburon	Sam Bonifacio	Assistant Planner
53	Tiburon	Dina Tasini	Director of Community Development
54	Tiburon	Laurie Nilsen	Emergency Services Coord.
Special Districts & Partner Agencies			
55	Bolinas Fire Protection District	Stephen Marcotte	Assistant Fire Chief
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director

Table 1: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	California Department of Public Health	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 123: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Las Gallinas Valley Sanitary District's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 2: Las Gallinas Valley Sanitary District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment

Table 2: Las Gallinas Valley Sanitary District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee	• HMGP (DR-4683) Funding Timeline • Public Outreach Status

Table 2: Las Gallinas Valley Sanitary District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Hazard Ranking Meeting	• Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 124: Las Gallinas Valley Sanitary District & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 243: Marin County OEM MJHMP and LGVSD Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 244: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

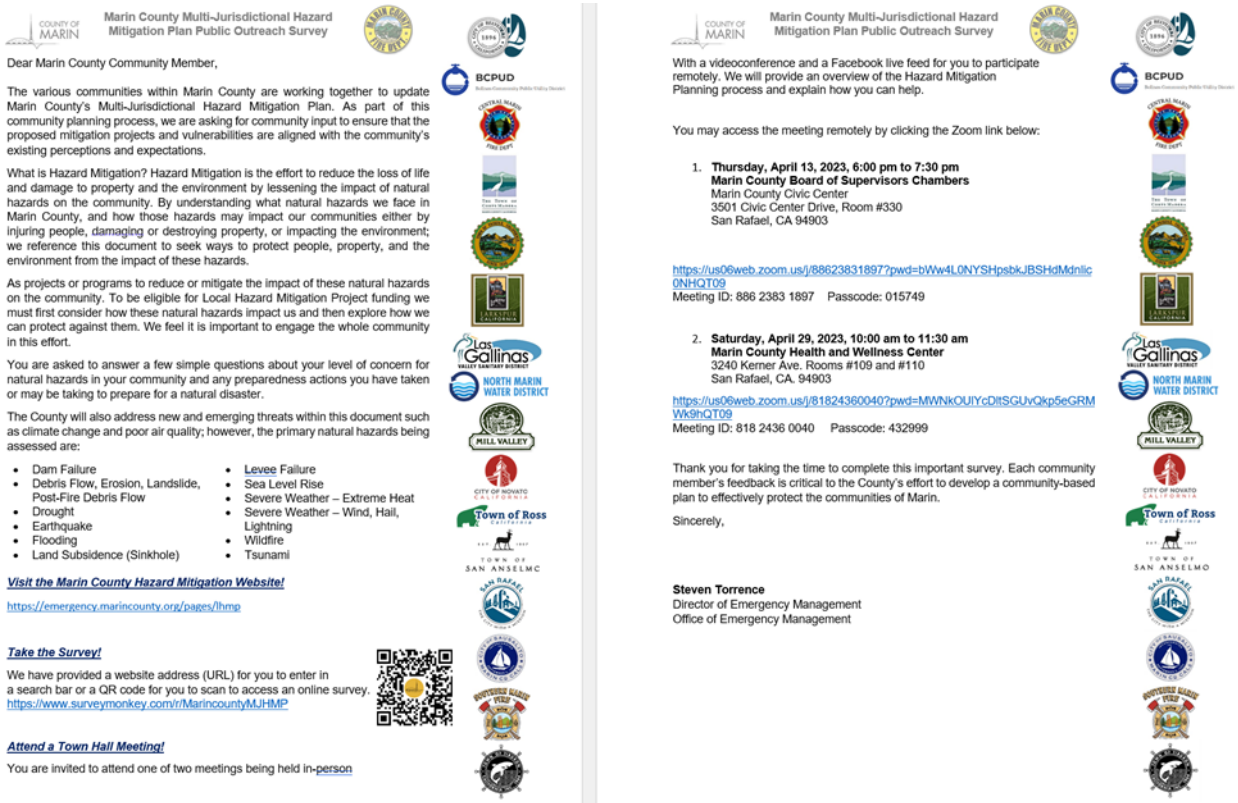
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 245: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 246: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach

through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The LGVSD had an additional 14-day comment period for the LGVSD Community Profile where their profile was posted on the District website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The LGVSD distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

LGVSD was formed on April 6, 1954, pursuant to the Sanitary District Act of 1923. The original wastewater treatment plant was constructed in 1955 to address health problems from failing septic tanks in Santa Venetia. New development in north San Rafael resulted in annexation of Terra Linda in 1956, followed by other areas including San Rafael Meadows, Marinwood, Lucas Valley, and other communities.

LGVSD is organized as a limited-purpose agency with municipal operations restricted to wastewater, recycled water, and solid-waste collection. Wastewater services are provided through LGVSD's 112-mile collection system that conveys wastewater to the District's own treatment facility before discharge into Miller Creek or used for beneficial purposes through a recycled water program. LGVSD's bio-solids are stored temporarily in lagoons and later disposed of at LGVSD's dedicated land disposal site, a process known as surface disposal.

LGVSD manages the refuse hauling service for the unincorporated areas in its District. The franchise has been awarded to Marin Sanitary Service which provides curbside recycling, solid waste, yard waste and food scraps hauling, and safe hazardous waste disposal services that are helping achieve Marin County's goal of zero waste.

1.4 SERVICE AREA

LGVSD is located in the Las Gallinas Valley between Novato and San Rafael, in Marin County, California and encompasses an approximate 9.4 square mile jurisdictional boundary within east-central Marin County. The District's wastewater treatment and recycling facilities are located on over 400 acres on San Pablo Bay. It is located approximately two miles northeast of the City of San Rafael and 20 miles north of San Francisco. The District currently serves over 32,000 people.

There are three local land use authorities that overlap LGVSD's jurisdictional boundary. The County of Marin is the single largest land use authority in terms of acreage with an estimated 63% of all LGVSD's lands lying within the unincorporated area and marked by the unincorporated communities of Marinwood and Santa Venetia. Another 36% of the jurisdictional boundary falls under the land use jurisdiction of the City of San Rafael and generally encompasses the Terra Linda area. The remainder of the jurisdictional boundary – 1% of the total – extends into the City of Novato and is specific to the Marin Valley Mobile Home Park and an adjacent open-space property. LGVSD lies within two adjacent watersheds, Miller Creek and Gallinas Creek. The District is primarily residential and built out, resulting in a stable customer base. Customers class was 81% residential and 19% commercial in 2022.

Today, LGVSD serves 32,000 customers in the northern San Rafael area and manages approximately 105 miles of collection lines. Boundaries of the facility span approximately 383 acres. In addition to the treatment plant, other aspects of LGVSD include solar generation, a garbage franchise encompassing all areas within the District excluding the City of San Rafael customers, and a multi-faceted reclamation project which includes a freshwater marsh, irrigated pastures, storage ponds and saltwater marsh – all of which are home to area wildlife, and provide access and recreation for the public.

Given the unique low-lying creek and bayside location of the District's service area, strict attention is given to the treatment process and green practices are an ongoing goal of LGVSD. During the summer non-discharge season (no discharge to San Pablo Bay via Miller Creek between May and October), approximately 2/3's of the District's treated water (effluent) is recycled by Marin Municipal Water District (MMWD) and North Marin Water District (NMWD). The LGVSD/MMWD/NMWD recycled water is utilized within the LGVSD boundaries. The remainder of treated effluent is utilized at LGVSD's irrigation pastures.

The LGVSD Secondary Treatment Plant Upgrade and Recycled Water Expansion Project increased capacity in order to better serve the present and future residents. LGVSD provides plant tours, site educational field trips and community outreach activities to raise awareness for pollution prevention, water quality and conservation.

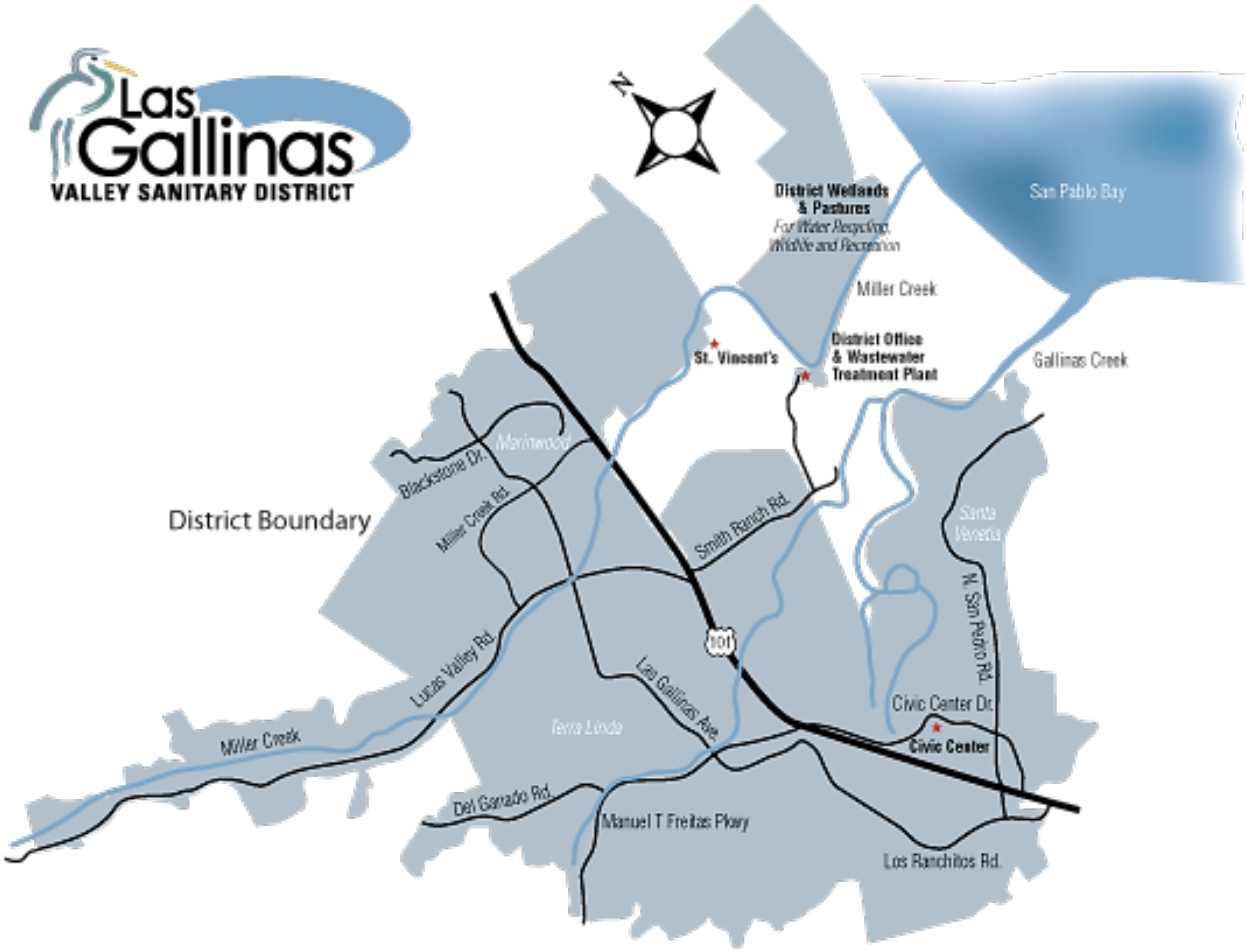


Figure 247: Map of the Las Gallinas Valley Sanitary District
Source: Marin County OEM

Figure 6 illustrates the Las Gallinas Sanitary District service area in purple and the jurisdictional boundaries of the Cities of Novato and San Rafael in the black dashed lines.

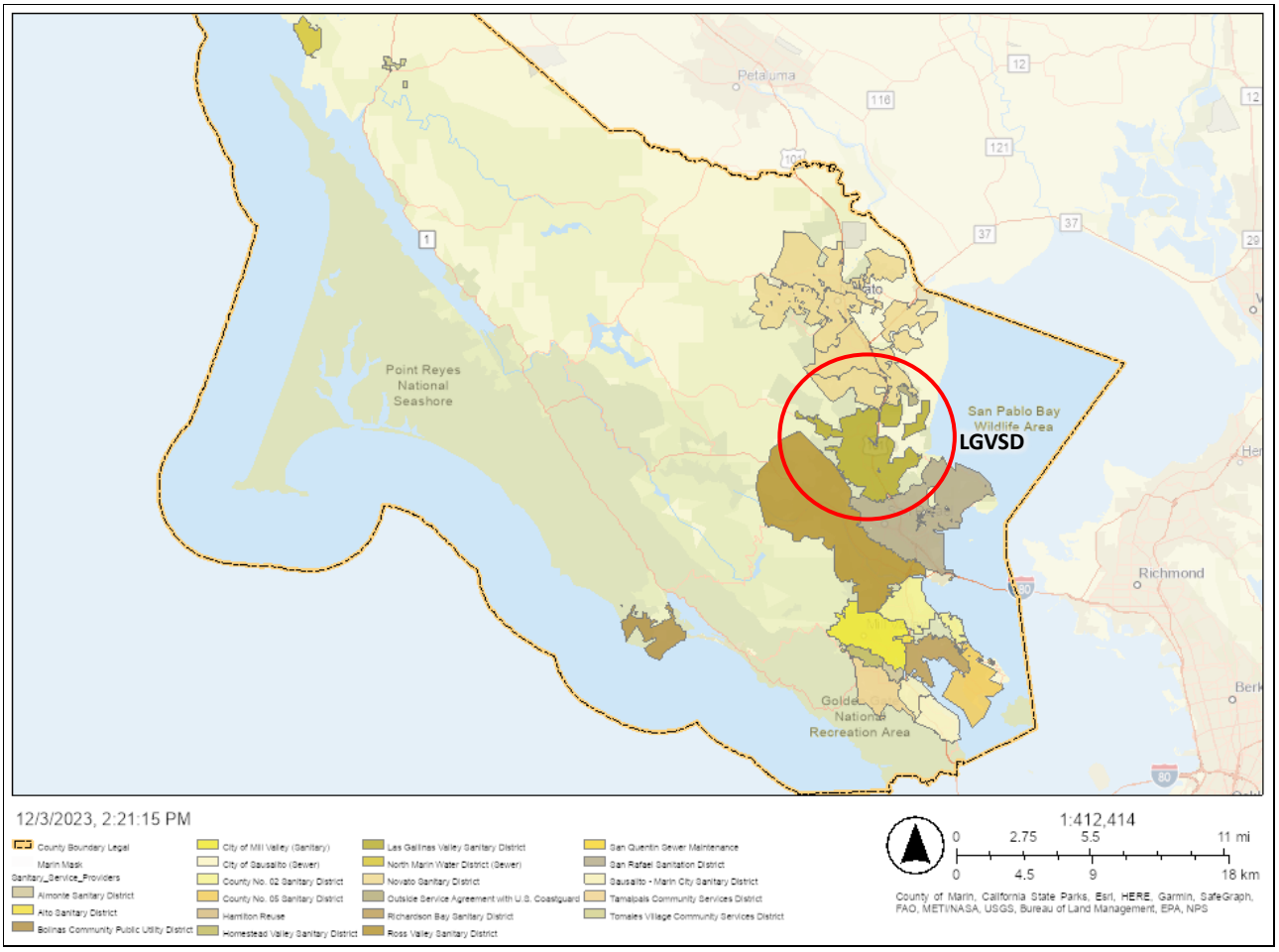


Figure 248: Map of the Las Gallinas Valley Sanitary District and Other Sanitary Districts
Source: Marin County OEM

1.5 ADMINISTRATION

Governance is provided by an independent five-member Board of Directors whose members are elected "at-large" from the District's electorate and serve staggered four-year terms. The individual Board members represent the District on other boards, committees and associations.

LGVSD appoints an at-will General Manager to oversee all District operations. The General Manager presently oversees 29 other full-time employees, which includes four senior management support positions: Administrative Services Manager; Collection Systems Maintenance & Safety Manager; District Engineer; and Plant Manager.

Board Meetings are held the first and third Thursday of every month at 4:00 p.m. at the District Office, 101 Lucas Valley Road, Suite 300 in San Rafael. All board meetings are open to the public, and we encourage attendance and participation by our citizens. The Agenda is posted on the bulletin board located outside the Las Gallinas Valley Sanitary District Administration Building. Current and archived meeting agendas and minutes can be viewed by clicking on the Board Meetings Page on the District's website at www.lgvsd.org.

Las Gallinas Valley Sanitary District is a special district, authorized by the Sanitary District Act of 1923, California Health and Safety Code Sections 6400-6941.9

1.6 FINANCING

LGVSD reports its activities as an Enterprise Fund under the broad category of funds called proprietary funds using the full accrual basis of accounting. Expenditures are tracked by department, with each department delineated by function and specific activity, to provide management and the Board with better cost control measures. At the end of each fiscal year, these costs are combined to arrive at the financial position and results of operations reflected in LGVSD's basic financial statements.

LGVSD maintains restricted funds for capital replacement and expansion purposes. The District budgets for the adequate maintenance of capital equipment and facilities to protect the public investment and ensure achievement of their maximum useful life. The District has a sewer system management plan and prepares and adopts at minimum a 5-Year Capital Improvement Program ("CIP") as part of the rate setting process which identifies and sets priorities for all major capital assets to be acquired, constructed, or replaced by the District. The District prepared a 7-Year CIP in 2023/24 which includes flood and sea-level mitigation projects that have been identified to take place after 2028.

LGVSD's total revenues were $20.6 million in FY 2022/23. Revenue sources include rates and charges (85%), non-operating revenue such as property tax and interest (12%), and connection fees and inter-governmental capital contributions (3%).

LGVSD's expenditures were $30.5 million in FY 2022/23. Of this amount, 15% was spent on services and supplies, 20% on salaries and employee benefits, 15% debt service, 17% towards reserve funding, and 33% on capital outlay including the completion of the Secondary Treatment Plant Upgrade and Recycled Water Expansion Project.

LGVSD adopted several policies on maintaining financial reserves. LGVSD held $11.1 million in cash and investments at the end of FY 2022/23 in five reserve funds. LGVSD maintains four restricted funds which serve a specific purpose and for which use is controlled by State law or inter-agency agreements, with a total of $1.0 million in cash and investments at the end of FY 2022/23.

1.7 WEATHER AND CLIMATE

The Las Gallinas Valley Sanitary District summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 48°F to 62°F and is rarely below 43°F or above 75°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month of highest relative humidity is February (79 %). The month with the lowest relative humidity is June (66 %). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.3 °C (48.7) °F	10 °C (50) °F	11.2 °C (52.2) °F	12.2 °C (54) °F	14.2 °C (57.5) °F	16.3 °C (61.3) °F	16.6 °C (61.8) °F	16.9 °C (62.4) °F	17 °C (62.6) °F	15.4 °C (59.7) °F	12.1 °C (53.8) °F	9.5 °C (49.1) °F
Min. Temperature °C (°F)	6.1 °C (43.1) °F	6.8 °C (44.3) °F	7.8 °C (46.1) °F	8.6 °C (47.6) °F	10.3 °C (50.5) °F	11.8 °C (53.3) °F	12.4 °C (54.4) °F	13 °C (55.3) °F	12.8 °C (55) °F	11.6 °C (52.8) °F	8.8 °C (47.9) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.6 °C (56.5) °F	14.4 °C (57.9) °F	15.8 °C (60.5) °F	17.2 °C (62.9) °F	19.4 °C (67) °F	22.2 °C (72) °F	22.5 °C (72.6) °F	22.8 °C (73) °F	23.2 °C (73.7) °F	21 °C (69.8) °F	16.7 °C (62.1) °F	13.5 °C (56.2) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	79%	77%	70%	69%	66%	72%	73%	70%	69%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 249: The Las Gallinas Valley Sanitary District Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.8 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 3: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 125: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

The following Tables and Figures illustrates the NRI Hazard Type Risk Index and the Social Vulnerability Map for the Las Gallinas Valley Sanitary District for the various Census Tracts within their service area.

Table 4: NRI Hazard Type Risk Index Census Tract 1150.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,405,941	Relatively Low	Very High	0.92	$1,286,817	93.1
Riverine Flooding	$363,156	Relatively Low	Very High	0.92	$332,386	94.6
Wildfire	$52,708	Relatively Low	Very High	0.92	$48,242	91
Heat Wave	$11,995	Relatively Low	Very High	0.92	$10,979	53.3
Tornado	$6,141	Relatively Low	Very High	0.92	$5,620	13.6
Landslide	$2,916	Relatively Low	Very High	0.92	$2,669	80.9
Strong Wind	$392	Relatively Low	Very High	0.92	$359	11.6
Coastal Flooding	$0	Relatively Low	Very High	0.92	$0	0
Drought	$0	Relatively Low	Very High	0.92	$0	0
Tsunami	$0	Relatively Low	Very High	0.92	$0	0

Table 126: NRI Hazard Type Risk Index for Census Tract 1150.00
Source: FEMA National Risk Index 2023

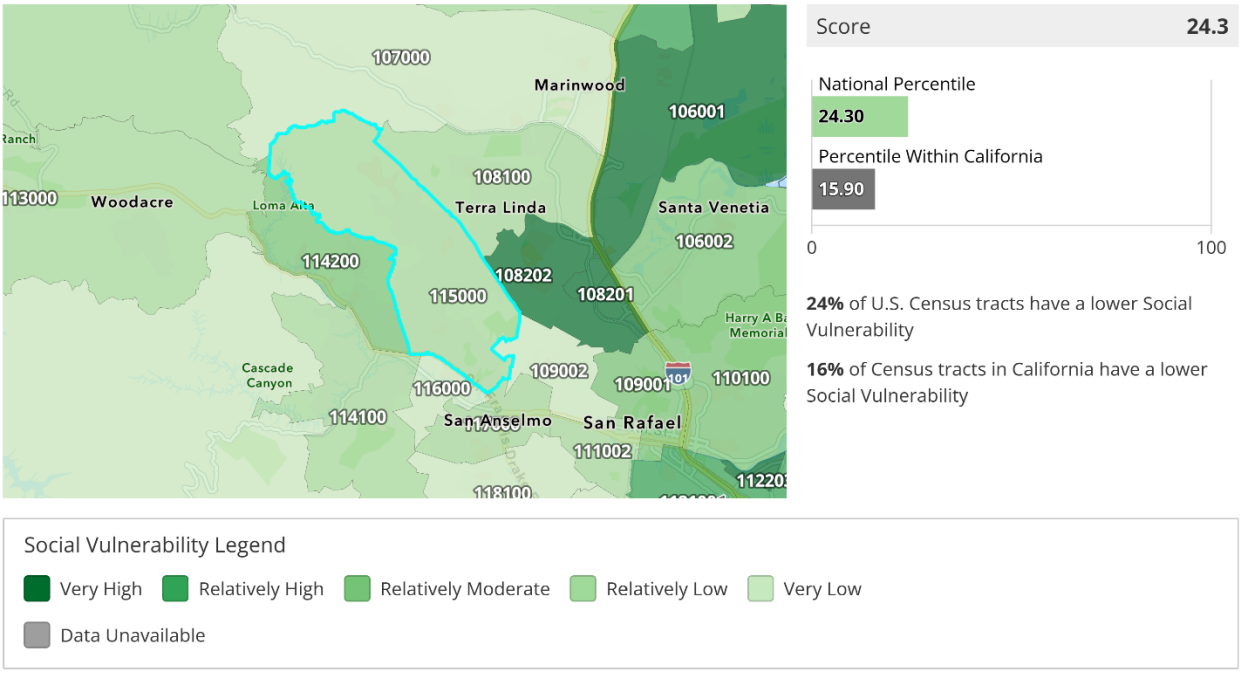


Figure 250: LGVSD Social Vulnerability Map Census Tract 1150.00
Source: FEMA National Risk Index 2023

Table 5: NRI Hazard Type Risk Index for Census Tract 1060.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$2,896,142	Very High	Very High	1.4	$4,040,816	98.9
Riverine Flooding	$558,070	Very High	Very High	1.4	$778,642	97.8
Coastal Flooding	$208,258	Very High	Very High	1.4	$290,569	98.2
Drought	$146,022	Very High	Very High	1.4	$203,736	98.7
Wildfire	$23,077	Very High	Very High	1.4	$32,198	89.3
Heat Wave	$7,811	Very High	Very High	1.4	$10,898	53.1
Tornado	$4,247	Very High	Very High	1.4	$5,925	14.3
Landslide	$4,006	Very High	Very High	1.4	$5,589	91.1
Strong Wind	$268	Very High	Very High	1.4	$373	11.9
Tsunami	$23	Very High	Very High	1.4	$33	0

Table 127: NRI Hazard Type Risk Index for Census Tract 1060.01
Source: FEMA National Risk Index 2023

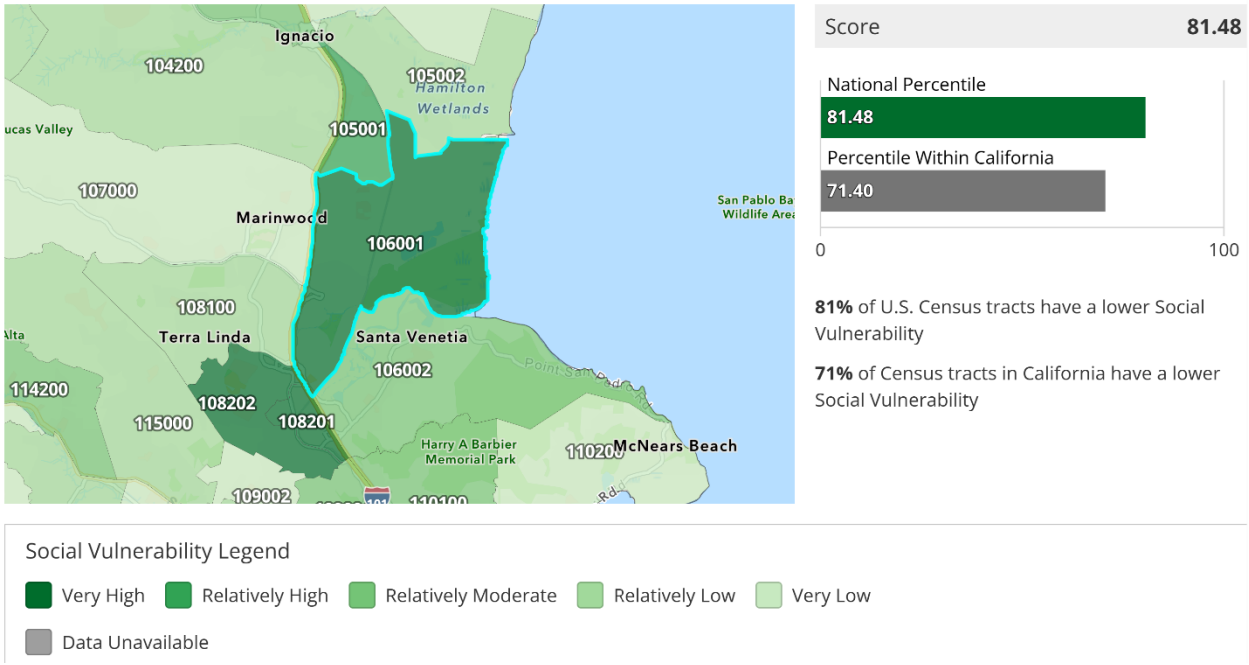


Figure 251: LGVSD Social Vulnerability Map Census Tract 1060.01
Source: FEMA National Risk Index 2023

Table 6: NRI Hazard Type Risk Index for Census Tract 1060.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Riverine Flooding	$1,416,010	Relatively Moderate	Very High	1.1	$1,552,678	99
Earthquake	$1,318,564	Relatively Moderate	Very High	1.1	$1,445,827	93.9
Coastal Flooding	$713,626	Relatively Moderate	Very High	1.1	$782,503	99.2
Landslide	$37,581	Relatively Moderate	Very High	1.1	$41,208	99.1
Heat Wave	$8,853	Relatively Moderate	Very High	1.1	$9,707	51
Wildfire	$5,798	Relatively Moderate	Very High	1.1	$6,358	81.7
Tornado	$4,594	Relatively Moderate	Very High	1.1	$5,037	12
Strong Wind	$295	Relatively Moderate	Very High	1.1	$324	10.7
Tsunami	$132	Relatively Moderate	Very High	1.1	$145	92.8
Drought	$0	Relatively Moderate	Very High	1.1	$0	0

Table 128: NRI Hazard Type Risk Index for Census Tract 1060.02
Source: FEMA National Risk Index 2023

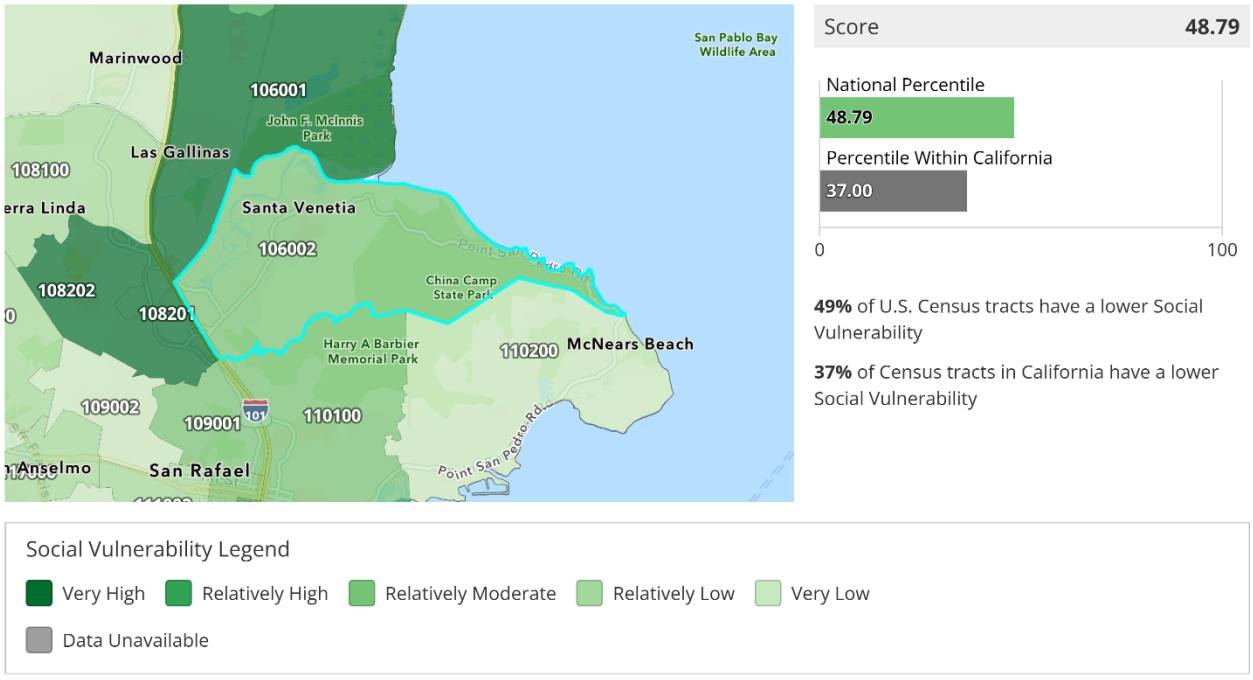


Figure 252: LGVSD Social Vulnerability Map Census Tract 1060.02
Source: FEMA National Risk Index 2023

Table 7: NRI Hazard Type Risk Index for Census Tract 1081.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,252,334	Relatively Low	Very High	1.03	$1,287,401	93.1
Wildfire	$31,464	Relatively Low	Very High	1.03	$32,345	89.3
Heat Wave	$10,456	Relatively Low	Very High	1.03	$10,749	52.8
Tornado	$4,772	Relatively Low	Very High	1.03	$4,906	11.6
Landslide	$3,550	Relatively Low	Very High	1.03	$3,650	85.7
Strong Wind	$336	Relatively Low	Very High	1.03	$345	11.2
Riverine Flooding	$308	Relatively Low	Very High	1.03	$317	29.3
Coastal Flooding	$0	Relatively Low	Very High	1.03	$0	0
Drought	$0	Relatively Low	Very High	1.03	$0	0
Tsunami	$0	Relatively Low	Very High	1.03	$0	0

Table 129: NRI Hazard Type Risk Index for Census Tract 1081.00
Source: FEMA National Risk Index 2023

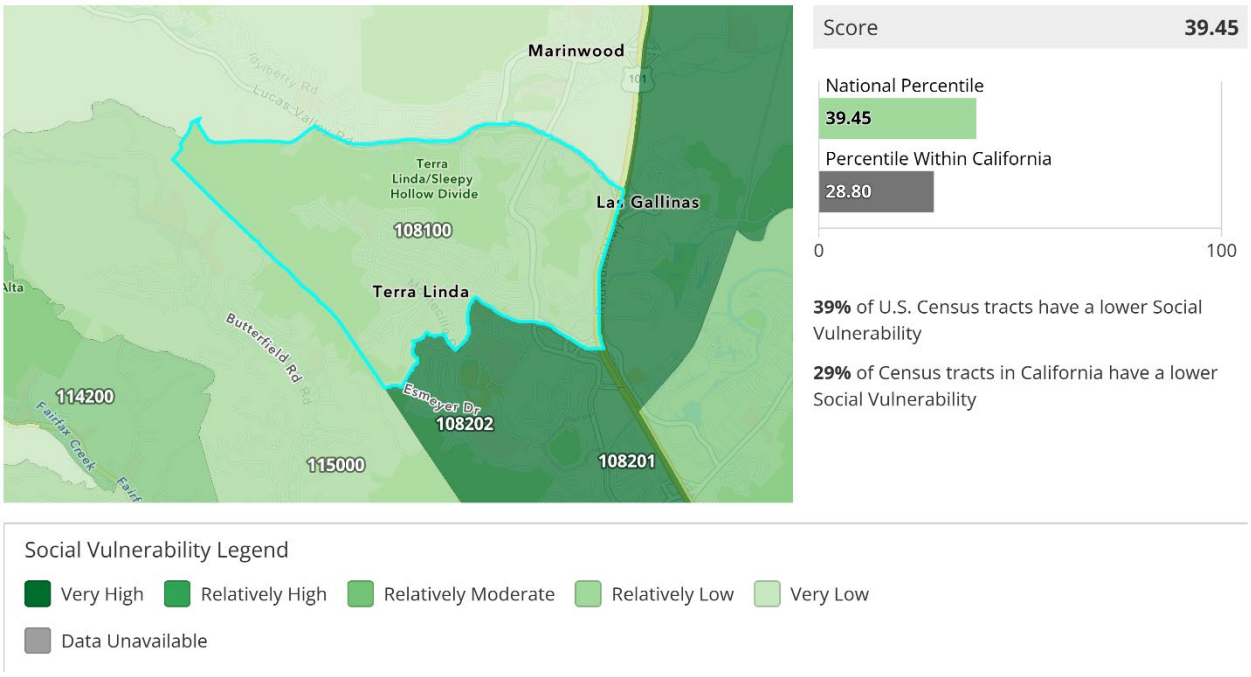


Figure 253: LGVSD Social Vulnerability Map Census Tract 1081.00
Source: FEMA National Risk Index 2023

Table 8: NRI Hazard Type Risk Index for Census Tract 1082.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$546,877	Very High	Very High	1.57	$859,791	90.1
Heat Wave	$3,994	Very High	Very High	1.57	$6,279	43.5
Tornado	$1,577	Very High	Very High	1.57	$2,480	5.7
Landslide	$599	Very High	Very High	1.57	$941	63.7
Wildfire	$158	Very High	Very High	1.57	$248	45.8
Strong Wind	$123	Very High	Very High	1.57	$194	7.2
Coastal Flooding	$0	Very High	Very High	1.57	$0	0
Drought	$0	Very High	Very High	1.57	$0	0
Riverine Flooding	$0	Very High	Very High	1.57	$0	0
Tsunami	$0	Very High	Very High	1.57	$0	0

Table 130: NRI Hazard Type Risk Index for Census Tract 1082.01
Source: FEMA National Risk Index 2023

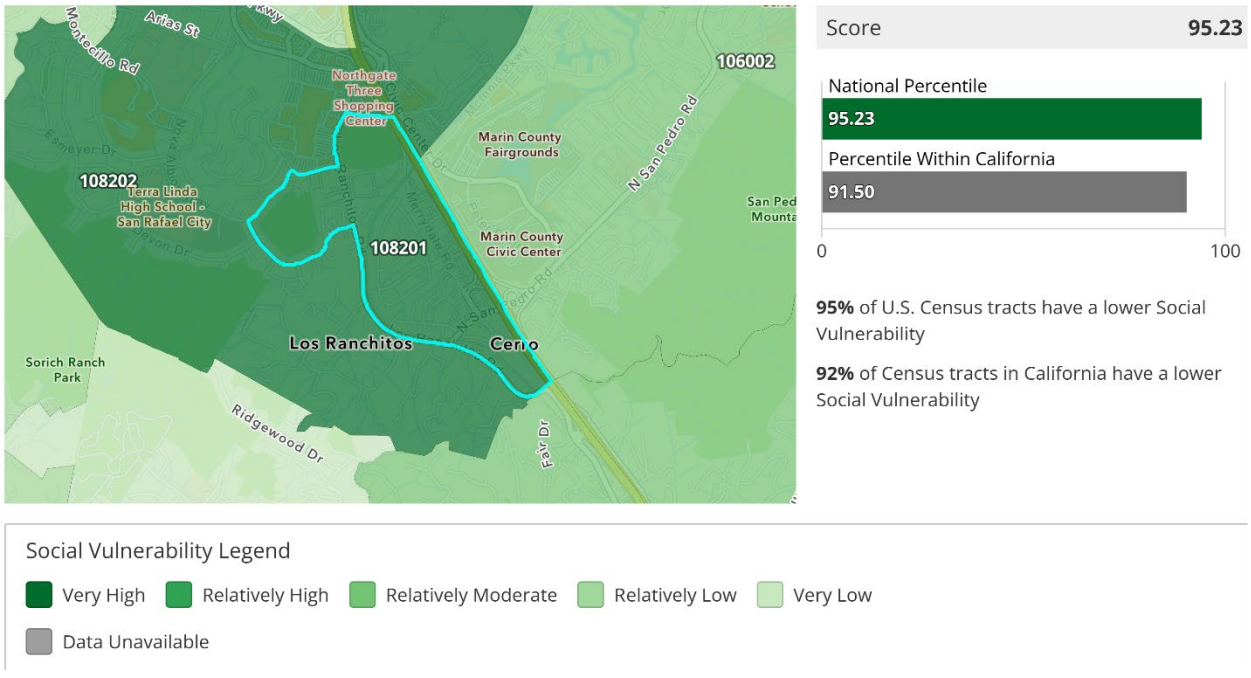


Figure 254: LGVSD Social Vulnerability Map Census Tract 1082.01
Source: FEMA National Risk Index 2023

Table 9: NRI Hazard Type Risk Index for Census Tract 1082.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,683,172	Very High	Very High	1.4	$2,358,985	97
Heat Wave	$6,786	Very High	Very High	1.4	$9,510	50.6
Tornado	$4,156	Very High	Very High	1.4	$5,825	14.1
Lightning	$310	Very High	Very High	1.4	$434	8.6
Strong Wind	$240	Very High	Very High	1.4	$336	11
Wildfire	$116	Very High	Very High	1.4	$162	40.9
Coastal Flooding	$0	Very High	Very High	1.4	$0	0
Drought	$0	Very High	Very High	1.4	$0	0
Riverine Flooding	$0	Very High	Very High	1.4	$0	0
Tsunami	$0	Very High	Very High	1.4	$0	0

Table 131: NRI Hazard Type Risk Index for Census Tract 1082.02
Source: FEMA National Risk Index 2023

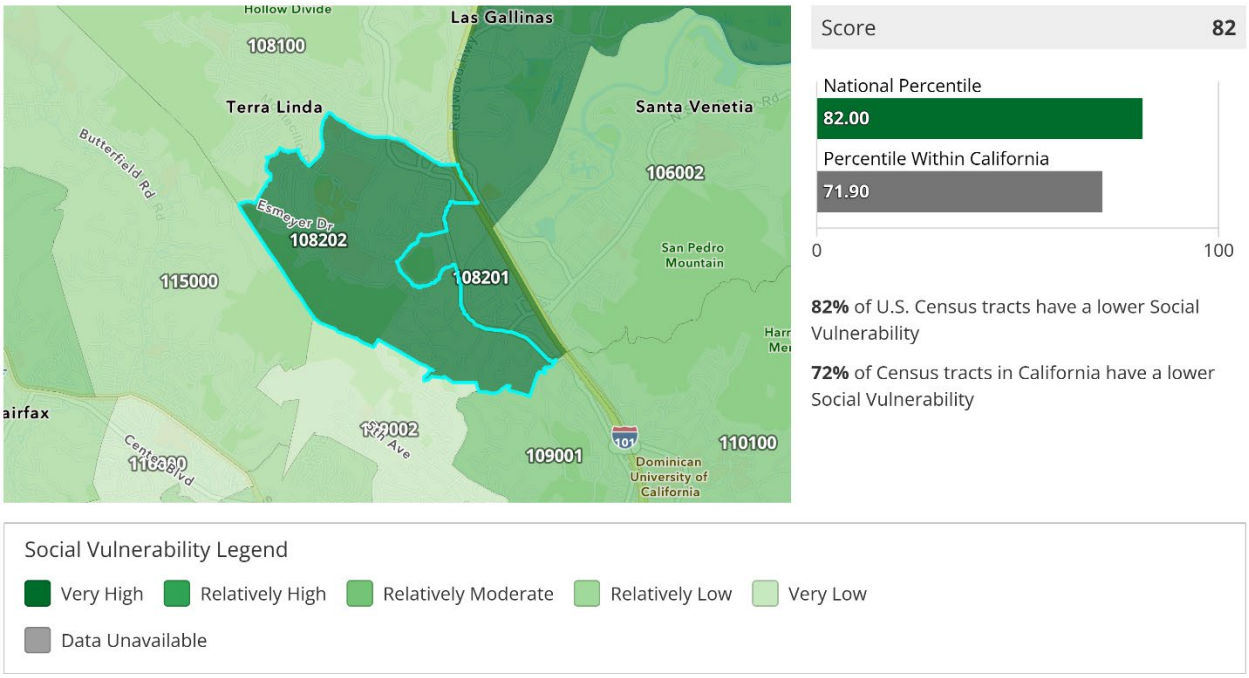


Figure 255: LGVSD Social Vulnerability Map Census Tract 1082.02
Source: FEMA National Risk Index 2023

Table 10: NRI Hazard Type Risk Index for Census Tract 1090.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$878,039	Very Low	Very High	0.77	$676,077	88.5
Landslide	$17,439	Very Low	Very High	0.77	$13,428	97.2
Heat Wave	$6,528	Very Low	Very High	0.77	$5,026	39.9
Wildfire	$5,930	Very Low	Very High	0.77	$4,566	80.1
Tornado	$3,032	Very Low	Very High	0.77	$2,335	5.4
Strong Wind	$211	Very Low	Very High	0.77	$162	6.4
Coastal Flooding	$0	Very Low	Very High	0.77	$0	0
Drought	$0	Very Low	Very High	0.77	$0	0
Riverine Flooding	$0	Very Low	Very High	0.77	$0	0
Tsunami	$0	Very Low	Very High	0.77	$0	0

Table 132: NRI Hazard Type Risk Index for Census Tract 1090.02
Source: FEMA National Risk Index 2023

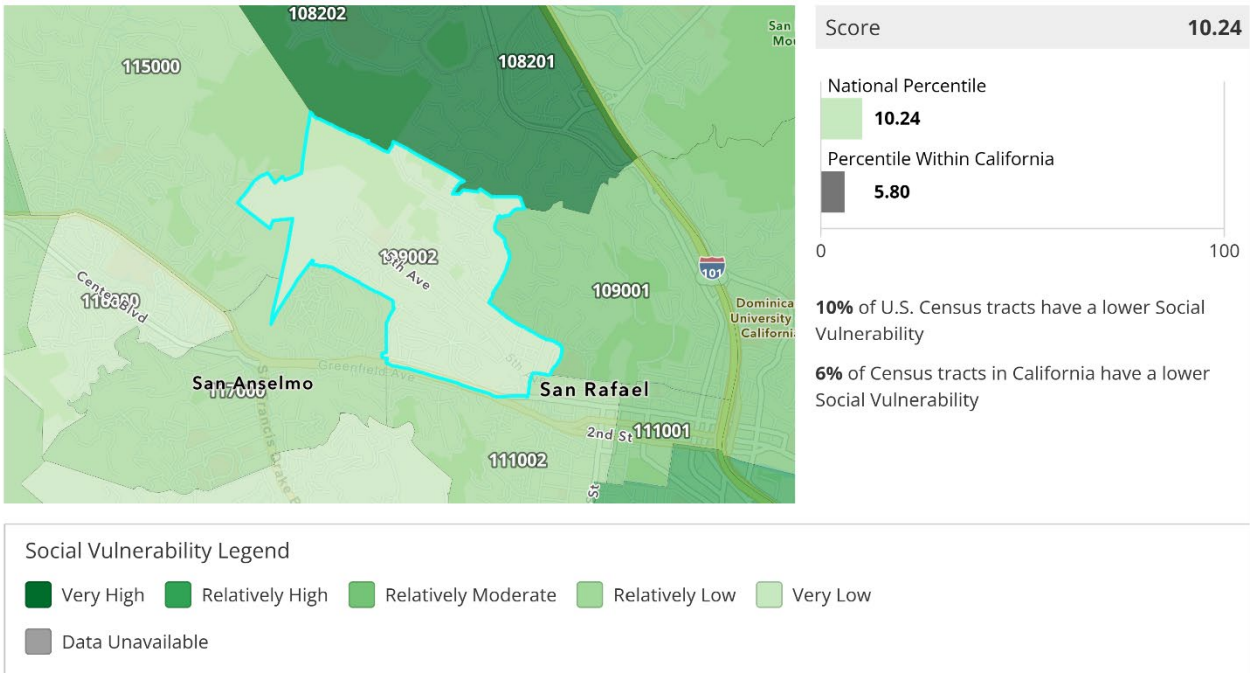


Figure 256: LGVSD Social Vulnerability Map Census Tract 1090.02
Source: FEMA National Risk Index 2023

Social Vulnerability in Marin County and the Las Gallinas Valley Sanitary District

Most socially vulnerable residents in Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and

the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary schools in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a "very high" ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a whole to have "Relatively High" risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category ("Very High Risk"), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

However, Marin City is ranked as "Very Low" risk for the National Risk Index. Previous discussion highlighted why the Expected Annual Loss was low, but further discussion is required. As a County, we know Marin City should not be classified as "Very Low" on the NRI. Marin City residents, for example, only have one way in and out of their community and this road floods frequently, making it unsafe to cross and leave the community for work, school, medical resources. Additionally, there is only one "grocery" store, a Target, in Marin City. Both of these elements contribute to the vulnerability of residents as they may be unable to leave or return home and have limited access to groceries, relying on a single store's supply chain. At the local elementary school in Marin City, 47% of students are eligible for free and reduced-price meals (2022–2023 school year), a reflection of the financial capacity of local families. All this means, we can expect the social and built capacity of Marin City to be limited.

Although, customers within the Las Gallinas Valley Sanitary District reside within census tracts that have a Social Vulnerability Index of "Relatively Moderate" to "Very High", the Las Gallinas Valley Sanitary District's ability to serve this community is limited to the sanitary services they provide. Their influence may be realized during an emergency by ensuring the continued delivery of sanitary services which are considered a community lifeline. They may also work with these impacted customers to provide fee relief through local, state, and or federal programs

where appropriate. The majority of socially vulnerable population services are provided through the county, state, and federal government or other non-governmental or volunteer agencies or organizations.

1.9 CRITICAL FACILITIES

Collection System

LGVSD provides wastewater collection and treatment services through its own infrastructure supported by an approximate 112-mile collection system with 28 pump stations leading to an advanced secondary-level treatment facility. The collection system is divided between 105 miles of gravity lines and 7 miles of force mains. There are 2,985 manholes and approximately 52.5 miles of privately owned laterals within the District.

Treatment Plant

The District operates a sewage treatment plant with a permitted dry weather average capacity of 2.92 million gallons per day (MGD). The treatment facility was initially constructed in 1955. Major plant expansions were completed in 1958, 1972, 1984 and most recently in 2023. The latter increased treatment capacity to 3.2 million gallons per day. Treated effluent is discharged to Miller Creek, stored, or further processed by LGVSD's recycled water facility.

Recycled Water

The expanded recycled water treatment facilities located at the LGVSD treatment plant allows the District to produce recycled water year-round to meet increasing demand during the dry months in summer and fall. In the past, recycled water was predominately used during the summer months, which aligned with the District's non discharge period of June through October. The District has a water reclamation project on 385 acres of diked bay lands located to the northeast of the treatment plant. The reclamation area includes a 20-acre wildlife marsh pond, 40 acres of storage ponds, 200 acres of irrigated pasture, and 3.5 miles of public trails which are part of the San Francisco Bay Trail. The ponds that are used to hold treated wastewater and the spray fields allow the District to withhold discharge in summer months to San Francisco Bay via Miller Creek.

LGVSD delivers recycled water effluent to two nearby agencies, Marin Municipal Water District and North Marin Water District, which further treats it so that it can be used for irrigation of landscapes, including golf courses and playing/ recreation fields, dual plumbing for toilet flushing, cooling water uses, and car washes within the District's jurisdictional boundaries.

The following list of facilities has been determined to be critical to the ability of the Las Gallinas Valley Sanitary District to fulfill the requirements of its mission during an emergency:

Table 11: Las Gallinas Valley Sanitary District Critical Facilities					
	Category	Name	Address	Fire Severity Zone	Flood Zone
1.	Wastewater Facilities	Wastewater Treatment Plant	300 Smith Ranch Rd, San Rafael, CA 94903	None	X
2.	Wastewater Facilities	Recycled Water Facility	300 Smith Ranch Rd, San Rafael, CA 94903	None	None
3.	Wastewater Facilities	Operations & Shop Buildings	300 Smith Ranch Rd, San Rafael, CA 94903	None	None
4.	Wastewater Facilities	Laboratory	300 Smith Ranch Rd, San Rafael, CA 94903	None	AE
5.	Wastewater Facilities	Administration Building	101 Lucas Valley Rd, Suite 300 San Rafael, CA 94903	High	None
6.	Wastewater Facilities	Northgate Industrial Park Pump Station	Near: 153 Paul Dr San Rafael, CA 94903	None	X
7.	Wastewater Facilities	John Duckett Pump Station	Near: 4238 Redwood Hwy, San Rafael, CA 94903	Moderate	X
8.	Wastewater Facilities	Rafael Meadows Pump Station	Near: 401 Merrydale Rd, San Rafael, CA 94903	None	None
9.	Wastewater Facilities	Civic Center North Pump Station	Near: 111 McInnis Pkwy, San Rafael, CA 94903	None	X
10	Wastewater Facilities	Marin Lagoon #1 Pump Station	Near: 33 Waterside Cir, San Rafael, CA 94903	None	AE
11	Wastewater Facilities	Marin Lagoon #2 Pump Station	Near: 92 Waterside Cir, San Rafael, CA 94903	None	AE
12	Wastewater Facilities	Marin Lagoon #3 Pump Station	Near: 156 Waterside Cir, San Rafael, CA 94903	None	AE
13	Wastewater Facilities	Marin Lagoon #4 Pump Station	Near: 216 Waterside Cir, San Rafael, CA 94903	None	AE
14	Wastewater Facilities	Marin Lagoon #5 Pump Station	Near: 264 Waterside Cir, San Rafael, CA 94903	None	AE
15	Wastewater Facilities	Marin Lagoon #6 Pump Station	Near: 99 Mariners Cir, San Rafael, CA 94903	None	AE
16	Wastewater Facilities	Marin Lagoon #7 Pump Station	Near: 14 Bridgewater Dr, San Rafael, CA 94903	None	AE
17	Wastewater Facilities	Marin Lagoon #8 Pump Station	Near: 14 Mariners Cir, San Rafael, CA 94903	None	AE
18	Wastewater Facilities	Marin Lagoon #9 Pump Station	Near: 56 Mariners Cir, San Rafael, CA 94903	None	AE
19	Wastewater Facilities	Mulligan Pump Station	47 Meadow Dr, San Rafael, CA 94903	None	None
20	Wastewater Facilities	Venetia Harbor Pump Station	85 Vendola Dr, San Rafael, CA 94903	None	AE
21	Wastewater Facilities	Hawthorne Pump Station	403 Vendola Dr, San Rafael, CA 94903	None	AE
22	Wastewater Facilities	Adrian Pump Station	Near: Candy's Park, 601 Adrian Way, San Rafael, CA 94903	None	AE
23	Wastewater Facilities	Descanso Pump Station	807 Descanso Way, San Rafael, CA 94903	None	AE
24	Wastewater Facilities	McPhail's Pump Station	Near: 1590 Vendola Dr, San Rafael, CA 94903	None	AE

25	Wastewater Facilities	Captain's Cove Flow Meter	Near: Corner of Yosemite Rd & Sailmaker Ct, San Rafael, CA 94903	Moderate	X
26	Wastewater Facilities	Captain's Cove #1 Pump Station	Near: 159 Captains Cove Dr, San Rafael, CA 94903	None	X
27	Wastewater Facilities	Captain's Cove #2 Pump Station	128 Captains Cove Dr, San Rafael, CA 94903	None	X
28	Wastewater Facilities	Captain's Cove #3 Pump Station	30 Wharf Cir, San Rafael, CA 94903	None	X
29	Wastewater Facilities	Captain's Cove #4 Pump Station	89 Dockside Cir, San Rafael, CA 94903	None	X
30	Wastewater Facilities	Captain's Cove #5 Pump Station	28 Dockside Cir, San Rafael, CA 94903	None	X
31	Wastewater Facilities	Captain's Cove #6 Pump Station	16 Keel Ct, San Rafael, CA 94903	None	X
32	Wastewater Facilities	Marinwood Pump Station	Adjacent to LGVSD Maintenance Shop: 300 Smith Ranch Rd, San Rafael, CA 94903	None	None
33	Wastewater Facilities	McInnis Park Pump Station	North Corner of McInnis Golf Course: 350 Smith Ranch Rd, San Rafael, CA 94903	None	None
34	Wastewater Facilities	Saint Vincent's Pump Station	Intersection: St Vincent's Dr and Levee Road, San Rafael, CA 94903	Moderate	AE
35	Wastewater Facilities	Reclamation Pump Station	Approx. 1,300 NE of 300 Smith Ranch Rd, San Rafael, CA 94903	Moderate	AE
36	Wastewater Facilities	Smith Ranch Road Pump Station & CNG Fueling Station	SWC Silveira Parkway & Smith Ranch Road, SWC near railroad tracks and Airport Rd, San Rafael, CA 94903	None	None
37	Electrical Power Facilities	Solar PV System	3 Miles NE of 300 Smith Ranch Road, San Rafael, CA 94903	Moderate	AE
38	Communication Facilities	Emergency Radio Communication Tower	San Rafael, CA 94903	High	None

Table 133: Las Gallinas Valley Sanitary District Critical Facilities
Source: Las Gallinas Valley Sanitary District

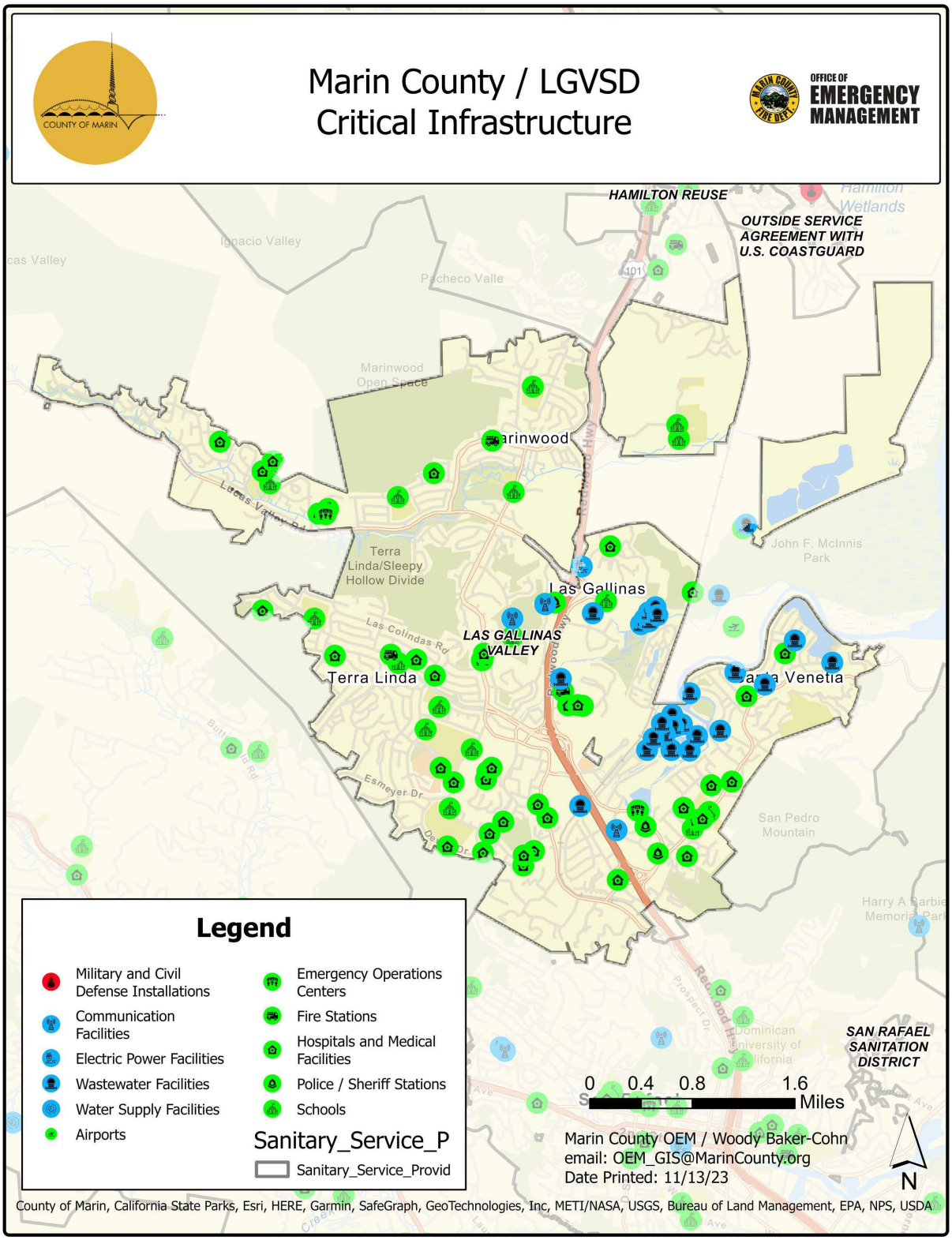


Figure 257: Map of the Las Gallinas Valley Sanitary District and Critical Facilities and Infrastructure within the District
Source: Marin County OEM

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Las Gallinas Valley Sanitary District identified hazards that affect the District and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 16 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

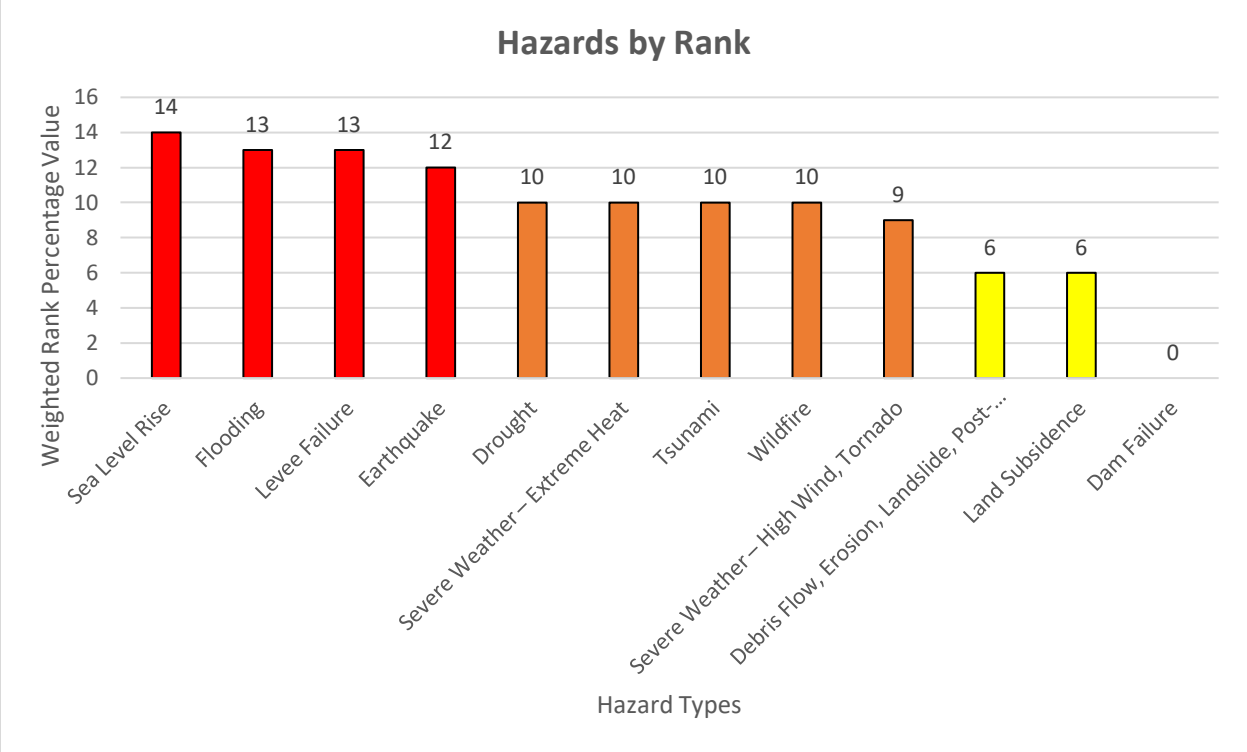


Figure 258: LGVSD Risk Assessment – Planning Team Top Hazards

Figure 17: Risk Rank Categorization	
Risk Level	Risk Numerical Score
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 259: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 12: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 134: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact

- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

ATMOSPHERIC METHANE CONCENTRATIONS
SINCE 1984

Data source: Data from NOAA, measured from a global network of air sampling sites

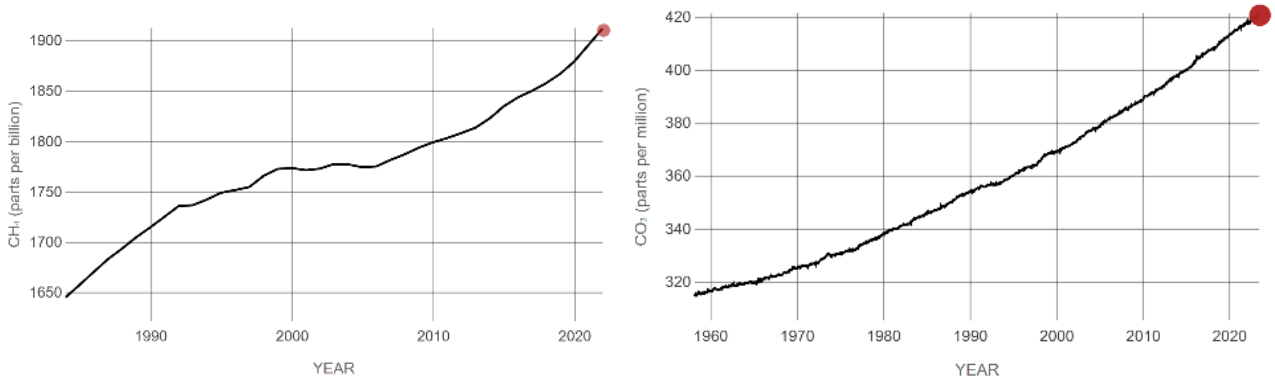


Figure 260: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

TIME SERIES: 1884 TO 2022

Data source: NASA/GISS
Credit: NASA's Scientific Visualization Studio

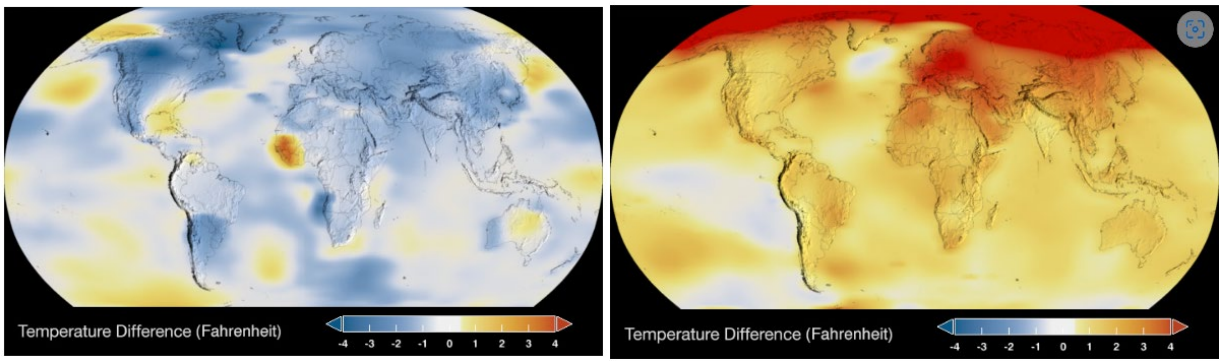


Figure 261: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

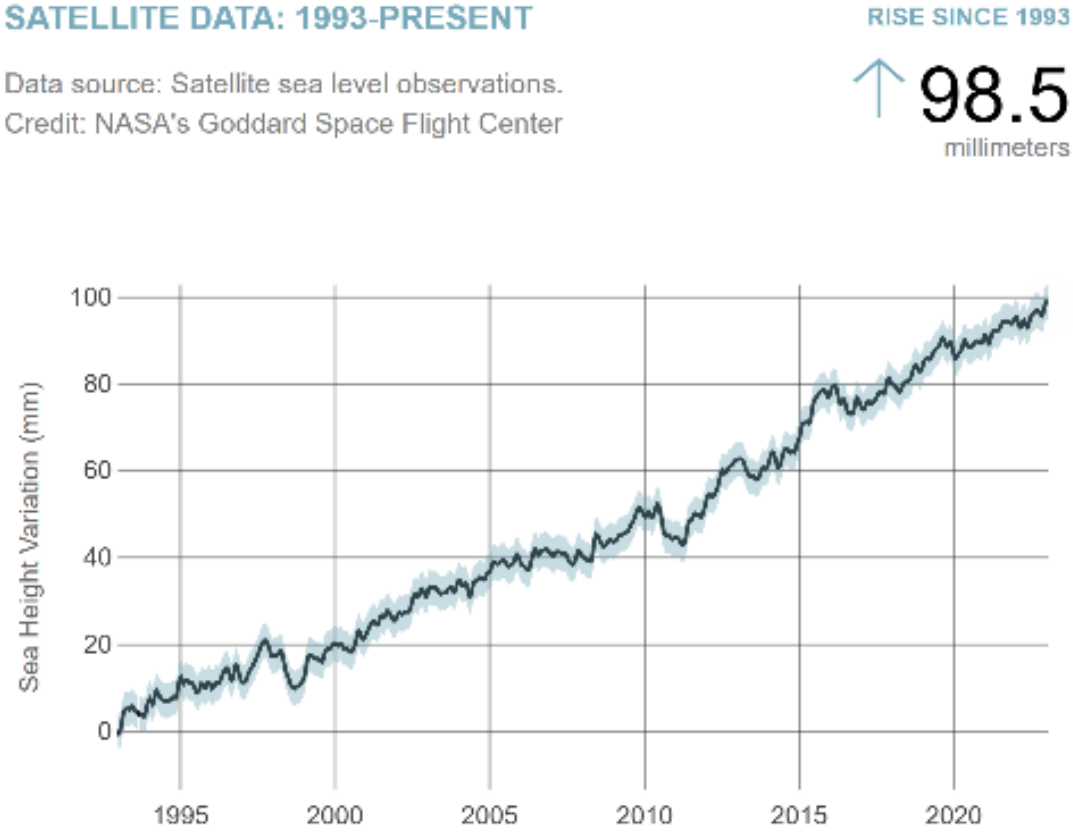


Figure 262: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.

- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County Hazard Mitigation Plan as a standalone hazard while addressing each of the other natural hazards. Marin County is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California

Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.

- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

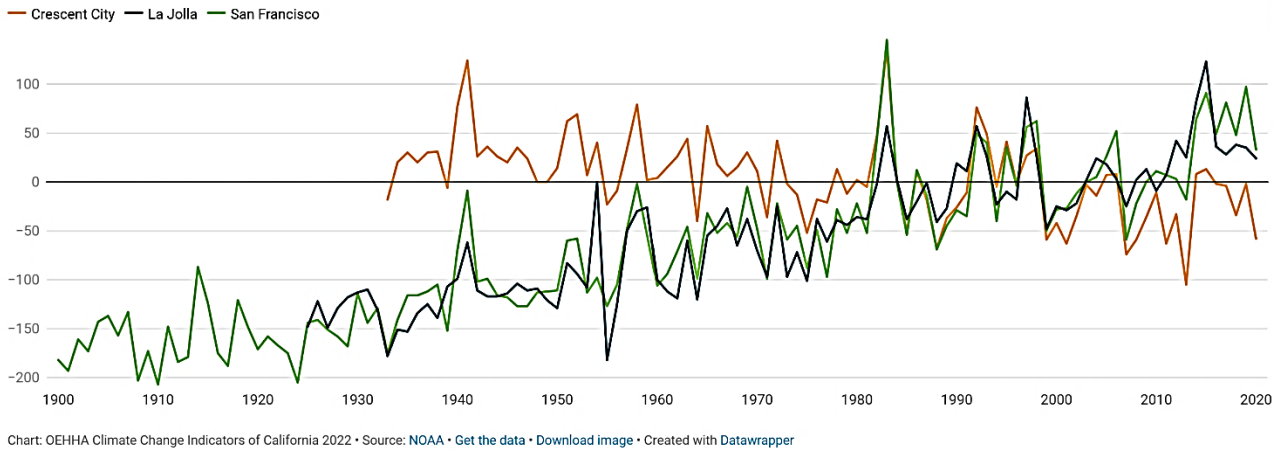


Figure 263: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water. Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In October 2022, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2020. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the Las Gallinas Valley Sanitary District as per the planning team.

Table 13: LGVSD Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Occasional	Negligible	Weak	Low	Low	**6.00**
Drought	Likely	Limited	None	High	Medium	**10.00**
Earthquake	Occasional	Extensive	Extreme	None	Medium	**12.00**
Flooding	Likely	Significant	Moderate	Medium	High	**13.00**
Land Subsidence	Occasional	Negligible	Weak	Low	Low	**6.00**
Levee Failure	Unlikely	Significant	Severe	High	High	**13.00**
Sea Level Rise	Likely	Significant	Moderate	High	High	**14.00**
Severe Weather – Extreme Heat	Highly Likely	Negligible	Weak	High	Low	**10.00**
Severe Weather – High Wind/Tornado	Likely	Negligible	Weak	Medium	Medium	**9.00**
Tsunami	Unlikely	Extensive	Severe	None	Medium	**10.00**
Wildfire	Likely	Negligible	Moderate	Medium	Medium	**10.00**

Table 135: LGVSD Hazard Risk Assessment
Source: Las Gallinas Valley Sanitary District

Omitted Hazards

Dam Failure: There are no dams that a failure of which would impact the Las Gallinas Valley Sanitary District Service. The District is not in any dam inundation zone.

Table 14: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 136: County of Marin Hazard Risk Assessment
Source: Marin County

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in

place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 22 shows landslide susceptibility classes.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

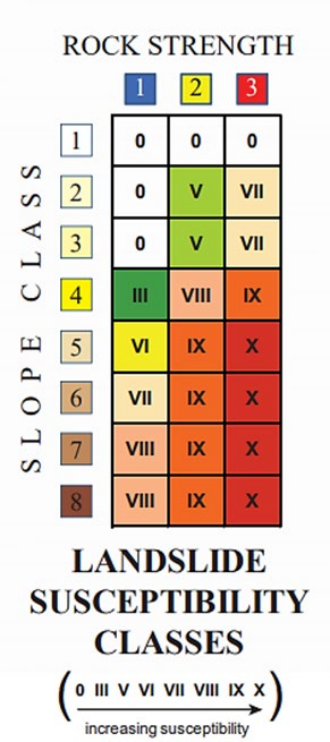


Figure 264: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 25 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

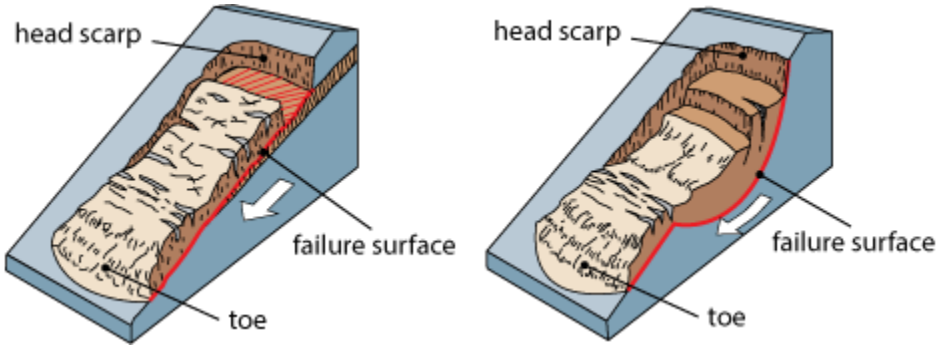


Figure 265: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in the LGVSD would most likely occur in any of the open spaces throughout the District where the terrain is steeper and is more susceptible to movement of hill slope materials. Most of the critical facilities in the District lie outside these areas, with the exception of the John Duckett Pump Station which lies in an area of high landslide susceptibility. The McInnis Park Pump Station and the six Captain Cove Pump Stations lie in area with some landslide susceptibility.

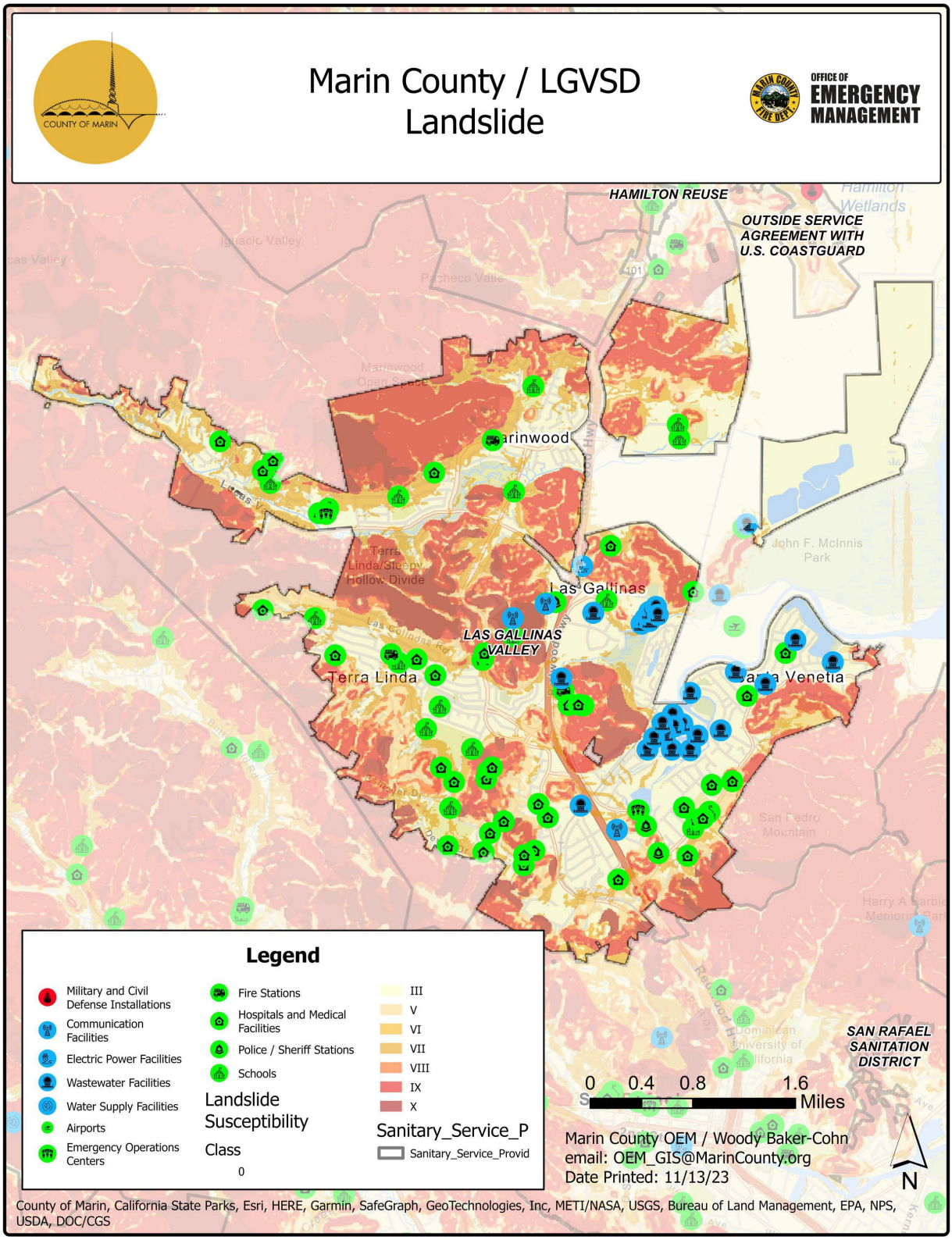


Figure 266: LGVSD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the critical facilities in the District could affect the provision of District services. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open spaces in the District could contribute to debris flows throughout the District, including along Gallinas Creek and the South Fork of Gallinas Creek. There have been no recorded debris flows in the District.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[18], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in the District service area could be susceptible to post-fire debris flows. This includes Miller Creek in the unincorporated County areas of Lucas Valley and Marinwood. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.

[18] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of the LGVSD, though its effects would be most felt in the mountainous areas where the risk of wildfire would increase. There are no District critical facilities in these areas. The wetland areas of the District, particularly the marshlands in Las Gallinas and Santa Venetia, could become drier during prolonged period of drought and experience marshland fires that could impact the District's critical facilities. Low water levels due to drought could impact the operability of the District's critical facilities, including its pump stations.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including in the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA, including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of the District in the City of San Rafael and the unincorporated County areas of Santa Venetia St. Vincent, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent could expose people to drier summer conditions that could increase

their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including the LGVSD, the City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 27).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 267: Modified Mercalli Intensity Scale
Source: USGS

Figure 28 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 268: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 29). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 269: Soil Types
Source: USGS

An earthquake fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around the LGVSD due to the number of active faults within and near Marin County.

Earthquake Shake Intensity
The colors on Figures 30 and 31 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

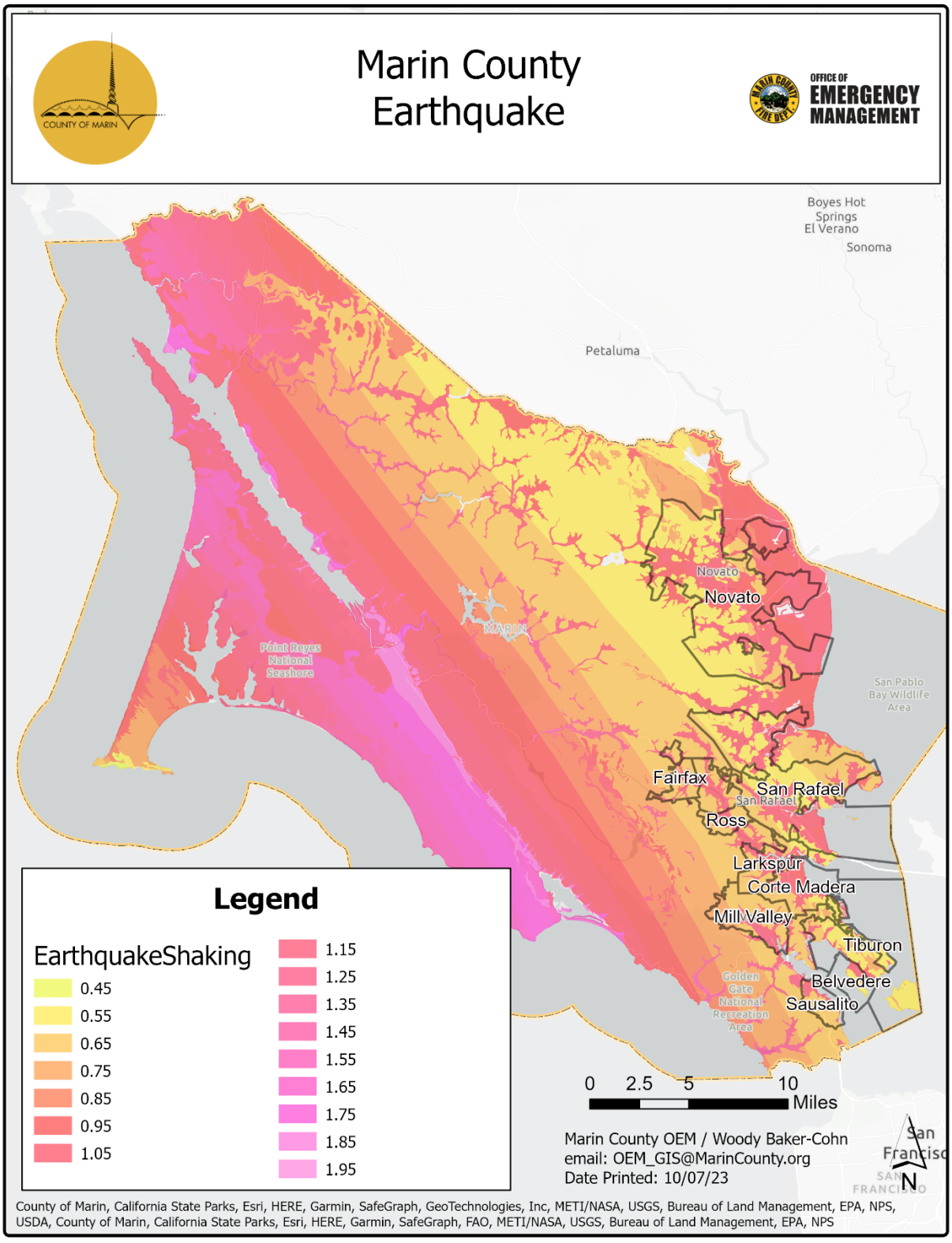


Figure 270: Marin County Earthquake Impact
Source: Marin County OEM

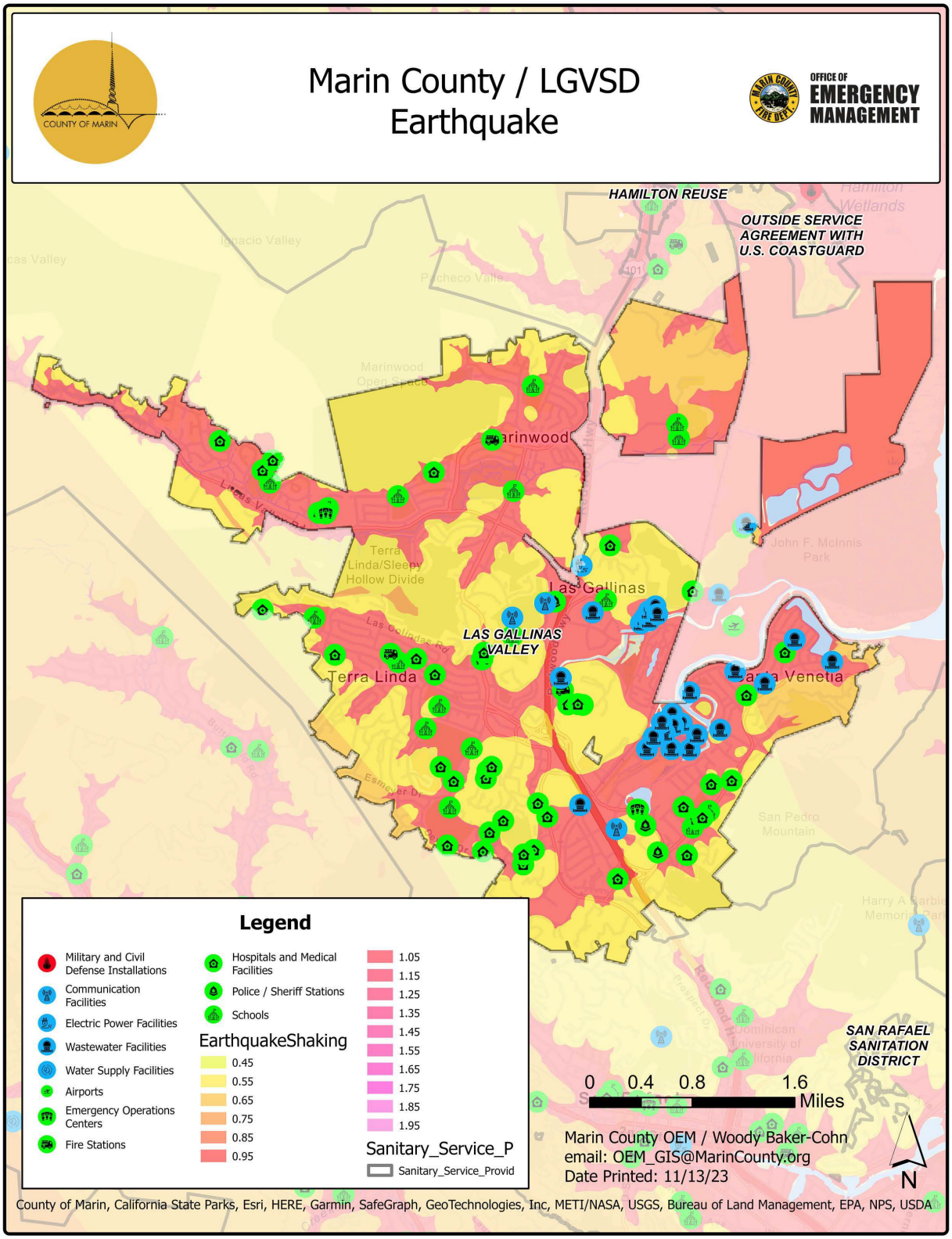


Figure 271: LGVSD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

The District is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the District. There is increased risk of shaking and liquefaction in the District from an earthquake, particularly in the central and eastern lowland areas where superficial deposits and fill are more prevalent. All of the Districts critical facilities lie in these areas and have a moderate susceptibility to earthquake shaking. Vulnerable structures include District infrastructure and facilities that have not undergone major seismic retrofitting. Utility infrastructure throughout the District could be impacted by an earthquake, disrupting service to District customers.

The LGVSD has not experienced a major earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in the District.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including LGVSD, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[19], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowland and creek side areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

[19] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 32.

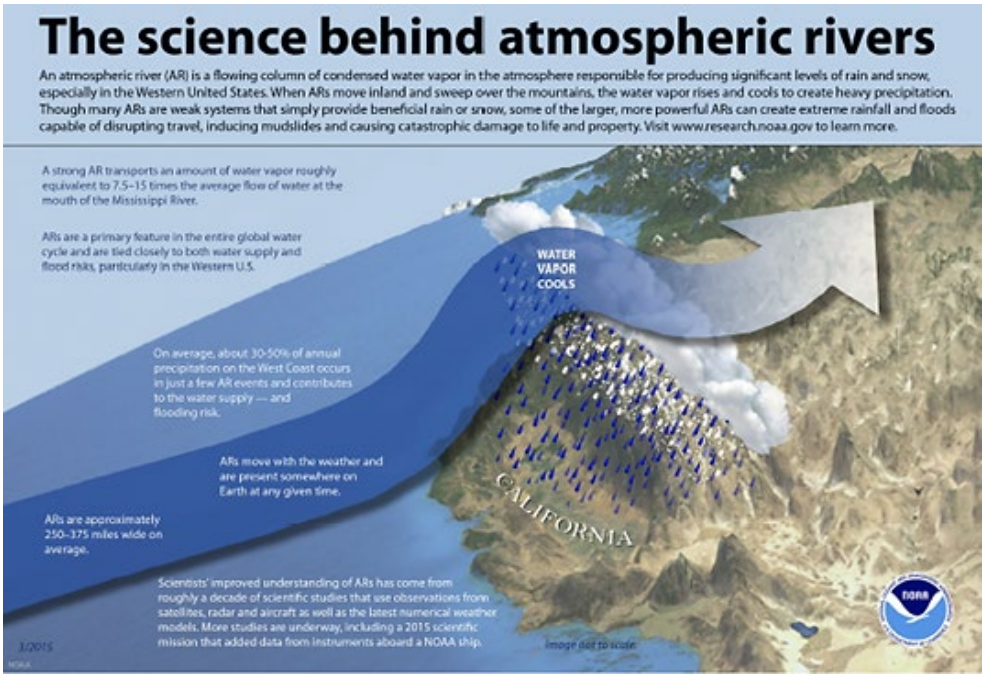


Figure 272: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in the LGVSD generally results from creek flooding in low-lying areas. Approximately half of the lowland areas in the District are in the 100-year floodplain, with the other half in the 500-year floodplain.

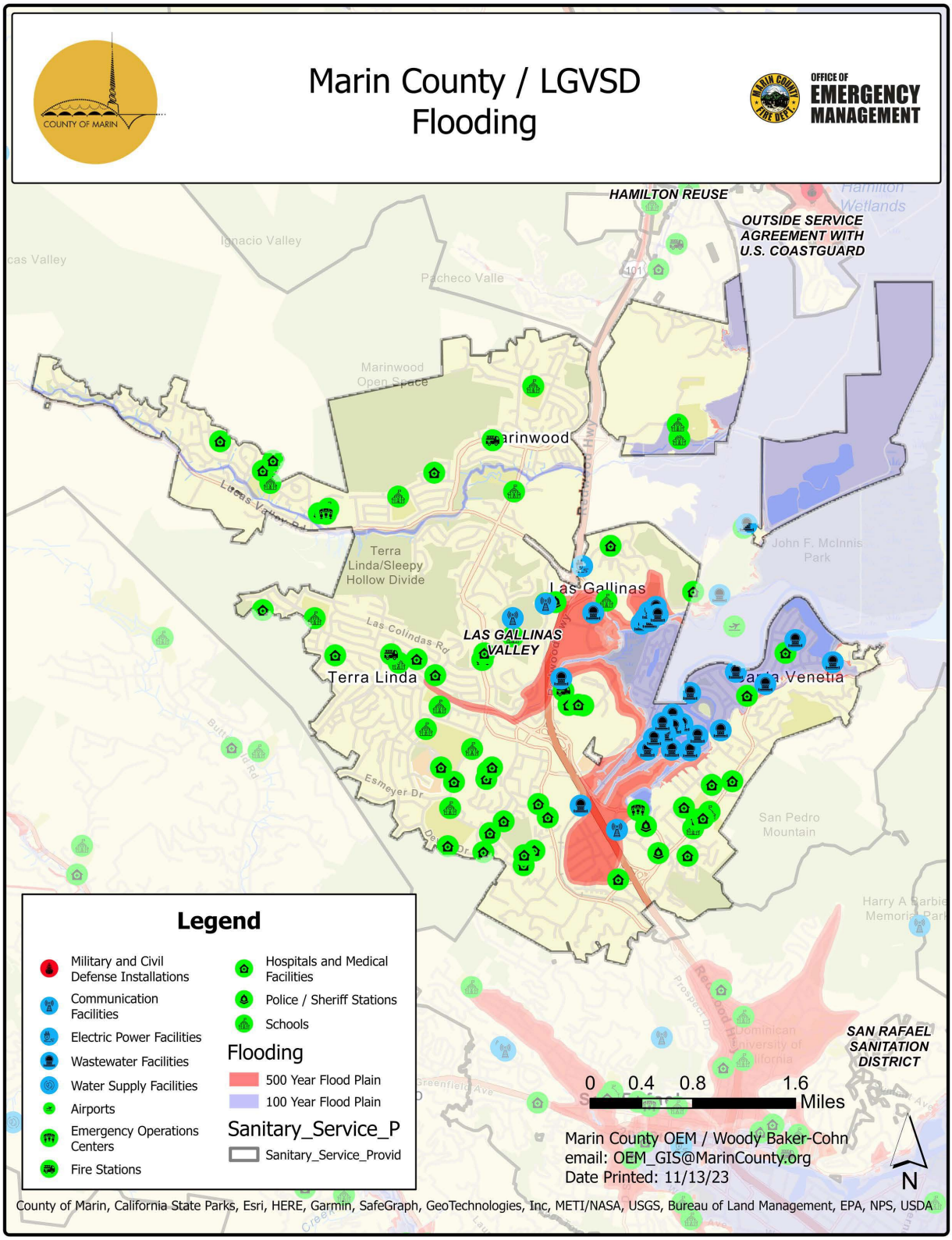


Figure 273: LGVSD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 15 shows the number of Las Gallinas Valley Sanitary District critical facilities by flood zone.

Table 15: Las Gallinas Valley Sanitary District Critical Facilities By Flood Zone

Category	Name	Address	Flood Zone
Wastewater Facilities	Wastewater Treatment Plant	300 Smith Ranch Rd, San Rafael, CA 94903	X
Wastewater Facilities	Laboratory	300 Smith Ranch Rd, San Rafael, CA 94903	AE
Wastewater Facilities	Northgate Industrial Park Pump Station	Near: 153 Paul Dr San Rafael, CA 94903	X
Wastewater Facilities	John Duckett Pump Station	Near: 4238 Redwood Hwy, San Rafael, CA 94903	X
Wastewater Facilities	Northgate Industrial Park Pump Station	Near: 153 Paul Dr San Rafael, CA 94903	X
Wastewater Facilities	John Duckett Pump Station	Near: 4238 Redwood Hwy, San Rafael, CA 94903	AE
Wastewater Facilities	Northgate Industrial Park Pump Station	Near: 153 Paul Dr San Rafael, CA 94903	AE
Wastewater Facilities	John Duckett Pump Station	Near: 4238 Redwood Hwy, San Rafael, CA 94903	AE
Wastewater Facilities	Northgate Industrial Park Pump Station	Near: 153 Paul Dr San Rafael, CA 94903	AE
Wastewater Facilities	John Duckett Pump Station	Near: 4238 Redwood Hwy, San Rafael, CA 94903	AE
Wastewater Facilities	Marin Lagoon #6 Pump Station	Near: 99 Mariners Cir, San Rafael, CA 94903	AE
Wastewater Facilities	Marin Lagoon #7 Pump Station	Near: 14 Bridgewater Dr, San Rafael, CA 94903	AE
Wastewater Facilities	Marin Lagoon #8 Pump Station	Near: 14 Mariners Cir, San Rafael, CA 94903	AE
Wastewater Facilities	Marin Lagoon #9 Pump Station	Near: 56 Mariners Cir, San Rafael, CA 94903	AE
Wastewater Facilities	Venetia Harbor Pump Station	85 Vendola Dr, San Rafael, CA 94903	AE
Wastewater Facilities	Hawthorne Pump Station	403 Vendola Dr, San Rafael, CA 94903	AE
Wastewater Facilities	Adrian Pump Station	Near: Candy's Park, 601 Adrian Way, San Rafael, CA 94903	AE
Wastewater Facilities	Descanso Pump Station	807 Descanso Way, San Rafael, CA 94903	AE
Wastewater Facilities	McPhail's Pump Station	Near: 1590 Vendola Dr, San Rafael, CA 94903	AE
Wastewater Facilities	Captain's Cove Flow Meter	Near: Corner of Yosemite Rd & Sailmaker Ct, San Rafael, CA 94903	X

Wastewater Facilities	Captain's Cove #1 Pump Station	Near: 159 Captains Cove Dr, San Rafael, CA 94903	X
Wastewater Facilities	Captain's Cove #2 Pump Station	128 Captains Cove Dr, San Rafael, CA 94903	X
Wastewater Facilities	Captain's Cove #3 Pump Station	30 Wharf Cir, San Rafael, CA 94903	X
Wastewater Facilities	Captain's Cove #4 Pump Station	89 Dockside Cir, San Rafael, CA 94903	X
Wastewater Facilities	Captain's Cove #5 Pump Station	28 Dockside Cir, San Rafael, CA 94903	X
Wastewater Facilities	Captain's Cove #6 Pump Station	16 Keel Ct, San Rafael, CA 94903	X
Wastewater Facilities	Saint Vincent's Pump Station	Intersection: St Vincent's Dr and Levee Road, San Rafael, CA 94903	AE
Wastewater Facilities	Reclamation Pump Station	Approx. 1,300 NE of 300 Smith Ranch Rd, San Rafael, CA 94903	AE
Electrical Power Facilities	Solar PV System	3 Miles NE of 300 Smith Ranch Road, San Rafael, CA 94903	AE

Table 137: Las Gallinas Valley Sanitary District Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Significant waterways that contribute to flooding within the District include Miller Creek, Gallinas Creek and the South Fork of Gallinas Creek. Most of the critical facilities in the District, including the LGVSD Treatment Plant and numerus pump stations, lie withing the 100-year floodplain of these creeks. Numerous pump stations, including all six of the Captain Cove Pump Station's, the Northgate Industrial Park Pump Station and the John Duckett Pump Station lie in the 500-year floodplain.

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. A breach and/or overtopping of the levees throughout the District could contribute to flooding in the lowland areas of the District where most of the District critical facilities lie.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[20] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of the City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of the City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along Miller Creek, Gallinas Creek and the North Fork of Gallinas Creek would expose more people, structures and infrastructure including major roads to creek flooding and storm surge as a result of climate change.

2.2.5 LAND SUBSIDENCE

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

[20] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

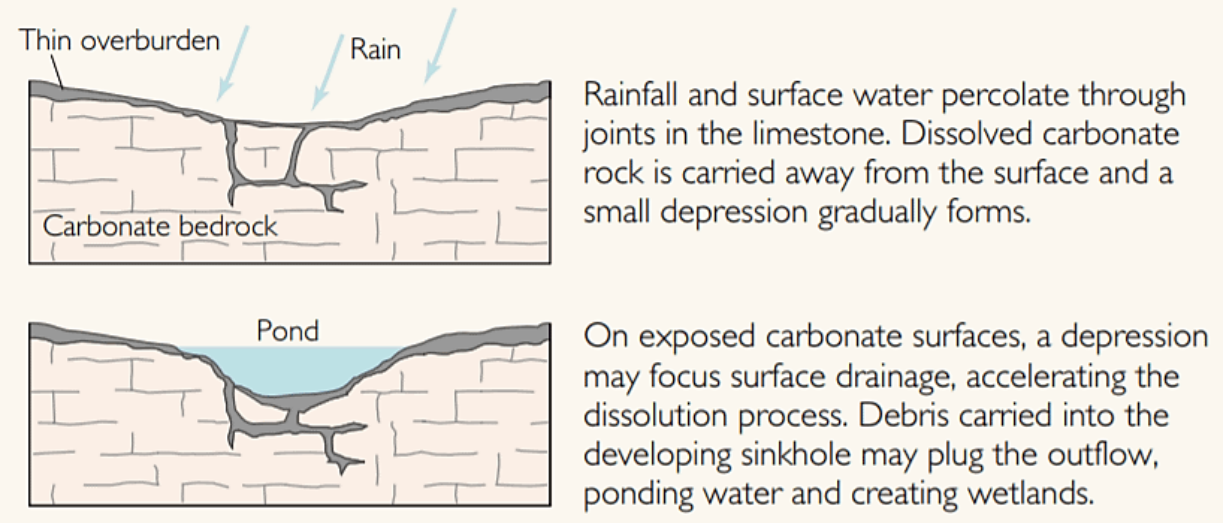


Figure 274: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 35 for a picture and description of how cover-subsidence sinkholes form.

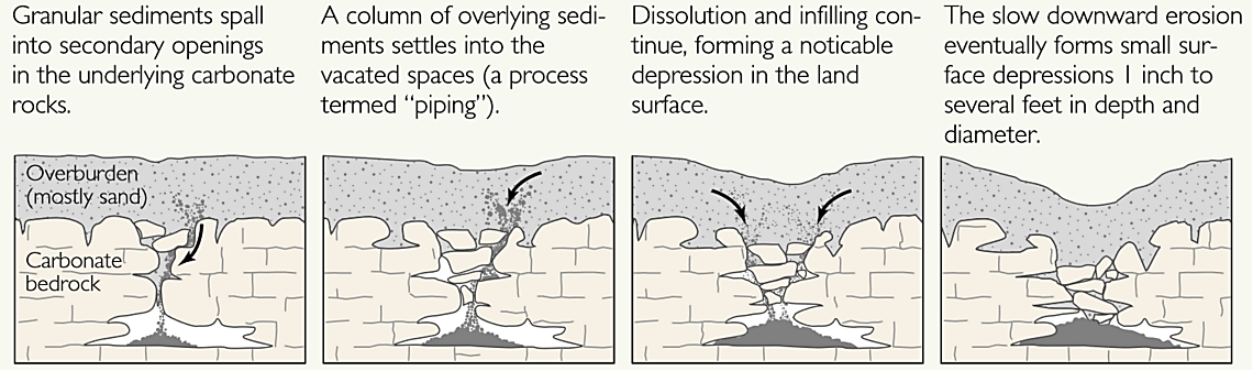


Figure 275: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 36 for a picture and description of how cover-collapse sinkholes form.

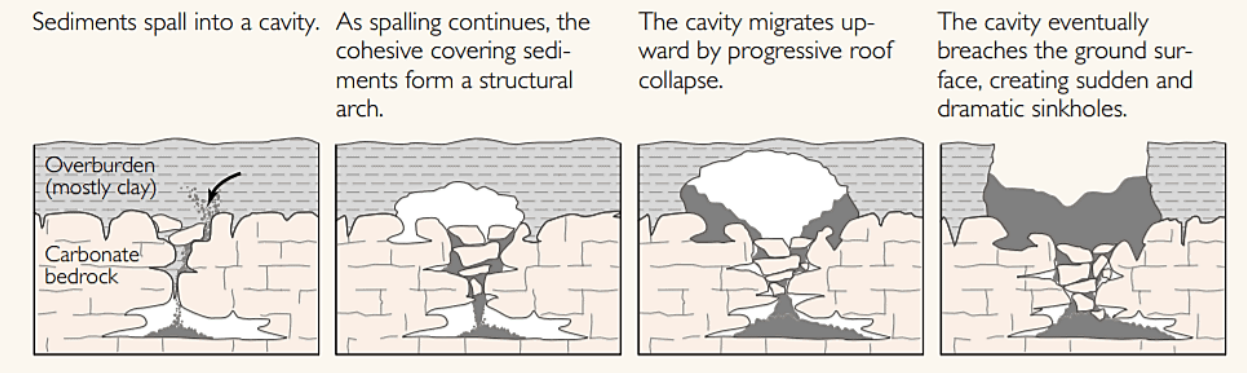


Figure 276: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central and eastern lowland areas of the LGVSD where superficial deposits and fill are more prevalent. This includes the areas around Las Gallinas and Santa Venetia where all of the District critical facilities lie. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for the District, including the settling of District facilities as well as the shifting of District infrastructure.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities in the District could increase with future development in the lowland populated areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent where land subsidence is more likely to occur.

2.2.6 LEVEE FAILURE

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

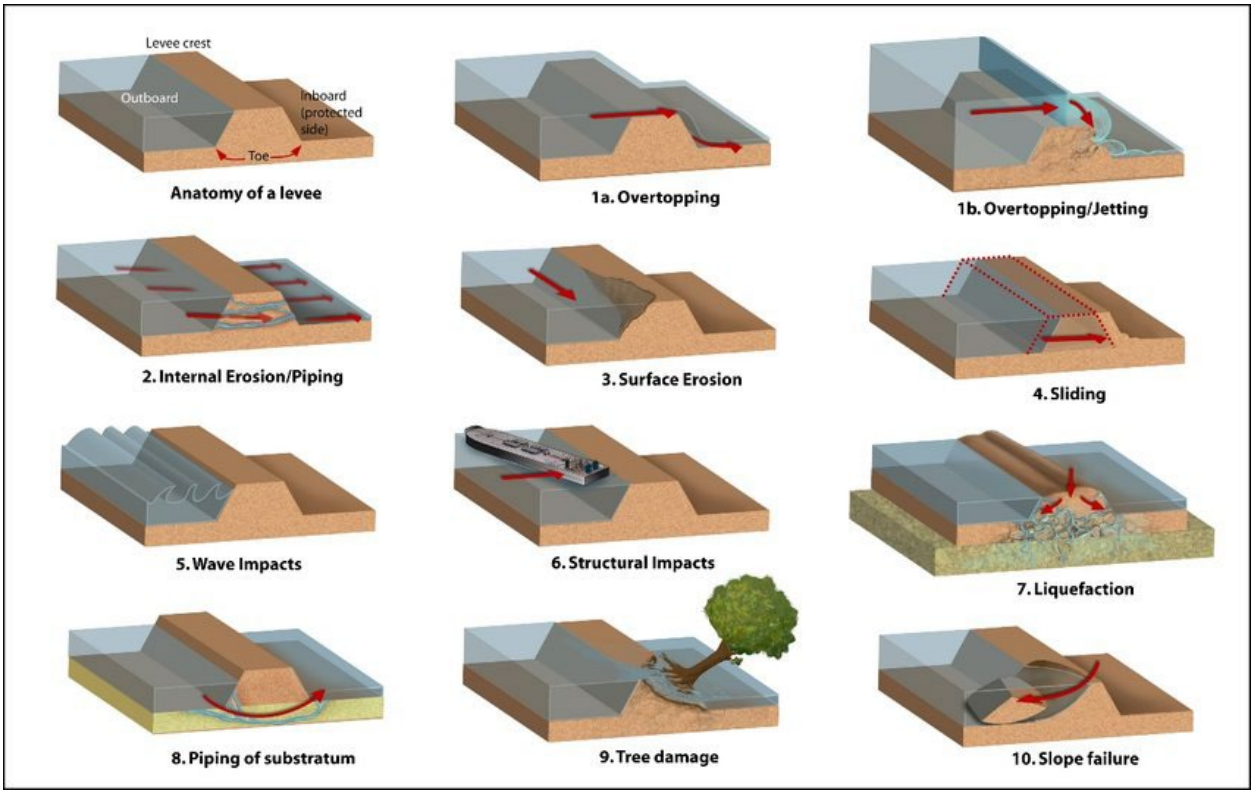


Figure 277: Levee Failure Mechanisms
Source: University of California

The LGVSD is protected by levees along Miller Creek, Gallinas Creek and the South Fork of Gallinas Creek. A failure of any of these levees during a high rain event could cause flooding into the District, with property and critical infrastructure within the 100-year floodplain being most susceptible.

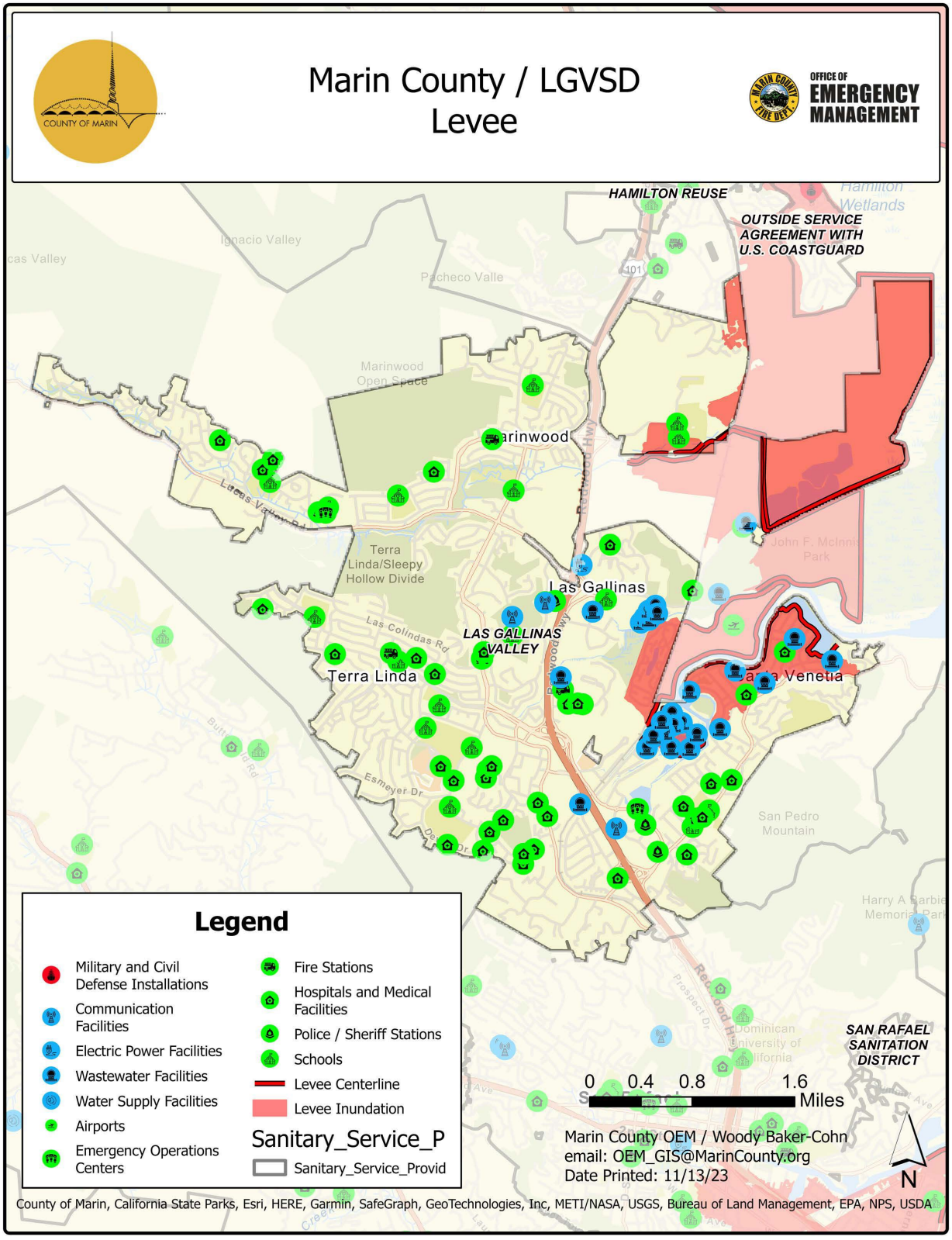


Figure 278: LGVSD Levee Inundation Map
Source: Marin County OEM

Three levee systems exist in St. Vincent. Two of them, Marin County Levee 33 and Marin County Levee 24, are located along the north bank of Miller Creek. Marin County Levee 33 is 0.25 miles long with an undocumented height and Marin County Levee 24 is 0.2 miles long with an undocumented height. The third levee is the LGVSD Levee which extends along the north and east bank of Miller Creek before diverging north to the Hamilton Wetlands and west to Long Point. It is 3.63 miles long with an undocumented height and protects the LGVSD Treatment Plant from flooding. Figure 39 shows the three levees in St. Vincent.

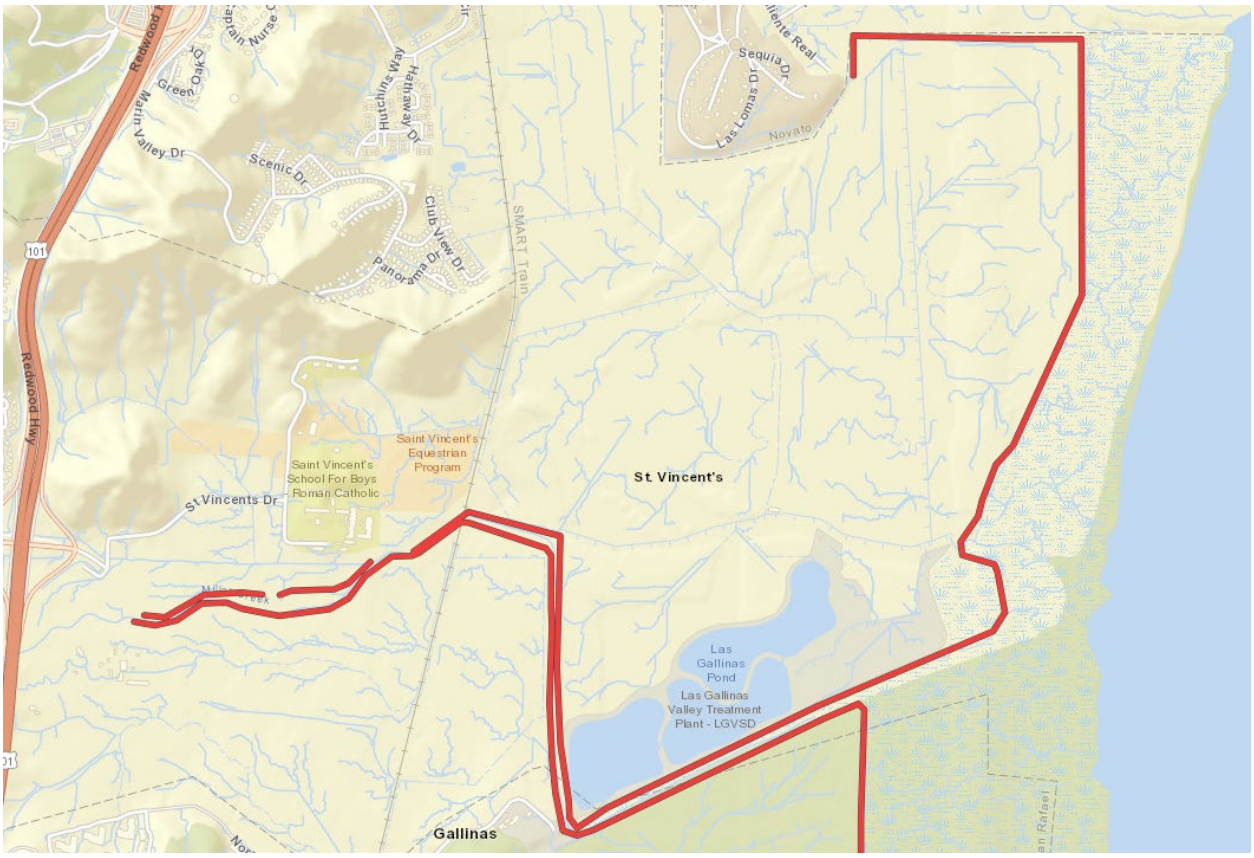


Figure 279: Marin County Levees 33 and 24 and the LGVSD Levee in St. Vincent
Source: U.S. Army Corps of Engineers

One levee system exists in Santa Venetia and is located along the South Fork of Galinas Creek. The Santa Venetia Levee is 1.45 miles long with an undocumented height. It protects six District pump stations in Santa Venetia from flooding. Figure 40 shows the Santa Venetia Levee in Santa Venetia.

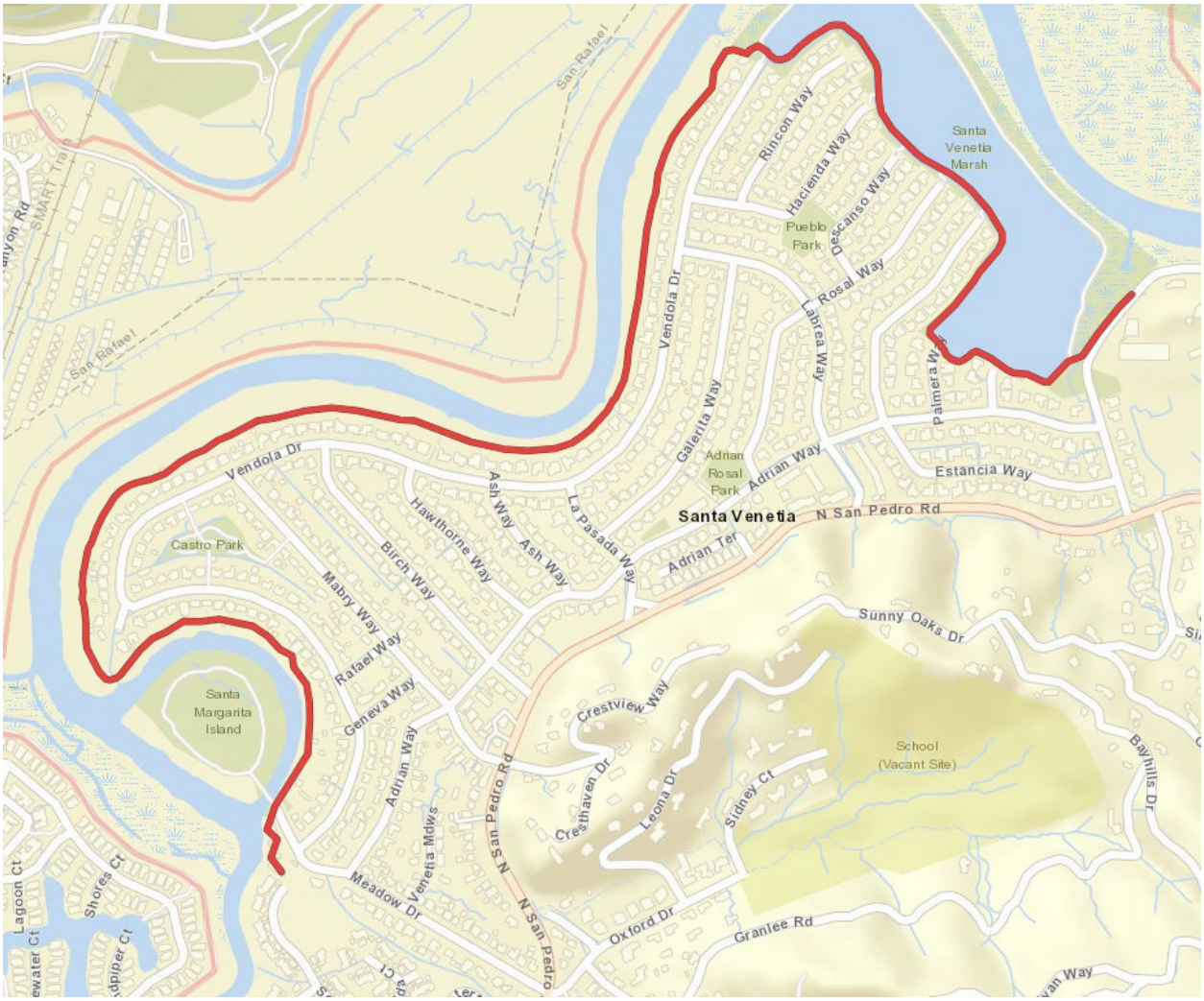


Figure 280: Santa Venetia Levee in Santa Venetia
Source: U.S. Army Corps of Engineers

Marin County Levee #3 is located on the south bank of the South Fork of Gallinas Creek. Marin County Levee #3 is 0.9 miles long with an undocumented height and protects the Marin Lagoon area of the District, including nine of its pump stations. Figure 41 shows the Marin County Levee #3.

Figure 281: Marin County Levee #3
Source: U.S. Army Corps of Engineers

The Smith Ranch Airport Levee is located along the north bank of the South Fork of Gallinas Creek and the South Bank of Gallinas Creek. It is 2.26 miles long with an undocumented height. No District critical facilities are protected by the Smith Ranch Airport Levee. Figure 42 shows the Smith Ranch Airport Levee.

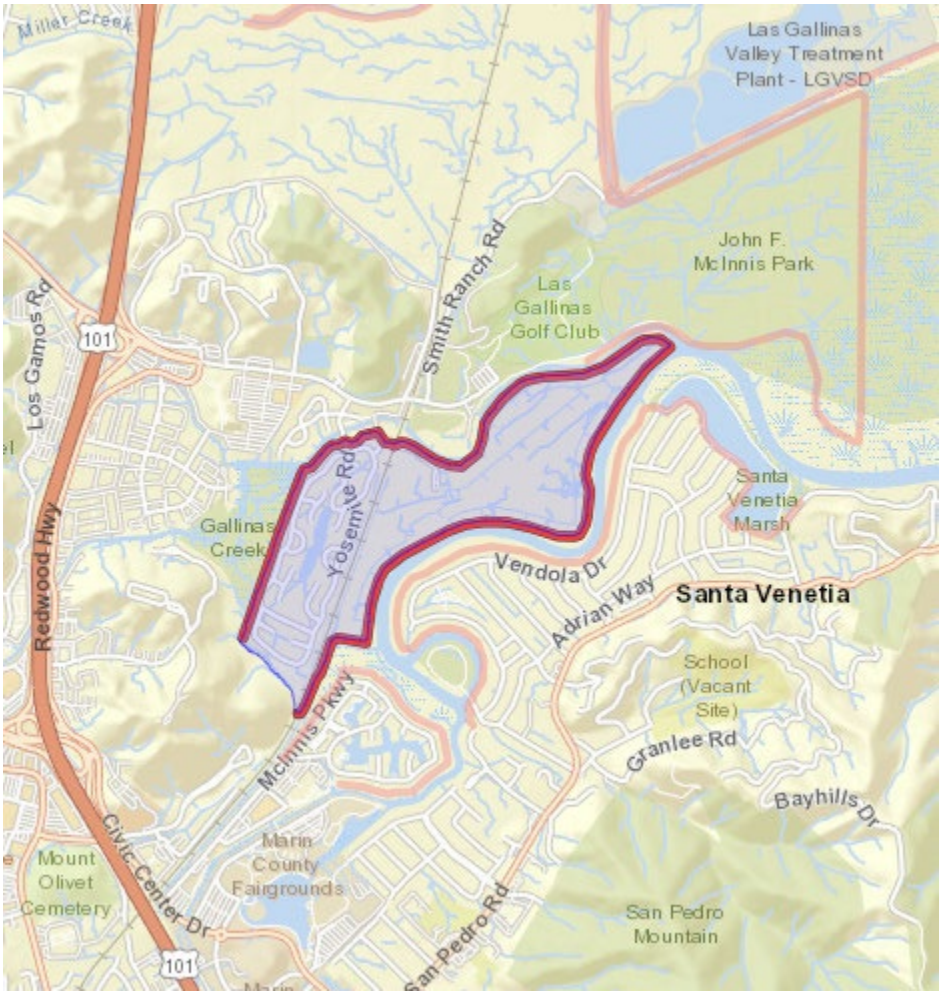


Figure 282: Smith Ranch Airport Levee
Source: U.S. Army Corps of Engineers

There has never been a documented levee failure in the District.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent protected by its levees, particularly along Gallinas Creek and the South Fork of Gallinas Creek and around their marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Much of the District lies at a lower elevation and most of its critical facilities, including the LGVSD and all of its pump stations in Santa Venetia and the Marin Lagoon are susceptible to sea level rise between one and five feet of inundation.

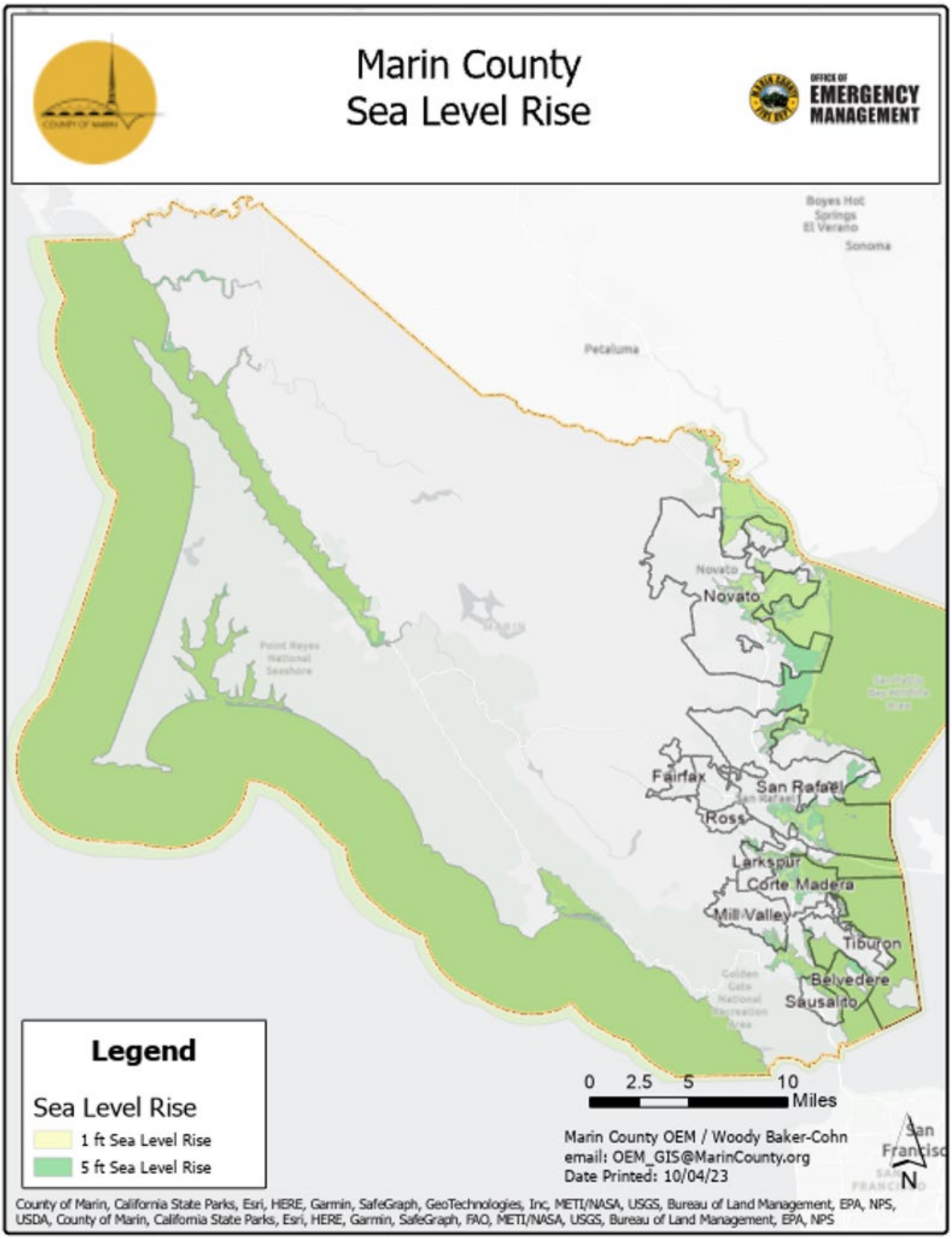


Figure 283: Marin County Sea Level Rise Impact
Source: Marin County OEM

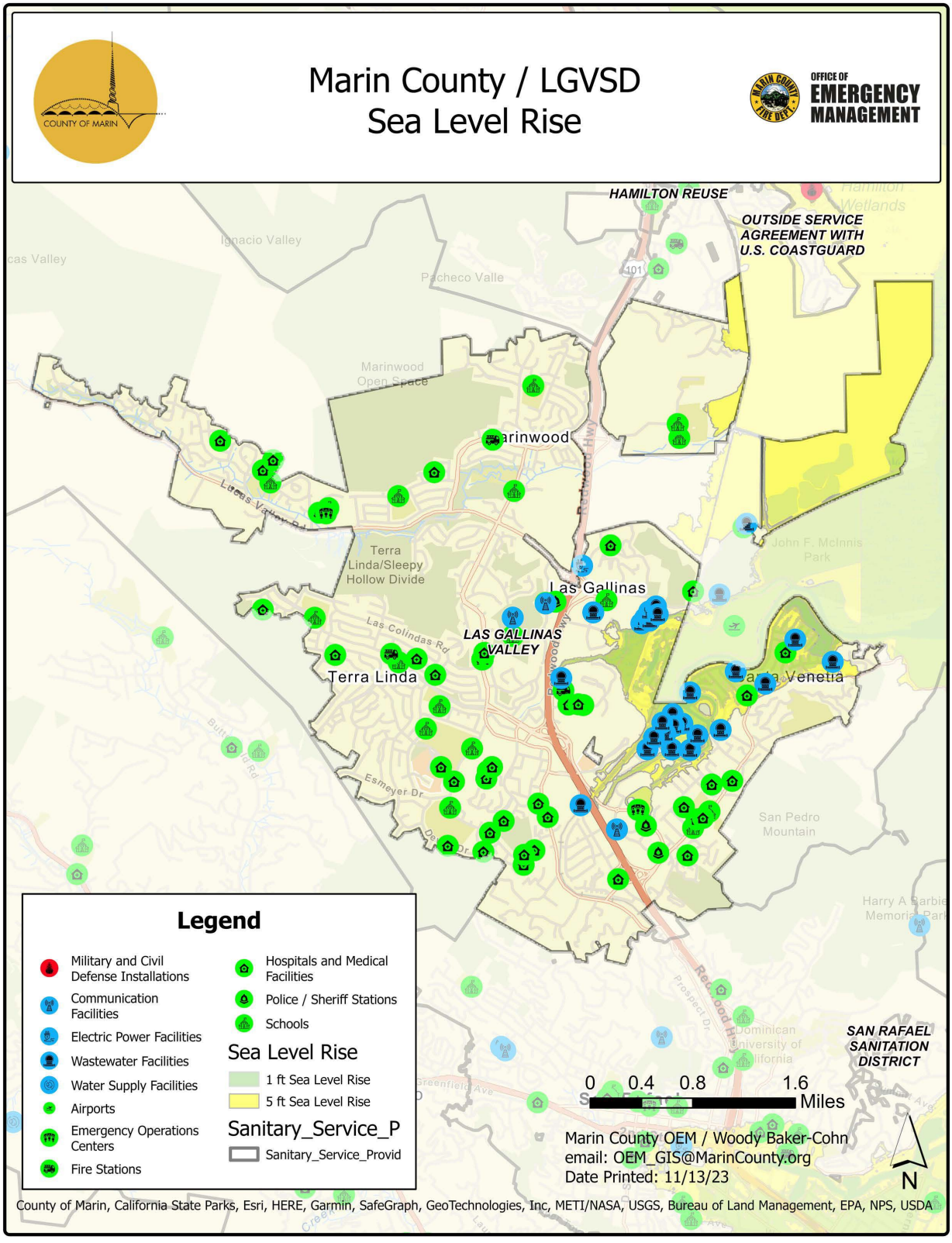


Figure 284: LGVSD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

Critical facilities throughout the District can become damaged extensively with their foundations compromised over time. Of particular concern are those facilities that have not been elevated to projected sea level rise heights over the next century. Sea level rise in the District has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into areas were critical facilities lie. Sea level rise can also cause increased subsidence in the District, which may damage underground water and wastewater pipelines and disrupt services.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

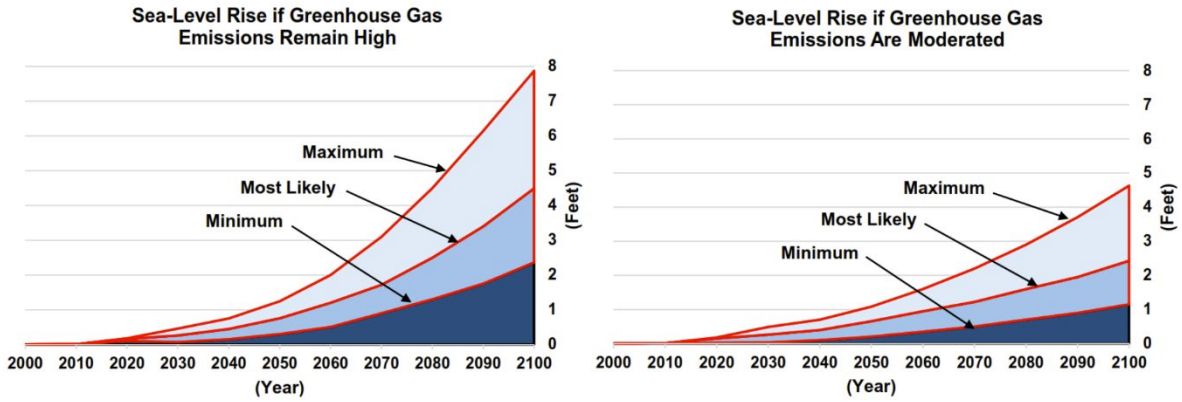


Figure 285: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around the northern City of San Rafael and the unincorporated County areas of Lucas Santa Venetia and St. Vincent will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent will continue to become inundated.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 46):

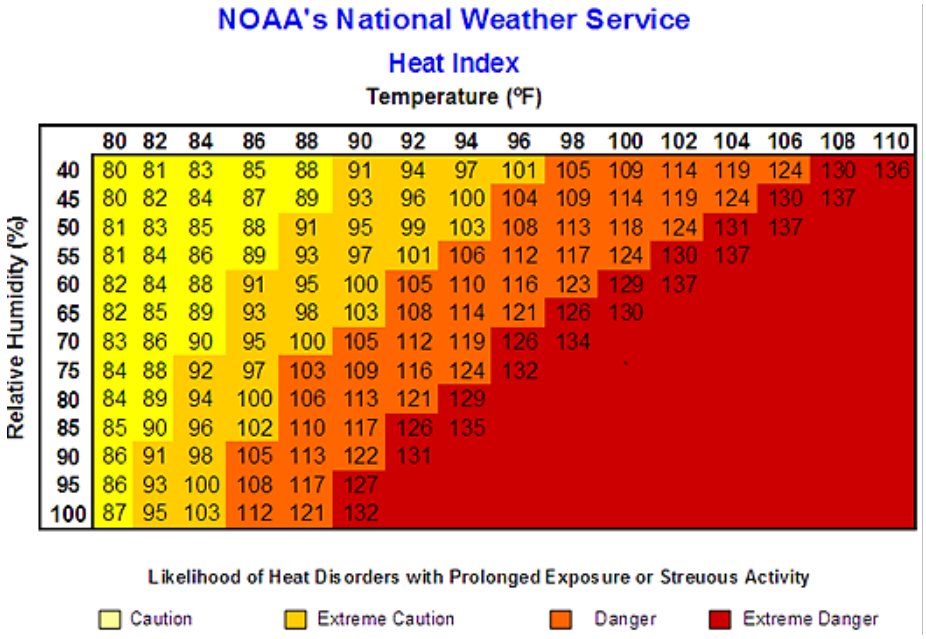


Figure 286: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Mill Valley and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city between Miller Avenue and E. Blithedale Avenue. There are dozens of residences in this area. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

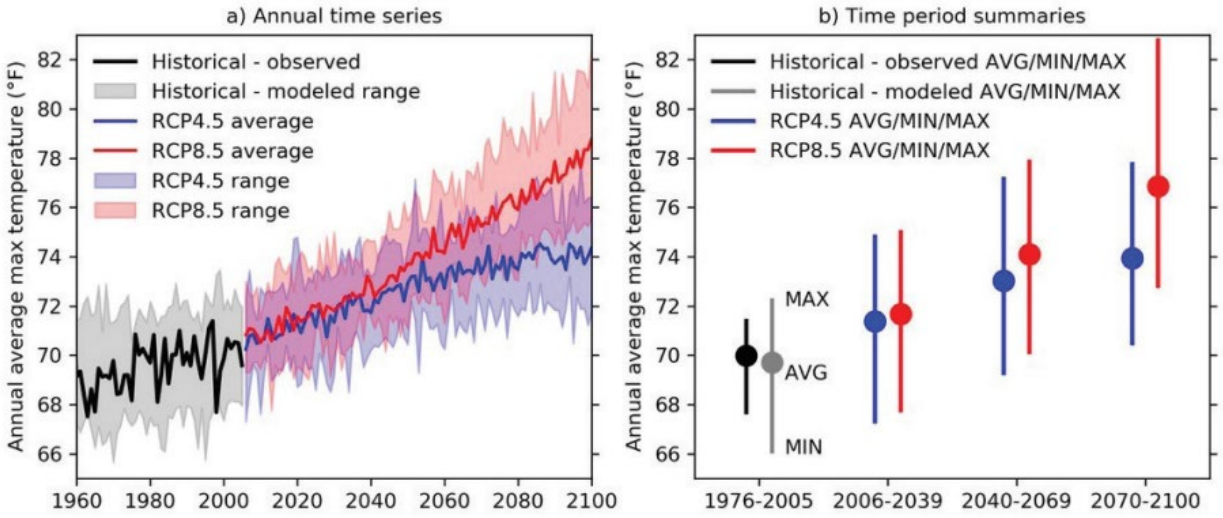


Figure 287: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent as conditions become hotter and drier. These effects will primarily be felt in the mountainous areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent; and the marshland areas of the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 48).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 288: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 49) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 289: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 290: Waterspout Formation
Source: MarineInsights

All of the LGVSD is susceptible to storms and damage from wind and tornadoes, though the hilly and mountainous areas throughout the District have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage critical facilities and infrastructure. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the delivery of services and access to critical facilities.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

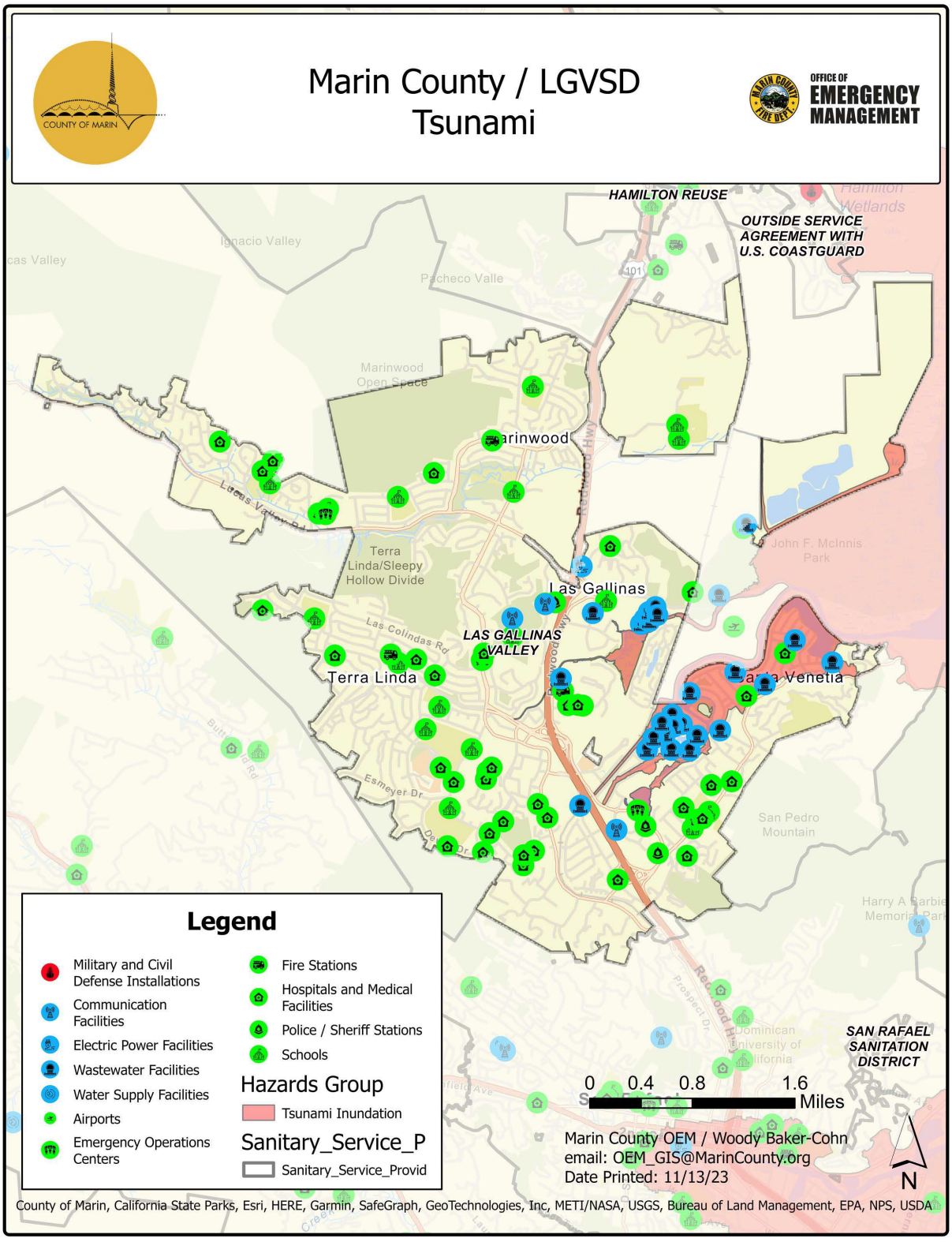


Figure 291: LGVSD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

A tsunami experienced by the LGVSD would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the District. Most of the eastern half of the District is at a lower elevation. Most of this area, including around the LGVSD Treatment Plant, is protected by levees and does not lie in a tsunami hazard area. The Santa Venetia area, while protected by a levee, does lie in a tsunami hazard area. There are five pump stations in this area that could be susceptible to a tsunami and could be inundated with floodwater in the event of a tsunami.

The LGVSD has never experienced a tsunami.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including LGVSD, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent. This is particularly true along Gallinas Creek and the South Fork of Gallinas Creek and around the marshland areas of the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Gallinas Creek and the South Fork of Gallinas Creek and along the shoreline of the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent as a result of high wave heights associated with a more significant tsunami.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. Marin County is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in

dangerous fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA.. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 52 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

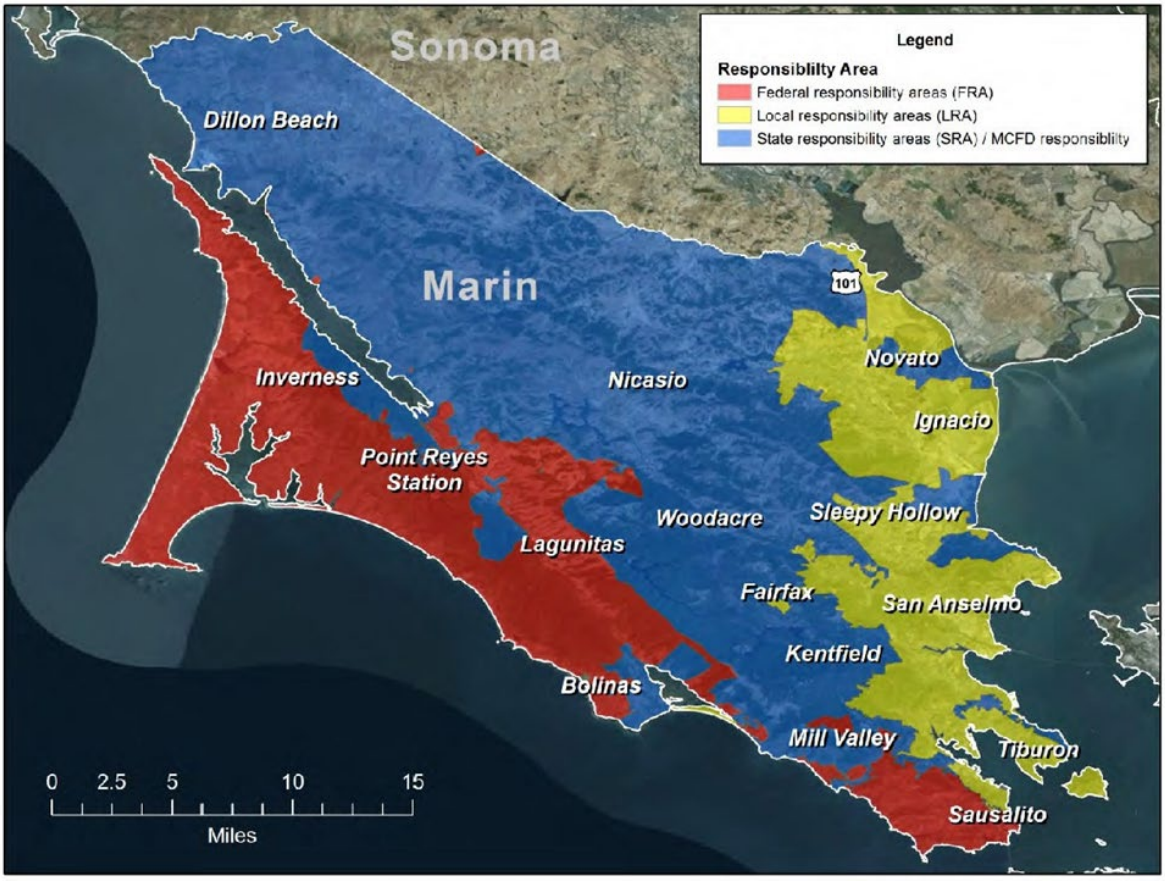


Figure 292: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

Marin County is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over southern Marin County near the San Francisco Bay). The fog often penetrates into the inland valleys of northern and central Marin County, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, and Lucas Valleys. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Great Basin to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph) and gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an

ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires.

A few times per year in the summer and early fall, monsoonal flow from Mexico brings in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, the lightning can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the CWPP, an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

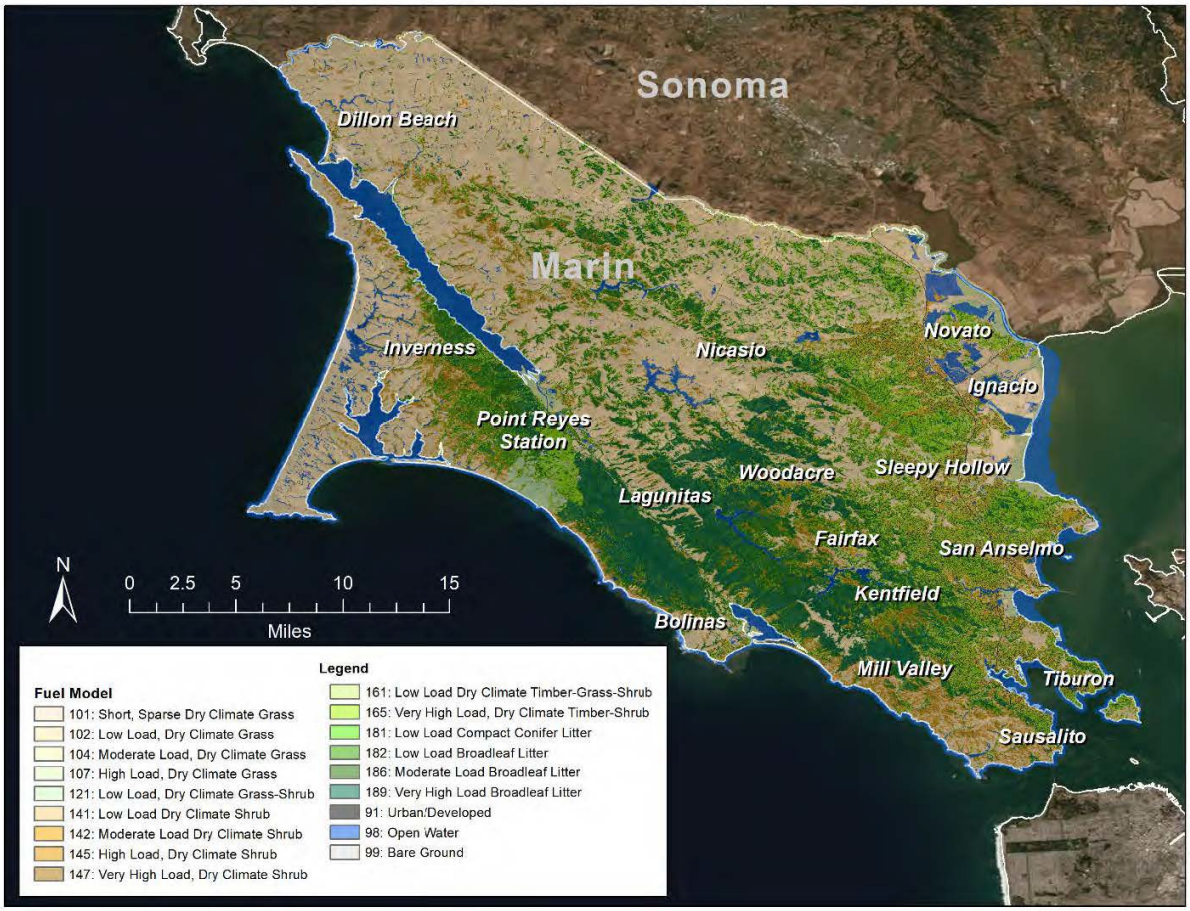


Figure 293: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is a concern since this specific desease can impact vegetation through Marin including the WUI .; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular, appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease

largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened

three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA.

A wildfire in the LGVSD would most likely occur in the areas of the District where there is more forested terrain. There are no District critical facilities in these areas. District critical facilities, including the LGVSD Treatment Plant and the McInnis Park Pump Station are in a high FHSZ and could be impacted by a brush fire in the vegetated marshland areas of the District adjacent to San Pablo Bay. As wildland areas around the District become drier due to climate change and drought, the risk of a wildfire or brush fire occurring and impacting the City will continue to increase as open spaces experience drier conditions.

The District has never experienced a major wildfire or brush fire.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

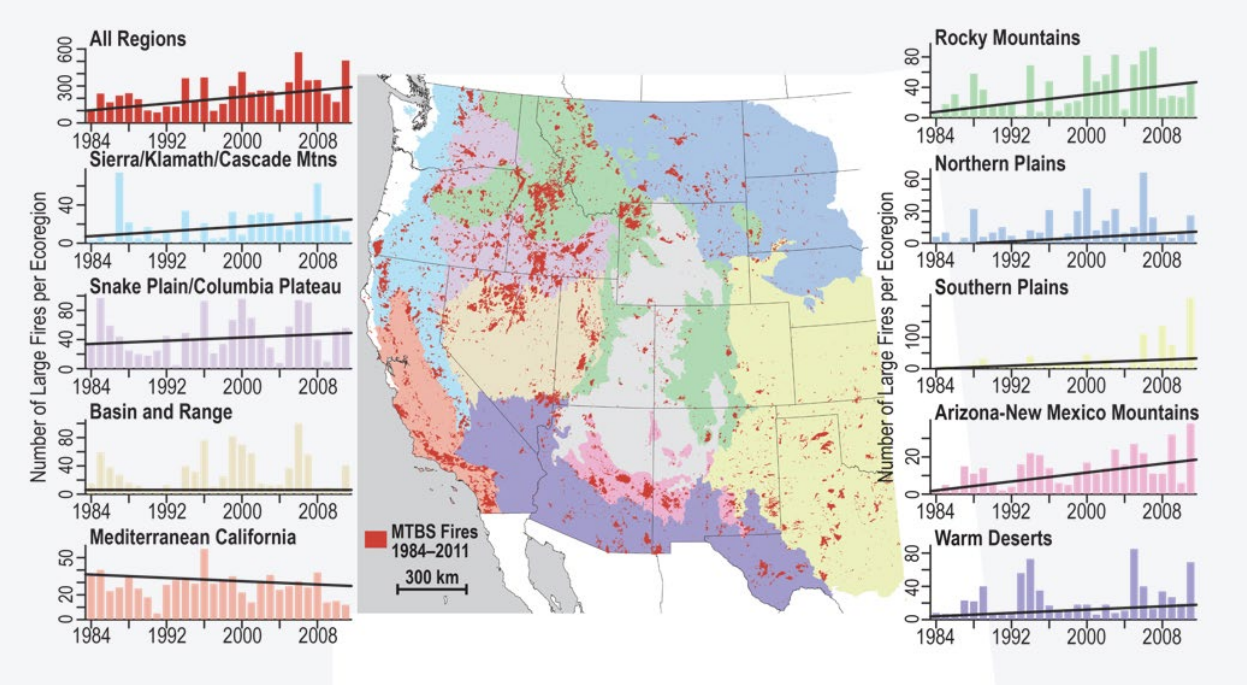


Figure 294: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate

change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent. Future development in the WUI throughout the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the northern City of San Rafael and the unincorporated County areas of Lucas Valley, Marinwood, Santa Venetia and St. Vincent WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the northern City of San Rafael and the unincorporated County areas of Santa Venetia and St. Vincent marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

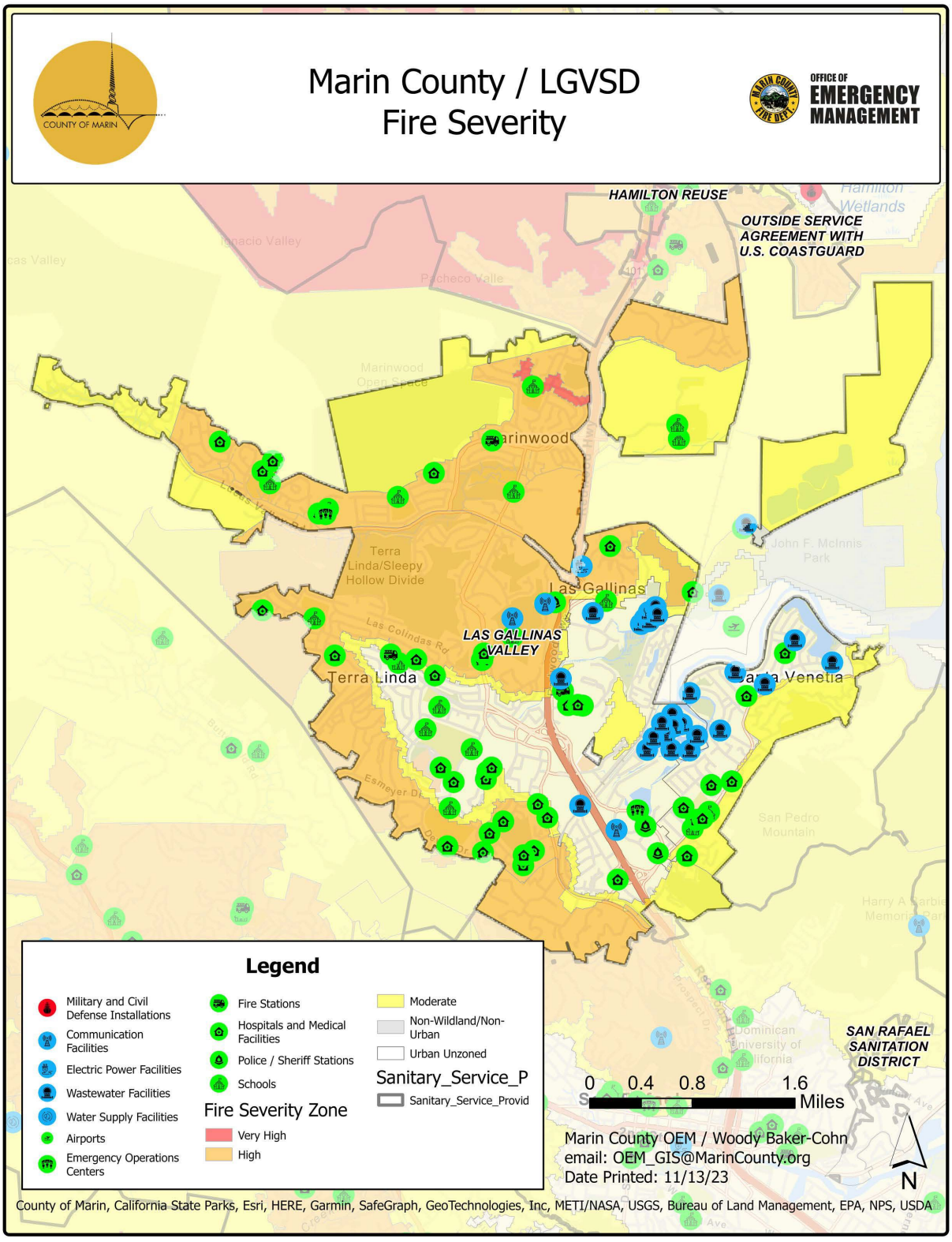


Figure 295: LGVSD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character. Future large development in the County is not expected within the next 5 years, however, some managed development has been identified, approved, or submitted.

There has been a significant amount of development within the Las Gallinas Valley Sanitary District since the last plan update in 2018. However, the development has been within the City of San Rafael or Marin County jurisdictions, and to existing facilities or within the facility footprint of the LGVSD. There has not been any increased risk to the District as a result of new development since the last plan update in 2018.

Future land use and growth management strategies in the Las Gallinas Valley Sanitary District are consistent with priorities detailed in the 2023 Marin County MJHMP and aim to concentrate future development into and toward existing areas away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. No further development is planned for the next five years.

3.2 CAPABILITY ASSESSMENT

The Las Gallinas Valley Sanitary District did not participate in the 2018 Marin County MJHMP. However, the strategies which support the overall District priorities are reflected in the sections below. Several current and future mitigation actions are identified to coincide with priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms and hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the District's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the LGVSD an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Community Wildfire Protection Plan:** The district may consider taking an active role in mitigation actions to enhance wildfire protection.
- **StormReady certification and Firewise Communities certification:** The district may consider participation in these programs.

Table 16: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive /Master Plan	Yes	Integrated Wastewater Master Plan (IWMP) addresses hazards, identifies projects, and it can be used to implement mitigation actions.
Strategic Plan	Yes	Guiding document determining vision including vision to action table. Does not address hazards. Can be used to identify goals but not to implement mitigation actions.
Capital Improvements Plan	Yes	Hazards identified in IWMP are funded based on priority. Mitigation projects could be included in the CIP. If Board approves CIP funding, the plan supports implementation of mitigation actions.
Economic Development Plan	No	N/A
Local Emergency Operations Plan	Yes	Emergency Preparedness Response Plan, District specific. Responds to hazards. Does not identify projects to mitigate.
Continuity of Operations Plan	Yes	Resilience plan for treatment plant required as part of NPDES permit. Sewer System Management Plan (SSMP) for continued operations of the collection system.
Flood Mitigation Plan (FMP)	Yes	District participates in the Marin County Plan.
Engineering Studies for Streams	No	N/A
Open Space Management Plan	No	N/A
Regional Transportation Plan (RTP)	No	N/A
Stormwater Management Plan/Program	Yes	District participates in the San Rafael & Marin County Plan.
Community Wildfire Protection Plan	Yes	District participates in the Marin County WPP
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal	No	N/A

zone management, climate change adaptation)		
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Yes	Yes, District adheres to city, county, state, & federal codes.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	Yes, District adheres to city, county, state, & federal codes.
Fire department ISO rating:	No	
Site plan review requirements	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
District Code	Yes	District Code allows for collection of sewer service fees and capacity fees to fund mitigation projects. Program is adequately administered. No enforcement.
Zoning ordinance	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Subdivision ordinance	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Floodplain ordinance	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Flood insurance rate maps	Yes	Yes, District participates San Rafael or Marin County plan reviews.
Elevation Certificates	Yes	Yes, District participates San Rafael/Marin County plan review.
Acquisition of land for open space and public recreation uses	No	
Erosion or sediment control program	Yes	Yes, District participates San Rafael or Marin County plan reviews.

Table 138: Las Gallinas Valley Sanitary District Legal and Regulatory Capabilities
Source: Las Gallinas Valley Sanitary District

Las Gallinas Valley Sanitary District Comprehensive Plan or Master Plan

Las Gallinas Valley Sanitary District boundaries overlap unincorporated areas of Marin County and the City of San Rafael, both of which are required to have a General Plan or Master Plan per California Government Code 65300. Please see their respective General Plan or Master Plan for details.

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the District personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 17: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Planning Commission	Yes	Yes, Coordinate & participate with San Rafael & Marin County.
Administrative Services	Yes	Yes, Coordinate with San Rafael & Marin County.
Hazard Mitigation Planning Committee	Yes	Yes, Coordinate & participate with San Rafael & Marin County.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Yes, Easements kept clear (trees and unpermitted obstructions) for emergency access
Mutual aid agreements	Yes	Between other local wastewater agencies and Marin OEM
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Yes	Yes, Coordinate & participate with San Rafael & Marin County.
Hazard data and information	No	
Grant writing	No	
Hazus analysis	No	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	No	
Floodplain Administrator	No	
Emergency Manager	Yes	General Manger serves in this role by definition. Leads the management team and coordinates with other wastewater agencies as needed during emergencies.
Community Planner	No	
Civil Engineer	Yes	District Engineer and Engineering Department enforce District regulations, have training on hazard mitigation, and coordinates with County and City officials.
Engineer(s), project manager(s), technical staff, equipment operators, and	Yes	Yes, Coordinate with San Rafael & Marin County on projects.

maintenance and construction staff.		
GIS Coordinator	No	
Community Development Staff	No	
City Planning, Building, and Public Works Staff	No	
Police Department Staff	No	
Fire Protection District Staff	No	
Community Development Staff	No	

Table 139: Las Gallinas Valley Sanitary District Administrative and Technical Capabilities
Source: **Las Gallinas Valley Sanitary District**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific future financial and budgetary tools available to the district such as Hazard Mitigation grants; capital improvements project funding; authority to work with San Rafael and Marin County to levy utility taxes for specific purposes; fees for sewer or impact fees for home buyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 18: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	Feasibility studies, planning, and construction. Resource can be used to fund future mitigation actions.
Authority to levy taxes for specific purposes	No	
Fees for water, sewer, gas, or electric services	Yes	The District has the ability to assess sewer service charge fees and capital facilities charges. If mitigation projects are identified and included in an adopted Sewer Rate Study or Capacity Fee Study, the fees can be use for mitigation project when adopted with the annual budget.
Impact fees for new development	Yes	Development impact fees may be required when permit for connection to the wastewater system is required.
Storm water utility fee	No	
Incur debt through general obligation bonds and/or special tax bonds	Yes	Recent upgrade of the Secondary Treatment Plant facility and expansion of the Recycled Water facility was funding in part by bond.
Incur debt through private activities	Yes	Funding of capital improvements to the sewer collection system to meet the capital financing needs of the District. Funds could be used to fund mitigation actions.

Community Development Block Grant	No	
Other federal funding programs	Yes	Federal grant and infrastructure awards could be used to fund mitigation projects, such as sea-level rise and drought contingency. Regional coordination through North Bay Water Reuse Authority was used to obtain federal grant in for partial funding used towards Secondary Treatment Plant facility and expansion of the Recycled Water facility.
State funding programs	Yes	California Clean Water State Revolving Fund obtained in 2010 to complete primary clarifier system improvements at the treatment plant. Funding can be used to fund future mitigation actions.

Table 140: Las Gallinas Valley Sanitary District Fiscal Capabilities
Source: **Las Gallinas Valley Sanitary District**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Las Gallinas Valley Sanitary District and the Las Gallinas Valley Sanitary District partnerships utilized to promote those programs.

Table 19: Las Gallinas Valley Sanitary District Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Local groups and non-profits may be able to help spread the word on environmental protection but may be limited by funding challenges. The District supports environmental protection. Educational center is part of the District's plan for new facilities near the District's treatment plant and/or reclamation ponds.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	Environmental education related to wastewater and pollution prevention programs are held at various regional events throughout the year. Newsletters round out the education initiative in the District. Both can support future implementation of future mitigation activities.
Natural disaster or safety related school programs	No	
StormReady certification	No	
Firewise Communities certification	No	
Community Rating System	Yes	Local groups and non-profits may be able to help spread the word on environmental protection but may be limited by funding challenges. The District supports

		environmental protection. Educational center is part of the District's plan for new facilities near the District's treatment plant and/or reclamation ponds.
Public-private partnership initiatives addressing disaster-related issues	Yes	Environmental education related to wastewater and pollution prevention programs are held at various regional events throughout the year. Newsletters round out the education initiative in the District. Both can support future implementation of future mitigation activities.

Table 141: Las Gallinas Valley Sanitary District Community Outreach
Source: **Las Gallinas Valley Sanitary District**

3.2.5 Participation in the National Flood Insurance Program

As a Special District the Las Gallinas Valley Sanitary District does not participate in the national flood insurance program (NFIP). However, the City of San Rafael and the County of Marin do participate in the NFIP and have profiled their flood risk in the Flood Profile in this Annex, the Marin County OA MJHMP, and the City of San Rafael Annex. Repetitive loss and severe repetitive loss structures are also addressed in the NFIP portion of the Marin County OA MJHMP, and the City of San Rafael Annex.

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long‐term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

The Las Gallinas Valley Sanitary District did not participate in the 2018 Marin County MJHMP and therefore, did not have any previous mitigation actions.

3.5 Hazard Mitigation Actions

The 2023 Marin County MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Las Gallinas Valley Sanitary District based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires District Board of Directors regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 20 lists the Current Hazard Mitigation Actions for the Las Gallinas Valley Sanitary District.

Table 20: Las Gallinas Valley Sanitary District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
LGV-1	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies or risk.	All Hazards 1, 2, 3, 4, 5	Las Gallinas Valley Sanitary Dist./ Marin County	New (2023)	Cost: General Funds	1 -2 Years/ High	
LGV-2	Flood Protection Plan/Sea Level Rise Mitigation Program Planning. Develop Flood Management Plan to improve flood protection and resilience of biosolids disposal area, reclamation, pump stations, and all critical treatment facilities.	Flooding, Sea Level Rise, Tsunami /1, 2	Las Gallinas Valley Sanitary District	New (2023)	Cost TBD; HMGP, BRIC, FMA, CDAA and Local Grants	1-2 Years/ High	
LGV-3	Standby Generators for Minor Pump Stations. Installation of permanent generators to provide emergency power backup to select wastewater pump stations during PG&E Public Safety Power Shutoff outages.	Wildfire/ 1, 2	Las Gallinas Valley Sanitary District	Existing	Cost $700k; LGVSD Capital Improvement Program (CIP)	On-going/ High	
LGV-4	John Duckett Pump Station Improvements. Improve sea level rise resiliency; pipeline structural integrity during earthquakes; and increase pumping capacity during major storm events.	Flooding, Sea Level Rise; Earthquake; Severe Weather/1, 2	Las Gallinas Valley Sanitary District	New (2023)	Cost TBD; Loan, LGVSD CIP	1-2 Years/ High	
LGV-5	Administration, lab, and Operations Control Building Construction. Design and construction of a state-of-the-art operations control center incorporating advanced communication and alarm system for pump stations and other facilities during service disruptions, such as major storm events, earthquakes, and other disasters. The administration, lab,	Earthquake; Flooding, Sea Level Rise; Severe Weather Heat and Wind; Tsunami, Wildfire/ 1, 2	Las Gallinas Valley Sanitary District	New (2023)	Cost TBD; SRF Loan, HMGP, BRIC, FMA, CDAA Grants, LGVSD CIP	1-2 Years/ High	

Table 20: Las Gallinas Valley Sanitary District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
	and control center building(s) shall comply with current Building Code requirements for seismic, flood, and fire.						
LGV-6	Miller Creek Vegetation Maintenance. Maintain vegetated sloped areas because of previous dredging of Lower Miller Creek on LGVSD property to control gravel and debris flow downstream and control landslide and erosion of existing levees.	Debris Flow/ 1, 2	Las Gallinas Valley Sanitary District	Existing	Cost $50k per year; LGVSD CIP	On-going/ High	
LGV-7	Miller Creek Dredging Project. Dredging Lower Miller Creek on LGVSD property to remove accumulated sediment and increase creek capacity to convey runoff during major storm events.	Flooding, Sea Level Rise; Tsunami, Severe Weather/ 1, 2	Las Gallinas Valley Sanitary District	New	Cost TBD; HMGP, BRIC, FMA, CDAA Grants, LGVSD CIP	2-5 Years High	
LGV-8	Recycled Water Expansion. Expanded capacity of Title 22 recycled water production for distribution by NMWD and MMWD.	Drought/ 1, 2	Las Gallinas Valley Sanitary District	Existing	Cost: $6M; USBR WaterSmart Grant and LGVSD CIP	On-going/ High	
LGV-9	Sewer Main Rehabilitation. Maintain and improve the wastewater collection system to minimize inflow and infiltration during peak wet weather events.	Flooding; Tsunami, Severe Weather/ 1, 2	Las Gallinas Valley Sanitary District	New (2023)	Cost TBD; LGVSD CIP	1-2 Years/ High	
LGV-10	Integrated Wastewater Master Plan. Address current issues and develop long-term strategies for the wastewater treatment plant, pump stations, force mains, and gravity sewers and reclamation facilities.	All hazards/ 1, 2	Las Gallinas Valley Sanitary District	Existing	Cost: $1.5M; LGVSD CIP	On-going/ High	

Table 142: Las Gallinas Valley Sanitary District Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Las Gallinas Valley Sanitary District. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 19 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Las Gallinas Valley Sanitary District identified and prioritized the mitigation actions as detailed in Table 20, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as master planning, strategic planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where the 2023 MJHMP will be used for further integration.

The planning team for the Las Gallinas Valley Sanitary District will maintain this plan and will serve as a lead staff for grant project applications on District projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Las Gallinas Valley Sanitary District will use existing plans and/or programs to implement hazard mitigation actions both directly within the District and through the coordinated efforts with the Cities and Towns they serve.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Las Gallinas Valley Sanitary District and the Cities and Towns they serve already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

District Master & Strategic Plans - Integrates hazard mitigation through the consideration of hazards most likely to impact the district.

District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Cities and Town's planned response to hazards most likely to impact the district.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

13. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
14. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
15. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

Marin County and the City of San Rafael have planning and development departments, LGVSD only is involved in issuing will-serve letters allowing connection to the sewer system for plan preliminary approved by the County and City of San Rafael. The LGVSD recently completed major upgrades to existing facilities and is considering the construction of Administration, Laboratory, and Operations Control Buildings on the existing LGVSD footprint. Upsizing of the District's sewer collection system as needed to support development as outlined in the District's Integrated Wastewater Master Plan. No other development projects are being considered.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Las Gallinas Valley Sanitary District.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Las Gallinas Valley Sanitary District Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and LGVSD plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The LGVSD is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The LGVSD Administrative Services Manager will monitor and update the LGVSD Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan

requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the LGVSD, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the LGVSD, to evaluate the plan after each update meeting.

4.4 Plan Update

The LGVSD Administrative Services Mgr. will monitor and update the LGVSD Annex to the Marin County OA MJHMP. During the five-year update cycle, the LGVSD and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of

Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

List of Figures

Figure 1: Marin County OEM MJHMP and LGVSD Website 6-18
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 6-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 6-20
Figure 4: Hazard Mitigation Plan Survey 6-22
Figure 5: Map of the Las Gallinas Valley Sanitary District 6-25
Figure 6: Map of the Las Gallinas Valley Sanitary District and Other Sanitary Districts 6-26
Figure 7: The Las Gallinas Valley Sanitary District Precipitation and Monthly Temperatures . 6-28
Figure 8: LGVSD Social Vulnerability Map Census Tract 1150.00 6-30
Figure 9: LGVSD Social Vulnerability Map Census Tract 1060.01 6-31
Figure 10: LGVSD Social Vulnerability Map Census Tract 1060.02 6-32
Figure 11: LGVSD Social Vulnerability Map Census Tract 1081.00 6-33
Figure 12: LGVSD Social Vulnerability Map Census Tract 1082.01 6-34
Figure 13: LGVSD Social Vulnerability Map Census Tract 1082.02 6-35
Figure 14: LGVSD Social Vulnerability Map Census Tract 1090.02 6-36
Figure 15: Map of the Las Gallinas Valley Sanitary District and Critical Facilities and Infrastructure within the District 6-41
Figure 16: LGVSD Risk Assessment – Planning Team Top Hazards 6-42
Figure 17: Hazard Risk Categorization 6-42
Figure 18: NASA Global Temperature Change CO2 Gas 6-46
Figure 19: NASA Global Temperature Change 1884 to 2022 6-46
Figure 20: NASA Global Temperature Change Sea Level 6-47
Figure 21: Annual Mean Sea Level Trends 6-49
Figure 24: Landslide Susceptibility Classes 6-54
Figure 25: Mud Flow Areas 6-55
Figure 26: LGVSD Debris Flow Critical Facilities and Infrastructure 6-56
Figure 27: Modified Mercalli Intensity Scale 6-60
Figure 28: Mercalli Scale vs. Magnitude 6-60
Figure 29: Soil Types 6-61
Figure 30: Marin County Earthquake Impact 6-62
Figure 31: LGVSD Earthquake Critical Facilities and Infrastructure 6-63
Figure 32: Diagram of an Atmospheric River Event 6-66
Figure 33: LGVSD Flooding Critical Facilities and Infrastructure 6-68
Figure 34: Dissolution Sinkhole Formation 6-72
Figure 35: Cover-Subsidence Sinkhole Formation 6-72
Figure 36: Cover-Collapse Sinkhole Formation 6-73
Figure 37: Levee Failure Mechanisms 6-74
Figure 38: LGVSD Levee Inundation Map 6-75
Figure 39: Marin County Levees 33 and 24 and the LGVSD Levee in St. Vincent 6-76
Figure 40: Santa Venetia Levee in Santa Venetia 6-77
Figure 41: Marin County Levee #3 6-78
Figure 42: Smith Ranch Airport Levee 6-79
Figure 43: Marin County Sea Level Rise Impact 6-82
Figure 44: LGVSD Sea Level Rise Impact on Critical Facilities 6-83

Figure 45: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 6-84
Figure 46: Heat Index..... 6-85
Figure 47: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100.. 6-86
Figure 48: Beaufort Wind Scale 6-87
Figure 49: Enhanced Fujita Scale 6-88
Figure 50: Waterspout Formation..... 6-89
Figure 51: LGVSD Tsunami Critical Facilities and Infrastructure..... 6-91
Figure 52: Federal, State and Local Responsibility Areas in the Marin County OA..... 6-94
Figure 53: Fuel Model Map for the Marin County OA 6-98
Figure 54: Trends in the Annual Number of Large Wildfires in the United States..... 6-101
Figure 55: LGVSD Wildfire Critical Facilities and Infrastructure..... 6-103

List of Tables

Table 1: 2023 MJHMP Planning Team Members..... 6-12
Table 2: Las Gallinas Valley Sanitary District & Marin County MJHMP Planning Meetings.... 6-15
Table 3: NRI Hazards and Marin County MJHMP Hazards..... 6-29
Table 4: NRI Hazard Type Risk Index for Census Tract 1150.00 6-30
Table 5: NRI Hazard Type Risk Index for Census Tract 1060.01 6-31
Table 6: NRI Hazard Type Risk Index for Census Tract 1060.02 6-32
Table 7: NRI Hazard Type Risk Index for Census Tract 1081.00 6-33
Table 8: NRI Hazard Type Risk Index for Census Tract 1082.01 6-34
Table 9: NRI Hazard Type Risk Index for Census Tract 1082.02 6-35
Table 10: NRI Hazard Type Risk Index for Census Tract 1090.02 6-36
Table 11: Las Gallinas Valley Sanitary District Critical Facilities..... 6-40
Table 12: Select Hazards Magnitude/ Severity Scale or Index..... 6-43
Table 13: LGVSD Hazard Risk Assessment..... 6-51
Table 14: County of Marin Hazard Risk Assessment 6-52
Table 15: Las Gallinas Valley Sanitary District Critical Facilities in the Flood Zones 6-70
Table 16: Las Gallinas Valley Sanitary District Legal and Regulatory Capabilities 6-106
Table 17: Las Gallinas Valley Sanitary District Administrative and Technical Capabilities 6-108
Table 18: Las Gallinas Valley Sanitary District Fiscal Capabilities 6-109
Table 19: Las Gallinas Valley Sanitary District Community Outreach.....6-110
Table 20: Las Gallinas Valley Sanitary District & Sanitary District #2 Current Hazard Mitigation Actions.....6-116

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AMI	Area Median Income
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency

CNRA	California Natural Resource Agency
CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance

FMP	Flood Mitigation Plan
FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department

MCOSD	Marin County Open Space District
MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management

OHP	Office of Historic Preservation
OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System

UCERF2	Uniform California Earthquake Rupture Forecast, Version 2
UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

7. City of Mill Valley Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The City of Mill Valley and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of Mill Valley more disaster resistant and sustainable.

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TABLE OF CONTENTS

CITY OF MILL VALLEY COMMUNITY PROFILE 7-1
Acknowledgements 7-3
Table of Contents 7-5
Section 1.0: Introduction 7-7
1.1 Introduction 7-7
1.2 Planning Process 7-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 7-8
1.2.2 Steering Committee Planning Process 7-9
1.2.3 Coordination with Stakeholders and Agencies 7-9
1.2.4 Public Engagement 7-16
1.3 Overview and History 7-23
1.4 Government 7-27
1.5 Weather and Climate 7-27
1.6 Demographics 7-28
1.7 Social Vulnerability and Risk 7-32
1.8 Economy and Tax Base 7-36
1.9 Critical Facilities 7-37
1.10 Historical Properties 7-43
Section 2.0: Hazard Identification and Risk Assessment 7-44
2.1 Climate Change 7-46
2.2 Hazards 7-53
2.2.1 Debris Flows 7-54
2.2.2 Drought 7-60
2.2.3 Earthquake 7-61
2.2.4 Flooding 7-68
2.2.5 Land Subsidence 7-80
2.2.6 Levee Failure 7-82
2.2.7 Sea Level Rise 7-85
2.2.8 Severe Weather – Extreme Heat 7-89
2.2.9 Severe Weather – High Wind & Tornado 7-90
2.2.10 Tsunami 7-93
2.2.11 Wildfire 7-95
Section 3.0: Mitigation Strategy 7-103

3.1 Changes in Development 7-103
3.2 Capability Assessment 7-106
3.2.1 Regulatory Capabilities 7-106
3.2.2 Administrative and Technical Capabilities 7-117
3.2.3 Fiscal Capabilities 7-121
3.2.4 Community Outreach 7-122
3.2.5 Participation in the National Flood Insurance Program 7-125
3.3 Mitigation Goals 7-129
3.4 Status of Previous Mitigation Actions 7-131
3.5 Hazard Mitigation Actions 7-133
3.6 Plan Integration 7-141
3.7 Future Development Trends 7-142
Section 4.0: Plan Review, Evaluation, and Implementation 7-143
4.1 Plan Adoption 7-143
4.2 Plan Monitoring 7-143
4.3 Plan Evaluation 7-144
4.4 Plan Update 7-144
Figures and Tables 7-146
Acronyms/Abbreviations 7-148

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of Mill Valley, Community Profile has been prepared in conjunction with the Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of Mill Valley.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population, both incorporated and unincorporated, is concentrated in the Eastern portion of the county. There are a total of 11 incorporated jurisdictions within Marin County. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA MJHMP Steering Committee, the City of Mill Valley involved additional internal planning team members to support the broader planning process. The City of Mill Valley jurisdictional representatives for the

coordinated Marin County OA MJHMP Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Patrick Kelly, Planning & Building Director
Telephone: 415-388-4039
E-mail: pkelly@cityofmillvalley.org

Alternate Point of Contact
Daisy Allen, Senior Planner
Telephone: 415-384-4811
E-mail: daisy.allen@cityofmillvalley.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: City of Mill Valley Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Mill Valley	Patrick Kelly	Department of Planning & Building	415-388-4039	pkelly@cityofmillvalley.org
Mill Valley	Daisy Allen	Senior Planner	415-384-4811	daisy.allen@cityofmillvalley.org
Mill Valley	Jared Barrilleaux	Deputy Director of Engineering	415-384-4818	jbarrilleaux@cityofmillvalley.org
Mill Valley	Ahmed A Aly	Project Manager (retired)		
SMFD	Chris Tubbs	Fire Chief/Southern Marin Fire District	415-388-8182	ctubbs@smfd.org
SMFD	Fred Hilliard	Fire Marshal/Southern Marin Fire District	415-388-8182	fhilliard@smfd.org
SMFD	Matt Barnes	Deputy Chief/Southern Marin Fire District	415-388-8182	mbarnes@smfd.org
SASM	Mark Grushayev	General Manager, SASM	415-388-2402	mgrushayev@cityofmillvalley.org

Table 143: City of Mill Valley Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of the unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the City of Mill Valley. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community of stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of Mill Valley Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of Mill Valley communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of Mill Valley Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of Mill Valley and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Matt Barnes	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Deputy Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 144: 2023 MJHMP Local Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Mill Valley's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups

assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of Mill Valley & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification

Table 3: City of Mill Valley & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process

Table 3: City of Mill Valley & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update

Table 3: City of Mill Valley & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 145: City of Mill Valley & Marin County OA MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on the Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meetings.

Additionally, to reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slides.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process included:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. During the five-year update cycle, the Marin County OEM will hold tri-annual update meetings with the hazard mitigation Steering Committee, including the City of Mill Valley, and local stakeholders to discuss revisions to the plan. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Mill Valley created news items regarding the plan that were posted on the City's main website (https://www.cityofmillvalley.org/), as well as the emergency preparedness section of the website (https://www.cityofmillvalley.org/210/Emergency-Preparedness). Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 296: Marin County OEM MJHMP and Mill Valley Website

PUBLIC MEETINGS

Two separate Marin County OAMJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slides.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms

#109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

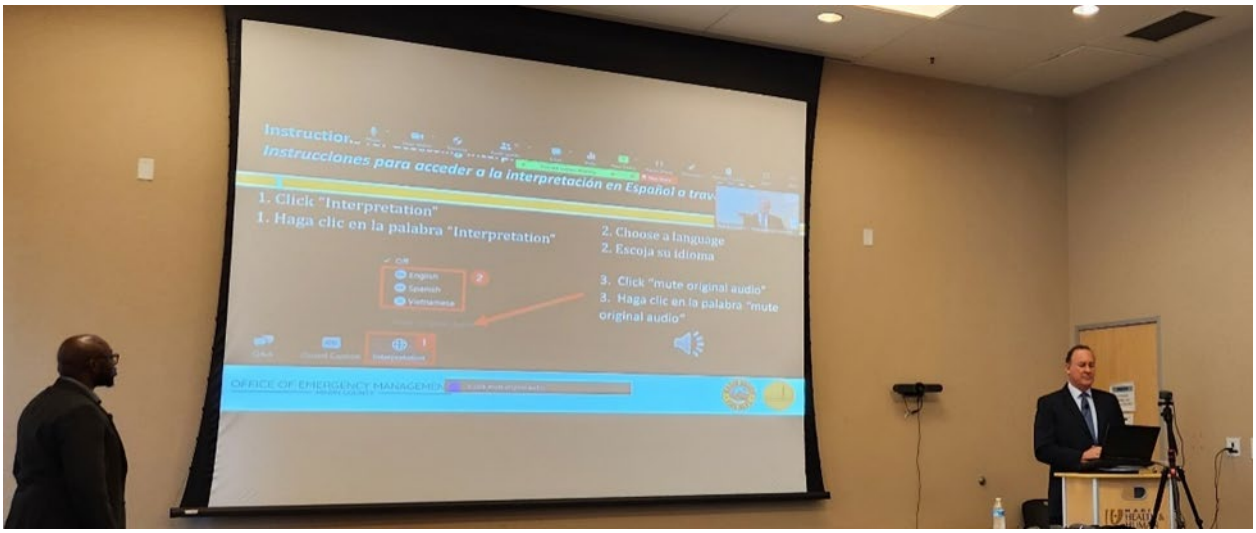


Figure 297: Marin County OA MJHMP Public Town Hall Meeting

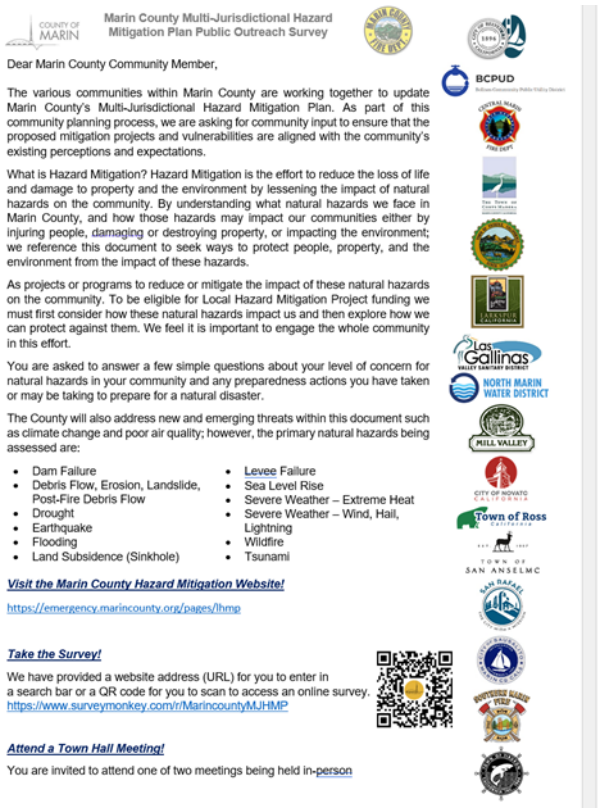
SOCIAL MEDIA

The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All County press releases were made available to the Mill Valley community in both English and Spanish. The Marin Independent Journal (Marin IJ) used the press release to write an article



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 298: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

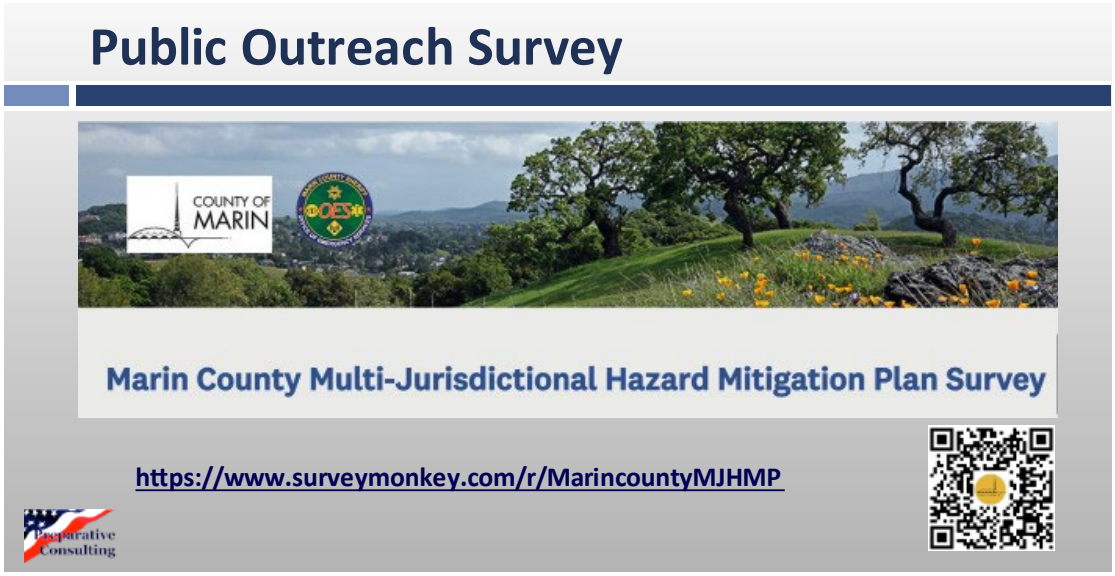


Figure 299: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of Mill Valley had an additional 14-day comment period for the City of Mill Valley Community Profile where their profile was posted on the City website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of Corte Madera distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 OVERVIEW AND HISTORY

Mill Valley is a City in Marin County, California, United States, located about 14 miles north of San Francisco via the Golden Gate Bridge.

The population was 14,231 at the 2020 census. According to the United States Census Bureau the city has a total area of 4.8 square miles, of which 4.7 square miles is land and 0.1 square miles or (1.74%) is water.

Mill Valley is located on the western and northern shores of Richardson Bay, and the eastern slopes of Mount Tamalpais. Beyond the flat coastal area and marshlands, it occupies narrow wooded canyons, mostly of second-growth redwoods, on the southeastern slopes of Mount Tamalpais.

The Mill Valley 94941 area code lies between Mt. Tamalpais on the west, the city of Tiburon on the east, the City of Corte Madera on the north, and the Golden Gate National Recreational Area (GGNRA) on the south. Two streams flow from the slopes of Mt. Tamalpais through Mill Valley to the bay: the Arroyo Corte Madera del Presidio; and Cascade Creek. Mill Valley is surrounded by hundreds of acres of state, federal, and county park lands. In addition, there are many municipally maintained open-space reserves, parks, and coastal habitats which, when taken together, ensconce Mill Valley in a natural wilderness.

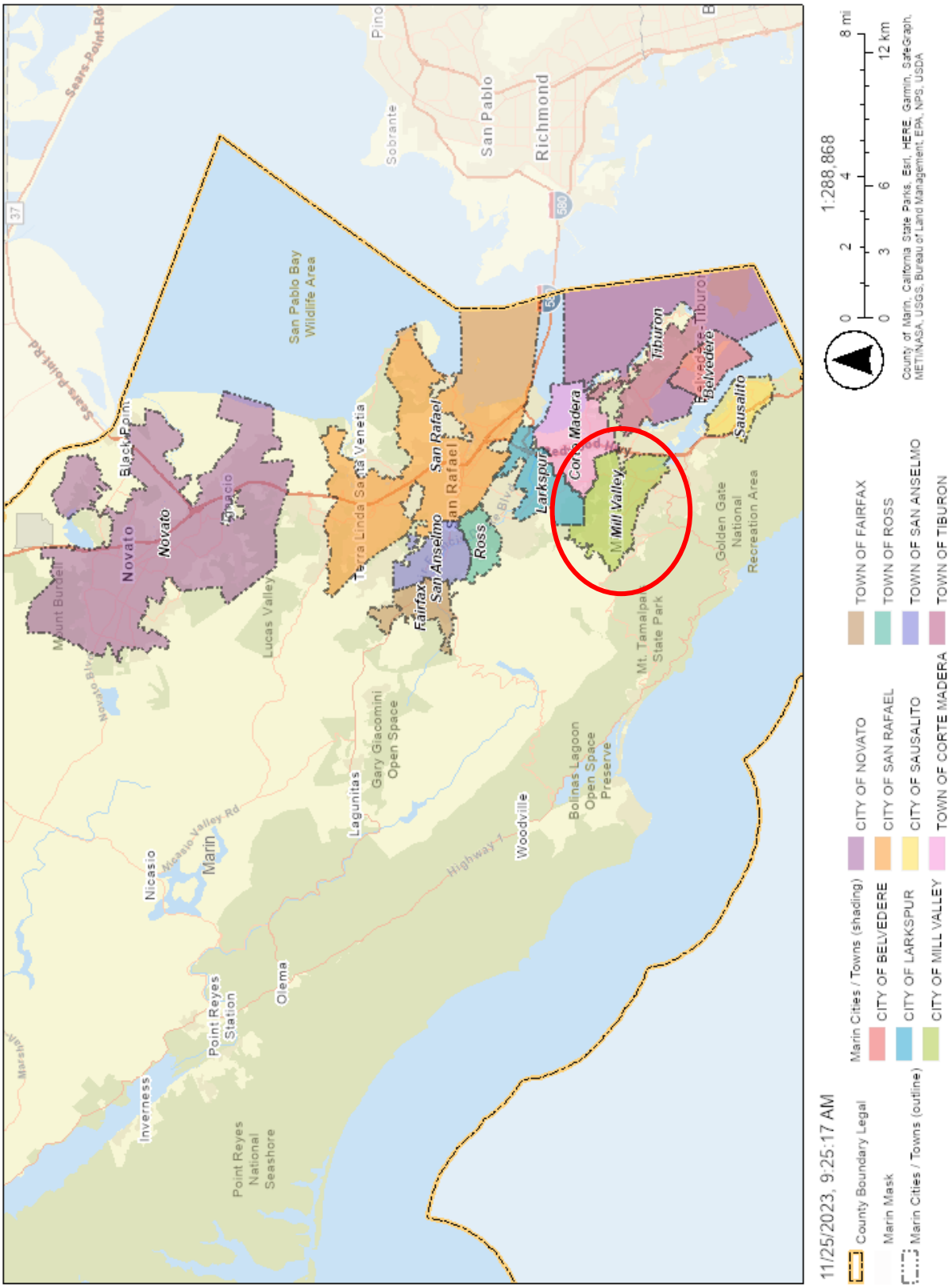


Figure 300: Map of City of Mill Valley in Marin County
Source: Marin County OEM

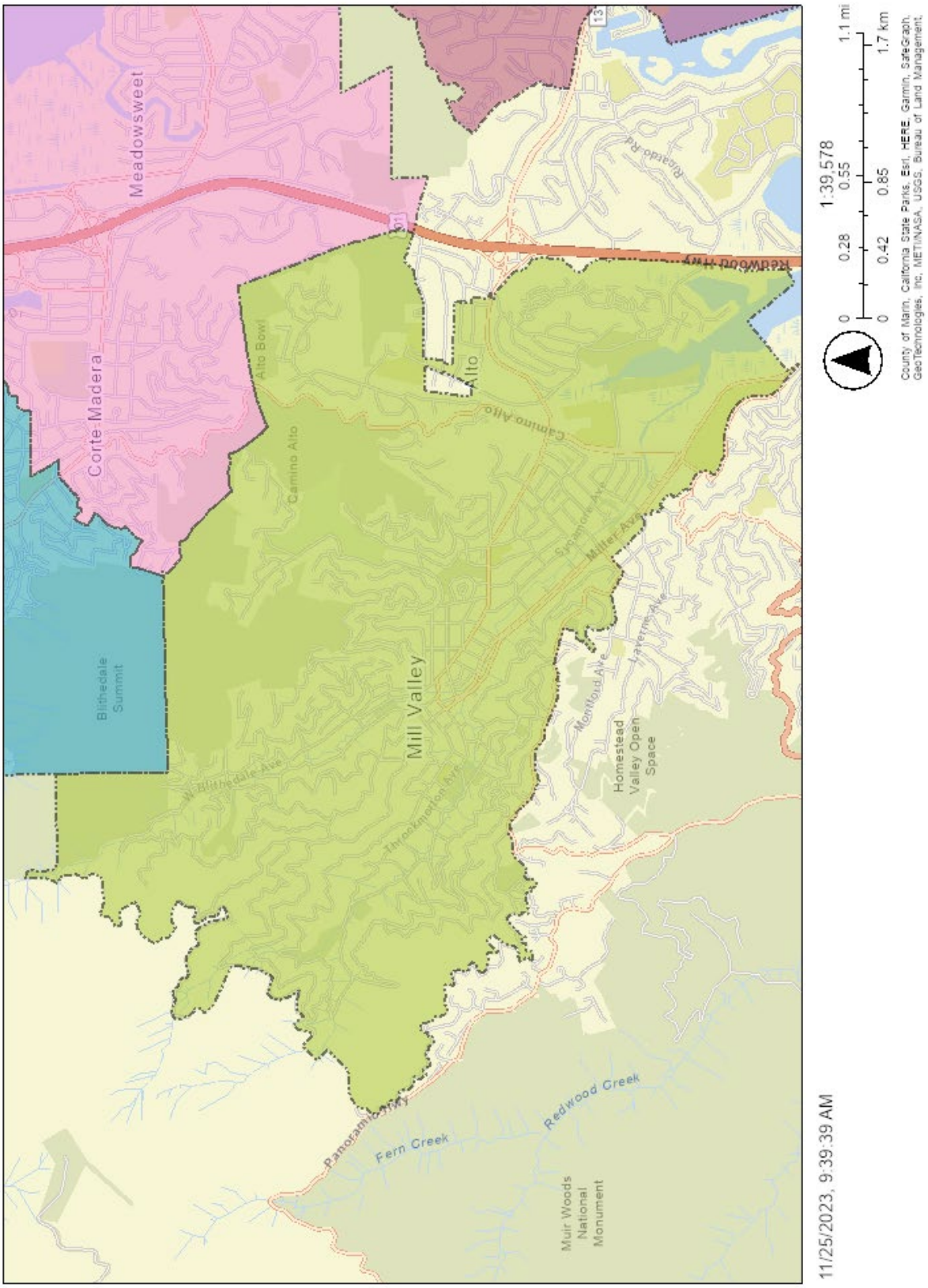


Figure 301: Map of the City of Mill Valley
Source: Marin County OEM

1.4 GOVERNMENT

The City of Mill Valley is governed by an elected five-person City Council responsible for passing local ordinances, approving the City budget, and setting strategic priorities for the City. The City Council elects a mayor and vice mayor each year from its membership, the executive head of the City; and appoints a City Manager, the administrative head of the City. The City consists of 10 departments: the City Manager (including the City Clerk), City Attorney, Finance & Human Resources, Fire, Library, Planning & Building, Police, Recreation, Public Works, and the Sewerage Agency of Southern Marin (SASM) Waste Water Treatment Plant (WWTP).

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

On July 1, 2023, Mill Valley Fire Department was officially annexed and consolidated fire agencies with the Southern Marin Fire Protection District. The Southern Marin Fire Protection District is an independent special district established by the Marin County Board of Supervisors in July of 1999. The Southern Marin Fire District serves the cities of Sausalito, and Mill Valley, approximately ¼ of the town of Tiburon, and communities of Tamalpais Valley, Almonte, Homestead Valley, Alto, Strawberry, Fort Baker and the Marin Headlands. The District covers over 25.3 square miles, a population of approximately 41,576 and over 20,500 homes and commercial properties. The District has 93 full time employees.

The Mill Valley Police Department is a full time police department of 17 sworn officers. Mill Valley Police provides a professional and proactive response through Law enforcement, criminal investigation, patrol, traffic, crime prevention, and other public safety duties.

1.5 WEATHER AND CLIMATE

The City of Mill Valley is approximately 79 feet above sea level. In the City of Mill Valley, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43°F to 73°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is 45 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 302: The City of Mill Valley Precipitation and Monthly Temperatures
Source: en.climate-data.org

1.6 DEMOGRAPHICS

The City of Mill Valley had an estimated population of 14,199 in 2022 according to the US Census Bureau. There has been a decrease in population in Mill Valley as well as the Marin County OA since 2018 based on population estimates.

Table 4: City of Mill Valley Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	255,470	262,321	262,179	-2.6%
City of Mill Valley	14,199	14,674	14,343	-1.0%

Table 146: City of Mill Valley Estimated Jurisdictional Population
Source: California Department of Finance

Prior to 2022, Census data indicates that prior to 2020 Mill Valley's population has had a slow but steady increase. Table 5 shows the population growth comparison of the State of California, County of Marin and the City of Mill Valley between 2010 – 2020.

Table 5: Population Change of The City of Mill Valley				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	260,831	8,422	3.3%
Mill Valley, City	13,903	14,674	771	5.5%

Table 147: Population Change of The City of Mill Valley
Source: US Census Bureau

Table 6 lists the various languages spoken in the City of Mill Valley.

Table 6: Languages Spoken in Mill Valley	
Primary Language Spoken	% of Population
English only	87.5%
Spanish	1.3%
Other Indo-European languages	8.9%
Asian and Pacific Islander languages	2.1%
Other languages	0.1%

Table 148: Languages Spoken in Mill Valley
Source: US Census Bureau (2020)

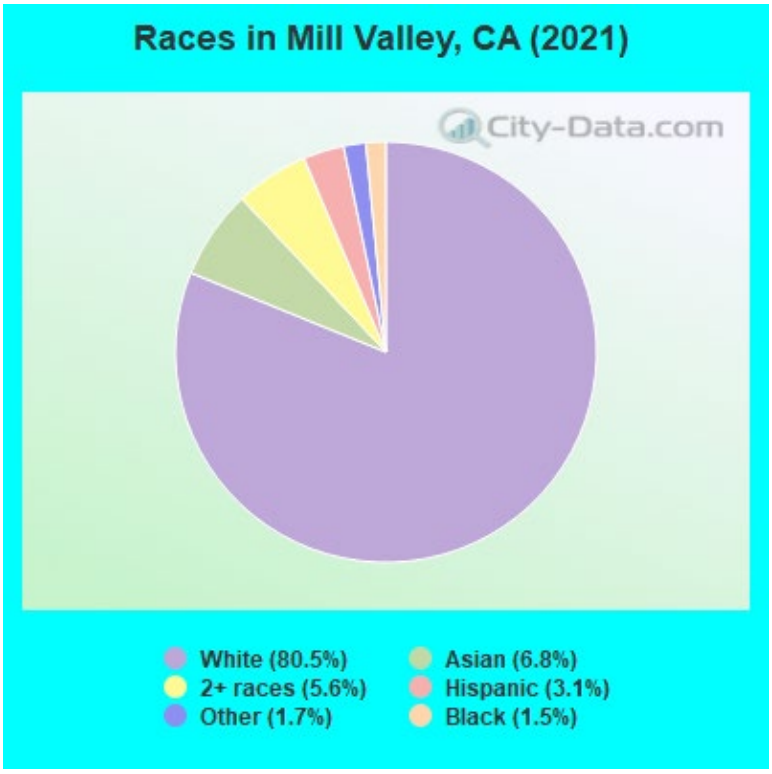


Figure 303: Races in Mill Valley
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,584,348	8,363,588	1,043,353	1,143,052	3,496,615	537,740
	Percent	100.0%	57.3%	7.2%	7.8%	24.0%	3.7%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,063	11,660	8,318	21,951	1,887
	Percent	100.0%	60.8%	10.4%	7.4%	19.6%	1.7%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of Mill Valley							
2022	Number	6,521	4,265	667	371	1,205	13
	Percent	100.00%	65.40%	10.23%	5.69%	18.48%	0.20 %
2018	Number	6,645	4,388	655	347	1,241	14
	Percent	100.00%	66.03%	9.86%	5.22%	18.68%	0.21%

Table 149: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

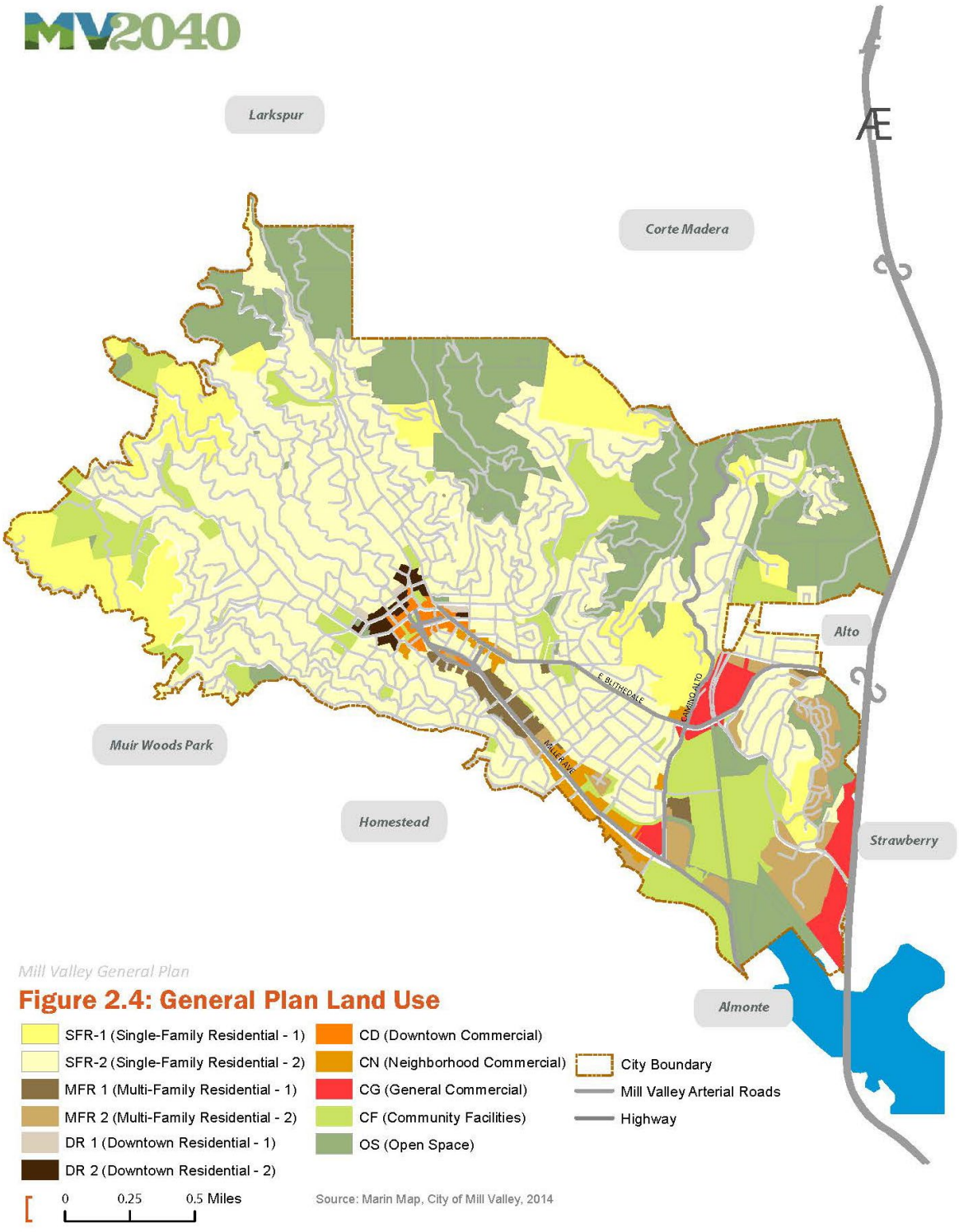


Figure 304: City of Mill Valley Land Use Map
Source: City of Mill Valley General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards

NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 150: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

Table 9 illustrates the NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00.

Table 9: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,347,641	Very Low	Very High	0.66	$894,146	90.4
Riverine Flooding	$893,441	Very Low	Very High	0.66	$592,789	97.1
Wildfire	$14,195	Very Low	Very High	0.66	$9,418	83.6
Heat Wave	$9,305	Very Low	Very High	0.66	$6,173	43.2
Tornado	$5,176	Very Low	Very High	0.66	$3,434	8
Landslide	$3,082	Very Low	Very High	0.66	$2,045	76.5
Coastal Flooding	$1,675	Very Low	Very High	0.66	$1,112	81.4
Tsunami	$505	Very Low	Very High	0.66	$335	94.3
Drought	$0	Very Low	Very High	0.66	$0	0

Table 151: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00
Source: FEMA National Risk Index 2023

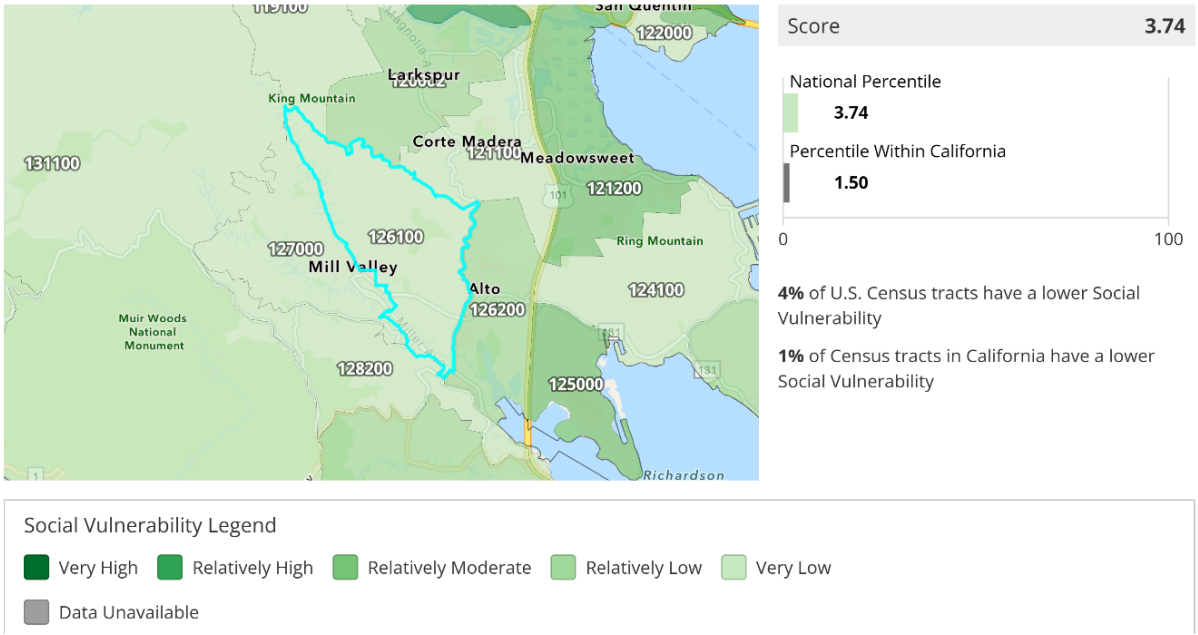


Figure 305: City of Mill Valley Social Vulnerability Map Census Tract 1261.00
Source: FEMA National Risk Index 2023

Table 10 illustrates the NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00.

Table 10: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,077,596	Relatively Low	Very High	0.94	$1,009,900	91.3
Riverine Flooding	$779,681	Relatively Low	Very High	0.94	$730,701	97.7
Coastal Flooding	$23,958	Relatively Low	Very High	0.94	$22,453	92.4
Heat Wave	$7,024	Relatively Low	Very High	0.94	$6,582	44.3
Tornado	$3,739	Relatively Low	Very High	0.94	$3,504	8.1
Landslide	$2,757	Relatively Low	Very High	0.94	$2,584	80.4
Tsunami	$1,144	Relatively Low	Very High	0.94	$1,072	96.5
Wildfire	$575	Relatively Low	Very High	0.94	$538	56

Table 152: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00
Source: FEMA National Risk Index 2023

Figure 11 illustrates the Social Vulnerability Map for Mill Valley Census Tract 1262.00.

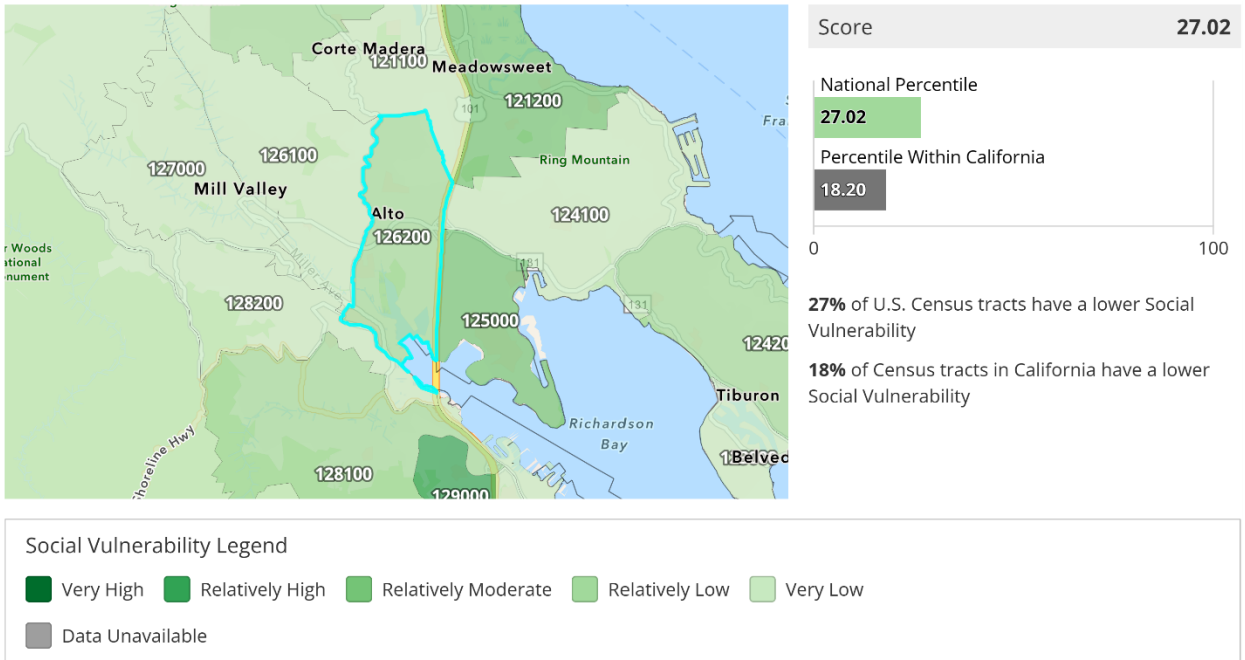


Figure 306: City of Mill Valley Social Vulnerability Map Census Tract 1262.00
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,217,445	Very Low	Very High	0.72	$880,410	90.3
Riverine Flooding	$176,890	Very Low	Very High	0.72	$127,920	87.5
Wildfire	$40,457	Very Low	Very High	0.72	$29,257	88.9
Heat Wave	$5,300	Very Low	Very High	0.72	$3,832	35.9
Tornado	$4,570	Very Low	Very High	0.72	$3,305	7.6
Landslide	$1,624	Very Low	Very High	0.72	$1,175	67.2
Strong Wind	$256	Very Low	Very High	0.72	$185	7
Coastal Flooding	$0	Very Low	Very High	0.72	$0	0
Drought	$0	Very Low	Very High	0.72	$0	0
Tsunami	$0	Very Low	Very High	0.72	$0	0

Table 153: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00
Source: FEMA National Risk Index 2023

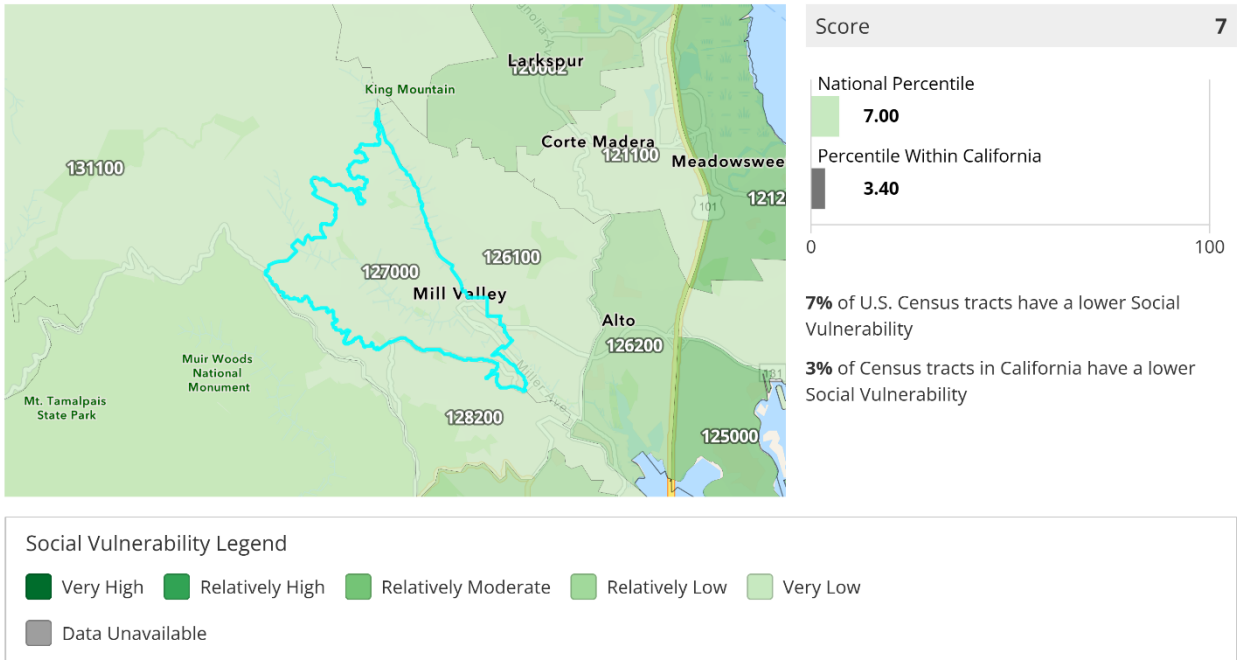


Figure 307: City of Mill Valley Social Vulnerability Map Census Tract 1270.00
Source: FEMA National Risk Index 2023

Social Vulnerability in Mill Valley and the Marin County OA

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia.

The median income for a household in the City was $179,529 and the per capita income for the City was $110,356. Approximately 2.4 percent of families and 4.5 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low or Relatively Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

1.8 Economy and Tax Base

Table 12 shows income by household in The City of Mill Valley as of 2019.

Table 12: Household Income for The City of Mill Valley as of 2021		
Household Income	Number	Percent
Total Households	5,622	-
Less than $10,000	174	3.1
$10,000 to $14,999	118	2.1
$15,000 to $24,999	90	1.6
$25,000 to $34,999	107	1.9
$35,000 to $49,999	242	4.3
$50,000 to $74,999	433	7.7
$75,000 to $99,999	394	7.0
$100,000 to $149,999	871	15.5
$150,000 to $199,999	703	12.5
$200,000 or more	2,491	44.3
Median household income (dollars)	$179,529	
Mean household income (dollars)	$277,907	

Table 154: Household Income for The City of Mill Valley as of 2019
Source: US Census Bureau American Community Survey 2021 Estimates

Table 13 shows the percentage of people in The City of Mill Valley over the age of 16 employed by industry.

Table 13: City of Mill Valley Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	6,955	-
Agriculture, forestry, fishing and hunting, and mining	19	0.27%
Construction	154	2.21%
Manufacturing	353	5.08%
Wholesale trade	162	2.33%
Retail trade	531	7.63%
Transportation and warehousing, and utilities	95	1.37%
Information	370	5.32%
Finance and insurance, and real estate and rental and leasing	999	14.36%
Professional, scientific, and management, and administrative and waste management services	2,016	28.99%
Educational services, and health care and social assistance	1,544	22.20%
Arts, entertainment, and recreation, and accommodation and food services	363	5.22%
Other services, except public administration	228	3.28%
Public administration	121	1.74%

Table 155 City of Mill Valley Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 Critical Facilities

The following list of facilities has been determined to be critical to the ability of the City of Mill Valley to fulfill the requirements of its mission during an emergency:

Table 14: City of Mill Valley Critical Facilities				
Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire Stations	Mill Valley Fire Department (MLV) & Public Safety Building / Fire Station 7	1 Hamilton Dr, Mill Valley, CA 94941	Unzoned	X[1]
Fire Stations	Marin County Fire Department (MRN) / Throckmorton Ridge Station	816 Panoramic Highway Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	High	X
Fire Stations	Southern Marin Fire District Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	High	X/AE
Fire Stations	Southern Marin Fire Protection District (SOM) / Station 4	309 Poplar Street Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	Very High	X
Fire Stations	Southern Marin Fire Protection District (SOM) / Station 9	308 Reed Blvd Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	Unzoned	X

Police/Sheriff Stations	Mill Valley Police Department & Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	Unzoned	X[1]
Emergency Operations Center	Mill Valley Police Department & Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	Unzoned	X[1]
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	High	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	Very High	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	Unzoned	X
Local Government	Mill Valley Corporation Yard, Mill Valley City Fuel Pumps	450 Sycamore Avenue Mill Valley, CA 94941	Unzoned	X/AE
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	Unzoned	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	High	AE
Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	Unzoned	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	Unzoned	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	Moderat e/High	X
Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	Very High	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	Unzoned	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	Moderat e/High	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	High	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	Very High	X
Evacuation Shelters	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	VHFHSZ / WUI	X
Evacuation Shelters	Park Elementary School	360 E Blithedale Ave, Mill Valley, CA 94941	N/A	X/AE
Evacuation Shelters	Edna McGuire Elementary School, Terra Marin School	70 + 80 Lomita Drive, Mill Valley, CA 94941	MFHSZ/ HFHSZ/ WUI	X
Evacuation Shelters	Mill Valley Community Center	180 Camino Alto	N/A	X

Mill Valley, CA 94941			N/A	X/AE
Evacuation Shelters	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	WUI	X/AE
Evacuation Shelters	Tamalpais High School	700 Miller Ave, Mill Valley, CA 94941	HFHSZ/ WUI	X
Evacuation Shelters	North Bridge Academy	17 Buena Vista Ave, Mill Valley, CA 94941	VHFHSZ / WUI	X
Evacuation Shelters	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	HFHSZ/ VHFHSZ / WUI	X
High Potential Loss Facilities				
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	Very High	X
Hazardous Materials	Former Mill Valley Dump (current site of middle school, school district office, community center, sewer treatment plant. Copper, lead, zinc main chemicals of concern)	411, 425, 450 Sycamore and 180 Camino Alto, Mill Valley, CA 94941	N/A	X/AE
Hazardous Materials	Former Mill Valley Landfill (1989 cleanup site, annually monitored. No current contaminants of concern)	Cypress and Edgewood Road, Mill Valley, CA 94941	VHFHSZ / WUI	X
Critical Infrastructure				
Communication Facilities	Mill Valley Post Office	751 E Blithedale Ave, Mill Valley, CA 94941	MFHSZ	AO
Communication Facilities	FAA Mill Valley Long Range Radar and Communications Station	East Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co)	HFHSZ	X
Communication Facilities	MERA Antenna Site – Mount Tamalpais	Middle Peak Rd, Mill Valley, CA 94941 37.929006, -122.587084 (unincorporated Marin Co)	HFHSZ	X
Communication Facilities	MERA Antenna Site – Mill Valley Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	WUI	X
Communication Facilities	MERA Antenna Site – Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	HFHSZ/ WUI	X/AE
Communication Facilities	Future MERA Antenna Site – Mill Valley Water Tank	37.902735, -122.558010	VHFHSZ / WUI	X
Electric Power Facilities	PG&E Alto Substation	90 Roque Moraes Dr, Mill Valley, CA 94941	WUI	X
Natural Gas	PG&E gas transmission lines terminate to distribution lines	37.904639, -122.525810	MFHSZ	X
Water Supply Facilities	Water tank	Edgewood Ave/Sequoia Valley Rd, Mill Valley, CA 94941 37.903110, -122.558023	VHFHSZ/ WUI	X
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	VHFHSZ/ WUI	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941	VHFHSZ/ WUI	X

		37.906425, -122.531301		
Water Supply Facilities	Water tank	H-Line Fire Road 37.927032, -122.556641	VHFHSZ/ WUI	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	MFHSZ / WUI	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	VHFHSZ/ WUI	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	VHFHSZ/ WUI	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	VHFHSZ/ WUI	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	VHFHSZ/ WUI	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	HFHSZ/ WUI	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	HFHSZ	X
Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	HFHSZ	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	HFHSZ/ WUI	X
Stormwater Facilities	Park Terrace Storm Water Pump Station	14 Park Terrace, Mill Valley, CA 94941	N/A	AE
Stormwater Facilities	Marin County Flood Control District Zone 3 – Ryan Creek Pump Station	37.8974771419235, -122.526719323848 (Behind Mill Valley Middle School)	N/A	X/AE
Stormwater Facilities	City of Mill Valley stormwater pump	6 Plymouth Cir, Mill Valley, CA 94941 37.89640, -122.53454	N/A	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin (SASM) Treatment Plant	450 Sycamore Ave, Mill Valley, CA 94941	N/A	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Camino Alto Pump Station	Camino Alto at Miller Ave, Mill Valley, CA 94941	N/A	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Shelter Bay Pump Station	6000 Shelter Bay Ave, Mill Valley, CA 94941	N/A	AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Sutton Manor Pump Station	Lomita Avenue at Ashford Ave, Mill Valley, CA 94941	N/A	AE
Transportation - Roads	Arterials	Miller Ave, E Blithedale Ave, Camino Alto, Molino Ave, Millwood St, Sunnyside Ave	MFHSZ	X
Transportation – Roads	Collectors	Redwood Hwy Frontage Rd, Hamilton Dr, Roque Moraes, Lomita Dr,	Various	Various

		Ashford Ave, Sycamore Ave, Nelson Ave, La Goma St, Vasco Dr, Buena Vista Ave, Manor Dr, Carmelita Ave, Sunnyside Ave, Molino Ave, Marion Ave, Cascade Dr, Throckmorton Ave, Summit Ave, W Blithedale Ave, Eldridge Ave		
Transportation – Bus Facilities	Marin Transit Agency and Golden Gate routes and ~15 stops	E Blithedale Ave, Sunnyside Ave, Miller Ave	Various	Various
Wastewater Facilities	Sewerage Agency of Southern Marin (SASM) Treatment Plant	450 Sycamore Ave, Mill Valley, CA 94941	Range from none to VHFHSZ	X and AE

1 The parcel at 1 Hamilton Drive contains a small area in the AE zone but the critical police and fire facilities are not located in that portion of the parcel.

Table 156: City of Mill Valley Critical Facilities
Source: City of Mill Valley

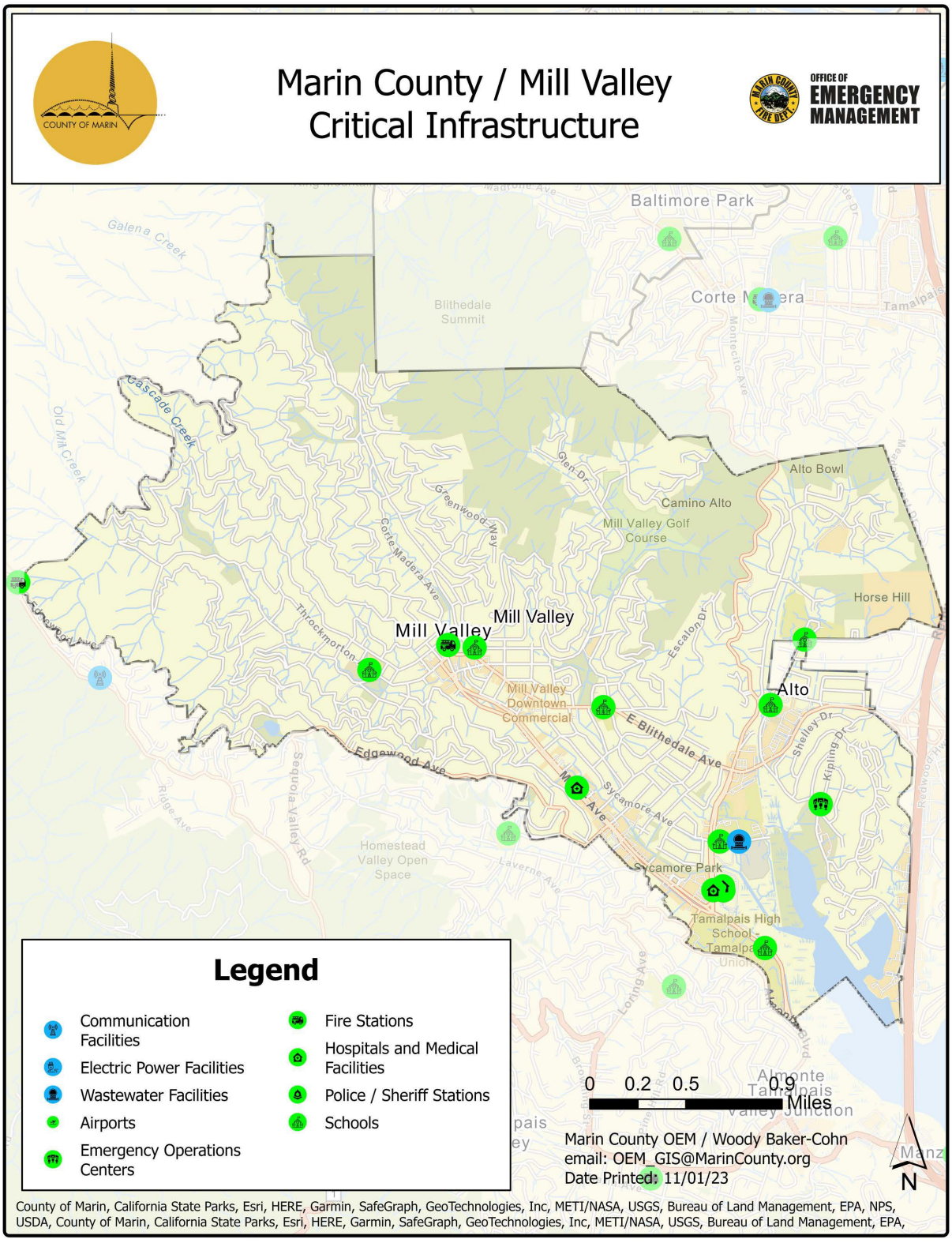


Figure 308: City of Mill Valley Critical Facilities & Infrastructure
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The City of Mill Valley has three registered national and state historically significant homes, public buildings, or landmarks, as indicated in Table 15. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of Mill Valley Chamber of Commerce.
- City of Mill Valley website.

The City also has a number of locally-designated historic resources identified in a historic overlay zone district as well as a historic resources inventory (https://www.cityofmillvalley.org/763/Historic-Preservation). Also, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA).

Table 15: National and State Registered Historic Sites In The City of Mill Valley

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
The Dipsea Trail	X			6/4/2010	Mill Valley/ Stinson Beach
First Sawmill in Marin County (207)		X	X		Mill Valley
Outdoor Art Club (922)	X	X	X	11/16/1978	Mill Valley

Table 157: Historic Sites In The City of Mill Valley
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of Mill Valley identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 14 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

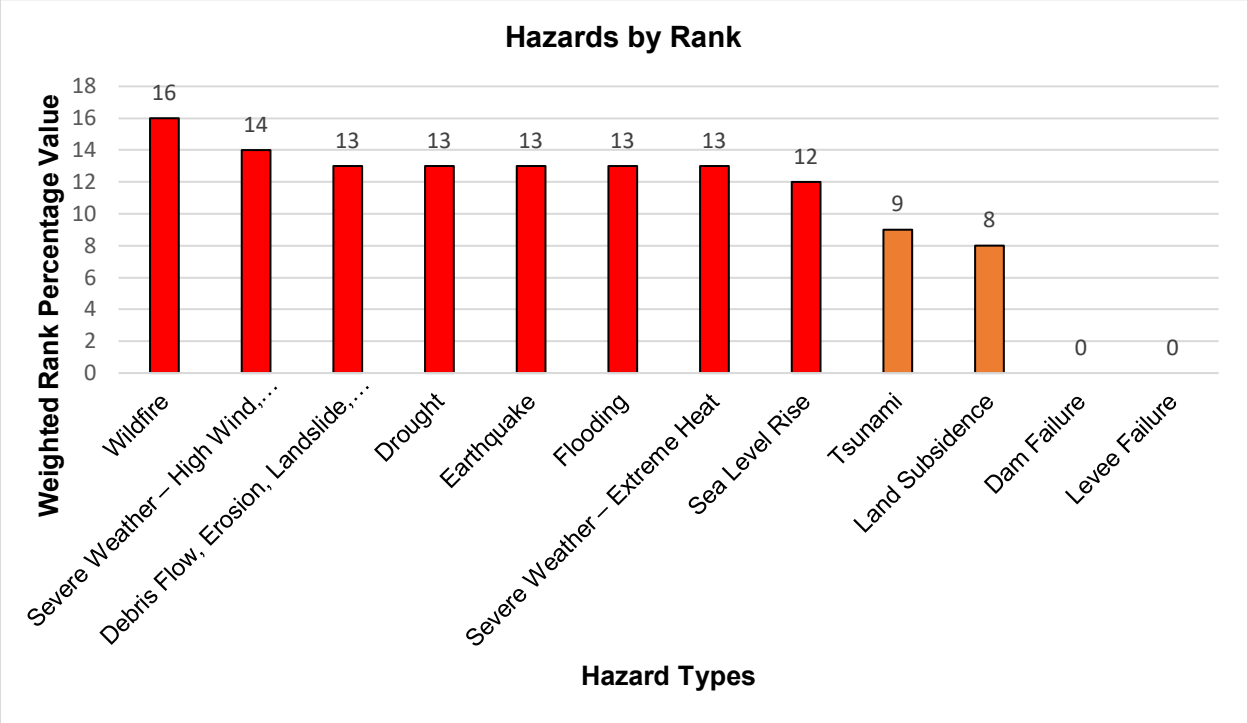


Figure 309: City of Mill Valley Risk Assessment – Planning Team Top Hazards

Figure 15: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 18**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 310: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 16: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 158: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

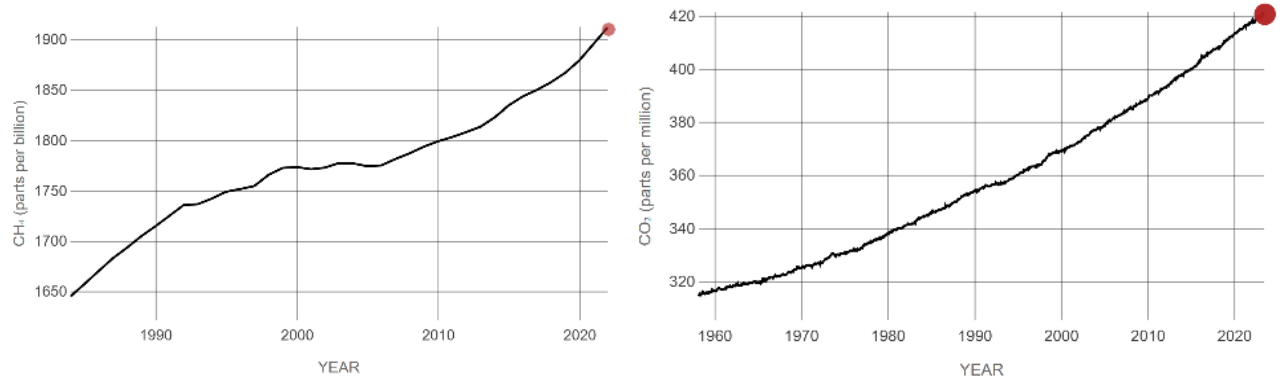


Figure 311: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

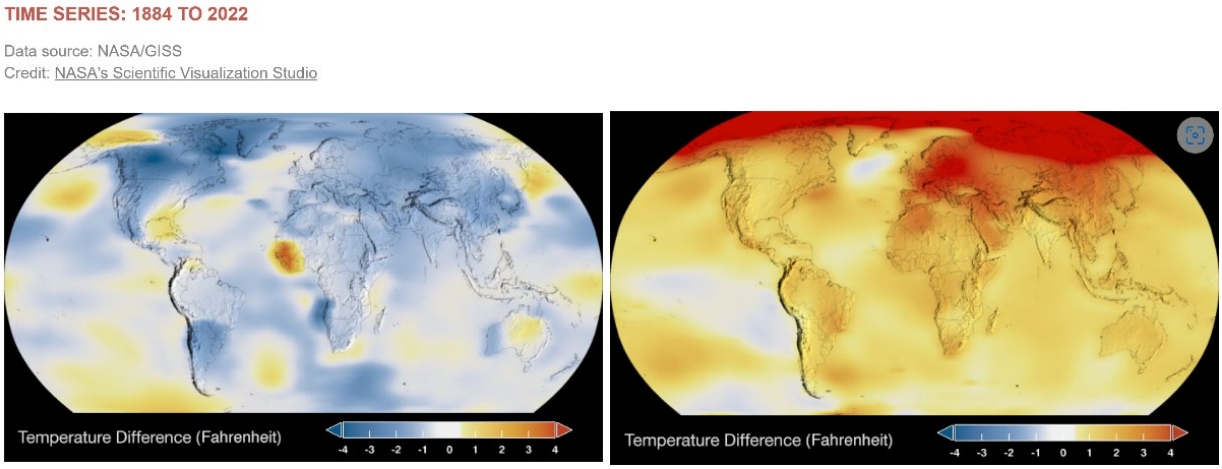


Figure 312: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

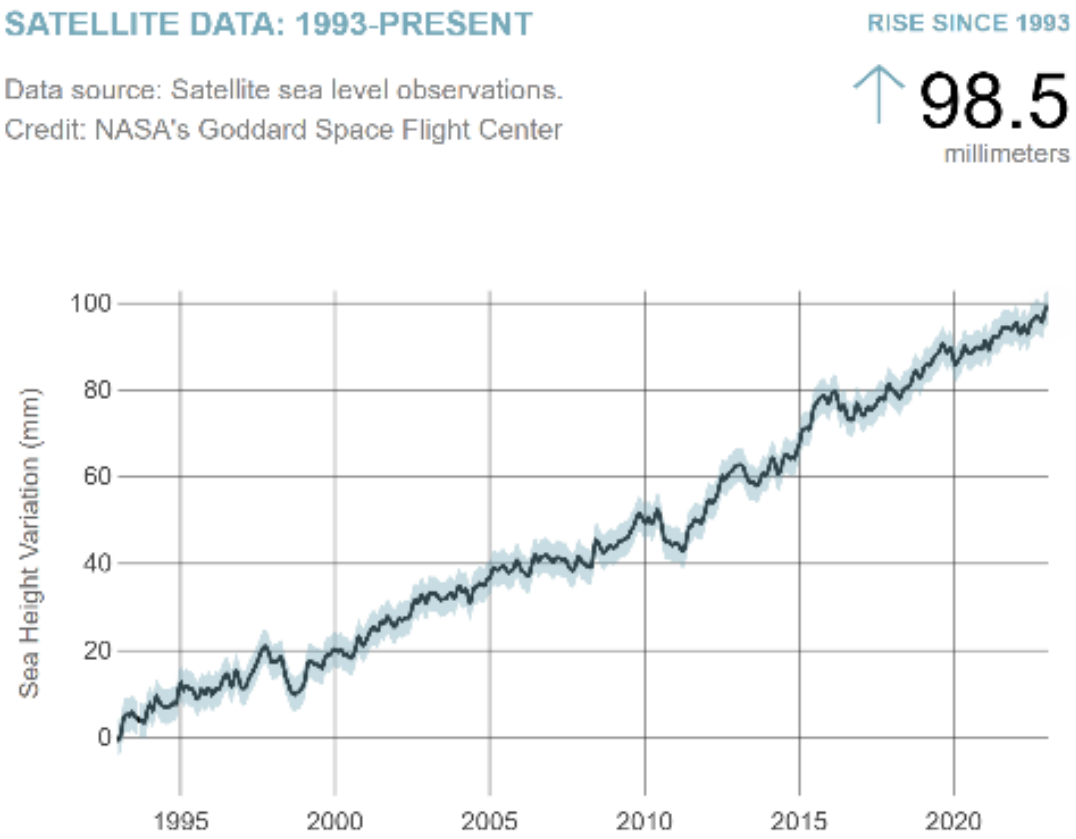


Figure 313: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.

- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, increased intensity of rain fall may occur and may become more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.

- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

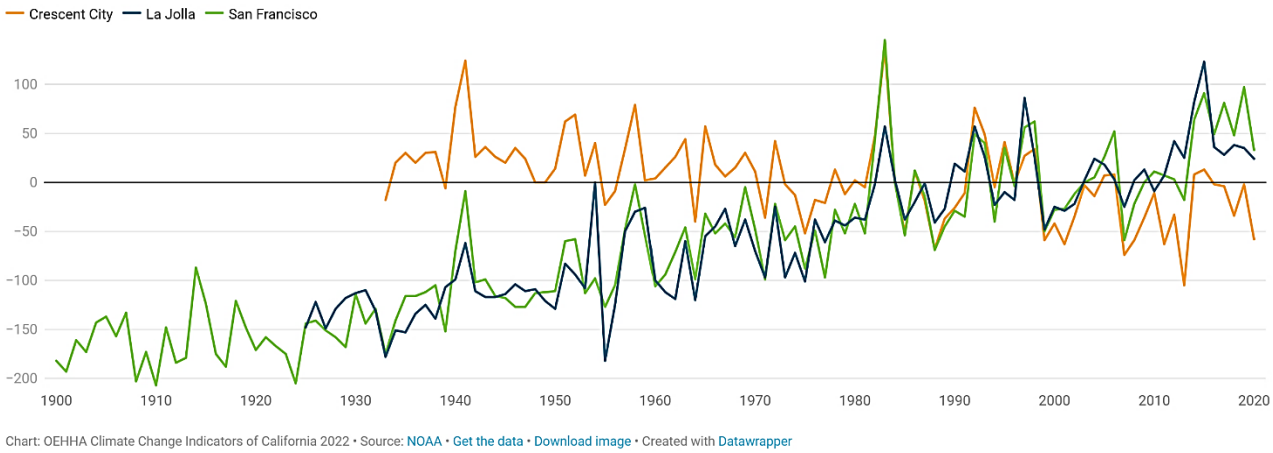


Figure 314: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable.

Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the City of Mill Valley as per the planning team.

Table 17: City of Mill Valley Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Likely	Significant	Moderate	Medium	High	**13.00**
Drought	Likely	Extensive	Weak	High	Medium	**13.00**
Earthquake	Occasional	Extensive	Extreme	Low	Medium	**13.00**
Flooding	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Land Subsidence (Sinkhole)	Likely	Negligible	Moderate	Low	Low	**8.00**
Levee Failure	None	None	None	None	None	**0.00**
Sea Level Rise	Highly Likely	Limited	Weak	High	Medium	**12.00**
Severe Weather – Extreme Heat	Likely	Extensive	Moderate	Medium	Medium	**13.00**
Severe Weather – Wind, Tornado	Highly Likely	Significant	Moderate	High	Medium	**14.00**
Tsunami	Unlikely	Negligible	Severe	Medium	Medium	**9.00**
Wildfire	Likely	Extensive	Severe	High	High	**16.00**

Table 159: City of Mill Valley Hazard Risk Assessment
Source: City of Mill Valley

Omitted Hazards

Dam Failure: The City of Mill Valley has one dam, the Cascade Canyon Dam. This dam, owned by the City of Mill Valley, is 20 feet tall, with a capacity of 2.08 acre-feet. The Cascade Canyon Dam is not in active use, is not a high hazard dam and does not pose a risk to life. For these reasons, dam failure was not included in the hazard analysis presented in the following section.

Table 18: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 160: County of Marin Hazard Risk Assessment
Source: County of Marin

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produces landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place

prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 20 shows landslide susceptibility classes.

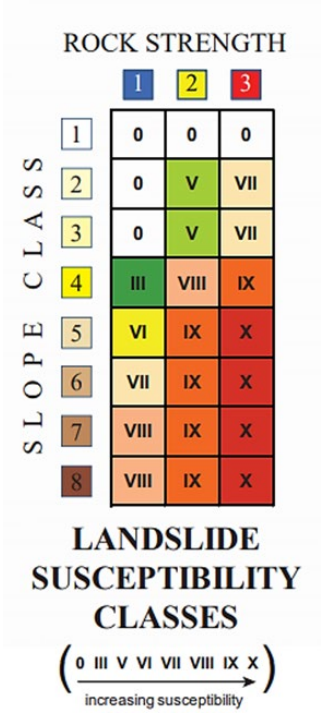


Figure 315: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 21 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

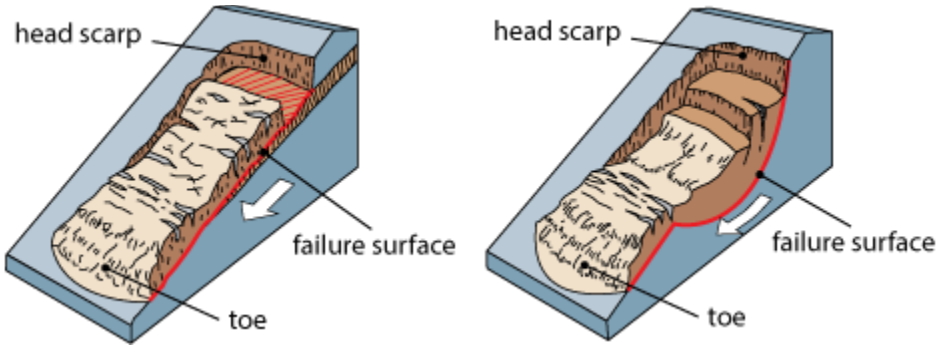


Figure 316: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

Most of Mill Valley is extremely susceptible to landslides due to the steepness of the terrain around the City. A landslide in Mill Valley could occur anywhere in the city where the terrain may be susceptible to soil movement. These areas primarily consist of numerous winding and dead end streets and hillside homes that may sustain damage from soil movement. Development in these areas was mostly done in the 1920s and 1930s before landslides were factored into design and construction regulations. Most of the downtown and commercial area of Mill Valley between Miller Avenue and E. Blithedale Avenue from Thockmorton Avenue to Camino Alto lies on relatively flat land with low to no landslide susceptibility. Approximately half of Mill Valley's critical facilities lie in areas of no landslide susceptibility but are adjacent to areas of moderate to high landslide susceptibility. The Old Mill Elementary School, The Mill Valley Fire Station #6, the Greenwood School, Park Elementary School, the Helix School, and Edna Maguire Elementary School all lie in areas of the City that have some landslide susceptibility. The Mill Valley Police Department and SMFD Fire Station #7 lie directly adjacent to an area of very high landslide susceptibility.

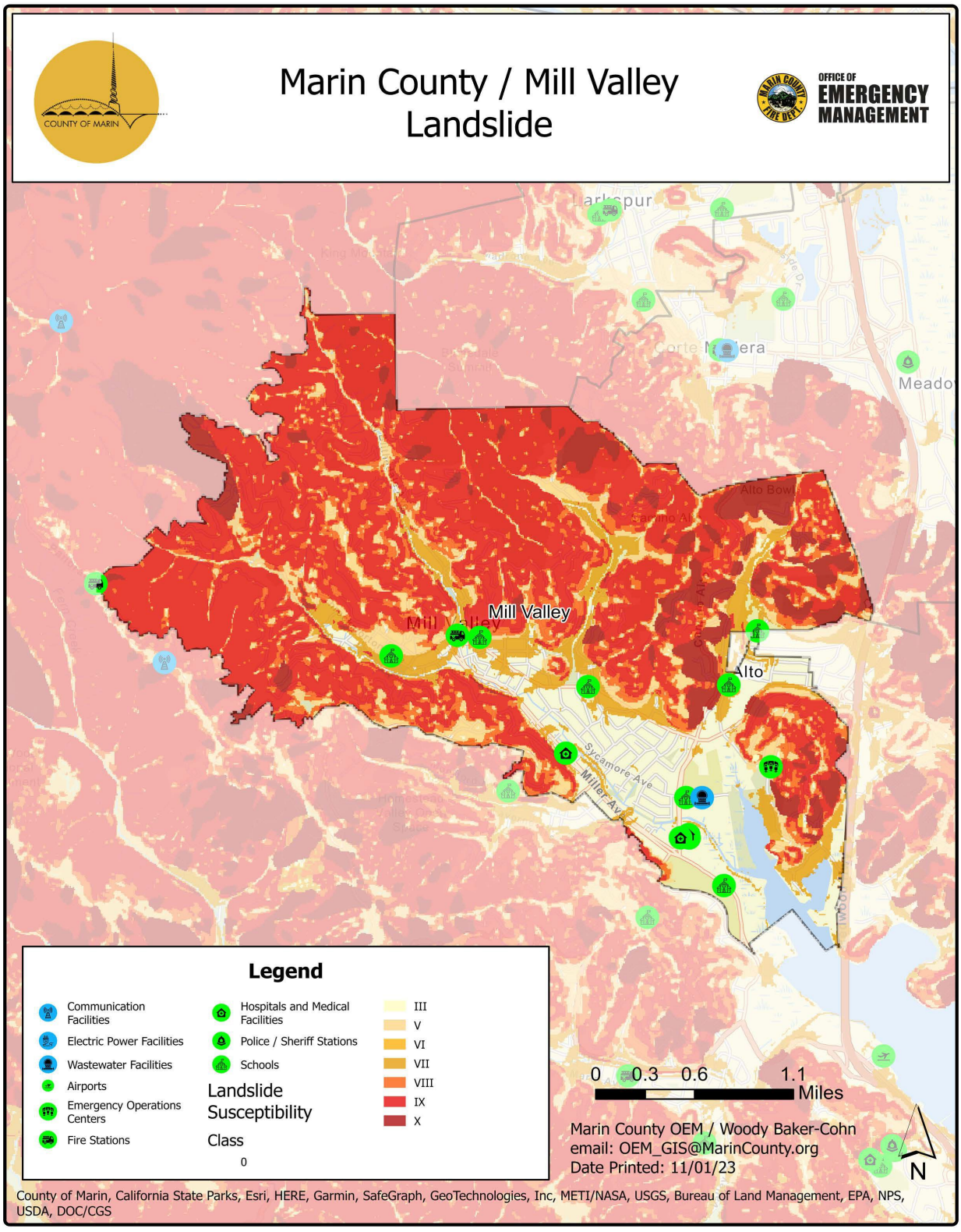


Figure 317: City of Mill Valley Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

Transportation challenges may be of particular concern with a landslide in the City, particularly in the hilly and mountainous residential areas around the city. Ingress and egress into these areas may be impacted by a landslide.

Earthquakes also have the potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Mill Valley may contribute to soil instabilities and pose a risk to properties and infrastructure in Mill Valley. Several small watersheds originate above Mill Valley in the Muir Woods National Monument and Mount Tamalpais State Park and flow towards Richardson Bay through Mill Valley. Erosion from these small watersheds can add to soil instability and could contribute to debris flows. Homes along Old Mill Creek, Arroyo Corte Madera del Presido and Warner Creek are particularly susceptible to a debris flow, which could destroy bridges and other road infrastructure.

On 10/24/2021, a severe storm caused a mudslide that damaged the Guidepost Montessori School.

On 4/12/2006, a mud flow coursed down the steep slope behind a home at 70 Bolsa Avenue, uprooting oak trees before crashing into the master bedroom. The debris flow was about 50 feet wide and 12- to 14-feet deep and it killed a resident who was found under 12 feet of mud.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[21], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Mill Valley that have a higher landslide susceptibility, including the numerous open spaces around the city will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Mill Valley could be susceptible to post-fire debris flows. This includes areas of Old Mill Creek and Arroyo Corte Madera del Presidio which flow and converge into downtown. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

[21] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on their effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Mill Valley and Marin, though its effects would be most felt in the hillside and mountainous areas where the risk of wildfire may increase. Dry trees throughout the city may become a safety hazard to the public due to falling trees or limbs.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Mill Valley may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the City of Mill Valley, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Mill Valley. Impacts to residents and infrastructure from wildfire as a

result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Mill Valley where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Mill Valley, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of Mill Valley could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Mill Valley can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 23).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 318: Modified Mercalli Intensity Scale
Source: USGS

Figure 24 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 319: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 25). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 320: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning, there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Mill Valley due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity
The colors on Figures 26 and 27 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

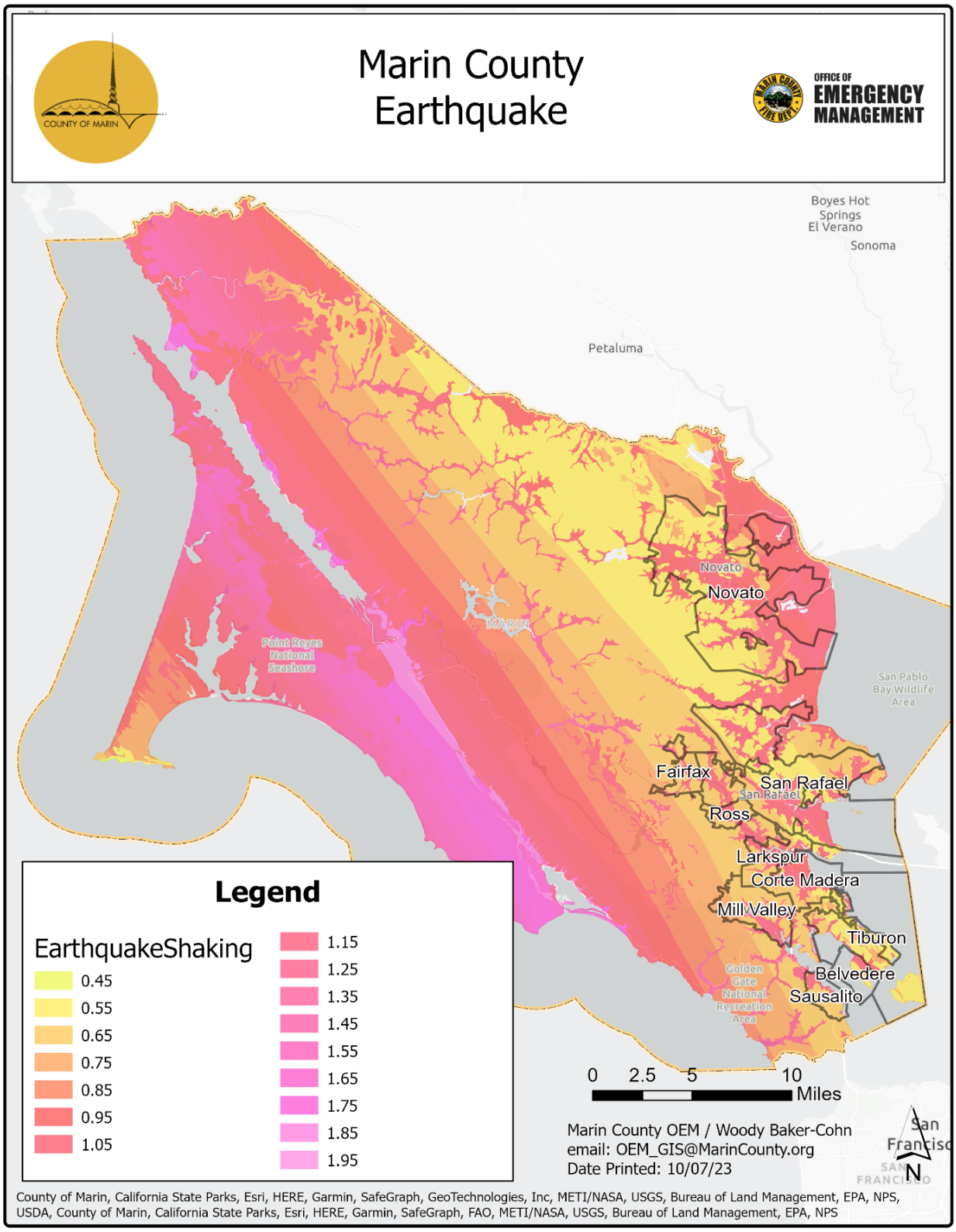


Figure 321: Marin County OA Earthquake Impact and Fault Lines
Source: Marin County OEM

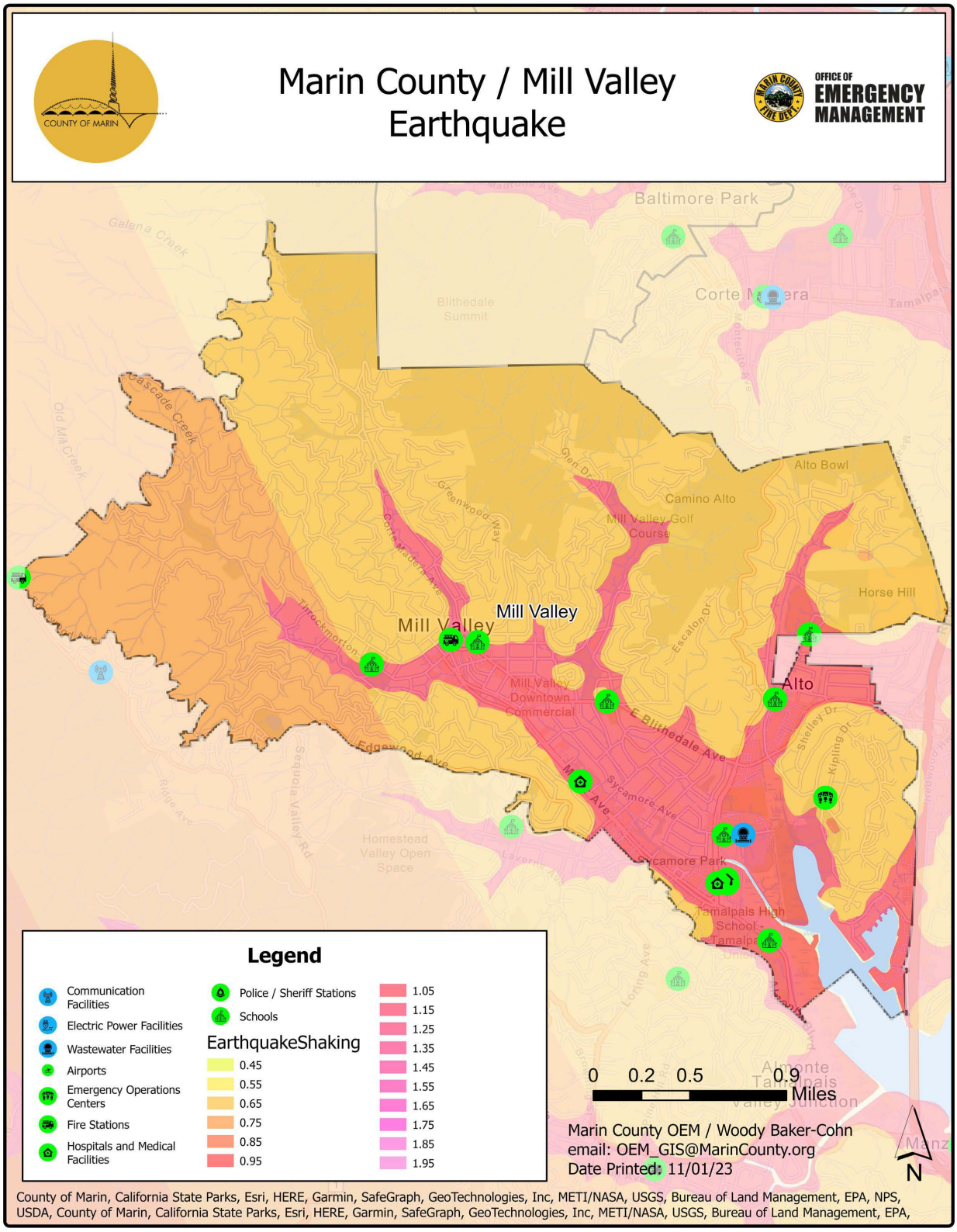


Figure 322: City of Mill Valley Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Mill Valley is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region may have major impacts to the City. In the upland areas of the City, most modern single-family buildings with foundations to bedrock should perform well to shaking. Modern multi-story buildings with foundations to bedrock should not be subject to collapse, although some serious damage may occur. There is increased risk of earthquake shaking and liquefaction in certain parts of Mill Valley, particularly in the area of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 where superficial deposits and fill are more prevalent. This area has greater development density and includes residences and the primary downtown and commercial areas of the City. Residential areas of the city along the lower reaches of Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creek also have an increased risk of earthquake shaking. All of the City's critical facilities lie areas of moderate earthquake shaking susceptibility. Unreinforced masonry buildings in the downtown area could suffer moderate to severe damage from an earthquake. Falling debris could endanger those in the vicinity of these older buildings. "Pancaking" of these older structures during business hours may entrap many people. The City's densely settled alluvial lowlands have a potential for heavy damage. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base.

Landslides in Mill Valley as a result of an earthquake may cause damage to homes and roads as a result of shifting soils, effecting ingress and egress in the hilly and mountainous residential areas of the city where there are numerous windy and dead-end roads. Many hillsides in Mill Valley are unstable in their natural state, and even minor changes in the shape of the land surface could create major landslide problems.

Mill Valley hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Mill Valley On 12/31/2020, a 3.6 magnitude earthquake originating from the San Andreas Fault struck near Mill Valley. There were no reports of damages or injuries.

In 2023, the Mill Valley City Council approved an ordinance that requires retrofitting for some apartment buildings built before 1978. The ordinance applies to "soft-story" apartment buildings or those with a wood-frame target story design and three or more residences. Approximately 50 to 90 buildings could meet the criteria according to the city.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Mill Valley, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[22], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Mill Valley. Climate change could also

[22] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Mill Valley downtown and along its creek beds and marshlands, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally resulting from prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the “Atmospheric River” contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the “Pineapple Express” because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 28.

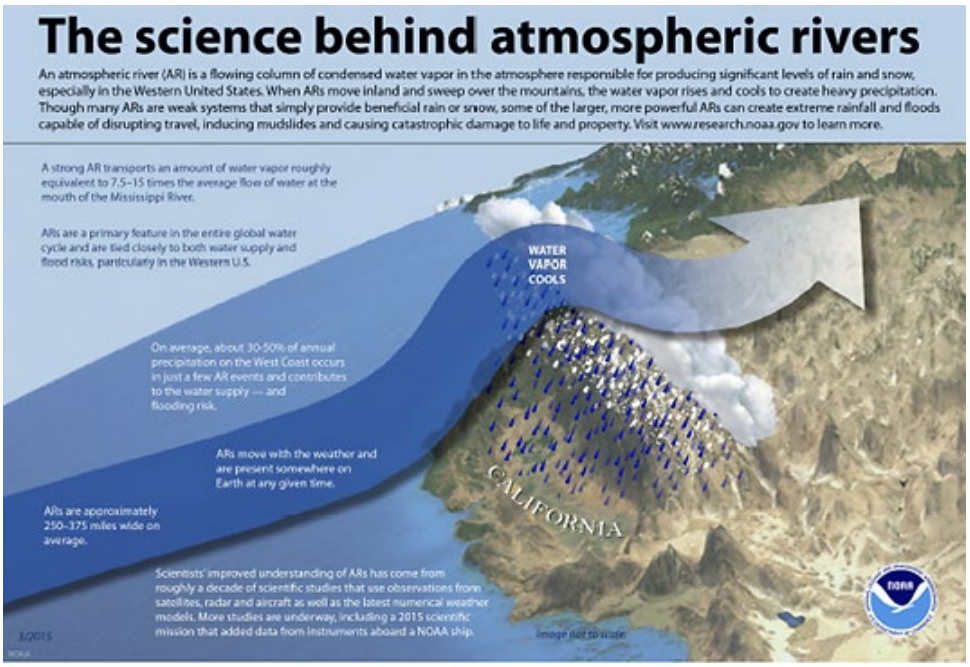


Figure 323: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Many developed and undeveloped Mill Valley lands are subject to flooding due to a combination of factors, including periodic heavy winter rainfalls, tidal fluctuations, and potential for tsunami due to seismic activity. Mill Valley has numerous drainage basins which lead to small riparian streams and creeks which drain to Richardson Bay. Flooding in Mill Valley generally results from a combination of creek flooding along Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creeks as well as from high tides and storm runoff in low-lying areas along Richardson Bay. Mill Valley drains into Richardson Bay mainly by way of the Arroyo Corte Madera del Presidio. The creek drains an area of about six square miles from the upper reaches of Mount Tamalpais. Creek bank gradients are, therefore, exceptionally steep in the upper elevations, and flatten markedly as the creek continues over alluvial plains and enters the tidal marshlands along the periphery of Richardson Bay. Consequently, the creek often overflows its banks in the lower reaches during periods of heavy rainfall. Sunny-day king tide flooding has become a common occurrence along the bay in Mill Valley. Several lowland areas in Mill Valley, particularly the alluvial fan where its creeks converge, are in the 100-year floodplain, with several pockets in in the 500-year floodplain. Significant encroachment by urban development and vegetative growth has occurred along Arroyo Corte Madera del Presidio. Both factors have

imposed extreme limitations on channel flow capacities along substantial portions of the creek, resulting in flood problems. During heavy rainfall conditions, floodwaters cascade down the steep upper reaches of the main tributary streams and flow through central Mill Valley, where they overflow the flatter, generally constricted and inadequate channels. Damaging floods have periodically occurred over this area as a result. Part of the downtown area, the commercial areas along Miller Avenue, E. Blithedale Avenue east of Lomita Drive and along Redwood Highway adjacent to Highway 101, and numerous residences lie in the 100-year floodplain and could be susceptible to flooding. Part of the Mill Valley City Hall and Fire Station #6, the Marin Terrace and Redwoods medical facilities, Tamalpais High School and part of the Mill Valley Treatment Plant lie in the 100-year floodplain. Part of the Mill Valley Middle School, the Redwoods medical facility, the Mill Valley Treatment Plant and dozens of homes and businesses lie in the 500-year floodplain and could be susceptible to flooding.

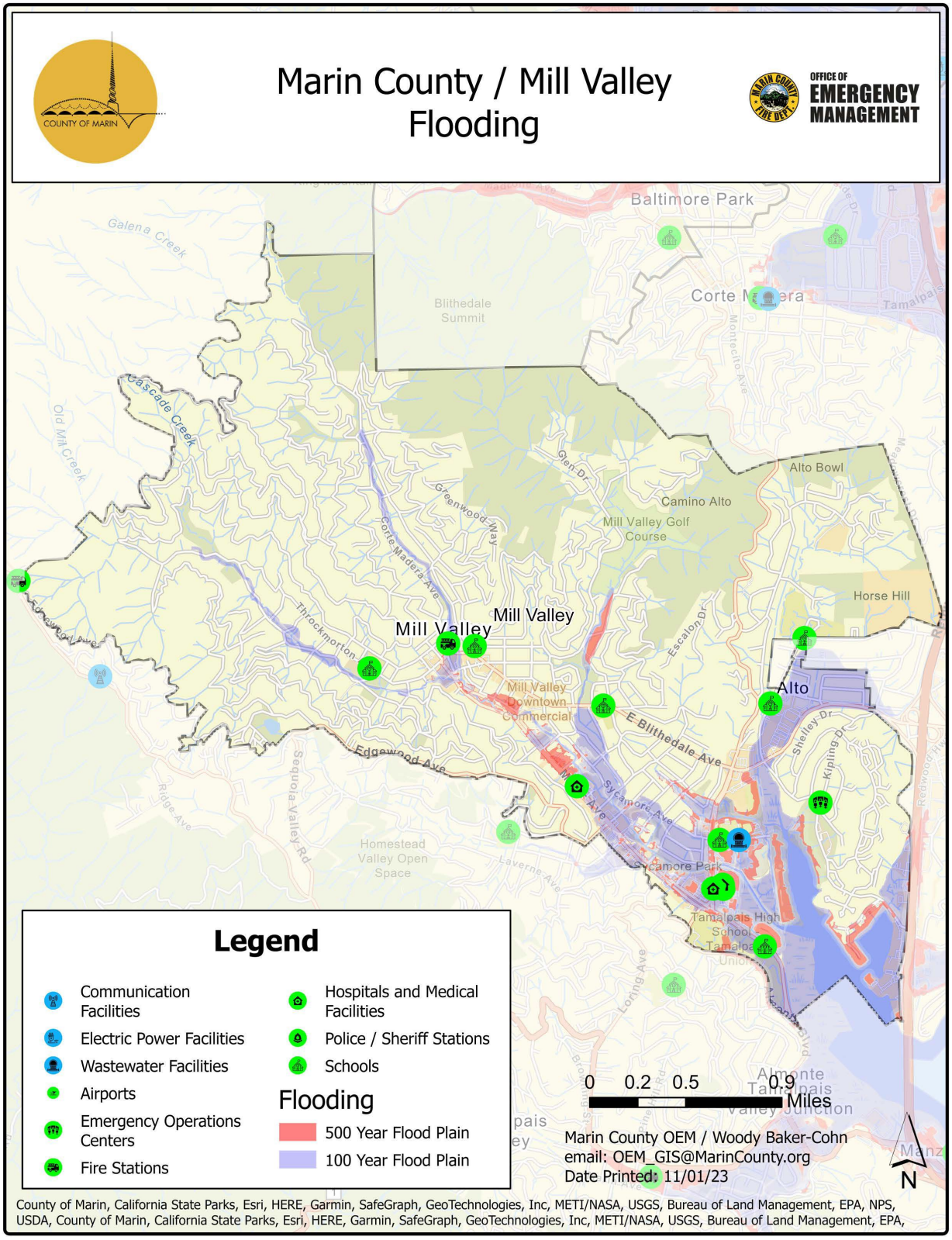


Figure 324: City of Mill Valley Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 19 shows the number of City of Mill Valley critical facilities by flood zone.

Table 19: City of Mill Valley Critical Facilities

Category	Name	Address	Flood Zone
Critical Facilities			
Fire Stations	Mill Valley Fire Department (MLV) & Public Safety Building / Fire Station 7	1 Hamilton Dr, Mill Valley, CA 94941	X[1]
Fire Stations	Marin County Fire Department (MRN) / Throckmorton Ridge Station	816 Panoramic Highway Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Fire Stations	Southern Marin Fire District Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	X/AE
Fire Stations	Southern Marin Fire Protection District (SOM) / Station 4	309 Poplar Street Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Fire Stations	Southern Marin Fire Protection District (SOM) / Station 9	308 Reed Blvd Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Police/Sheriff Stations	Mill Valley Police Department & Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	X[1]
Emergency Operations Center	Mill Valley Police Department & Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	X[1]
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	X
Local Government	Mill Valley Corporation Yard, Mill Valley City Fuel Pumps	450 Sycamore Avenue Mill Valley, CA 94941	X/AE
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	AE
Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	X

Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	X
Evacuation Shelters	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	X
Evacuation Shelters	Park Elementary School	360 E Blithedale Ave, Mill Valley, CA 94941	X/AE
Evacuation Shelters	Edna McGuire Elementary School, Terra Marin School	70 + 80 Lomita Drive, Mill Valley, CA 94941	X
Evacuation Shelters	Mill Valley Community Center	180 Camino Alto	X
Mill Valley, CA 94941			X/AE
Evacuation Shelters	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	X/AE
Evacuation Shelters	Tamalpais High School	700 Miller Ave, Mill Valley, CA 94941	X
Evacuation Shelters	North Bridge Academy	17 Buena Vista Ave, Mill Valley, CA 94941	X
Evacuation Shelters	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	X
High Potential Loss Facilities			
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	X
Hazardous Materials	Former Mill Valley Dump (current site of middle school, school district office, community center, sewer treatment plant. Copper, lead, zinc main chemicals of concern)	411, 425, 450 Sycamore and 180 Camino Alto, Mill Valley, CA 94941	X/AE
Hazardous Materials	Former Mill Valley Landfill (1989 cleanup site, annually monitored. No current contaminants of concern)	Cypress and Edgewood Road, Mill Valley, CA 94941	X
Critical Infrastructure			
Communication Facilities	Mill Valley Post Office	751 E Blithedale Ave, Mill Valley, CA 94941	AO
Communication Facilities	FAA Mill Valley Long Range Radar and Communications Station	East Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co)	X

Communication Facilities	MERA Antenna Site – Mount Tamalpais	Middle Peak Rd, Mill Valley, CA 94941 37.929006, -122.587084 (unincorporated Marin Co)	X
Communication Facilities	MERA Antenna Site – Mill Valley Public Safety Building	1 Hamilton Dr, Mill Valley, CA 94941	X
Communication Facilities	MERA Antenna Site – Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	X/AE
Communication Facilities	Future MERA Antenna Site – Mill Valley Water Tank	37.902735, -122.558010	X
Electric Power Facilities	PG&E Alto Substation	90 Roque Moraes Dr, Mill Valley, CA 94941	X
Natural Gas	PG&E gas transmission lines terminate to distribution lines	37.904639, -122.525810	X
Water Supply Facilities	Water tank	Edgewood Ave/Sequoia Valley Rd, Mill Valley, CA 94941 37.903110, -122.558023	X
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941 37.906425, -122.531301	X
Water Supply Facilities	Water tank	H-Line Fire Road 37.927032, -122.556641	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	X
Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	X
Stormwater Facilities	Park Terrace Storm Water Pump Station	14 Park Terrace, Mill Valley, CA 94941	AE

Stormwater Facilities	Marin County Flood Control District Zone 3 – Ryan Creek Pump Station	37.8974771419235, -122.526719323848 (Behind Mill Valley Middle School)	X/AE
Stormwater Facilities	City of Mill Valley stormwater pump	6 Plymouth Cir, Mill Valley, CA 94941 37.89640, -122.53454	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin (SASM) Treatment Plant	450 Sycamore Ave, Mill Valley, CA 94941	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Camino Alto Pump Station	Camino Alto at Miller Ave, Mill Valley, CA 94941	X/AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Shelter Bay Pump Station	6000 Shelter Bay Ave, Mill Valley, CA 94941	AE
Wastewater Facilities	Sewerage Agency of Southern Marin - Sutton Manor Pump Station	Lomita Avenue at Ashford Ave, Mill Valley, CA 94941	AE
Transportation - Roads	Arterials	Miller Ave, E Blithedale Ave, Camino Alto, Molino Ave, Millwood St, Sunnyside Ave	X
Transportation – Roads	Collectors	Redwood Hwy Frontage Rd, Hamilton Dr, Roque Moraes, Lomita Dr, Ashford Ave, Sycamore Ave, Nelson Ave, La Goma St, Vasco Dr, Buena Vista Ave, Manor Dr, Carmelita Ave, Sunnyside Ave, Molino Ave, Marion Ave, Cascade Dr, Throckmorton Ave, Summit Ave, W Blithedale Ave, Eldridge Ave	Various
Transportation – Bus Facilities	Marin Transit Agency and Golden Gate routes and ~15 stops	E Blithedale Ave, Sunnyside Ave, Miller Ave	Various
Wastewater Facilities	Sewerage Agency of Southern Marin (SASM) Treatment Plant	450 Sycamore Ave, Mill Valley, CA 94941	X and AE

1 The parcel at 1 Hamilton Drive contains a small area in the AE zone but the critical police and fire facilities are not located in that portion of the parcel.

Table 161: City of Mill Valley Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay have the potential to

significantly impact the Mill Valley storm drain system. Mill Valley already sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. Mill Valley areas subject to frequent flooding in the past are predominantly former marshlands (Bay Mud areas) that have previously been filled for urban expansion purposes. Consequently, the flood problem in Mill Valley has increased with time.

Mill Valley has experienced the impacts of flooding from winter storms, most notably in 1982, 1997, 1998, 2005 and 2006.

On 01/10/2023, roads and schools closed in Mill Valley as storms doused the region. Saturated soil caused fallen trees and landslides to impact roads. Power outages impacted thousands. Flooding in Mill Valley prompted closures at Sycamore Avenue and Locust Avenue and Miller Avenue at Evergreen Avenue, according to Southern Marin Fire District.

Figure 325: 2023 Flooding in Mill Valley – San Francisco Bay Trail
Source: SF Gate

On 12/23/2022, king tides in Mill Valley peaked preceding a storm. Water pooled on roads in some places, including the ramps on and off Highway 101 outside city limits, and along the San Francisco Bay Trail and on Miller Avenue and E Blithedale Avenue and at the SASM WWTP within city limits. The City worked to ensure that drains and debris were clear.

Figure 326: Flooding in Mill Valley – E Blithedale
Source: City of Mill Valley

On 10/21/2021, a storm caused flooding in Mill Valley, particularly in the Sycamore Triangle neighborhood. Residents were told to move their vehicles to higher ground at the Mill Valley Community Center. Miller Avenue was closed at three spots due to localized flooding including Montford Avenue, at Camino Alto, and between Camino Alto and Almonte Boulevard. Residents living along the Arroyo Corte Madera del Presidio were advised to monitor their properties closely for flooding.

On 1/3/2018, a king tide caused flooding in Mill Valley, inundating the shoreline in several places.

On 2/7/2017, a storm caused flooding across Mill Valley. Miller Avenue was closed at Almonte Street and along parts of Camino Alto, police said. Golden Gate Transit suspended bus service at the Manzanita Park and Ride lot because of flooding.

On 12/3/2014, storms caused such significant flooding across roads in Mill Valley that the city advised all residents to stay home due to heavy traffic congestion and so emergency crews could work.

Figure 327: Mill Valley Flooding – SASM WWTP
Source: City of Mill Valley

Figure 328: A cyclist rides through a flooded section of roadway Dec. 3, 2014
Source: CBS News

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[23] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Mill Valley. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Mill Valley will likely

[23] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regions. https://www.nature.com/articles/s41598-017-11285-y

experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of Mill Valley. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of Mill Valley would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along Old Mill Creek and Arroyo Corte Madera del Presidio would expose more people, structures and infrastructure including major roads to creek flooding as a result of climate change.

2.2.5 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

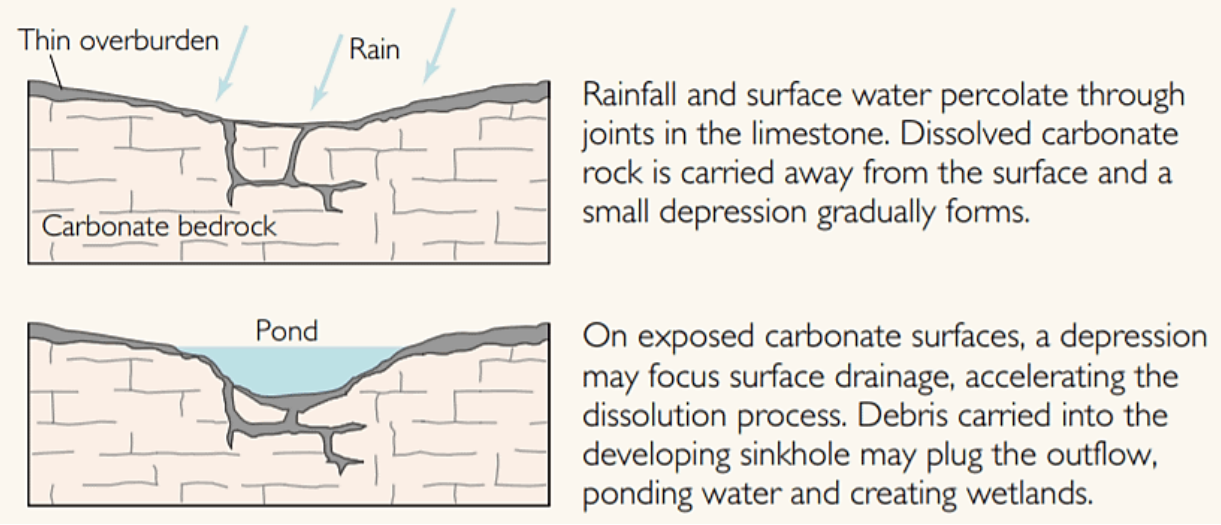


Figure 329: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go

undetected for long periods. See Figure 35 for a picture and description of how cover-subsidence sinkholes form.

Subsidence can also occur in bay mud areas which are prevalent around San Francisco Bay. Bay Mud, which has very little strength, can move and shift over long periods of time and is also affected by other natural events such as earthquakes, storm activities, water pressure and composition. Older construction of buildings placed on fill material on Bay Mud are susceptible to differential settlement which affects the service life of the structures as well as utilities, roadways and other infrastructure that supports these areas. The Marinship area and other low elevation areas built on bay mud have experienced significant differential settlement over time.

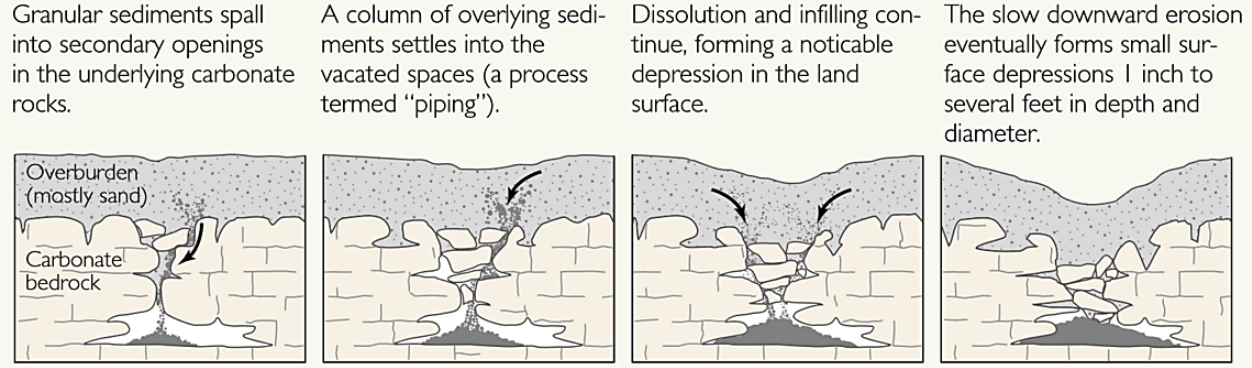


Figure 330: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 36 for a picture and description of how cover-collapse sinkholes form.

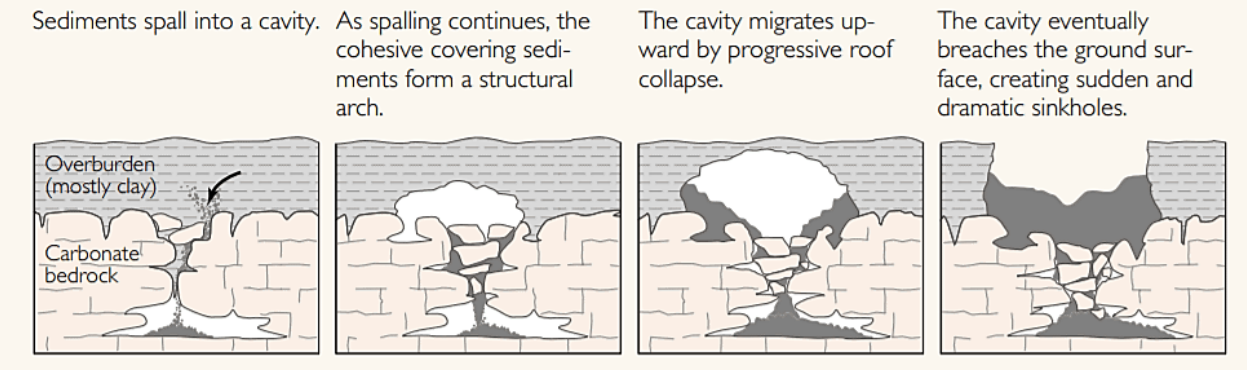


Figure 331: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the

new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Large areas of former bay mud marshlands in Mill Valley have been artificially filled over the years. Land subsidence and sinkholes would most likely occur in these lowland areas of Mill Valley along Richardson Bay where superficial deposits and fill are more prevalent. This includes the area around Bothin Marsh, Bayfront Park and the SASM WWTP. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base. There are several schools, medical facilities, and commercial buildings in area of increased land subsidence susceptibility. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. The Redwoods medical facility, Mill Valley Middle School, the Mill Valley Community Center, the Mill Valley Fire Station #7 and the Mill Valley Police Station are all located within very high liquefaction risk areas. Land subsidence could have numerous impacts for Mill Valley, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

There have been no major sinkholes recorded in Mill Valley, however, there have been several smaller sink holes around the city caused by a variety of factors.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Mill Valley, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Mill Valley as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Mill Valley could increase with future development in the lowland populated areas of the city where land subsidence is more likely to occur.

2.2.6 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

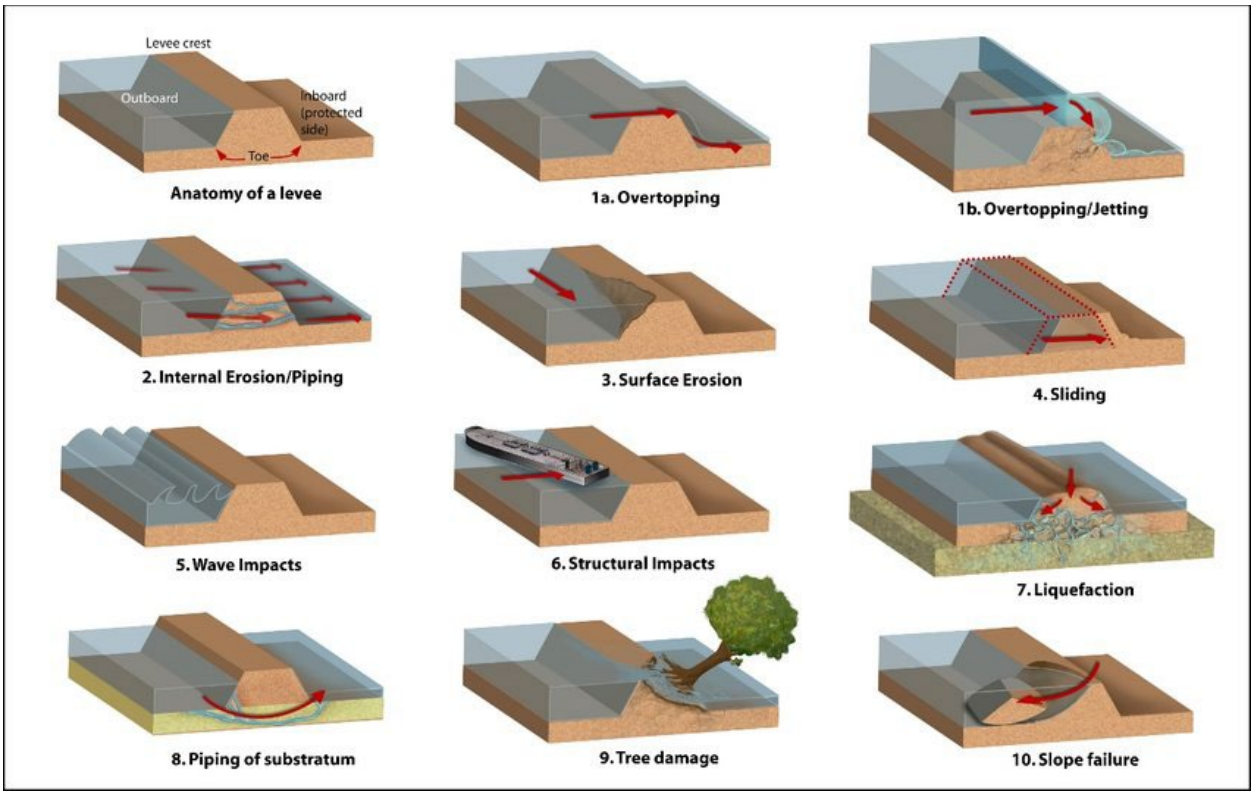


Figure 332: Levee Failure Mechanisms
Source: University of California

The City of Mill Valley has one existing levee. Marin County Levee 57 is 0.32 miles long with an undocumented height and surrounds the SASM WWTP on three sides. It is maintained by the SASM and according to the Mill Valley Department of Public Works, the levee at the SASM is above the high tide water mark and is not technically a levee but rather a berm to hold extra water storage at the side. It is not acting as a flood wall.

Twenty-six people and four buildings with a property value of $4.48 million are at risk from a failure of the Marin County 57 levee.

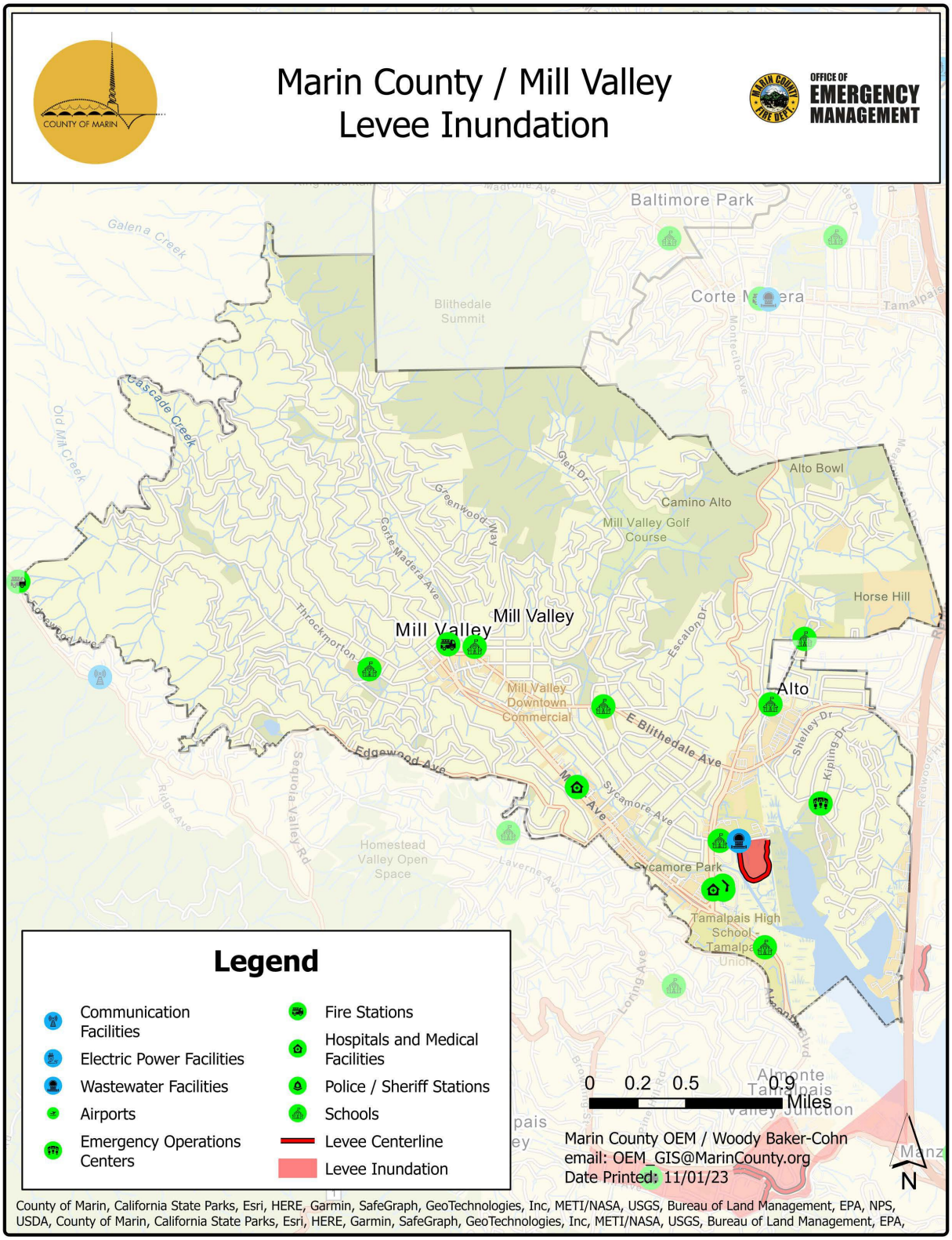


Figure 333: City of Mill Valley Levee failure Critical Facilities and Infrastructure
Source: Marin County OEM

There have been no failures of Marin County Levee 57.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Mill Valley, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Mill Valley, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Mill Valley protected by its levee, the potential for significant impacts to residents and infrastructure will only increase.

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called “storm surge.” The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels result in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

While only a small area of the Mill Valley could flood tidally from Richardson Bay, several key access routes and public facilities used by entire communities are in the exposed low-lying areas surrounding the Bay. The lowland areas of Mill Valley close to the Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are vulnerable to sea level rise and may experience between one and six feet of inundation based latest predictions of sea level rise in this area in the next 100 years.

Numerous commercial areas, dozens of residences, the Mill Valley Sewerage Agency of Southern Marin (SASM) Wastewater Treatment Plant (WWTP), Tamalpais High School, and the Redwoods medical facility lie in areas of Mill Valley susceptible to sea level rise. Several main thoroughfares including Miller Avenue and Camino Alto also lie in this area and already experience tidal flooding. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment

estimates Mill Valley could anticipate impacts to over 13,000 people and over 1,000 living units with $550 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, 44 acres of the City could be exposed to sea level rise. In the long-term, 190 acres of the City could be exposed to sea level rise; and 273 acres could be exposed with an additional 100-year storm surge. Ten percent of Mill Valley's land area could be exposed to five feet of sea level rise and a 100-year storm surge. Miller Avenue could be flooded in the near-term. This area already experiences seasonal flooding that extends to Tamalpais High School fields. Homes and businesses along and near Shelter Cove, Hamilton Drive, and the Frontage Road could expect near-term flooding impacts. The Redwoods, a retirement community, is vulnerable in the medium-term. The SASM WWTP, serving six sanitary districts and 30,000 people, including Mill Valley residents, could expect flooding impacts in the medium and long-term. The Mill Valley-Sausalito Bike Path could flood a majority of the year during average high tides in the medium-term. This Path currently floods regularly during major storms. Mill Valley Middle School could expect sea level rise impacts to the grounds and could expect flood waters reach the buildings with the 100-year storm coincidence. Bothin Marsh habitat could transition to mudflats without adequate sediment supply because the marsh does not have options for inland migration. Loss of marshland vegetation would remove natural buffers to stormwater inundation from Richardson Bay. The Mill Valley Recreation Center fields could be vulnerable to sea level rise in the long-term. A 100-year storm surge could impact nearly the whole site. Camino Alto, between Miller and Blithedale Avenues, and the neighborhood north of it, could expect flooding in the long-term.

Relative to other East Marin communities, Mill Valley has a low number of buildings vulnerable to sea level rise and a 100-year storm surge. However, several areas already vulnerable to stormwater backups could expect these conditions to worsen with added saltwater. Most of Mill Valley's buildings are wood-framed. While it is unclear how many buildings are older than 30 years, many in the low-lying areas are. Newer buildings typically have drilled piles 20-30 feet deep with reinforced steel cages and concrete to connect the homes to the foundation. This feature can help buildings withstand lateral forces from wind and water. However, even if buildings remain structurally intact, utility-related equipment could be vulnerable. Moreover, material and content damage from water and salt could occur.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

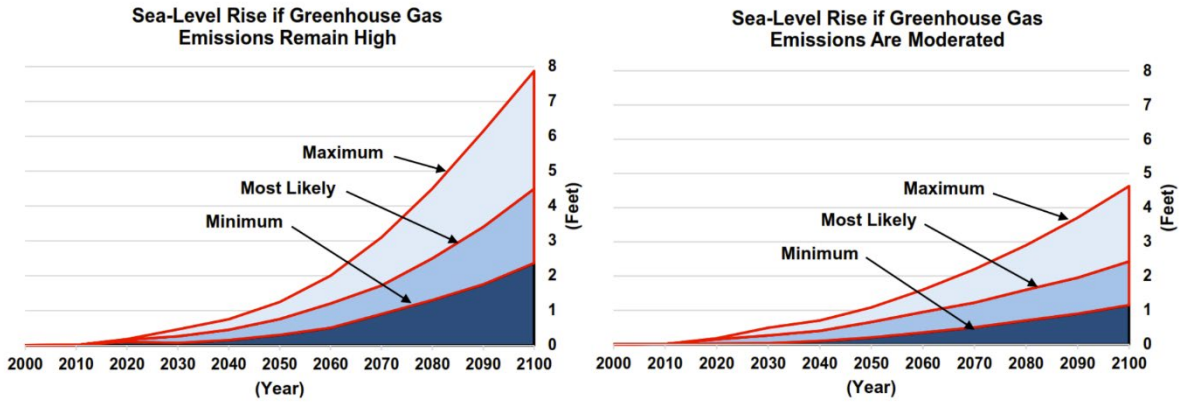


Figure 334: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Mill Valley already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Mill Valley with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Mill Valley will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Mill Valley will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across Mill Valley will continue to become inundated.

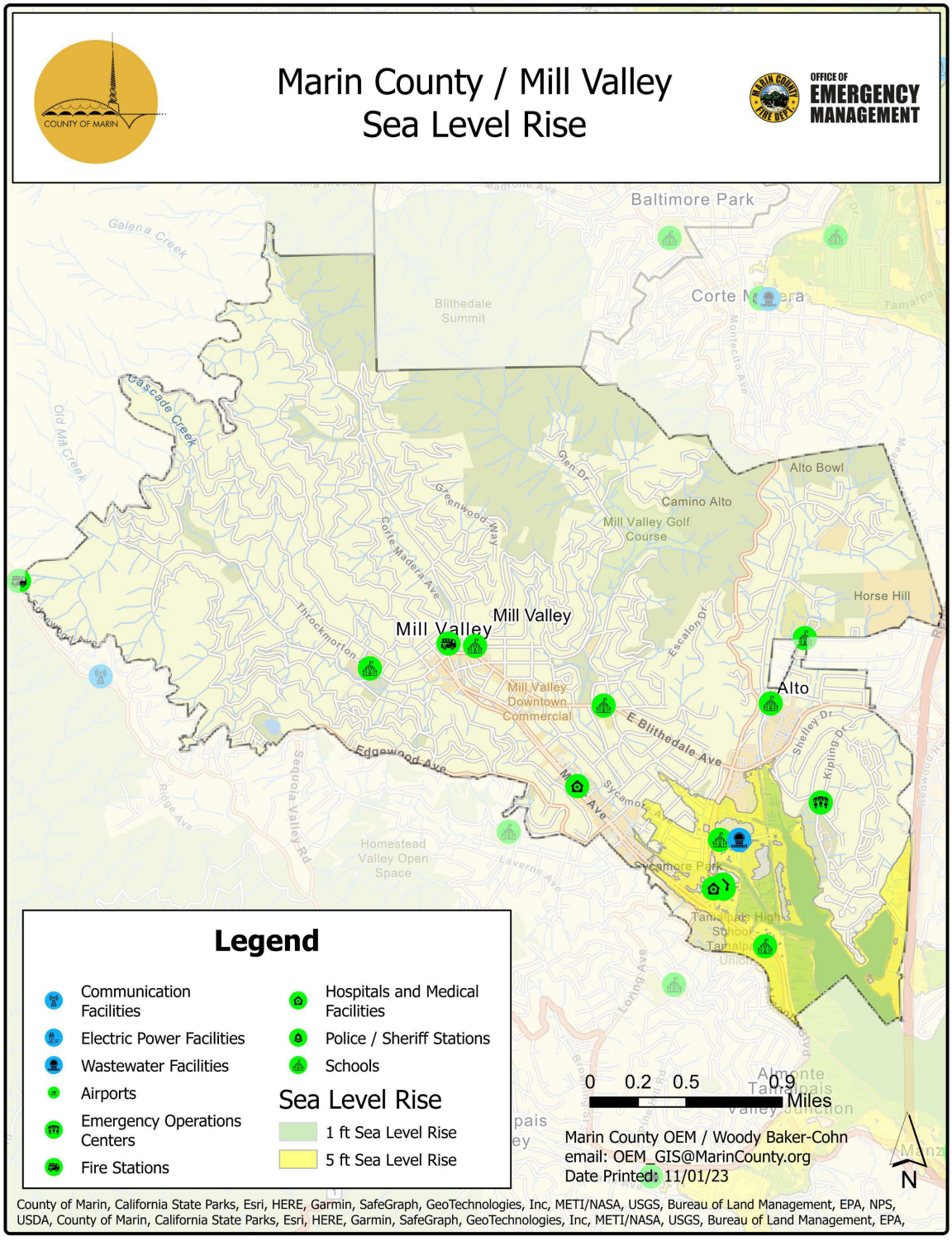


Figure 335: City of Mill Valley Sea Level Rise Impact
Source: Marin County OEM

2.2.8 SEVERE WEATHER – EXTREME HEAT

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 41):

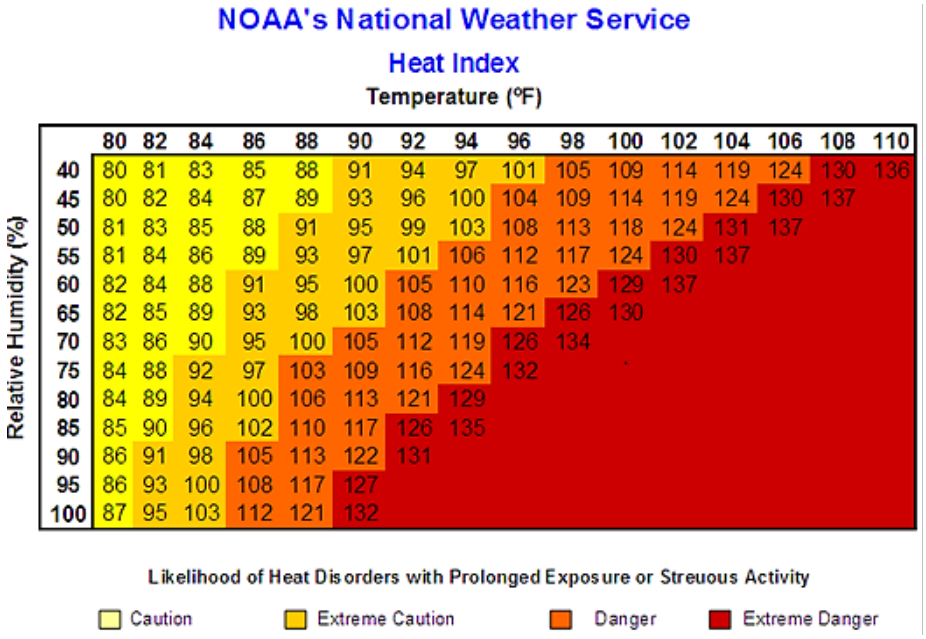


Figure 336: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Mill Valley and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city between Miller Avenue and E. Blithedale Avenue. There are dozens of residences in this area. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the City of Mill Valley experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

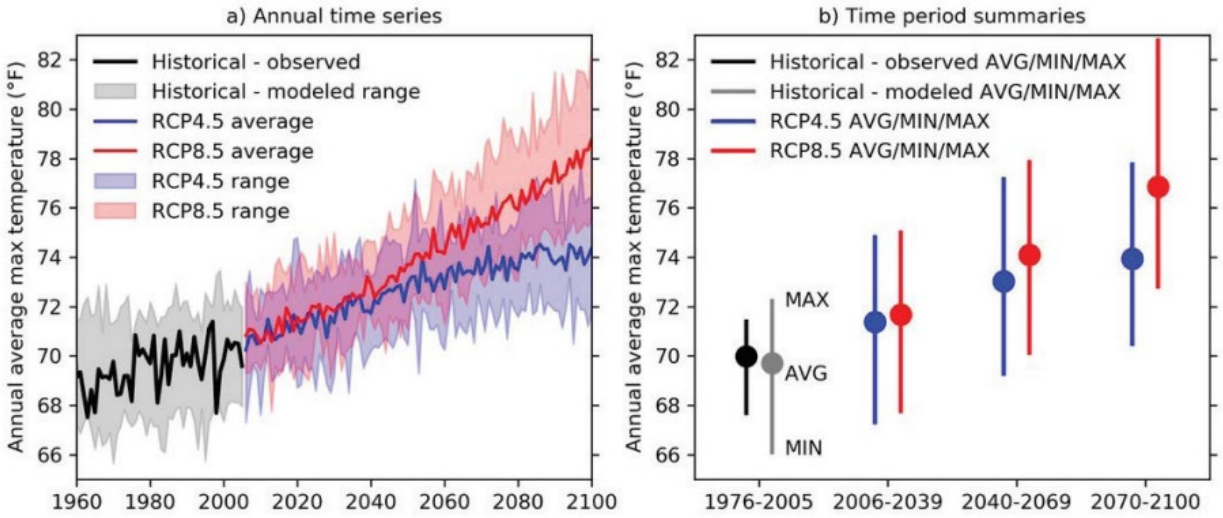


Figure 337: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Mill Valley. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Mill Valley where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Mill Valley could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Mill Valley as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of Mill Valley where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Mill Valley could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 43).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 338: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Mill Valley is susceptible to high winds during summer months when high temperatures in the central valley tend to pull in colder temperature air from the Pacific Ocean in the form of fog and winds. Some areas of Mill Valley have been named “Hurricane Gulch” referring to the phenomenon when wind associated with the marine layer rolls over the upper hillsides and proceeds to impact properties, trees and infrastructure in the city.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 44) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 339: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 340: Waterspout Formation
Source: MarineInsights

All of Mill Valley is susceptible to storms and damage from wind, though the hilly and mountainous areas around the City have increased susceptibility due to a higher presence of trees. There are numerous windy and dead end roads in these areas where a downed tree could hinder access. Mill Valley is unlikely to experience a tornado due to its terrain but it could experience a waterspout originating from Richardson Bay. Drought coupled with high winds which frequently occur may increase the susceptibility of trees toppling and falling branch damages to property. Fallen trees may damage homes and other facilities. Power lines may be impacted by fallen trees and wind, causing power outages. .

On 1/17/2023, a tree fell and destroyed a garage at 56 Monte Vista.

On 1/13/2023, a storm caused a large tree to fall, closing Marion Avenue.

On 1/16/2019 a man was struck and killed by a car as he was trying to avoid a falling tree at the intersection of Laverne Avenue and North Ferndale Avenue during a storm. A huge downed tree fell across the street from the Horizon School during the storm, crushing the rear of a car and narrowly missing the people inside. Nobody was hurt. A 125-foot-tall redwood tree fell off Molino Avenue splitting a power pole in two. It cut power to about 60 homes.

On 2/17/2017, a storm with high winds caused 2,100 people in Mill Valley to lose power.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Mill Valley. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Mill Valley as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Mill Valley with high tree cover including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Mill Valley would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the City. The entire shoreline of Mill Valley along Richardson Bay is in a lowland area and lies in a tsunami hazard area. The lowland areas of Mill Valley close to Richardson Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, the SASM WWTP, along Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are in a tsunami hazard area and

may be susceptible to a tsunami. Tamalpais High School, Mill Valley Middle School and the Redwood medical facility lie in this area.

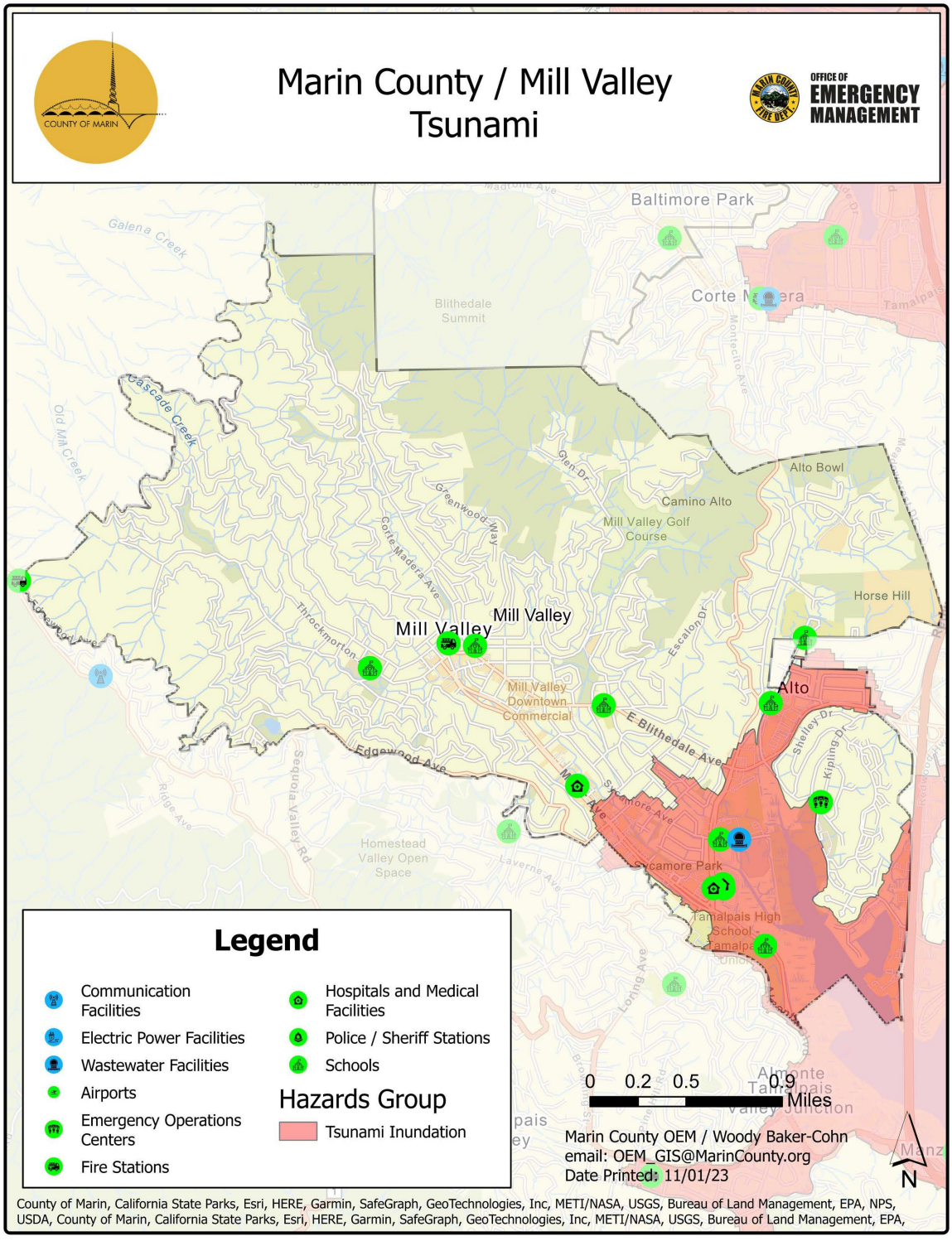


Figure 341: City of Mill Valley Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Mill Valley has experienced minor tsunamis in the past. Nevertheless, major tsunamis may occur in Mill Valley. Flooding from a tsunami may be similar to king tide flooding already experienced by the City with the exception that a tsunami occurs in a shorter time frame and may impact the City's vibrant bayside systems. Roadways and City infrastructure may become inundated with salt water, causing transportation issues and utility disruptions.

On 1/15/2022, an undersea volcano erupted in the Pacific Ocean near Tonga causing a minor surge from Richardson Bay. Rough waters were reported with no significant damage.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Mill Valley, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Mill Valley. This is particularly true along lower Arroyo Corte Madera del Presidio and around the marshland areas of Mill Valley where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Mill Valley would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas of levee failure along the shoreline in Mill Valley as a result of high wave heights associated with a more significant tsunami.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. Wildfires can be started naturally through lightning or combustion or can be set by humans. Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people. WUI fires have unique chemistry due to the combination of natural and human-made fuels that are burned, which may lead to the formation or release of toxic emissions not found in purely wildland fires.

Warning times for wildfires are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in extreme circumstances, they have been known to burn for months, or until they are completely extinguished by fall rains.

The Marin County OA has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

The Southern Marin Fire Protection District (SMFD) provides wildland fire protection and fire prevention activities for the City of Mill Valley as LRA. As a JPA of the Marin County OA, SMFD has response areas within the County for both LRA and SRA.

Figure 47 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

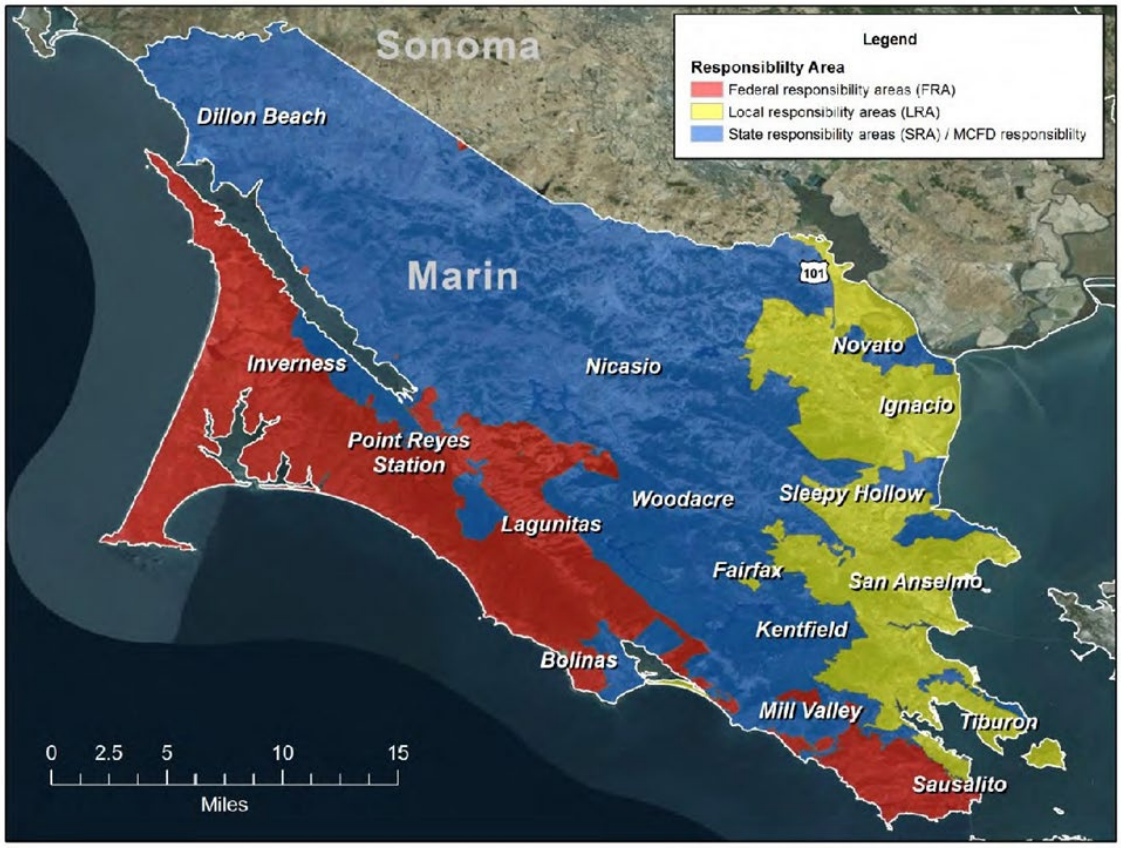


Figure 342: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. Fire risk in the Marin County OA in general and in Mill Vally in particular fluctuates throughout the year based on seasonal weather, and based on topography and vegetation. In addition, throughout the OA insect infestations and plant diseases are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Dead and dying trees have created large swaths of land with dense and dry fuel loads.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

In Mill Valley, significant portions of the community are in a designated WUI zone bordering Muir Woods National Monument, Tamalpais State Park and Marin County parkland. These areas are heavily vegetated with various fuel types and include Warner Canyon, Mill Valley Ridge, Blithedale Canyon, Blithedale Ridge, Cascade Canyon, Fern Canyon, Summit Ridge, Scott Valley, and the southeast face of Mount Tamalpais. These areas are characterized by steep slopes and are covered by dense stands of vegetation that can burn explosively and cause fire to spread rapidly. In addition, a significant number of properties and structures are located within these steep hillside communities. A major fire has not occurred in these areas since 1929, and, as a result, the density of dry vegetation has increased. Mill Valley experiences strong winds throughout the summer months and into the fall with the marine layer crossing over the mountains from the Pacific Ocean.

Wildfire protection in Mill Valley is provided by Southern Marin Fire District. Outside the City, CAL FIRE typically provides fire protection or contracts with Marin County Fire Department (MCFD). The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin

County OA) to help prevent the start of future wildfires. PG&E will, and has, initiated a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass-through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

PSPS events have occurred in Mill Valley and other areas of Marin in years past. While PG&E continues to address safety issues with their systems by installing equipment that can segregate their system in order to continue to provide power to their customers wildfires from overhead electrical systems. While wildfires can start anywhere, the high winds and high abundance of fuels within and upslope from the jurisdictional boundary of Mill Valley make this WUI area the

most likely location for a wildfire to occur. Areas which are also heavily vegetated and are primarily residential and consist of numerous winding streets and hillside homes may be damaged or destroyed by a wildfire.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

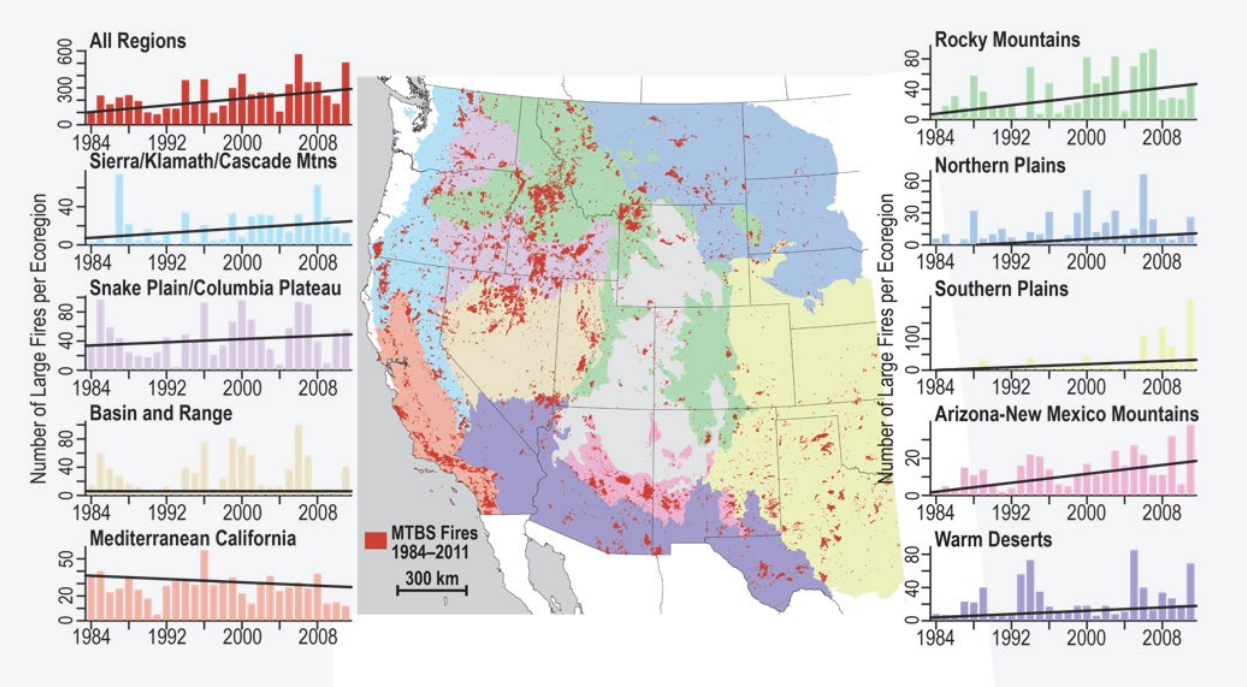


Figure 343: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Mill Valley is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Mill Valley. Future development in the WUI throughout Mill Valley will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Mill Valley WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Mill Valley marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

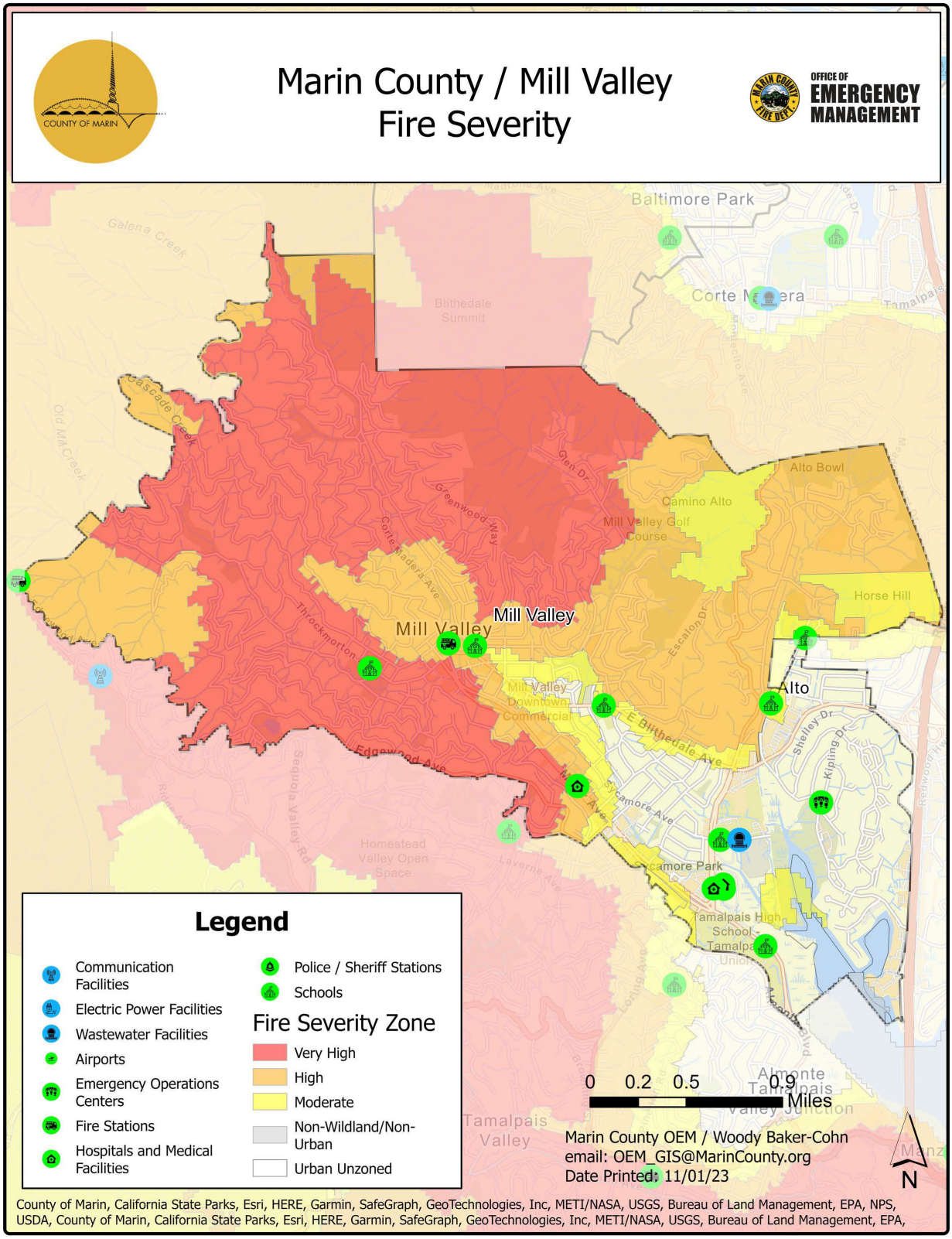


Figure 344: City of Mill Valley Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Specific communities in Mill Valley around the northern side of the city are in a Very High FHSZ and are at a higher risk of wildfire. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access. The Old Mill Elementary school lies in this area. Hundreds of homes and parts of the downtown and commercial area along Miller Avenue in Mill Valley lie in a High FHSZ and could be susceptible to wildfire. The Mill Valley Fire Station #6, the Greenwood School and the Marin Terrace medical facility lie in this area. Dozens of residences and parts of the commercial areas along Miller Avenue and E. Blithedale Avenue east of Lomita Drive lie in a Moderate FHSZ and have some susceptibility to wildfire. The Helix School and Edna Maguire Middle School lie in this area. Marshland around Bayfront Park is also in a moderate FHSZ and could be susceptible to a brush fire when vegetation is dry. All of Mill Valley could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Mill Valley, including in Muir Woods National Monument, Mount Tamalpais State Park and the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City may continue to increase. Brush fires in the City may increase over time as parks and other open spaces experience drier conditions.

On 9/27/2022, a brush fire broke out on a populated hillside adjacent to the Camino Alto Open Space Preserve near Kite Hill Lane and Camino Alto in Mill Valley. The fire burned a half-acre.

Figure 345: 2022 City of Mill Valley Wildfire
Source: KTVU

In 1929, the base of Mt. Tamalpais in Mill Valley experienced a significant fire known as the Great Mill Valley Fire. That fire's footprint is now developed with more than 1,100 homes (valued at over $1 billion) which have significantly altered the natural vegetation through urban and suburban development.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

Completed development within the City of Mill Valley since the last plan update in 2018 has included 16 single-family homes and 90 accessory dwelling units scattered throughout the city. There has not been new commercial development since 2018 aside from tenant improvements.

Future land use and growth management strategies in City of Mill Valley aim to concentrate future development into and toward existing communities and away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and density standards, with higher densities established along the main arterials and flatland areas of Mill Valley.

The City's commercial and multifamily zone districts are concentrated downtown and along the E Blithedale Ave and Miller Ave corridors and Highway 1 frontage. Hillside areas continue to be zoned for single-family development, with very low density development allowed in the areas far from main roads with high fire hazard. Also, the City's 2023-2031 Housing Element includes creation of three Housing Overlay Zoning Districts on certain commercial and multi-family zoned sites, with increased densities and development standards to encourage multifamily and mixed-use development on the parcels. Minimum densities are also established to ensure efficient use and infrastructure design, conservation of natural resources, and to avoid conflicting uses.

Table 20 identifies 74 parcels included in the new Housing Overlay Zoning Districts that have increased maximum density of 40 units/acre (as opposed to Mill Valley's typical maximum density of 29 units/acre). In addition to these specific identified parcels, over the next five years the City anticipates more multifamily and mixed-use development concentrated in the new overlay zone districts, as well as continued applications for single-family homes and ADUs throughout the City.

Table 20 also identifies mixed-use and multifamily housing projects currently in the construction and entitlement phase. These projects are located along E Blithedale Ave, Miller Ave, and at 1 Hamilton Drive (a City-owned site). Not listed in the table below are the continued applications for single-family home improvement projects that tend to increase square footages of homes and new ADUs built throughout the City. The City averages approximately 12 new ADUs per year.
As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Mill Valley has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 20: City of Mill Valley Projected Growth Areas

Development	# of Units	# of Parcels	Project Date[1]	Acres	Fire Severity Zone	Flood Zone
Multifamily and Mixed-Use Projects in Progress						
500 Miller Ave (Mixed-use development)	9	11	In construction. Estimated completion 2023	1.1	Moderate	X
Simons Way Subdivision 548 Miller Ave (Single-family dwellings and duplexes)	16	13	In construction. Estimated completion 2024	1.6	Moderate	X

Table 20: City of Mill Valley Projected Growth Areas						
Development	**# of Units**	**# of Parcels**	**Project Date[1]**	**Acres**	**Fire Severity Zone**	**Flood Zone**
550 Miller Ave (Mixed-use development)	6	9	Entitlement received 2019, building permit application in progress	0.29	Moderate	X/AE
160 Corte Madera Ave	2	1	Entitled 2016, building permit pending	0.51	High	X/AE
575 E Blithedale Ave (Mixed-use development)	25	1	Entitlement received Feb 2023; building permit application pending	1.2	Moderate	X
1 Hamilton Drive (Multifamily affordable housing)	45	1	Entitlement phase. Construction estimated 2024-2025	1.75	N/A but in WUI	X
20 Sunnyside Ave (Mixed-use development)	12	2	Entitlement phase. Construction estimated 2024-2025	0.27	N/A	X
Housing Element Rezoning Sites: Downtown Mill Valley						
35 Corte Madera	6	1	N/A	0.21	High	X
71 Throckmorton	2	1	N/A	0.04	High	AE
124-130 Throckmorton	8	1	N/A	0.30	Very High	X
19 Madrona	4	1	N/A	0.15	Very High	X
18 Miller Ave	4	1	N/A	0.14	Very High	AE
38 Miller Ave	23	1	N/A	0.83	Very High	AE Floodway
42 Miller Ave	16	1	N/A	0.56	Very High	X/AE
19 Sunnyside	6	1	N/A	0.22	High	X
24 Sunnyside Ave	4	1	N/A	0.11	High	X
30 Sunnyside Ave	4	1	N/A	0.09	High	X
55 Sunnyside Ave	3	1	N/A	0.38	High	X
8 E Blithedale Ave	7	1	N/A	0.31	High	X
64 E Blithedale Ave	11	1	N/A	0.40	High	X
78 E Blithedale Ave	3	1	N/A	0.12	High	X
91 E Blithedale Ave	3	1	N/A	0.11	Moderate	X
103 E Blithedale Ave	5	1	N/A	0.17	Moderate	X
Housing Element Rezoning Sites: East Blithedale Corridor/Camino Alto						
187 E Blithedale Ave	3	1	N/A	0.13	Moderate	X
238 E Blithedale Ave	10	1	N/A	0.54	Moderate	X/AE
650 E Blithedale Ave	7	1	N/A	0.67	N/A	X/AE
653 E Blithedale Ave	25	1	N/A	0.88	N/A	AO
250 Camino Alto	23	1	N/A	0.81	Moderate	X/AO

Table 20: City of Mill Valley Projected Growth Areas						
Development	**# of Units**	**# of Parcels**	**Project Date[1]**	**Acres**	**Fire Severity Zone**	**Flood Zone**
141 Camino Alto	3	1	N/A	0.34	N/A	X/AE
125 Camino Alto	8	1	N/A	0.48	N/A	AE
61 Camino Alto	22	1	N/A	0.79	N/A	AE
45 Camino Alto	20	1	N/A	0.70	N/A	AE
Housing Element Rezoning Sites: Miller Ave Corridor						
163 Miller Ave	4	1	N/A	0.31	High	AE Floodway
225 Miller Ave	3	1	N/A	0.64	High	X/AE
270 Miller Ave	5	1	N/A	0.60	Very High	X
10 Willow Street	9	1	N/A	0.33	Moderate	AE Floodway
15 Locust	3	1	N/A	0.11	Moderate	AE Floodway
No Site Address (APN 028-211-06)	2	1	N/A	0.08	Moderate	AE Floodway
No Site Address (APN 028-212-10)	2	1	N/A	0.08	Moderate	AE Floodway
310 Miller Ave	10	1	N/A	0.35	High	X
338 Miller Ave	5	1	N/A	0.17	High	X/AE
340 Miller Ave	4	1	N/A	0.15	High	X/AE
363 Miller Ave and 55 La Goma St	28	2	N/A	1.0	Moderate	AE Floodway
16 La Goma	29	3	N/A	1.05	N/A	AE Floodway
374 Miller Ave	8	1	N/A	0.29	Moderate	AE
380-384 Miller/ 9 Montford	13	1	N/A	0.45	N/A	AE
No Site Address (APN 030-271-69)	5	1	N/A	0.18	N/A	AE Floodway
390 Miller Ave	4	1	N/A	0.15	N/A	AE
392, 398, 400 Miller Ave and 10 Evergreen Ave	15	4	N/A	0.58	Moderate	AE
12 Evergreen Ave	4	1	N/A	0.13	Moderate	AE
401 Miller	24	4	N/A	0.87	N/A	AE Floodway
413 Miller	16	1	N/A	0.60	N/A	AE/AE Floodway
438 Miller Ave	5	1	N/A	0.17	Moderate	AE
458 Miller Ave	9	1	N/A	0.31	Moderate	AE
No Site Address (030-073-09)	2	1	N/A	0.08	Moderate	AE
430 Miller	15	1	N/A	0.52	Moderate	AE
433 Miller Ave	11	1	N/A	0.40	Moderate	AE
465 Miller Ave	3	1	N/A	0.10	Moderate	X/AE

Table 20: City of Mill Valley Projected Growth Areas						
Development	**# of Units**	**# of Parcels**	**Project Date[1]**	**Acres**	**Fire Severity Zone**	**Flood Zone**
493 Miller Ave	11	1	N/A	0.40	N/A	AE
510 Miller	18	1	N/A	0.66	Moderate	X/AE
524 Miller Ave	3	1	N/A	0.11	Moderate	X/AE
530 Miller Ave	8	1	N/A	0.29	Moderate	X
554 Miller Ave	5	1	N/A	0.19	Moderate	X/AE
600 Miller Ave	7	1	N/A	0.25	N/A	X/AE
546 Miller Ave	9	1	N/A	0.31	Moderate	X/AE
Housing Element Rezoning Sites: Redwood Highway						
765-777 Redwood Highway	53	4	N/A	1.93	N/A	AE
707 Redwood Highway	29	1	N/A	1.03	N/A	AE
Total	**726**	**110**		**31**		

1. "N/A" indicated for those parcels that do not have an active development application or entitled project. The number of units for these properties is a conservative and approximate number of units anticipated on the property based on rezoning the property to include a Housing Overlay that allows up to 40 units/acre. See City of Mill Valley 2023-2031 Housing Element for details.

Table 162: City of Mill Valley Future Growth Areas
Source: City of Mill Valley

3.2 Capability Assessment

The overall hazard mitigation priorities in the City of Mill Valley have not changed since the 2018 MJHMP update. However, in some cases the strategies to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and

land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the City of Mill Valley an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Local Emergency Operations Plan and Continuity of Operations Plan**: The City would benefit from the current 2023 update of our own emergency operations Plan and Continuity of Operations Plan. These Plans would allow the City to develop response and contingency plans for the risk and vulnerability of the City to the hazards identified in the Hazard Mitigation Plan.
- **Community Wildfire Protection Plan:** The City plans to take an active role in mitigation actions to enhance wildfire protection.
- **Emergency Manager:** The City will consider identifying staff to provide emergency management or disaster preparedness duties as a collateral role.
- **StormReady certification and Firewise Communities certification:** The City will consider participation in these programs.

Table 21: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y 2013-2040	Mill Valley's General Plan outlines long-term direction for development and policy. Hazards are addressed in all chapters, but especially in Chapter 6 (Climate Action) and Chapter 7 (Hazards and Public Safety), where policies and programs include hazard mitigation actions. See "General Plan" table for more information.
Strategic Plan	N	
Capital Improvements Plan	Y 2020-2025	Every five years, the City develops a CIP which serves as a planning tool to direct construction activities for City owned facilities and infrastructure. Projects may involve construction of new or upgraded facilities and infrastructure. The plan is updated every two years to reflect the latest community priorities, completed projects, updated project cost estimates and available revenue sources. Capital improvement projects are appropriate to include in the hazard mitigation plan strategy.
Economic Development Plan	N	
Local Emergency Operations Plan	Y 2014 + update in	The Emergency Operations Plan incorporates and coordinates all facilities and personnel of the City into an efficient organization for emergency response. The plan is

	progress 2023	an extension of the Marin Operational Area Emergency Operations Plan. The plan deals with immediate emergency response, not mitigation strategies.
Continuity of Operations Plan	Y	Continuity of Operations is part of the EOP.
Flood Mitigation Plan (FMP)	N	See the Floodplain Management Ordinance under "Land Use Planning and Ordinances" below.
Open Space Management Plan	N	Mill Valley does not have a comprehensive Open Space Management Plan, but open space management and protection is addressed in General Plan Chapter 5: Natural Environment. Natural resources along Mill Valley's edges are made up of both public and private land. Some of the land is under the jurisdiction of the Marin County Open Space District. These natural areas are protected in a series of open space preserves: Blithedale Summit, Camino Alto, and Alto Bowl to the north and Bothin Marsh to the southeast. The City has several tools at its disposal to accumulate and protect open space. These tools include direct acquisition through purchase, purchase of tax defaulted property, acceptance of property donations, and negotiated development plans, which may be in the form of conservation easements or acquisition of development rights. The Marin County Open Space District conducts open space management in collaboration with the Marin County Fire crew, FIRE Foundry workforce development program, contracted tree services, Conservation Corps North Bay, and animal grazing. City of Mill Valley jurisdictional boundaries border many of these open space areas.
Bay Area Regional Transportation Plan (RTP)	Y 2021-2050	Every 4 years, the Metropolitan Transportation Commission prepares a regional transportation plan that identifies regional transportation investments integrated with a sustainable land use strategy over a long-term planning horizon, to accommodate future population growth and meet greenhouse gas emissions reduction targets set by the California Air Resource Board. The Transportation Authority of Marin (Marin's Congestion Management Agency) works with 11 cities and towns and the County — to coordinate, fund and implement transportation projects and programs that support this regional transportation plan. Some of these projects may be appropriate as hazard mitigation strategies.
Stormwater Management	N	The City does not have a Stormwater Management Plan, but Public Works staff follow the standards contained in the Marin County Stormwater Pollution Prevention Program's guidance for small construction projects as best practices. https://www.millvalleylibrary.org/DocumentCenter/View/494/Marin-County-Stormwater-Pollution-Prevention-Program-Best-Management-Practices-PDF

Engineering Studies for Streams	N	
Marin County Community Wildfire Protection Plan	Y 2020	This plan provides a science-based assessment of wildfire hazards and threats to homes in the WUI of Marin County. The purpose of the plan is to provide fire agencies, land managers and other stakeholders in Marin County with guidance and strategies to reduce fire risk in the WUI while promoting protection and enhancement of economic assets and ecological resources. Implementation of this plan serves to mitigate fire risk.
Strategic Communications Plan	Y 2014	This strategic plan was developed to identify goals and strategies to effectively communicate with community members, drive development internal communications policies, and improve the overall effectiveness of the City in meeting community needs. Action 3 of Objective 3 in this plan is dissemination of videos related to emergency information and high-profile issues. This action could be added as a hazard mitigation strategy.
Climate Action Plan	Y 2013 + update in progress	The City's CAP is contained as an element within the General Plan and is used to identify actions that the community and local government can take to reduce emissions based on emission targets set for the community and the city's government operations. The City has successfully achieved 2020 emission reduction targets (20% below year 2000 levels) and is working to identify new targets and update its CAP. Please see General Plan table for specific actions in the current CAP.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code (Mill Valley Municipal Code Titles 14 and 15)	**Y**	In December 2022, the City adopted the 2022 State of California Building Standards Building Code with certain amendments, especially additional detail regarding construction in the Wildland-Urban Interface (WUI) to safeguard life, health, property, and public welfare. The code allows the City to require the undergrounding of utilities in the case of new construction and major remodels. The City has a "Dangerous Buildings Code" to provide for the abatement of unsafe and/or uninhabitable buildings. The City also just adopted a "Soft Story Ordinance" requiring inspection and remodeling of soft story structures in Mill Valley on a priority schedule based on level of risk assessed.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating: 01/1X	Y 2016	In July 2015 SMFD was notified by the Insurance Services Office (ISO) that the District was due for an ISO review and update to its current public protection class (PPC) rating. The 2016 survey resulted in an improved PPC of 1/1X with a total score of 90.4.

Permitting and Inspections requirements	Y	Building permits are required for any work involving utilities and any building or structure exceeding certain minimum thresholds. Final inspections are required to close out building permits. Depending on the type of permit in question, inspections by other departments such as Fire, Public Works, and Planning may also be required.
Residential Building Report	Y	Upon sale of property, a Residential Building Report is prepared summarizing site conditions and existing development, and identifying any unpermitted or dangerous conditions, including hazard risks such as FEMA flood zones and fire severity zone. Data for this report comes from both the City and the County Assessor and is widely used by prospective buyers and agents.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code Chapter 2.12: Emergency Services	Y (1972)	This ordinance lays out roles and responsibilities during an emergency and provides for preparation of the City of Mill Valley emergency plan. It is adequately administered and enforced by the City Manager and designated staff.
Municipal Code Title 12: Trees, Weeds and Vegetation	Y (amend 2017)	This ordinance aims to protect public trees and shrubs for both aesthetic and safety reasons. The ordinance also clarifies that trees must be kept trimmed, and no exposed electrical should be in contact with trees, which is an important measure to reduce fire risk. This ordinance is adequately administered and enforced by the Public Works Dept. Public Works staff maintain certain Eucalyptus Trees governed by the Eucalyptus Management Plan, street trees in the Tamalpais Park Assessment District, and street trees in the Downtown Tree Management Plan. Other public trees must be maintained by adjacent private property owners, and DPW issues citations to property owners for compliance based on complaints received.
Municipal Code Title 14: Building and Construction **Municipal Code Title 15: Fire**	Y (amend 2022)	See Building Code discussion above. Titles 14 and 15 of the Mill Valley Municipal Code are updated and adopted on a three-year cycle when the state code is updated. Title 14 is administered by the Building Official and Title 15 is administered by Southern Marin Fire Protection District. The building and fire codes are adequately enforced by inspection and code enforcement staff as well as the Building Official and Fire Marshal.
Municipal Code Chapter 17.06: Urban Runoff Pollution Prevention	Y (amend 2015)	This ordinance aims to reduce pollutants in stormwater discharges, and maintain pre-development stormwater runoff rates in new development whenever possible, in compliance with the NPDES Phase II Stormwater Permit. Enhanced quality and reduced quantity of stormwater runoff reduces risk of flooding damage from storm events. This ordinance is adequately administered by Public Works staff via responding to discharge of spills, requiring best management practices for construction projects, and requiring new development to minimize

		new stormwater runoff with stormwater management controls.
Municipal Code Title 18: Floodplain Management	Y (amend 2012)	This ordinance aims to protect life and health, restrict certain land uses and construction allowed in flood hazard zones, minimize public and private losses due to flood conditions in specific areas, minimize the need for rescue and relief efforts associated with flooding, and minimize spending for flood control projects. The ordinance clarifies that no development is allowed in floodways, and projects considered to be "substantial improvement" in a floodplain triggers special construction standards such as floodproofing and elevation above base flood elevation. These construction standards reduce risk of damage from future flood events. This ordinance is adequately administered by Planning staff as part of the development review process. However, there is not a specialized floodplain administrator and there is a lack of in-house staff expertise on this subject.
Municipal Code Title 20: Zoning	Y (amend 2021)	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance. The ordinance is adequately administered by Planning staff via Building and Planning Permit application review.
Municipal Code Title 21: Plats and Subdivisions	Y (amend 1985)	The Subdivision ordinance provides regulations regarding when and how property may be subdivided. Minimum lot size depends on slope – steep slopes may not be as easily subdivided. As a result, a lower density of homes is allowed to be built on the steep hillsides with greatest fire and landslide risk. The ordinance is adequately administered by Public Works Engineering staff.
Flood insurance rate maps	Y	Flood insurance rate maps are available online via MarinMap (https://www.marinmap.org/dnn/default.aspx) and FEMA (https://msc.fema.gov/portal/home).
Elevation Certificates	Y	Letters of Map Amendment (LOMAs) and Letters of Map Revision (LOMRs) are linked to property addresses in MarinMap Viewer. The City is not involved with issuing these letters.
Acquisition of land for open space and public recreation uses	N	The City is not currently in the process of acquiring land for open space and public recreation uses. There are multiple open space areas in the unincorporated county just outside city borders. About 20 years ago there was an initiative to identify vacant properties that would be better served with public open space rather than private development, based on factors such as species habitat, fire danger, and geographic location adjacent to existing open space areas. However, further action was not

		taken by the City towards acquiring new property for open space.

Table 163: City of Mill Valley Legal and Regulatory Capabilities
Source: City of Mill Valley

City of Mill Valley General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of Mill Valley MV2040 General Plan, adopted in 2013, was prepared over a two-year period that included an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City, with chapters dedicated to the following topics: land use (how land can be developed), mobility (circulation), housing, community vitality, natural environment, climate action, hazards and public safety, and noise.

The City of Mill Valley specific goals and policies related to mitigation of natural hazards are as follows:

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
Land Use Element	
Land Use Map	Commercial and higher density residential land use designations are concentrated along Miller Avenue, East Blithedale Avenue, and in downtown Mill Valley. In the hills and canyons, land use is limited to low density single-family residential. This land use layout reduces the population at risk of a wildfire disaster and also reduces climate change impacts through promotion of a walkable downtown core.
Policy LU.1-3: The residential density (dwelling units per acre) of a new or redeveloped residential development project or residential development as part of a mixed-use project may be reduced to below the minimum density established by this General Plan where there is adequate evidence in the record that the physical characteristics of the site (including but not limited to lot size, slope, habitat value, soil conditions, flood hazard, etc. or other conditions identified through the environmental review process clearly indicate that the minimum density cannot be met without appropriate mitigation or is determined to be detrimental to the health, safety, or welfare of the community.	Lower density housing construction is appropriate in areas at risk for natural disasters.
Mobility Element	
Goal MOBILITY-2: Sustainable Transportation. Reduce	This goal and supporting

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
transportation-related emissions by reducing traffic congestion and vehicle miles traveled while promoting the use of lower emissions vehicles and non-automotive modes of travel. **Objective M.3 Leadership and Coordination** **Objective M.4 Interconnected transportation Network** **Objective M.5 Education and Technology** **Objective M.6 City Operations** **Objective M.7 Low- and Zero-Emission Vehicles** **Objective M.8 Compact Development**	objectives encourage lower greenhouse gas emissions which directly mitigates climate change impacts.
Objective M.9 Traffic Management: Maintain a well-functioning roadway network that provides for the safe and efficient flow of vehicular traffic.	This objective and supporting policies prioritize maintenance and upgrades to key access points and corridors.
Policy M.10-3: Coordinate with PG&E to underground utilities or, where possible, relocate utility poles to improve sidewalk accessibility. Explore assessment bonds or other financing options to fund undergrounding costs.	Undergrounding electrical infrastructure reduces risk of wildfire caused by this infrastructure and also reduces risk of power outages and other damage from severe weather.
Policy M.10-5: Continue to renovate, repair and maintain the City's steps, lanes and paths that provide pedestrian connections to residential and commercial areas and complete emergency evacuation routes. **Policy M.12-5: The Bicycle and Pedestrian Committee, Parks and Recreation Commission and Emergency Preparedness Commission shall make recommendations for new priorities as the top 25 SLPs projects identified in the Bicycle and Pedestrian Transportation Plan are completed.**	Mill Valley's residential neighborhoods are connected via a network of steps, lanes and paths that allow for easy pedestrian access to downtown from hillside areas. These pathways reduce the need for driving, thus mitigating for climate change, and also provide for pedestrian emergency evacuation.
Policy M.13-2: Promote three-way collaboration among Safe Routes to School, the Bicycle and Pedestrian Advisory Committee, and the Mill Valley Police Department to advance education, safety, and enforcement programs that encourage more walking and cycling.	This policy supports increased pedestrian and bike use, indirectly reducing emissions associated with vehicular travel.
Objective M.14 Improved Transit Network: Work with Marin Transit to support the continued development of and improvements to safe, efficient, and reliable transit service.	This objective supports increased transit use, indirectly reducing emissions associated with private vehicular travel.
Objective M-16 Funding: Seek funding from all possible sources for continued improvements and ongoing maintenance of roadways and bicycle, transit and pedestrian facilities.	This objective and supporting policies ensure adequate funding to address identified maintenance and improvements to roadways and other mobility infrastructure.
Housing Element	
Goal 1, Program 2: Home Maintenance and Public Information: Adopt the Soft Story ordinance in 2023 as a means of protecting the preserving the City's existing affordable multi-family housing stock.	This program protects vulnerable buildings against risk of catastrophic earthquake damage.

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
Policy 2.1: Encourage Mixed-Use by Incorporating Residential Housing in Commercial Buildings. Encourage the efficient use of land by allowing commercial and residential uses on the same property in both horizontal and vertical mixed-use configurations. **Policy 5.3: Efficient Use of Multi-Family Zoning. Encourage the sustainable use of land and promote affordability by prohibiting new single-family development within multi-family or commercial land use districts.** **Goal 8: Promote a healthy and sustainable Mill Valley through support of existing and new housing which minimizes reliance on natural resources and automobile use.** **Policy 8.1: Promote Smart Growth. Preserve open space, watersheds and environmental habitats, while accommodating new growth in compact forms in a manner that de-emphasizes the automobile, allowing residents to use their cars less or not at all.**	These goals and policies encourage concentration of new development in areas zoned for multifamily and commercial use. These zone districts are located in the "flats" of Mill Valley away from fire and landslide danger (although some sites are at risk of flooding).
Policy 8.2: Create Healthy, Sustainable Buildings through Green Building Design. Ensure new development, including major remodels and additions, are sustainably designed, and consider establishing incentives to achieve energy efficiencies higher than those required under the CalGreen Building Code. Promote energy efficiency and the use of alternative energy sources such as solar energy, cogeneration, and non-fossil fuels through education materials and providing information on grant funding and other financial resources for home improvement projects. **Program 32. Prioritization of Sustainable Housing Projects. Prioritize redevelopment projects competing for funds and grants that are within a quarter to half mile radius of transit stops, have a large number of amenities and services within a half mile radius, and/or have a higher walk score.** **Program 33A. Green Building and Water/Energy Conservation. Provide outreach and education to developers, architects, and residents to provide information on new proposed CALGREEN regulations as part of the building code update process. Expand website information, including developing handouts on ways to incorporate sustainability into project design and in existing structures as well as funding and grant opportunities available to reduce costs of green home improvement projects.**	These policies and programs encourage energy and water efficiency, which ultimately contributes to reduced risk associated with climate change. On-site energy generation and low water use also enable more resiliency in recovery from disasters such as storms and extreme heat events.
Program 33B. Water Availability. Work with the County of Marin on its collaboration efforts with water service providers to conduct a strategic water supply assessment to evaluate increased supply within Marin (e.g. increased reservoir capacity, new reservoirs, increase use of recycled water, desalination plant) and external to Marin (e.g. EBMUD, Russian River, etc.)	This program encourages collaboration across multiple agencies for water supply resiliency, which is critical for preparation for drought conditions.
Program 33C. Transportation Demand Management	This program encourages reduced

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
program to reduce automobile use and vehicle miles traveled. The City Council shall discuss TDM measures that are identified as potentially reducing VMT by the California Air Pollution Control Officers Association Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity and adopt those measures that are considered effective at reducing automobile trips based on the feasibility and cost analysis related to the size and scale of redevelopment.	automobile use for the purpose of reducing greenhouse gas emissions, directly addressing climate change risk.
Program 34. Addressing Natural Hazards. Continue to work with local jurisdictions and through the Multi-Jurisdictional Local Hazard Mitigation Plan and the MV2040 General plan to address and mitigate natural hazards, including fire and flood protection and mitigation. Support redevelopment in the commercial and multi-family zoning districts that are outside of the hazard zones through incentives such as Density Bonus, Senate Bill 9, State Streamlining, reduced fees and local housing overlays.	This program summarizes the City's dedication to cross-agency collaboration to reduce natural hazard risks.
Community Vitality Element	
Objective CV.3 Community Collaboration and Communication: Support the work of community institutions, government agencies, non-profit, and local businesses that contribute to the quality of life of Mill Valley residents.	This objective and supporting policies encourage enhanced community connections via community groups and various forms of communication, which is critical in response to natural disasters.
Natural Environment Element	
Policy NE.3-1: Work with Marin Municipal Water District (MMWD) to optimize storage, transmission, and distribution capacities and efficiencies and to minimize water outages due to drought, emergencies, or other disasters.	This policy encourages collaboration across agencies to prepare for droughts and other water distribution emergencies.
Policy NE.3-2: Explore the retrofit of Cascade Dam for use during drought or emergency, consistent with habitat and species preservation policies and programs.	Cascade Canyon Dam is a small dam originally built by Tamalpais Land and Water Company in the 1800s, creating the Cascade Reservoir. This reservoir is not actively used by any jurisdiction at this time.
Objective NE.4 Conservation of Water Resources: Improve water quality by capturing source pollution, sedimentation, and run-off on public and private properties and allow for conservation of water resources through rainwater storage and greywater systems.	This objective encourages both decreased water use and increased on-site water retention, serving to mitigate risk associated with drought as well as storms and flood events.
Policy NE.5-10: Provide information to residents on local sustainability efforts, surrounding natural environment, potential hazards, and emergency preparedness.	As more residents become educated about sustainability and hazards, they will take measures to mitigate hazard risk.

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
Climate Action Plan	
Goal CLIMATE-1: Climate Change and Greenhouse Gas Emissions Reduction. Reduce the community's carbon footprint. **Objective CL.1 Clean Energy and Energy Efficiency** **Objective CL.2 Carbon Offsets** **Objective CL.3 Monitoring** **Objective CL.5 Recycling and Waste Management**	These goals and objectives serve to identify energy efficiency, zero waste, and adaptation planning strategies to lower the community's GHG contribution.
Goal CLIMATE-2: Climate Change Adaptation. Develop strategies for adapting to climate change. **Objective CL.4 Adapting to Climate Change. Ground climate change adaptation strategies in the best-available scientific understanding of hazards, risks, impacts, and vulnerabilities, and make adaptation planning and implementation a City budgeted item and operational priority.** **Policy CL.4-1. Immediately begin to develop plans and policies that will guide the City's ability to recognize, understand, and respond to the effects of climate change on the community (rather than waiting for more complete understanding of climate change and/or data). Adjust plans and actions according to new data and information and establish a permanent adaptation funding mechanism through the City's budget.** **Policy CL.4-2. Plan and fund long-term adaptation strategies to help the people, places, natural systems, and infrastructure that are vulnerable to the effects of climate change, including but not limited to sea level rise and more extreme heat and storm conditions.** **Policy CL.4-3. Encourage adaptation across multiple sectors, geographical scales, and levels of government. Build on the existing efforts and knowledge of a wide range of stakeholders who understand local or regional risks and needs.** **Policy CL.4-4. Update community hazard mitigation plans to recognize that the effects of climate change will also affect the type and intensity of potential community hazards and to anticipate impacts and responses. Include planning for extreme heat and storm events, identifying populations and neighborhoods most vulnerable to these events.**	Adaptation goals, objective and policies serve to provide a policy basis for the City to prioritize long-term adaptation strategies addressing climate-change related risks such as sea level rise, extreme heat, and extreme storm events.
Hazards and Public Safety Element	
Goal Hazard-1: Community Hazard Resilience. Minimize loss of life, property, and important elements of the natural ecosystem and maximize Mill Valley's ability to prevent, mitigate, prepare for, respond to, and recover from disaster.	This goal parallels key goals of the Local Hazard Mitigation Plan.
Policy HZ.1: Hazard Identification and Mitigation. Identify all hazards that threaten the City. Determine the likelihood of occurrence and severity of all hazards, further categorize	Hazard identification is addressed in this way in both the General Plan and the

Table 22: City of Mill Valley General Plan: MV2040	
Goal/Policy/ Program	**Explanation**
them as either "sudden onset" disasters (e.g. earthquakes, wildfire) or "slow onset" disasters/phenomena (e.g., drought, extreme heat, sea level rise), and strengthen hazard mitigation policies and regulations	Local Hazard Mitigation Plan.
Policy HZ.2: Administrative and Equipment Capacity. Maintain adequate concentration and distribution of staff, facilities, materials, and equipment to provide a timely disaster response consistent with the needs of a demographically changing community and a challenging natural environment, while recognizing the difficulties of maintaining these systems on a daily basis.	The City's Emergency Operations Plan addresses appropriate emergency response capabilities. This plan is continuously updated as needs change.
Policy HZ.3: Critical Infrastructure. Develop strategies for critical facilities and services (local and regional) that will minimize problems during post-disaster evacuation rescues, and major clean-up operations following a major disaster.	These strategies are appropriately developed within the Local Hazard Mitigation Plan.
Policy HZ.4: Civic Duty and Responsibility. Promote education and events that reinforce the personal responsibility of all residents, business owners, and City staff to plan for, respond to, and recover from disasters.	As residents, business owners and city staff become more educated, we will be able to better mitigate risk from natural disasters.
Policy HZ.5: Emergency Response and Evacuation Routes. Maintain and expand the network of anticipated emergency response routes and regularly exercise evacuation protocols and procedures.	The City's EOC conducts drills to ensure that staff and residents are aware of and understand emergency protocols.
Policy HZ.6: Prevention and Protection. Reduce injury and damage from hazards.	Implementation of proper emergency preparedness and emergency protocols means lowered risk of injury or damage from hazards.

Table 164: City of Mill Valley General Plan: MV2040
Source: City of Mill Valley General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the City personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 23: Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	The City Manager is the overall administrator for the City, with the City Clerk and two Senior Management Analysts working under the Manager. Within each City department there are administrative services staff. The Finance & Human Resources Department handles budgeting,

		revenue and business license collections, cash flow management, and oversight of all investments and accounts receivable as well as human resource services for employees. Administrative coordination across departments is adequate but could be more efficient.
Planning Commission	Y	The Planning Commission is a decision-making body made up of five Mill Valley Residents (including at least two architects). This body meets every two weeks to review and vote on long range planning documents such as zoning ordinances and General Plan updates, as well as discretionary planning applications such as design reviews, conditional use permits, and variance applications. Staff updates Commissioners periodically on upcoming projects, and meets with Commissioners annually to create the next year's policy work plan. Coordination is amicable and effective.
Hazard Mitigation Planning Committee	Y	The City participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	The City's Public Works Department is engaged in the following maintenance programs to reduce risk (per the CIP): • Annual vegetation maintenance program to reduce fuel sources and maintain evacuation routes • Annual sewer rehabilitation and maintenance program, which reduces risk of flooding during storms • Steps, Lanes and Paths (SLP) annual maintenance to improve pedestrian connections and evacuation routes • Annual slide repair program provides emergency response and cleanup of slides plus funding for roadway stabilization projects • Pump station improvement program to allow backup into SCADA system and auto transfer during power outages
Mutual aid agreements	Y	The City is engaged in a Joint Powers Agreement with Southern Marin Fire District for provision of fire services. Coordination is effective, especially in plan review where staff from SMFD and the City work together to discuss key issues on weekly calls.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	The City utilizes the emergency warning systems through the County EAS (Emergency Alert System) via TV and radio as their primary warning capability. The City also uses MERA (Marin Emergency Ratio Authority) voice radio system, TENS (Telephone Emergency Notification System), and the RACES/ACS countywide organization of amateur radio operators.

Hazard data and information	Y	Hazard data is available via MarinMap (with various source data) and this hazard data has been analyzed as part of the development of the Mill Valley General Plan Safety Element, as well as the Emergency Operations Plan.
Grant writing	N	Grant writing has not been used in the past to support hazard mitigation, but there is potential for this skill to be developed. Currently there is not sufficient full-time staff to support this work.
Hazus analysis	N	The City has not previously used FEMA's Hazus program to estimate natural disaster risk.
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	Building personnel include the Building Official, two staff plan checkers, contract plan checkers, and an administrative assistant. Staffing is adequate to enforce regulations and coordination among staff is effective, especially evident in multi-jurisdictional code enforcement cases and stop work orders.
Floodplain Administrator	Y/PT	The Planning and Building Director functions as the Floodplain Administrator. This is one of many roles that the Planning and Building Director fulfills. Staff is not particularly trained in this area, and more support and training would be useful.
Emergency Manager	Y/PT	The City Manager functions as the Director of Emergency Services for the City of Mill Valley, with responsibilities laid out in the City's Emergency Operations Plan. This is one of many roles that the City Manager fulfills. There are periodic coordinated trainings and drills to ensure that the City Manager and staff understand their roles in the event of a disaster.
Community Planner	Y/FT	Planning personnel include the Planning Director, four staff planners, two contract planners, and an administrative assistant. Staff maintain and update the General Plan, including the Safety Element, maintain and update zoning ordinances, and review development projects for consistency and conformity with the General Plan and zoning code. Planning staff coordinate with other agencies for both policy work and development review. Staffing is adequate to enforce regulations.
Civil Engineer	Y/FT	The Public Works Director is the City Engineer, and there is a Deputy Director who is also trained as a civil engineer, with associate level engineers working below the Deputy Director. There are also contract engineering staff to assist with plan reviews and other tasks when full time engineering staff is not available or full time positions are unfilled.
GIS Coordinator	N	GIS staff is located at Marin County. City of Mill Valley staff utilize MarinMap and feed data to the County to

		update the map layers for Mill Valley as needed.
Community Development Staff	Y/FT	See "Community Planner" above.
City Planning, Building, and Public Works Staff	Y/FT	See "Building Official," "Civil Engineer" and "Community Planner" above.
Police Department Staff	Y/FT	The Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department. Staffing is adequate to enforce regulations.
Fire Department Staff	Y/FT	Southern Marin Fire District protects the city from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire. Staffing is adequate to enforce regulations.
Planner(s), engineer(s) and technical staff with knowledge of land development, land management practices, and natural hazards.	Y/FT	Land development, land management practices, and natural hazards knowledge are critical to successful job performance for Community Development, Public Works, and Fire District staff. These departments are involved trainings and drills as part of the Emergency Operations Plan, and work together to prepare the Capital Improvement Plan, General Plan Safety Element, and Local Hazard Mitigation Plan.
Engineer(s), Building Inspectors/Code Enforcement Officers or other professional(s) and technical staff trained in construction requirements and practices related to existing and new buildings.	Y/FT	The Building Official, building plan check technicians, building inspector, code enforcement officers and contract staff together provide adequate staffing to enforce building regulations. Code enforcement is complaint-based. Building staff is not particularly trained in hazard mitigation aside from code requirements.
Engineers, construction project managers, and supporting technical staff.	Y/FT	The Deputy Public Works Director and staff engineers project manage the city's capital improvement projects. Contract staff is brought in as needed to assist when in-house staffing is not adequate to cover all projects. Many CIP projects provide hazard risk mitigation.
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Y/FT	The Department of Public Works Operations Superintendent, along with the Building, Parks, and Streets Maintenance Supervisors, is responsible maintaining and operating of a wide range of local equipment and facilities as well as providing assistance to members of the public. Staff is trained on hazard mitigation as related to maintenance programs. Staffing is generally adequate to provide services. Contract staff may be brought in as needed to assist when in-house crews are not adequate to cover all projects.

Table 165: City of Mill Valley Administrative and Technical Capabilities
Source: **City of Mill Valley**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 24: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	The FY 2022-2027 CIP includes funding allocated to mitigation-focused programs as follows: Annual Vegetation Maintenance: $1,500,000 Fire Engine Access Improvement Program: $300,000 Annual Slide Repair Program: $645,245 Bridges and Culverts Repair Program: $375,000 The Mill Valley Public Financing Authority is a JPA for public financing of the CIP through issuance of revenue bonds.
Authority to levy taxes for specific purposes	Y	The Municipal Service Tax is set at $266 per single family residence with an annual adjustment of 2% to keep up with inflation. The funds generated by the MST go to the maintenance, repair and improvement of streets and roads, as well as fire suppression activities including vegetation removal. The MST could continue to fund future mitigation activities. The General Fund “all purpose” tax sources could also be used for mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Mill Valley collects funds on the tax roll for sewer fees and these fees are used to reduce inflow and infiltration. Funding could possibly fund future mitigation activities. The City does not tax utilities other than a PGE franchise fee. Water is provided by MMWD which is a special district.
Impact fees for new development	Y	New developments are subject to road impact fees and drainage charges which are used toward roadway repair and maintenance. Funding could possibly fund future mitigation activities.
Storm water utility fee	Y	Stormwater fees are assessed for certain types of private development projects. These fees are a parcel tax placed on the property tax roll. Funds from these fees go towards public stormwater improvements as well as the City’s Marin Countywide Stormwater Pollution Prevention Program (MCSTOPPP) member agency fees.

Table 24: Fiscal Capabilities		
Financial	**Yes/No**	**Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?**
Incur debt through general obligation bonds and/or special tax bonds	Y	The City provides payments on the CFD 1996-1 Library Renovation Bond, 2009 Clean Renewable Energy Bond for a solar array, 2011 Community Center COPS, 2021 Sewer Fund Capital Improvement Bond, which could fund mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	N	
State funding programs	N	

Table 166: City of Mill Valley Fiscal Capabilities
Source: **City of Mill Valley**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of Mill Valley and the City of Mill Valley partnerships utilized to promote those programs.

Table 25: City of Mill Valley Community Outreach		
Outreach and Partnerships	**Yes/No**	**Could the program/organization help implement future mitigation activities?**
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Mill Valley's Community Engagement Coordinator collaborates with schools, businesses, and faith-based organizations and provides emergency preparedness materials and trainings. This position provides online and print guides for emergency preparedness tailored to a variety of populations in the community (including employees, faith-based organizations, and business/organization leaders). This position creates ongoing content for a social media presence for the Mill Valley Emergency Preparedness Commission, serves as an on-call resource for emergency preparedness information, and provides support for local schools for annual emergency drills. The Mill Valley Emergency Preparedness Commission (EPC), comprised of 7 volunteer residents and supported by first responder staff, educates residents, businesses, non-profit organizations, and schools on risk awareness and disaster preparedness. The EPC engages in frequent community outreach events, providing preparedness education, and assists fire and police staff in hosting evacuation drills. Recent successes include educational

Table 25: City of Mill Valley Community Outreach		
Outreach and Partnerships	**Yes/No**	**Could the program/organization help implement future mitigation activities?**
		videos, guidance for families in how to create emergency plans, and formation of a Neighborhood Response Group. The Southern Marin (formerly Mill Valley) Community Emergency Response Team (CERT) is comprised of citizens from Mill Valley and surrounding unincorporated communities who have taken a hands-on 20-hour training provided jointly by Southern Marin Fire District, Mill Valley Fire Department, Larkspur Fire Department, Tiberon Fire District, and Marin County Fire Department. Training covers disaster first aid/triage, emergency preparedness, fire prevention/suppression, light search and rescue, and utilities. Mill Valley Neighborhood Response Groups are grassroots-led neighborhoods that prepare as a community for emergencies such as earthquakes and floods. Each group of 15-20 homes has a team of block captains to look after residents within their block. As of 2022 there are 9 designated NRGs in Mill Valley and additional NRGs in Tam Valley and other surrounding unincorporated areas. Sustainable Mill Valley is a local non-profit committed to building a community that is zero carbon, zero waste, water smart, and environmentally safe. Reusable MV, a subgroup of Sustainable Mill Valley, works to eliminate single-use disposables and champion a reusable culture. Resilient Neighborhoods is a nonprofit that brings people together and empowers them to do something about climate change by creating low-impact households, adopting sustainable lifestyle practices, strengthening communities and preparing for emergencies. One Tam is a nonprofit partnership between the National Park Service, California State Parks, Marin Municipal Water District, Marin County Parks and Golden Gate National Parks Conservancy to support ecological restoration, wildlife monitoring, and use and enjoyment of Mount Tamalpais. Clean Mill Valley is a nonprofit focused on litter prevention. Mill Valley Streamkeepers focuses on protecting and improving Mill Valley's watersheds, in collaboration with Watershed Alliance Marin. The combined organizations of Clean Mill Valley, StreamKeepers and Marin Clean Highways, and other activists from throughout Marin County are known as "Clean Marin."
Ongoing public education or information program (e.g., responsible water use, fire safety,	Y	The City website contains links to a wide variety of mitigation information and training opportunities. https://www.cityofmillvalley.org/210/Emergency-Preparedness Neighborhood Response Groups hold a semi-annual

Table 25: City of Mill Valley Community Outreach		
Outreach and Partnerships	**Yes/No**	**Could the program/organization help implement future mitigation activities?**
household preparedness, environmental education)		OK/HELP drill that helps practice how neighborhoods would react after a disaster that doesn't require evacuation. The last drill was held 3/12/23. The Southern Marin Fire District hosts Firewise Communities and NFPA Defensible Space classes as well as free CPR classes at the Mill Valley Community Center. In September 2023, the Emergency Preparedness Commission and SMFD helped the Mill Valley Library lead weekly preparedness workshops for Emergency Preparedness Month, with focuses on fire readiness and defensible space; Go Bag; making a plan; evacuation and community refuge areas; and basic first aid/CPR. Also, the Marin Wildfire Prevention Authority (MWPA) and the Mill Valley Public Library recently held a focus group on perceptions of wildfire risk and access to prevention and preparation resources. The MWPA will use these perspectives to inform program design in coming years to best meet the needs of Marin County residents. In 2022, the Emergency Preparedness Commission provided disaster preparedness education at many Mill Valley community events such as Earth Day, Memorial Day Pancake Breakfast, Mill Valley Campout, Family FunFest, National Night Out, Truck or Treat, and Winterfest. At these events the EPC and staff helped residents sign up for alerts, encouraged them to think about evaluation methods and routes, guided them on emergency supplies, and crafting an emergency plan. The EPC also met with cub scouts and parents to educate about emergencies. In 2022, Public Safety officials held five neighborhood evacuation drills in Mill Valley in the Cascade, Almonte, Shelter Ridge, and Tam Valley neighborhoods. Staff and CERT collaborated to create a video demonstrating how to park vehicles on narrow roads to allow for emergency access. Staff also created a 4-page emergency preparedness guide for businesses in Mill Valley. Mill Valley EPC also participated in Marin County's annual Stop the Bleed/Sidewalk CPR Program.
Natural disaster or safety related school programs	Y	There is a Mill Valley School District EPC and a Mill Valley High School EPC. Mill Valley School District emergency preparedness resources can be found online: https://www.mvschools.org/domain/393. Resources include an emergency preparedness plan, emergency communications protocols, and videos on important topics such as earthquakes, go bags, first aid, and search and rescue.

Table 25: City of Mill Valley Community Outreach		
Outreach and Partnerships	**Yes/No**	**Could the program/organization help implement future mitigation activities?**
		In 2022, city staff ensured that firefighters and police were on scene to provide feedback at all public school sites for the Mill Valley School District's annual disaster drill. Staff also arranged site assessments for school facilities and grounds with the Mill Valley Policy and Marin County Sheriff's office.
StormReady certification	N	Marin County is a National Weather Service StormReady and TsunamiReady site. City of Mill Valley has not participated in this program.
Firewise Communities certification	Y	Multiple neighborhoods and homeowners associations are Firewise Communities: Mill Valley Meadows Homeowner's Association; Marsh Drive Homeowner's Association; Middle Ridge Homeowner's Association; Shelter Ridge Homeowner's Association; Blithedale Highlands Owner's Association; Scott Valley Homeowner's Association; Scott Highland Neighborhood Association; Edgewood Cypress & Lower Edgewood Neighborhoods; Alto Sutton Neighborhood. These groups can provide future mitigation support through education and public engagement.
Community Rating System	N	Marin County is a CRS participating community as of 5/1/2016. City of Mill Valley has not participated in this program.
Public-private partnership initiatives addressing disaster-related issues	Y	ReadyMarin is a comprehensive source of emergency preparedness information for Marin County, and coordinates public agency resources and neighborhood response groups. In September 2021, City of Mill Valley partnered with Google to conduct its Annual Evacuation Drill. The drill was a timed event to help validate Google's current evacuation research. https://www.cityofmillvalley.org/778/Evacuation-Drill

Table 167: City of Mill Valley Community Outreach
Source: **City of Mill Valley**

3.2.5 Participation in the National Flood Insurance Program

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Detailed below is a description of the City of Mill Valley's flood management program to ensure continued compliance with the NFIP.

The City of Mill Valley has participated in the Regular Phase of the NFIP since January 3, 1979. Since then, the City has administered floodplain management regulations that meet or exceed the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the City. The Community Rating System (CRS) was created in 1990. It is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. City of Mill Valley is not currently a CRS participant.

In addition to the capabilities in the municipal code regarding floodplains, the City of Mill Valley has additional capabilities. Table 26 shows the City of Mill Valley's participation in and continued compliance with the NFIP, and identifies areas for improvement that could be potential mitigation actions.

Table 26: City of Mill Valley NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	417 active contracts. Total premium/net payment $916,969.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	213 claims filed. $1,924,940 paid. 21 of the paid claims were for > $20,000.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	597
Describe any areas of flood risk with limited NFIP policy coverage	49.1% of properties located in a FEMA special flood hazard area in Mill Valley have flood insurance.
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	The City has a dedicated website with resources for properties located in the floodplain. Projects in the floodplain are evaluated for whether they meet the threshold for "substantial improvement" and compliance with Title 18 of the Mill Valley Municipal Code. https://www.cityofmillvalley.org/239/Floodplain-Management-and-Construction-i.
What are the barriers to running an effective NFIP program in the community, if any?	The Planning & Building Department Director functions as the floodplain administrator. There is not specialized staff running this program for Mill Valley.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	Unknown

Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	January 3, 1979
Are the FIRMs digital or paper?	Digital dynamic and printable FIRMs are available from the FEMA Flood Map Service Center. https://msc.fema.gov/portal/home
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Title 18 of the Mill Valley Municipal Code meets FEMA and State minimum requirements. See explanation below.
Provide an explanation of the permitting process.	Title 18 of the Mill Valley Municipal Code implements a permitting process for properties located in floodzones. The ordinance clarifies that no development is allowed in floodways, and projects considered to be "substantial improvement" in a floodplain triggers special construction standards such as floodproofing and elevation above base flood elevation. These construction standards reduce risk of damage from future flood events. Title 18 standards must be met as a condition of approval of a building permit in a floodplain.
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
What categories and activities provide CRS points and how can the class be improved?	N/A
Does the plan include CRS planning requirements	N/A

Table 168: City of Mill Valley NFIP Status
Source: FEMA, City of Mill Valley

NFIP Insurance Coverage Details

The City of Mill Valley joined the NFIP on January 3, 1979. The city does not participate in the Community Rating System. NFIP insurance data indicates that as of July 25, 2023, there were 417 policies in force in the City with $916,969 in premiums. There have been 213 claims filed and 142 closed paid losses totaling $1,924,940. Twenty-one of the claims were over $20,000 and may be considered substantial damage losses. All of these losses were in A zones, including six parcels in the AE zone and 15 parcels in the AE floodway. All of the claims over $20,000 were associated with pre-FIRM structures. There were 29 repetitive loss structures in the City. Twenty-seven were in A zones, and two were in X zones. These repetitive loss structures account for $915,886 of the total losses in the City of Mill Valley. There was one severe repetitive loss property in the City totaling $124,123 (775-777

Redwood Highway Frontage Road), but claims were from 1980-1983 and the property is no longer residential.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 29
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 1
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 1
- Repetitive Loss Residential Structures: 29
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 1
- Severe Repetitive Loss Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 27 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 27: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures. *A report was completed several years ago but work is still ongoing.*	X	X			X
Strengthen and/or replace City-owned buildings in the identified prioritized order as funding is available.		X			X
Assessment of Soft-Story Buildings (non-City owned) for Potential Mandated Retrofit Program. *City adopted a soft-story wood frame retrofit ordinance in 2023.*	X	X			X
Reduce hazard vulnerabilities for non-City-owned buildings throughout Mill Valley. Enforce as properties come in for retrofits.		X			X
Reduce fire risk in existing and new development through fire code updates and enforcement. *Fire code was most recently updated December 2022.*		X			X
Reduce fire risk in existing and new development (non-City owned) through vegetation management. *Vegetation management plan is required for new buildings and substantial remodel projects.*		X			X
Collect, analyze and share information with the Mill Valley community about Mill Valley hazards and associated risk reduction activities. *Emergency Preparedness Commission,*		X			X

Table 27: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
CERT, and other groups facilitate this information sharing.					
Ensure that the City provides leadership and coordinate with the private sector, public institutions, and other public agencies in disaster mitigation.		X			X
Work with MMWD to ensure an adequate water supply during emergencies and for disaster recovery. *DPW reviews MMWD plans for upgrades in Mill Valley.*		X			X
Streamline the zoning and permitting process to rebuild residential and commercial structures following disasters. *Instead of continuing this action into the new plan, Mill Valley will implement a streamlined process if necessary due to disaster.*			X		
Develop an Energy Assurance Plan for City Operations. *Generators have been accounted for at critical city owned facilities, but task is ongoing because more may be needed in the future.*		X			X
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption during and after a disaster. *This is a PG&E responsibility so this action will not be carried over into the new plan.*			X		
Rehabilitate and improve the capacity of the City's storm water system to reduce local flooding caused by inadequate storm drainage.		X			X
Reduce Mill Valley's vulnerability to extreme heat events and associated hazards. *Example strategies: SMFD's veg management program, community refuge centers with AC.*		X			X
Reduce Mill Valley's vulnerability to severe storms and associated hazards. *Key strategies include maintaining stormwater infrastructure and undergrounding utilities.*		X			X
Collaborate with local, state, regional and federal partners to increase the security and capacity of Mill Valley's water supply from climate change impacts. *The City coordinates with MMWD on their programs.*		X			X
Maintain City participation in the National Flood Insurance Program.		X			X
Mitigate the impacts of sea-level rise in Mill Valley.		X			X

Table 27: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
*The City is **building on the work completed as part of the 2017 Marin Shoreline Sea Level Rise Vulnerability Assessment.***					
Ensure that the City provides leadership and coordinate with the private sector, public institutions, and other public agencies in disaster mitigation.		**X**			**X**
Streamline the zoning and permitting process to rebuild residential and commercial structures following disasters.		**X**			**X**
Improve the disaster-resistance of the natural gas delivery system to increase public safety and to minimize damage and service disruption during and after a disaster.		**X**			**X**
Rehabilitate and improve the capacity of the City's storm water system to reduce local flooding caused by inadequate storm drainage.		**X**			**X**
Reduce Mill Valley's vulnerability to extreme heat events and associated hazards.		**X**			**X**
Reduce Mill Valley's vulnerability to severe storms and associated hazards.		**X**			**X**
Collaborate with local, state, regional and federal partners to increase the security and capacity of Mill Valley's water supply from climate change impacts		**X**			**X**

Table 169: Status of Previous Hazard Mitigation Actions
Source: City of Mill Valley

3.5 Hazard Mitigation Actions

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. The planning team for the City of Mill Valley identified and prioritized the mitigation actions as detailed in Table 28, based on the hazard risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation. This plan has been created as a "living" document with input from the population and professionals within the City of Mill Valley.

Mill Valley's hazard mitigation actions are supported by the mitigation goals and objectives, and are organized using the following criteria: hazard mitigation goals met; jurisdiction/responsible party; approximate cost; and timeframe of completion. Funding sources are identified for all projects. All actions consider new or existing and will be marked as completed or removed during the five-year life of this plan.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

In addition to the mitigation actions provided in Table 28, all mitigation actions provided Table 4.9 of the MJHMP base document can be pursued in Mill Valley as well, and Mill Valley can seek FEMA funding for both Mill Valley and County hazard mitigation actions..

Table 28: City of Mill Valley Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
Policies, Codes and Standards						
MV-1: Climate Action Plan. Adopt Mill Valley Climate Action Plan 2030 and implement strategies identified in the plan.	All Hazards/ 1, 2, 3, 4	Mill Valley City Council, Planning + Building Dept, others as ID'd in the CAP	New (2023)	Outstanding cost for EIR: $18,000 (General Fund)	1-10 years/ Medium	Existing CAP dates from 2014. 2030 CAP update has been completed, adoption is scheduled for first quarter 2024.
MV-2: Safety Element. Update Safety Element of the General Plan. [FEMA Project MU-4 Adopt Development Regulations in Hazard Areas]	All Hazards/ 1, 2, 4, 5	Mill Valley Planning + Building Dept	New (2023)	Cost TBD (General Fund, grants as needed)	1 – 3 years/ High	Safety Element of the General Plan last updated 2014. Additional update planned to further align with state law and other long-term city plans.
MV-3: Building and Fire Code. Review and adopt current California Building and Fire codes. Amend Fire Code to reduce damage to structures from hazard risk specific to Mill Valley. [FEMA Project MU-8 Adopt and Enforce Building Codes]	Wildfire/All Hazards/ 1,4	Mill Valley Planning + Building Dept, SMFD	Existing (2018)	Cost TBD (Approx $10,000, General Fund)	1 – 3 years/ High	The Building and Fire codes were most recently updated December 2022. Mill Valley continues to review and adopt current California Building and Fire codes with updates specific to Mill Valley as necessary.
MV-4: NFIP. Continue to maintain good standing and compliance under National Flood Insurance Program through implementing floodplain management programs. [FEMA Project F-8 Join or Improve Compliance with NFIP]	Flooding/ 5	Mill Valley Planning + Building Dept	Existing (2018)	See floodplain management projects.	Ongoing	
Private Development						
MV-5: Soft-Story Buildings. Assessment and retrofit of soft-story buildings (non-City owned). [FEMA Project EQ-2 Incorporate Earthquake Mitigation into Local Planning]	Earthquake/1	Mil Valley Planning + Building Dept	New (2023)	Cost will be covered by Plan Check and Building Permit Fees	1 – 6 years/ Medium	In June 2023 the City Council adopted a soft-story wood frame retrofit ordinance with three required compliance tiers.

Table 28: City of Mill Valley Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
MV-6: Building Safety. Reduce hazard vulnerabilities for buildings throughout Mil Valley. Enforce as properties come in for retrofits. [FEMA Project EQ-1: Adopt and Enforce Buildings Codes]	All Hazards/ 1	Mill Valley Planning + Building Dept, SMFD	Existing (2018)	Cost is covered by Plan Check and building Permit fees.	Ongoing/ High	Planning and Building Permit plan check process includes review for code compliance by Planning, Building, DPW, and SMFD.
MV-7: Roadway and driveway safety. As new development occurs, roadways and driveways are required to be of minimal 12 to 20 foot width and with approved turnarounds and/or turnouts.[FEMA Project WF-3: Reduce Risk through Land Use Planning]	All Hazards/ 1, 2, 4, 5	Mill Valley Public Works Dept, SMFD	New (2023)	Cost is covered by project applicants in most cases.	1 – 3 years/ High	
MV-8: Vegetation Management. Reduce fire risk in existing and new private development in the Wildland Urban Interface through Vegetation Management Plans. [FEMA Project WF-9 Implement a Fuels Management Program]	Wildfire/ 1	SMFD	Existing (2018)	Cost is covered by plan check fees. HMGP, BRIC, CDAA Grant funding needed for larger projects	Ongoing/ High	VMPs are required for new buildings and substantial remodel projects, reducing the chance of a wildland fire igniting structures and reciprocally, wildland ignition from a structure fire.
City Facilities and Infrastructure						
MV-9: MERA. Conduct Marin Emergency Radio Authority (MERA) Upgrades. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	All Hazards/ 1, 2, 3, 4, 5	Marin County and City of Mill Valley	New (2023)	Cost: TBD (Taxes, State and/or Federal grants)	Ongoing/ High	City is participant, also studying replacement for the system as it reaches the end of its service life.
MV-10: City Building Assessment and Upgrade. Perform appropriate seismic and fire safety analysis based on current and future use for all City-owned facilities and structures. Strengthen and/or replace city-owned buildings in the identified prioritized order as funding is available. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	Earthquake, Wildfire, All Hazards/ 2	Mill Valley Public Works and Planning + Building Depts, SMFD	Existing (2018)	$250,000/year (General Fund), bond	Ongoing/ Medium	City Hall was retrofitted in 1990s. City completed a facilities assessment in 2018. Work to implement this plan is ongoing via Annual Civic Building Upgrade Program.

Table 28: City of Mill Valley Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
MV-11: Community Refuge Centers. Enhance Community facilities to support the socially vulnerable population during extreme heat and other extreme weather events. [FEMA Project ET-3 Assist Vulnerable Population]	Severe Weather – Extreme Heat/All Hazards/ 1,2,3	Mill Valley Public Works Dept, SMFD	New (2023)	Cost TBD (HMGP, BRIC, CDAA, Private Grants)	1 - 2 years/ High	Provide community refuge centers with AC and other accommodations for emergencies. Example: Mill Valley Library
MV-12: Energy Resilience. Enhance resilience of power supply for city facilities during emergencies. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	All Hazards/ 2	Mill Valley Public Works Dept, SMFD, PG&E	Existing (2018)	Cost TBD (General Fund or grant as needed)	Ongoing - 2-5 years/ Medium	Generators have been accounted for at critical city owned facilities, but task is ongoing because more may be needed in the future.
MV-13. Corporation Yard Master Plan. Evaluate flooding potential and develop master plan to improve facilities. Construct a 1,300 linear foot perimeter flood wall and install flood gate system to protect Mill Valley DPW assets and SASM WWTP. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	Flooding/ 2	Mill Valley Public Works Dept	New (2023)	$7,000,000 General CIP Fund for Master Plan improvement plus $3,000,000 HMGP, BRIC, CDAA, FMA grant/FEMA OES for flood wall	Ongoing - 2-5 years/ Medium	
MV-14: Severe Storms. Reduce Mill Valley's vulnerability to severe storms and associated hazards. [FEMA Project SW-4 Protect Power Lines and Infrastructure]	Severe Weather- Wind, Tornado/ 1,2	Mill Valley Public Works Dept	Existing (2018)	Cost TBD (General Fund, Flood Control Zone 3, HMGP, BRIC, CDAA grants as needed)	Ongoing - 2-5 years/ Medium	Example projects: Undergrounding power lines on E Blithedale Ave, widening stormwater pipes on Miller Ave. These are the city's two main evacuation routes.
MV-15: Storm Water System. Rehabilitate and improve the capacity of the City's storm water system to reduce local flooding caused by inadequate storm drainage. [FEMA Project F-13 Improve Stormwater Drainage System Capacity]	Flooding, Severe Weather – Wind, Tornado/ 2	Mill Valley Public Works Dept	Existing (2018)	Specific projects are costed out in the CIP, cost covered by General Fund, Flood Control Zone 3, HMGP, BRIC, CDAA Grants	Ongoing - 2-5 years/ Medium	Specific project planning in progress: replace Mill Valley's Sycamore Stormwater Pump Station ($1.9 Million, 2024/2025)

Table 28: City of Mill Valley Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
MV-16: Flood Control Pumps. Update or enhance flood control pump stations and gravity storm lines around town. This will also include maintaining and dredging existing flood control open channels and canals. [FEMA Project F-14 Conduct Regular Maintenance for Drainage Systems and Flood Control Structures]	Flooding, Sea Level Rise/ 1, 2, 4, 5	Mill Valley Public Works Dept	New (2023)	Cost TBD (HMGP, FMA, CDAA)	Ongoing - 2-5 years/ Medium	Implement projects in the Flood Management and Drainage Master Plan.
MV-17: Sewer System. Implement Annual Sewer Rehabilitation Program. [FEMA Project F-18 Protect Critical Facilities]	Flooding/Sea Level Rise/All Hazards/ 2	Mill Valley Public Works Dept	New (2023)	$2,400,000/year (Annual Sewer Service Charge)	Ongoing - 2-5 years/ Medium	Annually the city designs and constructs sewer projects around the city.
MV-18: Sanitation Pumps. Implement Sanitation Pump Station Improvement Program. [FEMA Project F-18 Protect Critical Facilities]	Flooding/Sea Level Rise/All Hazards/ 2	Mill Valley Public Works Dept	New (2023)	$1,250,000 (Annual Sewer Service Charge)	Ongoing - 2-5 years/ Medium	
MV-19: Sea Level Rise. Adaptation projects to protect against flooding and sea level rise including raising structures out of the flood zone, raising road elevations, and other projects implementing and building on the 2017 Marin Shoreline Sea Level Rise Vulnerability Assessment. [FEMA Project F-15 Elevate or Retrofit Structures and Utilities]	Flooding, Sea Level Rise/ 1, 2, 4, 5	Mill Valley Public Works and Planning + Building Depts	New (2023)	Cost TBD (Flood Control Zone 3, HMGP, BRIC, CDAA, FMA Grant funding)	1 - 5 years/ Medium	
MV-20: Water Supply. Work with MMWD to ensure an adequate water supply during emergencies and for disaster recovery. [FEMA Project D-3 Monitor Water Supply]	All Hazards/ 1,2,4	Mill Valley Public Works Dept, MMWD	Existing (2018)	This work is funded through MMWD	Ongoing - 2-5 years/ Medium	DPW reviews MMWD plans for upgrades in Mill Valley.
MV-21: Fire Engine Access Improvements. Hillside neighborhoods adaptation projects to protect against wildfire risk including widening narrow roads and adding road pullouts, increasing number of emergency egress roads from neighborhoods, continue	Wildfire/ 1, 2, 4, 5,	Mill Valley Public Works Dept, SMFD	New (2023)	$100,000/year (General CIP Fund, Municipal Service Tax), grants	Ongoing - 1-2 years/ High	

Table 28: City of Mill Valley Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
vegetation management in highest risk areas, and other projects listed in the assessment.						
MV-22: Annual Vegetation Maintenance Program. Conduct maintenance to reduce fuel sources and maintain evacuation routes on City ROW and on City owned lands. [FEMA Project WF-10 Implement a Fuels Management Program]	Wildfire/ 1,2	SMFD	New (2023)	$550,000/year (MST, Marin Wildfire Prevention Authority Measure C)	Ongoing - 1 - 2 years High	Ongoing program since 1997.
MV-23: Power Line Vegetation Maintenance. Coordinate with PG&E to conduct vegetation management around at risk power lines and electrical line undergrounding projects. [FEMA Project WF-7 Create Defensible Space Around Structures and Infrastructure]	Wildfire/ 1, 2, 4, 5,	PG&E, Mill Valley DPW, Marin County, SMFD	New (2023)	Cost TBD (HMGP, BRIC, CDAA Grants as needed)	1 - 2 years High	Pursue targeted vegetation management by in house staff with grant funding if utility does not address this issue.
MV-24: Steps, Lanes and Paths. Maintain and improve SLP pedestrian evacuation network through the SLP Annual Maintenance Program and SLP Design and Construction Program.	All Hazards/ 1,2	Mill Valley Public Works Dept	New (2023)	Maintenance: $85,000/year (General CIP Fund, MST) Design: $50,000/ year (General CIP Fund)	Ongoing - 2-5 years/ Medium	
MV-25: Landslide Repair. Implement the City's Annual Slide Repair Program to repair landslides in the public ROW and on City properties and lower risk of future slides. [FEMA Project ER-5 Stabilize Erosion Hazard Areas]	Debris Flow/ 1,2	Mill Valley Public Works Dept	New (2023)	$250-$300,000/year (General CIP Fund)	Ongoing - 2-5 years/ Medium	This program includes emergency response and cleanup of hillside slides as well as design and construction of roadway stabilization projects.
Outreach and Coordination						
MV-26: Hazard Information. Collect, analyze and share information with the Mill Valley community about Mill Valley hazards and associated risk reduction activities. [FEMA Project MU-14 Increase Hazard Education and Risk Awareness]	All Hazards/ 3	SMFD, Emergency Preparedness Commission, CERT	Existing (2018)	$10,000 (EPC Budget), SMFD costs for outreach as needed	1 - 2 years High	Activities include Emergency Preparedness Commission meetings and trainings, SMFD trainings and demonstrations, CERT trainings, Neighborhood Response Group meetings

Table 28: City of Mill Valley Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
MV-27: Community Groups. Continue to encourage neighborhoods and community members to participate in programs such as Firewise Communities, Neighborhood Response Groups, CERT, and other community organizations.	All Hazards/ 3	Mill Valley City Manager, SMFD	New (2023)	TBD (General Fund)	Ongoing - 2-5 years/ Medium	
MV-28: Build Internal Capacity. Recognize and address gaps in capacity for emergency preparedness.	All Hazards/ 4	Mill Valley City Manager, Public Works and Planning + Building Depts, SMFD	New (2023)	TBD (General Fund, HMGP, BRIC, CDAA, FMA grants as needed)	1-5 years/ Medium	Examples: staff training on floodplain administration; GIS license/training to map and analyze hazard risks more comprehensively.
MV-29: Partnerships. Ensure that City provides leadership and coordinate with the private sector, public institutions, and other public agencies in disaster mitigation.	All Hazards/ 4	Mill Valley City Manager, Public Works and Planning + Building Depts, EPC, SMFD	Existing (2018)	Cost: $10,000 (EPC Budget), additional budget as needed	Ongoing - 2-5 years/ Medium	
MV-30: Water Security. Collaborate with local, state, regional and federal partners to increase the security and capacity of Mill Valley's water supply from climate change impacts.	Drought/ 1	Mill Valley City Manager, Public Works and Planning + Building Depts, MMWD	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA, Private Grants	Ongoing - 2-5 years/ Medium	MMWD leads this effort.
MV-31: Cybersecurity. Enhance resiliency of city systems to cyberattacks to improve resiliency in an emergency.	All Hazards/ 4	Mill Valley City Manager	New (2023)	Cost TBD (General Fund, Private Grants)	1-5 years/ Medium	

Table 170: City of Mill Valley Current Hazard Mitigation Actions

3.6 PLAN INTEGRATION

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

Public Works, SASM, Southern Marin Fire District, and Planning & Building staff for the City of Mill Valley will maintain this plan and will share responsibility for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into city plans and mechanisms. Where possible the City of Mill Valley will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of Mill Valley already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the City.

City Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the City.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

Capital improvement plans and budgets - Integrates hazard mitigation through the consideration of strategies for the development and funding of critical facilities and infrastructure.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

16. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
17. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
18. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.7 Future Development Trends

The City of Mill Valley has established two primary goals in the MV2040 General Plan: 1. To protect and enhance the natural beauty and small-town character of Mill Valley; and 2. To encourage continued diversity of housing, income levels, and lifestyles in the community.

While Mill Valley has experienced only modest population growth over the past several decades, analysis of the City's demographic and household characteristics illustrates changes in the make-up of the population that may result in higher population growth.

Demographic data for Mill Valley indicate that senior citizens continue to represent a growing segment of the community, currently comprising 24 percent of Mill Valley residents, compared to just 19 percent a decade ago.

Most young adults depart Mill Valley in their early 20s and are replaced by parents in their 30s with school-age children. This appears to be attributable to a "demographic shift" in existing single-family housing occupancy, as elderly "empty nesters" seek smaller units closer to shopping and services and are replaced by young families with school-age children. This trend anticipates that older, single or two-occupant households in existing single-family homes in Mill Valley will continue to turn over to younger households with school age children over the long term, thereby yielding a significant net increase in population growth.

This trend could significantly affect community facilities and services (especially traffic, schools, and recreational facilities) beyond what is addressed by the City of Mill Valley General Plan's policies and programs assuming Association of Bay Area Governments (ABAG) population estimates.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Mill Valley has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of Mill Valley.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of Mill Valley Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of Mill Valley plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of Mill Valley is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of Mill Valley Planning and Building Director will monitor and update the City of Mill Valley Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of Mill Valley, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of Mill Valley, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of Mill Valley Planning and Building Director will monitor and update the City of Mill Valley Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of Mill

Valley and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP and Mill Valley Website 7-19
Figure 2: Marin County OA MJHMP Public Town Hall Meeting 7-20
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 7-21
Figure 4: Hazard Mitigation Plan Survey 7-22
Figure 5: Map of City of Mill Valley in Marin County 7-25
Figure 6: Map of the City of Mill Valley 7-26
Figure 7: The City of Mill Valley Precipitation and Monthly Temperatures 7-28
Figure 8: Races in Mill Valley 7-29
Figure 9: City of Mill Valley Land Use Map 7-31
Figure 10: City of Mill Valley Social Vulnerability Map Census Tract 1261.00 7-33
Figure 11: City of Mill Valley Social Vulnerability Map Census Tract 1262.00 7-34
Figure 12: City of Mill Valley Social Vulnerability Map Census Tract 1270.00 7-35
Figure 13: City of Mill Valley Critical Facilities & Infrastructure 7-42
Figure 14: City of Mill Valley Risk Assessment – Planning Team Top Hazards 7-44
Figure 15: Hazard Risk Categorization 7-44
Figure 16: NASA Global Temperature Change CO2 Gas 7-48
Figure 17: NASA Global Temperature Change 1884 to 2022 7-48
Figure 18: NASA Global Temperature Change Sea Level 7-49
Figure 19: Annual Mean Sea Level Trends 7-51
Figure 20: Landslide Susceptibility Classes 7-56
Figure 21: Mud Flow Areas 7-57
Figure 22: City of Mill Valley Debris Flow Critical Facilities and Infrastructure 7-58
Figure 23: Modified Mercalli Intensity Scale 7-62
Figure 24: Mercalli Scale vs. Magnitude 7-62
Figure 25: Soil Types 7-63
Figure 26: Marin County OA Earthquake Impact and Fault Lines 7-65
Figure 27: City of Mill Valley Earthquake Critical Facilities and Infrastructure 7-66
Figure 28: Diagram of an Atmospheric River Event 7-70
Figure 29: City of Mill Valley Flooding Critical Facilities and Infrastructure 7-72
Figure 30: 2023 Flooding in Mill Valley – San Francisco Bay Trail 7-77
Figure 31: Flooding in Mill Valley – E Blithedale 7-78
Figure 32: Mill Valley Flooding – SASM WWTP 7-79
Figure 33: A cyclist rides through a flooded section of roadway Dec. 3, 2014 7-79
Figure 34: Dissolution Sinkhole Formation 7-80
Figure 35: Cover-Subsidence Sinkhole Formation 7-81
Figure 36: Cover-Collapse Sinkhole Formation 7-81
Figure 37: Levee Failure Mechanisms 7-83
Figure 38: City of Mill Valley Levee failure Critical Facilities and Infrastructure 7-84
Figure 39: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 7-87
Figure 40: City of Mill Valley Sea Level Rise Impact 7-88
Figure 41: Heat Index 7-89
Figure 42: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 7-90
Figure 43: Beaufort Wind Scale 7-91

Figure 44: Enhanced Fujita Scale 7-92
Figure 45: Waterspout Formation 7-92
Figure 46: City of Mill Valley Tsunami Critical Facilities and Infrastructure 7-94
Figure 47: Federal, State and Local Responsibility Areas in the Marin County OA 7-97
Figure 48: Trends in the Annual Number of Large Wildfires in the United States 7-100
Figure 49: City of Mill Valley Wildfire Critical Facilities and Infrastructure 7-101
Figure 50: 2022 City of Mill Valley Wildfire 7-102

List of Tables

Table 1: City of Mill Valley Local Hazard Mitigation Planning Team Members 7-8
Table 2: 2023 MJHMP Local Planning Team Members 7-12
Table 3: City of Mill Valley & Marin County OA MJHMP Planning Meetings 7-16
Table 4: City of Mill Valley Estimated Jurisdictional Population 7-28
Table 5: Population Change of The City of Mill Valley 7-29
Table 6: Languages Spoken in Mill Valley 7-29
Table 7: Marin County OA Jurisdictional Housing Stock 7-30
Table 8: NRI Hazards and Marin County OA MJHMP Hazards 7-32
Table 9: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00 7-33
Table 10: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00 7-34
Table 11: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00 7-35
Table 12: Household Income for The City of Mill Valley as of 2019 7-36
Table 13 City of Mill Valley Civilian Employed Population 16 years+ by Industry 7-37
Table 14: City of Mill Valley Critical Facilities 7-41
Table 15: Historic Sites In The City of Mill Valley 7-43
Table 16: Select Hazards Magnitude/ Severity Scale or Index 7-45
Table 17: City of Mill Valley Hazard Risk Assessment 7-53
Table 18: County of Marin Hazard Risk Assessment 7-54
Table 19: City of Mill Valley Critical Facilities in the Flood Zones 7-76
Table 20: City of Mill Valley Future Growth Areas 7-106
Table 21: City of Mill Valley Legal and Regulatory Capabilities 7-112
Table 22: City of Mill Valley General Plan: MV2040 7-117
Table 23: City of Mill Valley Administrative and Technical Capabilities 7-120
Table 24: City of Mill Valley Fiscal Capabilities 7-122
Table 25: City of Mill Valley Community Outreach 7-125
Table 26: City of Mill Valley NFIP Status 7-127
Table 27: Status of Previous Hazard Mitigation Actions 7-133
Table 28: City of Mill Valley Current Hazard Mitigation Actions 7-140

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

8. North Marin Water District Profile

NORTH MARIN WATER DISTRICT

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The North Marin Water District and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities and district of the North Marin Water District more disaster resistant and sustainable.

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TABLE OF CONTENTS

NORTH MARIN WATER DISTRICT PROFILE 8-1
Acknowledgements 8-3
Table of Contents 8-5
Section 1.0: Introduction 8-7
1.1 Introduction 8-7
1.2 Planning Process 8-7
1.2.1 Steering Committee Members (District Representatives) 8-8
1.2.2 Steering Committee Planning Process 8-9
1.2.3 Coordination with Stakeholders and Agencies 8-9
1.2.4 Public Engagement 8-16
1.3 Overview and History 8-23
1.4 Service Area 8-24
1.5 Office of the General Manager & Administration 8-28
1.6 Financing 8-28
1.7 Weather and Climate 8-29
1.8 Social Vulnerability and Risk 8-30
1.9 Critical Facilities 8-38
Section 2.0: Hazard Identification and Risk Assessment 8-41
2.1 Climate Change 8-43
2.2 Hazards 8-50
2.2.1 Dam Failure 8-51
2.2.2 Debris Flows 8-62
2.2.3 Drought 8-69
2.2.4 Earthquake 8-70
2.2.5 Flooding 8-76
2.2.6 Land Subsidence 8-83
2.2.7 Levee Failure 8-85
2.2.8 Sea Level Rise 8-92
2.2.9 Severe Weather – Extreme Heat 8-99
2.2.10 Severe Weather – High Wind & Tornado 8-101
2.2.11 Tsunami 8-104
2.2.12 Wildfire 8-106
Section 3.0: Mitigation Strategy 8-118

3.1 Changes in Development 8-118
3.2 Capability Assessment 8-119
3.2.1 Regulatory Capabilities 8-119
3.2.2 Administrative and Technical Capabilities 8-122
3.2.3 Fiscal Capabilities 8-123
3.2.4 Community Outreach 8-125
3.2.5 Participation in the National Flood Insurance Program 8-125
3.3 Mitigation Goals 8-126
3.4 Status of Previous Mitigation Actions 8-128
3.5 Hazard Mitigation Actions 8-128
3.6 Progress in Local Mitigation Efforts 8-133
3.7 Plan Integration 8-133
3.8 Future Development Trends 8-134
Section 4.0: Plan Review, Evaluation, and Implementation 8-135
4.1 Plan Adoption 8-135
4.2 Plan Monitoring 8-135
4.3 Plan Evaluation 8-136
4.4 Plan Update 8-136
Figures and Tables 8-138
Acronyms/Abbreviations 8-140

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The North Marin Water District Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the North Marin Water District (NMWD).

1.2 PLANNING PROCESS

The majority of Marin County Operational Area (OA) is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the North Marin Water District involved additional internal planning team members to support the broader planning process. The North Marin Water District jurisdictional representatives for the coordinated Marin County Multi-Jurisdictional

Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (District Representatives)

Primary Point of Contact
Eric Miller, Asst. General Manager
Telephone: 415-897-4133
E-mail Address: emiller@nmwd.com

Alternate Point of Contact
Tim Fuette, Senior Engineer
Telephone: 415-761-8925
E-mail Address: tfuette@nmwd.com

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
North Marin Water District	Eric Miller	Asst. General Manager	415-897-4133	emiller@nmwd.com
North Marin Water District	Robert Clark	Operations & Maintenance Superintendent	415-897-4133	rclark@nmwd.com
North Marin Water District	Anthony "Tony" Williams	General Manager	415-897-4133	twilliams@nmwd.com
North Marin Water District	Tim Fuette	Senior Engineer	415-761-8925	tfuette@nmwd.com

Table 171: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the North Marin Water District. All participating jurisdictions and districts are within the geographical boundary of Marin County OA and have jurisdictional or district authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.

- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and NMWD Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the NMWD communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other

community services and needs.

The Marin County and NMWD Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the NMWD and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-seven planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Assistant Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Robert Clark	Operations & Maint. Superintendent
40	North Marin Water District	Anthony Williams	General Manager
41	North Marin Water District	Tim Fuette	Senior Engineer
42	Novato	David Dammuller	Engineering Services Mgr.
43	Novato	Dave Jeffries	Consultant/JPSC
44	Ross	Richard Simonitch	Public Works Director
45	San Anselmo	Sean Condry	Public Works & Building Director
46	San Anselmo	Erica Freeman	Building Official
47	San Anselmo	Scott Schneider	Asst. PW Director
48	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
49	San Rafael	Cory Bytof	Sustainability
50	San Rafael	Joanna Kwok	Senior Civil Engineer
51	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
52	Sausalito	Andrew Davidson	Senior Engineer/ DPW
53	Sausalito	Kevin McGowan	Director of Public Works
54	Sausalito	Brandon Phipps	Planning Director
55	Tiburon	Sam Bonifacio	Assistant Planner
56	Tiburon	Dina Tasini	Director of Community Development
57	Tiburon	Laurie Nilsen	Emergency Services Coord.
Special Districts & Partner Agencies			
58	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
59	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
60	Emergency Medical Services	Chris Le Baudour	EMS Authority
61	Fire Departments	Jason Weber	Fire Chiefs
62	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
63	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
64	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
65	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
66	Marin City Community Services District	Juanita Edwards	Interim General Manager
67	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
68	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
69	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
70	Marin County Parks	Max Korten	General Manager and Director

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
71	PG&E	Mark Van Gorder	Government Affairs, North Bay
72	PG&E	Ron Karlen	PG&E Public Safety Specialist
73	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
74	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
75	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
76	Cal OES – ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
77	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
78	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
79	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
80	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
81	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
82	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
83	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
84	National Park Service	Stephen Kasierski	OneTam
85	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
86	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
87	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 172: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the North Marin Water District's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of

Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: North Marin Water District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment

Table 3: North Marin Water District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview

Table 3: North Marin Water District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes.

Table 3: North Marin Water District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Emergency Management Website	• Opportunity for public comment and questions and answers.

Table 173: North Marin Water District & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

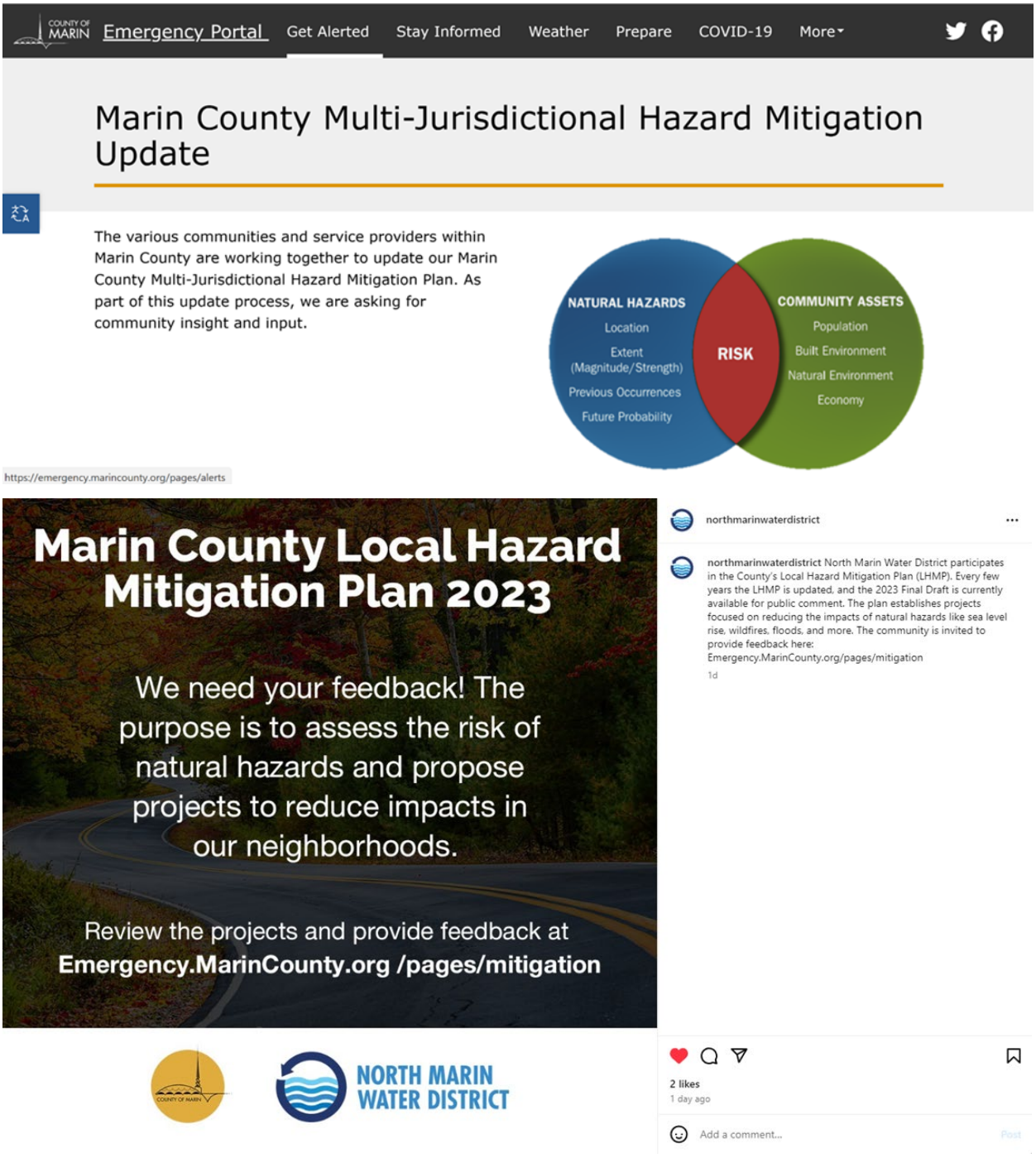


Figure 346: Marin County OEM MJHMP and NMWD Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people

where they are." Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

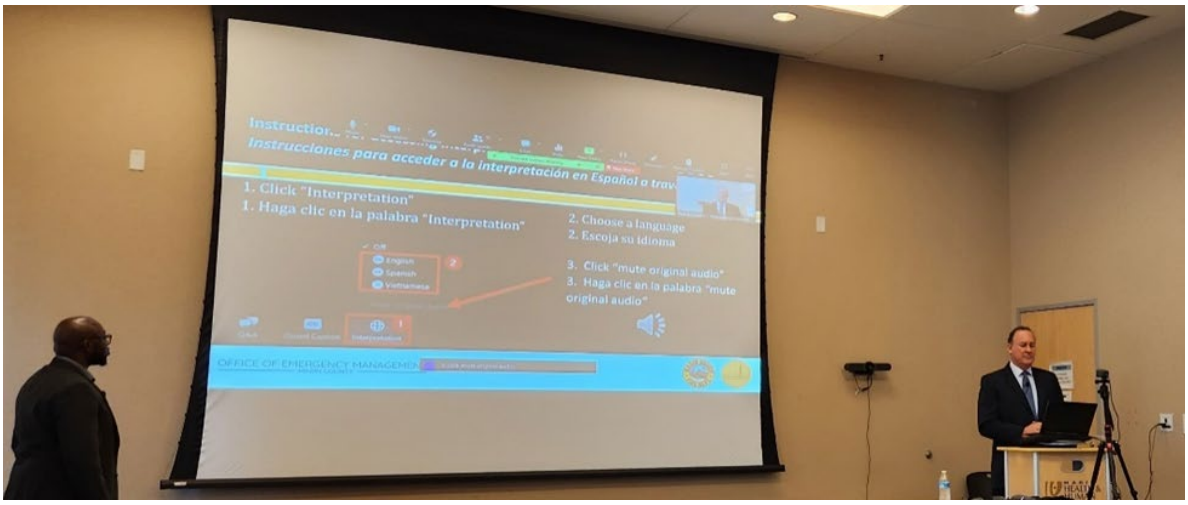


Figure 347: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and

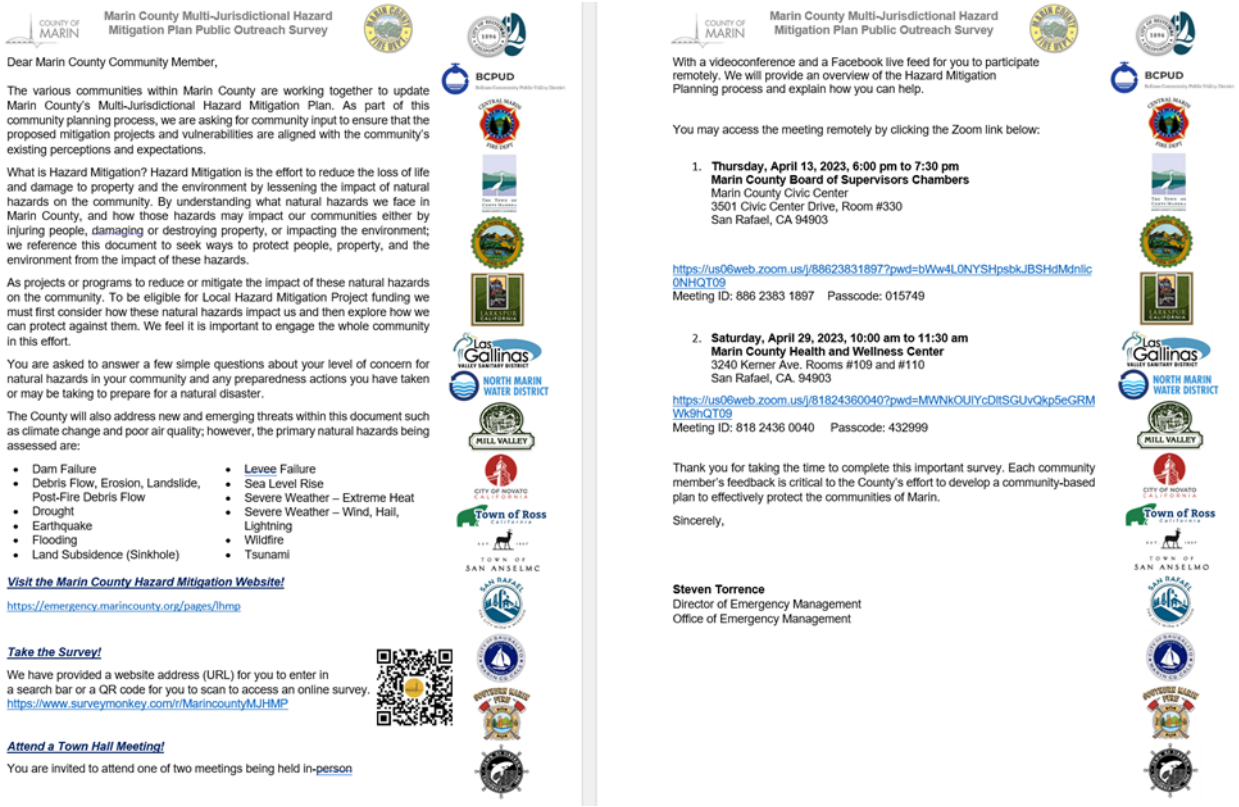
customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 348: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to

gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 349: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The NMWD had an additional social media and website postings for final public comment from December 18, 2023 until submission of the profile to Cal OES on February 12, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The NMWD distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

The North Marin Water District (NMWD) was formed in April of 1948 following voter approval under the State law known as the County Water District Law (Division 12 of the California Water Code). North Marin Water District is an independent special district governed by a five-member Board of Directors elected by division for four-year terms.

Prior to 1948, water service to the Novato area was provided by the Novato Water Company, a privately-owned public utility, operated for many years by the Cain family. In 1947, as Novato began to change and grow from a small agricultural community, Al Tresch acquired the water system. With about 500 customers the Novato Water Company began to experience serious water supply problems, since its existing wells were not producing sufficient high-quality water to meet its customers' needs.

In the fall of 1947, with the specter of limited water supply looming, the town leaders invited Marin Municipal Water District to a meeting to request that it extend its transmission line serving Hamilton Field to also serve the community of Novato. Marin Municipal turned down the request. A committee was then formed to advance the idea of purchasing the Novato Water

Company, developing a new source of water supply, and to upgrade and expand the system to meet the needs of the growing Novato community. The District was originally named North Marin County Water District. (In 1984, the word “County” was dropped from the name to eliminate any possible confusion as to whether or not the District was an agency of the County of Marin.)

1.4 Service Area

NMWD primarily serves the City of Novato and surrounding unincorporated areas in Marin County, encompassing approximately 20,750 active service connections serving approximately 24,100 dwelling units, as well as commercial, industrial and institutional customers. The NMWD service area covers 100 square miles. The estimated Novato Service Area population is 62,655. NMWD also provides service to several small improvement districts in the West Marin Service Area near the Pacific Ocean, via approximately 800 service connections.

The District has a unique territorial boundary (or boundaries as indicated) that includes: the Novato Water System that covers all of the City of Novato and surrounding unincorporated areas; the West Marin Water System that covers Point Reyes Station, Olema, Bear Valley, Silver Hills, Inverness Park and Paradise Ranch Estates; the Oceana Marin Wastewater System; and an area on the eastern side of Tomales Bay near Marshall that currently has no services available.

Figure 350: Map of the North Marin Water District
Source: Marin County OEM

Figure 6 illustrates the North Marin Water District service area in purple and the jurisdictional boundaries of the Cities of Novato and San Rafael in the black dashed lines.

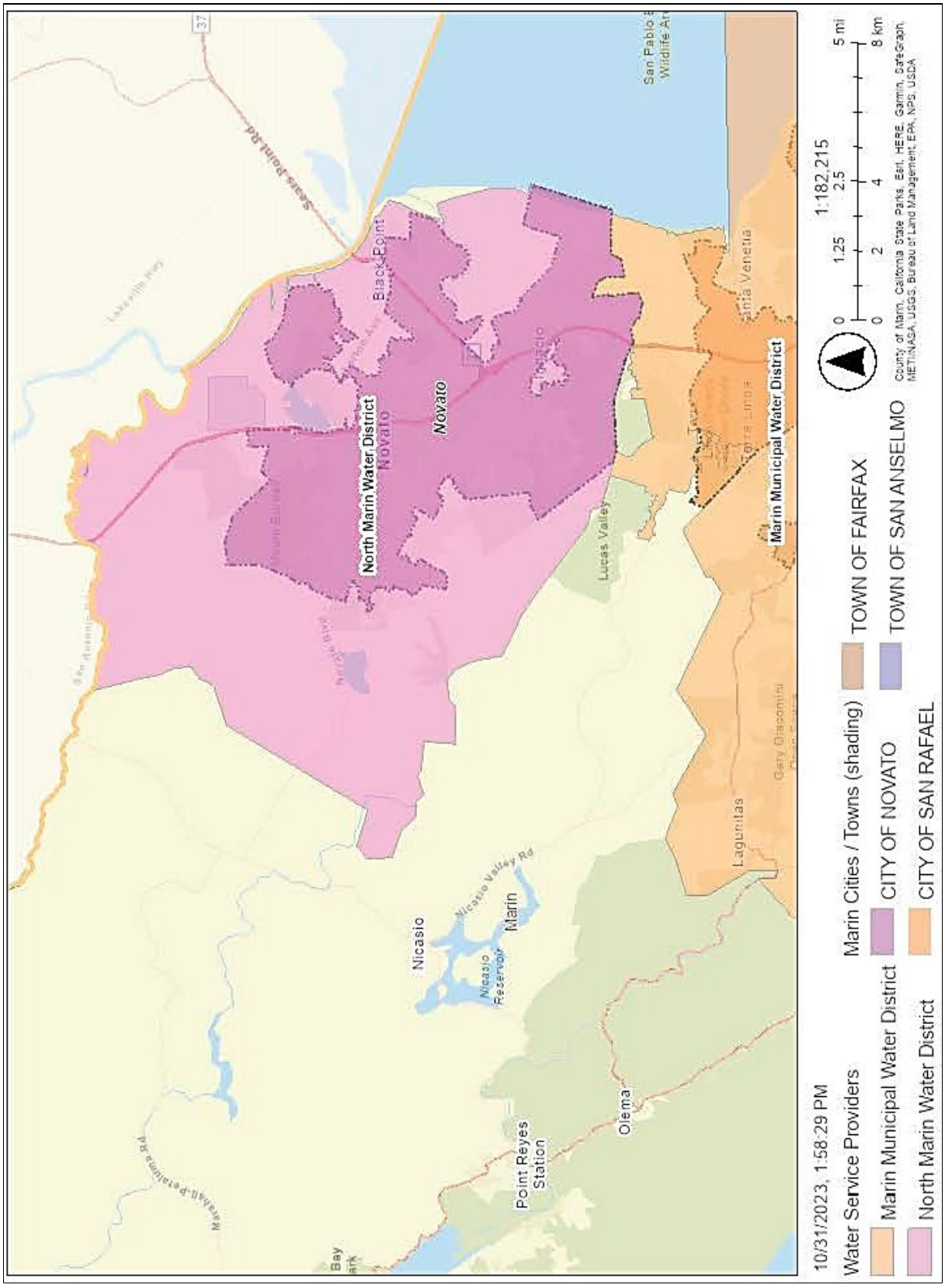


Figure 351: Map of the North Marin Water District and Jurisdictions
Source: Marin County OEM

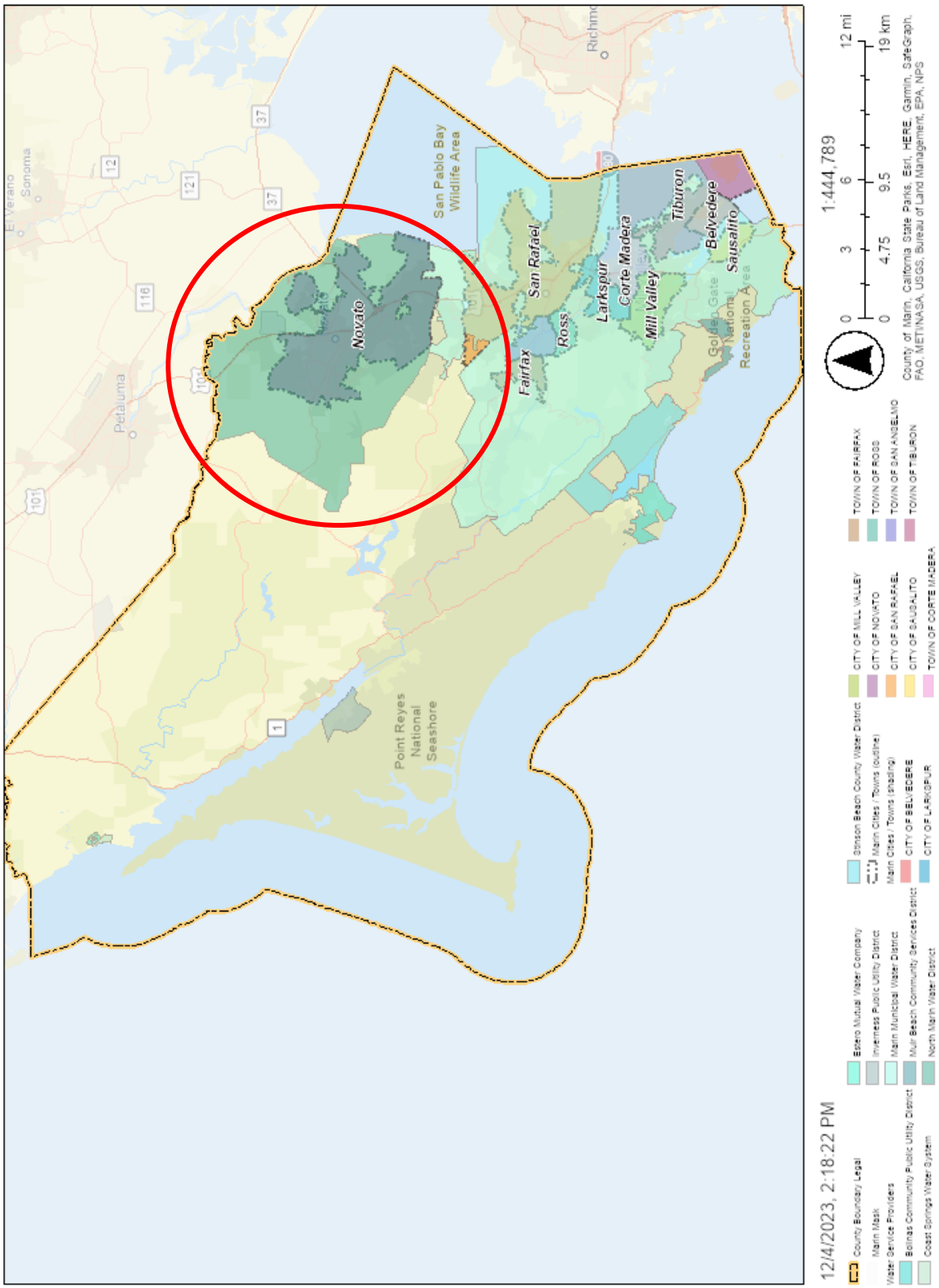


Figure 352: Map of the North Marin Water District within Marin County
Source: Marin County OEM

The North Marin Water District owns and operates Stafford Lake, Stafford Dam (DSOD Dam No. 88-0, National ID No. CA00321) and the associated treatment plant, which provides approximately 20% of Novato's water. The lake lies four miles west of downtown Novato and collects runoff from 8.3 square miles of watershed property located upstream at the upper tributary reaches of Novato Creek. Water from Stafford Lake is drawn by the intake tower and fed by gravity or by pumping (depending on the lake level) into the treatment plant located just below the dam. In addition to providing water supply for domestic needs and firefighting purposes, Stafford Dam provides flood protection for the greater Novato area. The Marin County Flood Control and Water Conservation District has partnered with NMWD to share in the cost of obtaining additional flood liability insurance. Stafford Dam (also known as the Novato Creek Dam) is approximately 71 feet tall with a crest length of 650 feet, is classified as an Extremely High Hazard Dam based on its size and potential for loss of life and property should the dam fail.

Water from the Russian River via connection to the Sonoma County Water Agency's aqueduct provides the remaining 80% of the Novato Service Area supply of water. This water originates from both the Eel River and the Russian River watersheds. The water supply for the West Marin Service Area is derived from groundwater from the Lagunitas Creek watershed.

NMWD maintains and operates approximately 340 miles of pipeline, 42 tanks totaling over 37 million gallons of storage, and associated pump stations, hydropneumatic systems, and regulator valves. NMWD sizes its storage tanks to meet operational, firefighting and emergency requirements. Storage requirements for both the Novato and West Marin Service Areas are updated on a 5-year cycle and are based in part on input provided by Novato Fire Protection District and Marin County Fire Department. NMWD evaluates water supply and consumer consumption on a 5-year cycle via its Urban Water Management Plan (UWMP) and associated Water Shortage Contingency Plan (WSCP) in accordance with state Department of Water Resources (DWR) guidelines and requirements.

Ensuring water quality and protecting public health is one of NMWD's primary goals. Water quality data is routinely collected throughout the distribution systems and at water sources.

1.5 Office of the General Manager & Administration

The General Manager is appointed by the Board of Directors to carry out the day-to-day activities of NMWD pursuant to the NMWD Regulations and Board Policies. The Manager has full responsibility for the maintenance, operation and construction of the NMWD water and wastewater systems and authority to determine employee duties to carry out these responsibilities. Refer to NMWD'S website https://nmwd.com/about/ for the most current organizational and administrative matters related to the Office of the General Manager

1.6 Financing

NMWD reports its activities as an Enterprise Fund under the broad category of funds called proprietary funds using the full accrual basis of accounting. Expenditures are tracked by department, with each department delineated by function and specific activity, to provide management and the Board with better cost control measures. At the end of each fiscal year, these costs are combined to arrive at the financial position and results of operations reflected in

NMWD's basic financial statements. For the latest NMWD financial statement, refer to https://nmwd.com/about/documents - NMWD Annual Comprehensive Financial Reports.

Fiscal year 2022 financial highlights include:

The District, on a consolidated basis, received 99% of budgeted operating revenue and expended 114% of budgeted operating expenditures, resulting in a net loss of $3.3 million. Four million (36%) of the Capital Improvement Project Budget was expended. The year ended with a cash balance of $44.7 million, an increase of $20 million from the prior year.

Novato potable water consumption decreased 20% from the prior fiscal year. Stafford Lake Water Treatment Plant produced 168MG, down 20% from the prior fiscal year. The net loss of $3.3 million exceeded the $34,000 budgeted net loss, and compares to a net income of $463,000 the prior fiscal year. Novato Water ended the fiscal year with a cash balance of $37.1 million. A 6% increase applicable to Novato Water customers was approved effective July 1, 2021.

The Novato Sanitary District and Las Gallinas Valley Sanitary District, along with the Deer Island Recycled Facility, combined to produce 252MG of Recycled Water, down 2% from the prior fiscal year. The fiscal year net income of $83,000 was greater than the $448,000 budgeted net loss and compares to a net loss of $52,000 the prior fiscal year. Recycled Water ended the fiscal year with a cash balance of $6.2 million. A 6% increase applicable to Recycled Water customers was approved effective July 1, 2021.

West Marin Water consumption was down 25% from the prior fiscal year. The $136,000 net loss compares to a budgeted net income of $165,000 and to a net loss of $8,000 from the prior fiscal year. West Marin Water ended the fiscal year with a cash balance of $793,000. A 6% increase applicable to West Marin Sewer customers was approved effective July 1, 2021.

Oceana Marin Sewer's net income of $48,000 compares to a budgeted net income of $92,000 and to net income of $48,000 from the prior fiscal year. Oceana Marin ended the year with a $485,000 cash balance. A 5% increase applicable to Oceana Marin Sewer customers was approved effective July 1, 2021.

1.7 Weather and Climate

The North Marin Water District and the City of Novato lie 30 feet above sea level. In the District and Novato, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 41.8°F to 74.7°F and is rarely below 41°F or above 75°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month of highest relative humidity is February (79 %). The month with the lowest relative humidity is June (65 %). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	8.9 °C (48.1) °F	9.7 °C (49.5) °F	11 °C (51.8) °F	12.2 °C (53.9) °F	14.4 °C (57.9) °F	16.8 °C (62.2) °F	17.1 °C (62.8) °F	17.3 °C (63.1) °F	17.2 °C (63) °F	15.4 °C (59.7) °F	11.9 °C (53.3) °F	9.1 °C (48.5) °F
Min. Temperature °C (°F)	5.5 °C (41.8) °F	6.2 °C (43.1) °F	7.3 °C (45.1) °F	8.2 °C (46.8) °F	10.1 °C (50.1) °F	11.8 °C (53.3) °F	12.4 °C (54.4) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.2 °C (52.1) °F	8.2 °C (46.7) °F	5.9 °C (42.6) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	16 °C (60.8) °F	17.5 °C (63.4) °F	20 °C (68.1) °F	23.2 °C (73.8) °F	23.6 °C (74.5) °F	23.7 °C (74.7) °F	23.9 °C (75.1) °F	21.4 °C (70.6) °F	16.8 °C (62.3) °F	13.5 °C (56.2) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	79%	76%	70%	68%	65%	70%	71%	68%	68%	74%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

Figure 353: The North Marin Water District Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.8 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 4: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 174: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index
Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index
Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

The following Tables and Figures illustrates the NRI Hazard Type Risk Index and the Social Vulnerability Map for the North Marin Water District for the various Census Tracts within their service area.

Tables 5 - 9 illustrate the NRI Hazard Type Risk Index for the NMWD service area Census Tracts

Table 5: NRI Hazard Type Risk Index for Novato Census Tract 1022.03						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$2,722,258	Relatively High	Very High	1.35	$3,686,835	98.6
Riverine Flooding	$183,359	Relatively High	Very High	1.35	$248,329	92.9
Heat Wave	$8,084	Relatively High	Very High	1.35	$10,949	53.2
Tornado	$3,889	Relatively High	Very High	1.35	$5,267	12.6
Landslide	$2,470	Relatively High	Very High	1.35	$3,345	84.4
Strong Wind	$264	Relatively High	Very High	1.35	$357	11.5
Wildfire	$68	Relatively High	Very High	1.35	$92	35.4
Coastal Flooding	$0	Relatively High	Very High	1.35	$0	0
Drought	$0	Relatively High	Very High	1.35	$0	0
Tsunami	$0	Relatively High	Very High	1.35	$0	0

Table 175: NRI Hazard Type Risk Index for Novato Census Tract 1022.03
Source: FEMA National Risk Index 2023

Figures 9 - 13 illustrate the Social Vulnerability Maps for the NMWD service area Census Tracts.

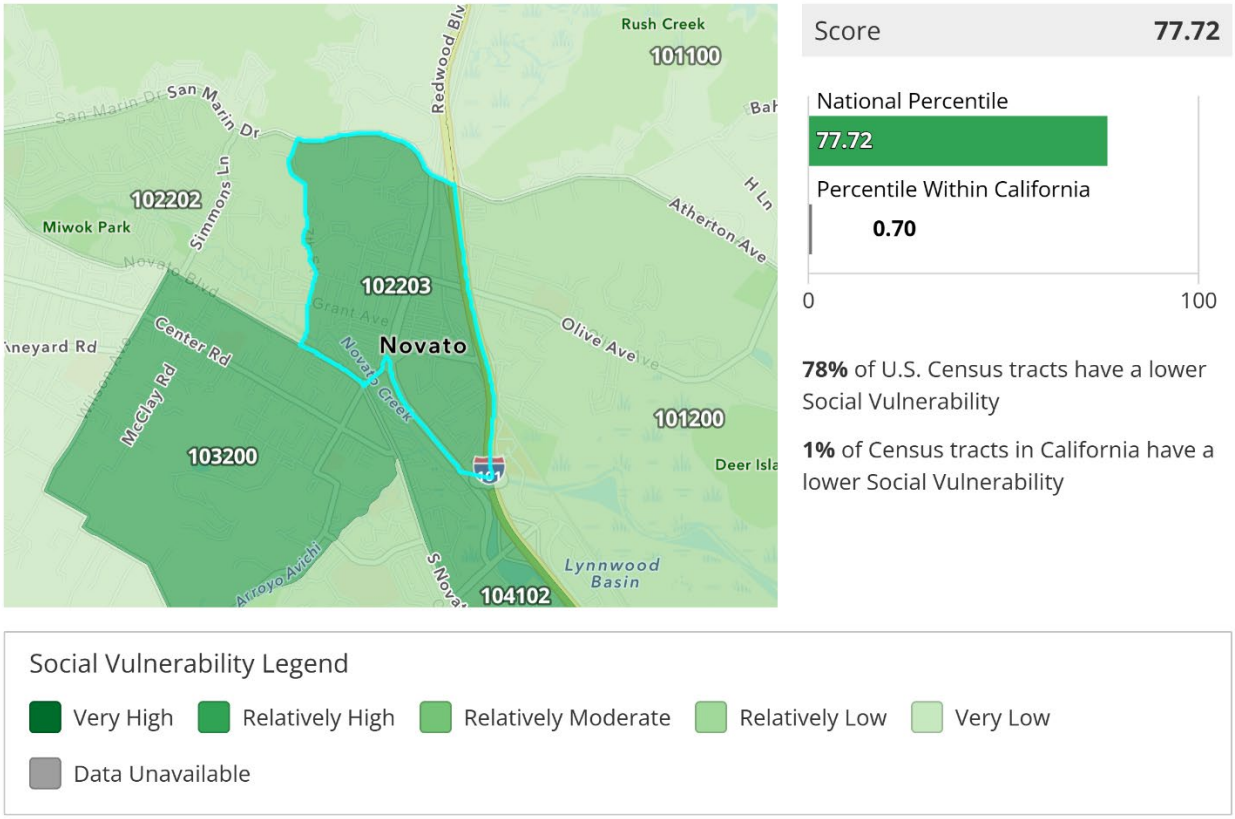


Figure 354: City of Novato Social Vulnerability Map Census Tract 1022.03
Source: FEMA National Risk Index 2023

Table 6: NRI Hazard Type Risk Index for Novato Census Tract 1032.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,889,584	Relatively High	Very High	1.37	$2,597,248	97.5
Riverine Flooding	$1,697,035	Relatively High	Very High	1.37	$2,332,588	99.4
Wildfire	$43,948	Relatively High	Very High	1.37	$60,407	91.9
Heat Wave	$10,500	Relatively High	Very High	1.37	$14,432	58.7
Tornado	$5,050	Relatively High	Very High	1.37	$6,941	16.8
Landslide	$3,209	Relatively High	Very High	1.37	$4,411	88.3
Strong Wind	$342	Relatively High	Very High	1.37	$471	13.8
Coastal Flooding	$0	Relatively High	Very High	1.37	$0	0
Drought	$0	Relatively High	Very High	1.37	$0	0
Tsunami	$0	Relatively High	Very High	1.37	$0	0

Table 176: NRI Hazard Type Risk Index for Novato Census Tract 1032.00
Source: FEMA National Risk Index 2023

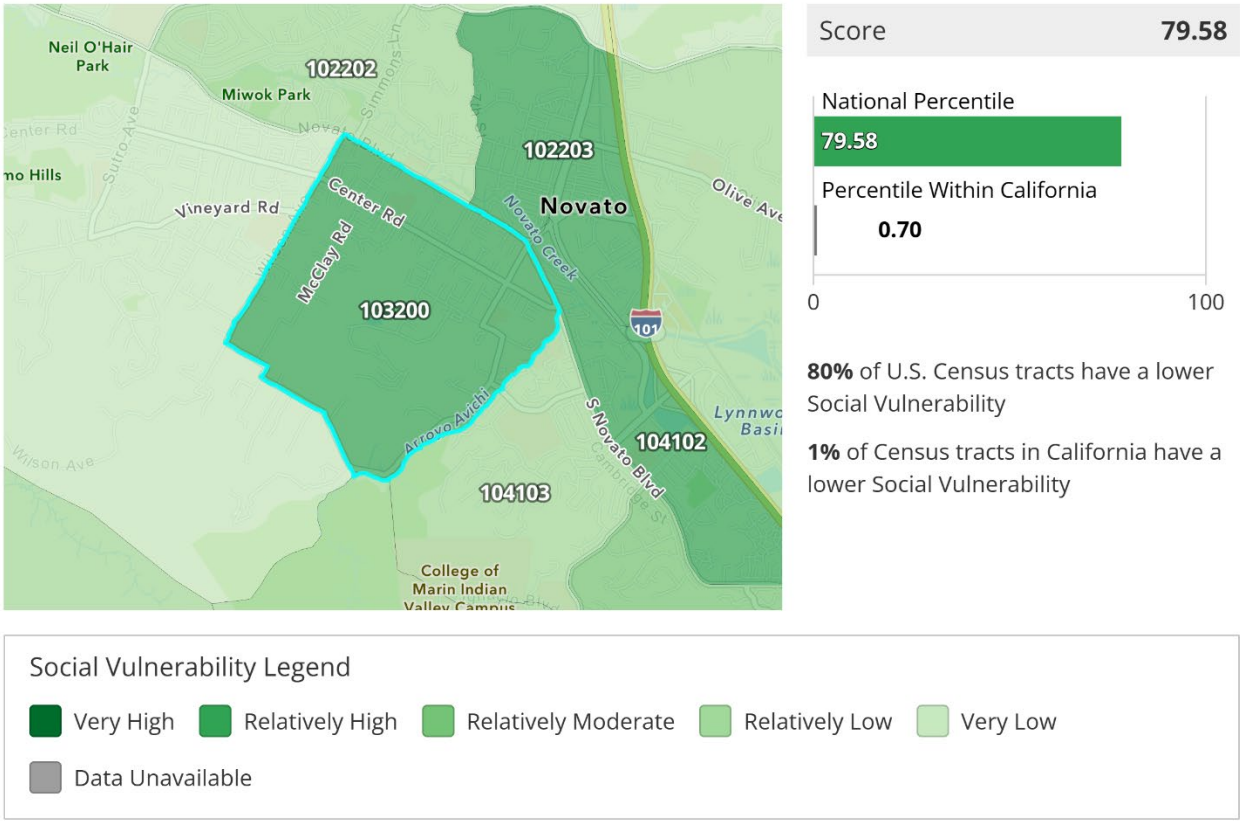


Figure 355: City of Novato Social Vulnerability Map Census Tract 10320.00
Source: FEMA National Risk Index 2023

Table 7: NRI Hazard Type Risk Index for Novato Census Tract 1012.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$2,569,756	Relatively Low	Very High	0.88	$2,272,662	96.8
Riverine Flooding	$154,980	Relatively Low	Very High	0.88	$137,063	88.1
Coastal Flooding	$64,204	Relatively Low	Very High	0.88	$56,781	95
Drought	$44,177	Relatively Low	Very High	0.88	$39,070	95.8
Heat Wave	$4,569	Relatively Low	Very High	0.88	$4,041	36.7
Wildfire	$4,251	Relatively Low	Very High	0.88	$3,760	79
Tornado	$3,094	Relatively Low	Very High	0.88	$2,736	6.3
Landslide	$2,521	Relatively Low	Very High	0.88	$2,230	77.9
Strong Wind	$168	Relatively Low	Very High	0.88	$148	6
Tsunami	$0	Relatively Low	Very High	0.88	$0	0

Table 177: NRI Hazard Type Risk Index for Novato Census Tract 1012.00
Source: FEMA National Risk Index 2023

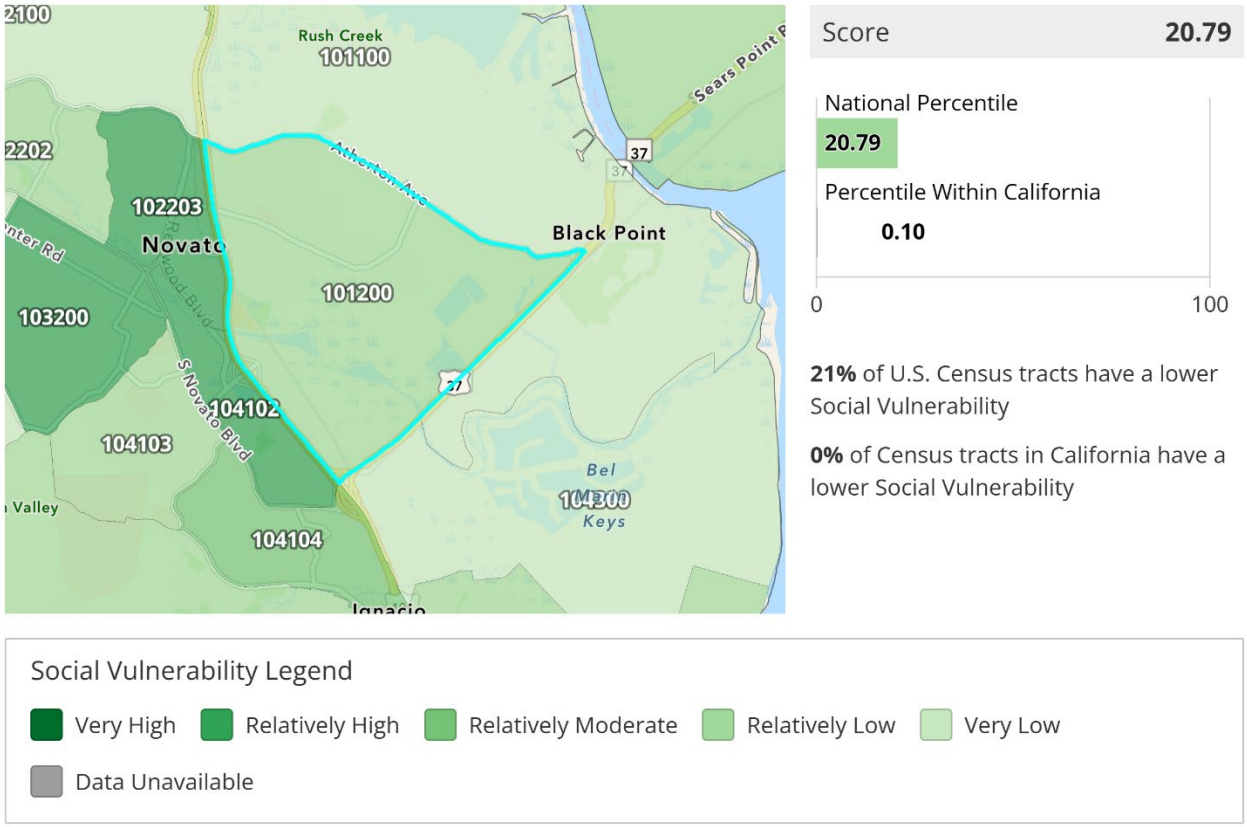


Figure 356: City of Novato Social Vulnerability Map Census Tract 1012.00
Source: FEMA National Risk Index 2023

Table 8: NRI Hazard Type Risk Index for Novato Census Tract 1022.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,255,306	Relatively Low	Very High	0.94	$1,177,508	92.4
Riverine Flooding	$375,636	Relatively Low	Very High	0.94	$352,356	94.9
Heat Wave	$9,379	Relatively Low	Very High	0.94	$8,798	49.2
Tornado	$3,991	Relatively Low	Very High	0.94	$3,744	8.7
Landslide	$3,696	Relatively Low	Very High	0.94	$3,467	85
Wildfire	$1,511	Relatively Low	Very High	0.94	$1,417	69.9
Strong Wind	$295	Relatively Low	Very High	0.94	$277	9.6
Coastal Flooding	$0	Relatively Low	Very High	0.94	$0	0
Drought	$0	Relatively Low	Very High	0.94	$0	0
Tsunami	$0	Relatively Low	Very High	0.94	$0	0

Table 178: NRI Hazard Type Risk Index for Novato Census Tract 1022.02
Source: FEMA National Risk Index 2023

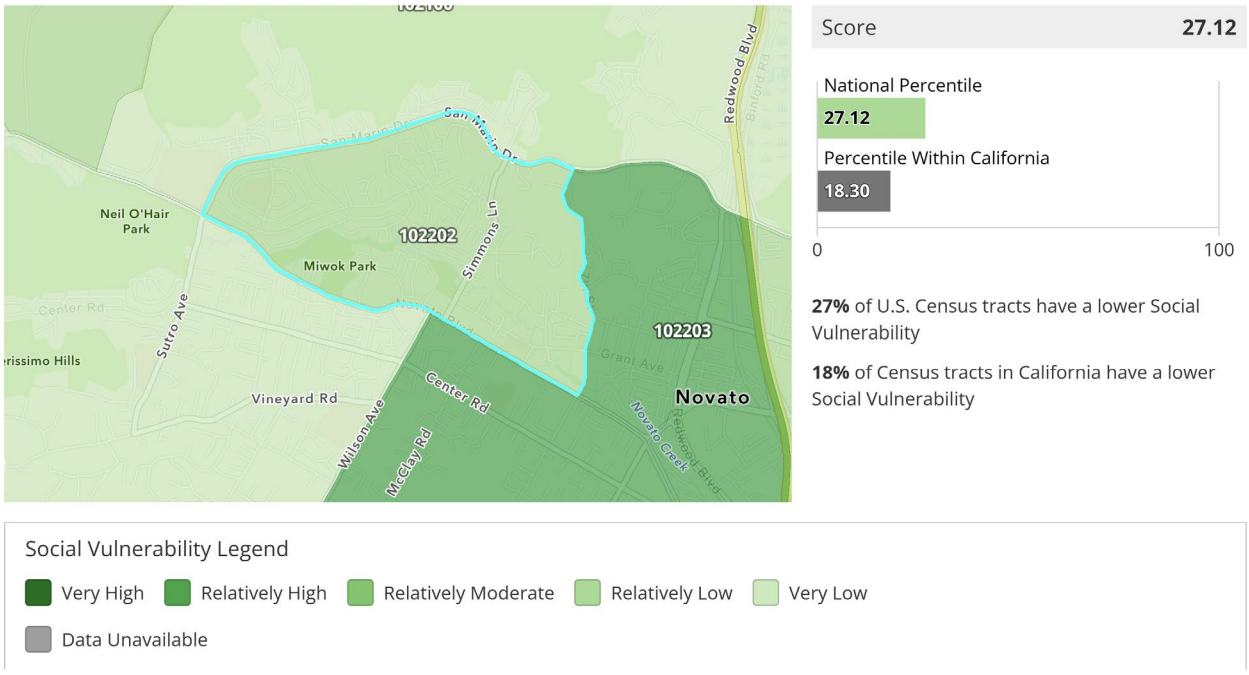


Figure 357: City of Novato Social Vulnerability Map Census Tract 1022.02
Source: FEMA National Risk Index 2023

Table 9: NRI Hazard Type Risk Index for Novato Census Tract 1041.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,540,791	Relatively High	Very High	1.19	$1,837,291	95.6
Riverine Flooding	$690,513	Relatively High	Very High	1.19	$823,391	98
Heat Wave	$8,314	Relatively High	Very High	1.19	$9,914	51.4
Coastal Flooding	$5,903	Relatively High	Very High	1.19	$7,038	88.3
Tornado	$3,151	Relatively High	Very High	1.19	$3,757	8.8
Landslide	$2,413	Relatively High	Very High	1.19	$2,878	82.1
Wildfire	$282	Relatively High	Very High	1.19	$337	49.7
Strong Wind	$254	Relatively High	Very High	1.19	$303	10.2
Drought	$0	Relatively High	Very High	1.19	$0	0

Table 179: NRI Hazard Type Risk Index for Novato Census Tract 1041.02
Source: FEMA National Risk Index 2023

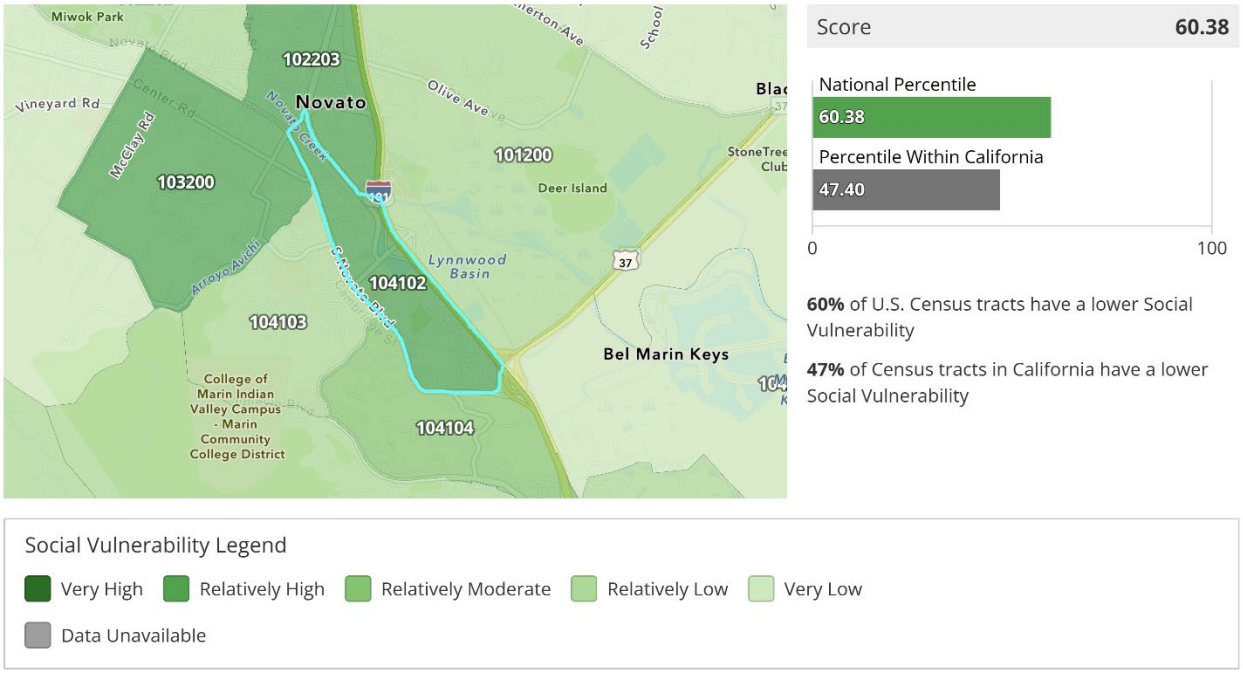


Figure 358: City of Novato Social Vulnerability Map Census Tract 1041.02
Source: FEMA National Risk Index 2023

Social Vulnerability in Marin County and the North Marin Water District

Most socially vulnerable residents in Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a “very high” ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a whole to have “Relatively High” risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category (“Very High Risk”), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

However, Marin City is ranked as “Very Low” risk for the National Risk Index. Previous discussion highlighted why the Expected Annual Loss was low, but further discussion is required. As a County, we know Marin City should not be classified as “Very Low” on the NRI. Marin City residents, for example, only have one way in and out of their community and this road floods frequently, making it unsafe to cross and leave the community for work, school, medical resources. Additionally, there is only one “grocery” store, a Target, in Marin City. Both of these elements contribute to the vulnerability of residents as they may be unable to leave or return home and have limited access to groceries, relying on a single store’s supply chain. At the local elementary school in Marin City, 47% of students are eligible for free and reduced-price meals (2022 – 2023 school year), a reflection of the financial capacity of local families. All this means, we can expect the social and built capacity of Marin City to be limited.

Although, customers within the North Marin Water District reside within census tracts that have a Social Vulnerability Index of “Relatively High” to “Relatively Low”, the North Marin Water District’s ability to serve this community is limited to the potable water they provide. Their

influence may be realized during an emergency by ensuring the continued delivery of potable water which are considered a community lifeline. They may also work with these impacted customers to provide fee relief through local, state, and or federal programs where appropriate. The majority of socially vulnerable population services are provided through the county, state, and federal government or other non-governmental or volunteer agencies or organizations.

1.9 Critical Facilities

Novato

Stafford Lake – Local source provides 20-25% of North Marin's supply. Stafford Lake lies four miles west of downtown Novato and collects the runoff from 8.3 square miles of watershed land adjacent to the upper reaches of Novato Creek. The lake has a surface area of 230 acres and holds 4,450-acre feet or 1,450 million gallons (MG) of water. Water from Stafford Lake is fed into the Stafford Lake Water Treatment Plant, (located just below the dam) at a maximum rate of 6 million gallons per day. In FY 2021-22, 515.8 acre feet (168.1MG) of water was produced from the facility between July and October.

Russian River – Provides 75-80% of North Marin's annual supply. Russian River water originates from both the Eel River and the Russian River watersheds northeast of the City of Ukiah (Lake Mendocino) and west of Healdsburg (Lake Sonoma). The Coyote Dam at Lake Mendocino impounds the Eel River diversions and winter runoff from the local watershed. Warm Springs Dam at Lake Sonoma impounds winter runoff from the Dry Creek and Warm Springs local watersheds. Lakes Mendocino and Sonoma combined can store 367,500-acre feet to meet regional water supply needs, which totaled 46,200-acre feet in FY 2019 20. Releases from the lakes flow to a point about 10 miles upstream of Guerneville (see map on page 31 of this report), where six collector wells draw river water that has been filtered through 60 to 90 feet of natural sand and gravel to perforated pipes located at the bottom of each well. The thick layer of sand and gravel through which the water must pass before reaching the intake pipes provides a highly efficient, natural filtration process which, with chlorination treatment, produces a clear, potable, bacteria-free water. This water is then fed directly into the SCWA aqueduct system. In FY 21-22, North Marin received 5,797-acre feet (1,889MG) of Russian River water. North Marin has an agreement in place with SCWA to provide sufficient supply and meet Novato's current and future water supply needs. There continues to be competing interests for Russian River water, principally to protect steelhead and salmon listed as threatened or endangered species under the Endangered Species Act.

West Marin

Groundwater Wells – Local source provides 100% of North Marin's supply. Four active wells provide water for our West Marin customers: Coast Guard Well #2, Coast Guard Well #4, Gallagher Well No. 1, and Gallagher Well No. 2. In FY 21-22, 176.5-acre feet (57.5MG) of water was produced from a combination of the first three wells listed, as construction of the new Gallagher Well No. 2 was completed in October 2022 which added approximately 180,000 gallons per day to the water system.

The following list of facilities has been determined to be critical to the ability of the North Marin Water District to fulfill the requirements of its mission during an emergency:

Table 10: NMWD Critical Facilities in Fire and Flood Zone				
Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
District Building	NMWD Headquarters: Administration, Laboratory, and Corporation Yard	999 Rush Creek Place Novato, CA 94945	Moderate	500-year flood plain (Zone X)
District Building	Stafford Water Treatment Plant	3500 Novato Blvd. Novato, CA 94945	Moderate	n/a
District Building	Point Reyes Water Treatment Plant	101 Commodore Webster Dr. Point Reyes Station, CA 94956	Moderate	100-year flood plain (Zone AE)
High Potential Loss Facilities				
DAM	Novato Creek Dam	3500 Novato Blvd. Novato, CA 94945	Moderate	n/a
Critical Infrastructure				
Water	North Marin Aqueduct, 30”-42” water transmission pipeline	Linear utility –generally paralleling US 101	Various	n/a
Water	San Marin Pump Station	APN 125-411-25	High	n/a
Water	Lynwood Pump Station	Intersection of S. Novato Blvd & Sunset Parkway, Novato, CA 94945	Moderate	n/a
Water	Cherry Hill Pump Station	APN 143-421-33	High	n/a
Water	School Road Pump Station	Intersection of School Road & Sunset Trail, Novato, CA 94945	High	n/a
Water	Black Point @ Hwy 37 Regulating Station	Intersection of Harbor Drive & Hwy 37 Eastbound On-Ramp, Novato, CA 94945	High	AE
Water	Black Point @ Grandview Avenue Regulating Station	Intersection of Harbor Drive & Grandview Avenue, Novato, CA 94945	High	AE
Water	Coast Guard Wells (No. 2 & 4)	101 Commodore Webster Dr. Point Reyes Station, CA 94956	Moderate	AE
Water	Gallagher Well No. 1	APN 119-050-12	Moderate	AE
Water	Gallagher Well No. 2	APN 119-050-17	Moderate	AE
Water	Olema Pump Station	APN 166-220-10	Moderate	AE
Water	Bear Valley Pump Station	APN 166-350-10	Moderate	n/a
Water	Inverness Park Pump Station	APN 114-294-33	High	n/a
Water	Paradise Ranch Estates Pump Station No. 1	APN 114-111-19	Moderate	n/a
Water	Paradise Ranch Estates Pump Station No. 2	APN 114-100-89	High	n/a
Water	Paradise Ranch Estates Pump Station No. 3	APN 114-100-91	High	n/a
Water	Paradise Ranch Estates Tank No. 1	APN 114-111-19	Moderate	n/a
Water	Paradise Ranch Estates Tank No. 2	APN 114-100-89	High	n/a
Wastewater	Tahiti Way Lift Station	APN 100-261-47	Moderate	n/a
Wastewater	Oceana Marin Wastewater Storage and Treatment Ponds	APN 100-100-56	Moderate	n/a

Table 180: North Marin Water District Critical Facilities
Source: North Marin Water District

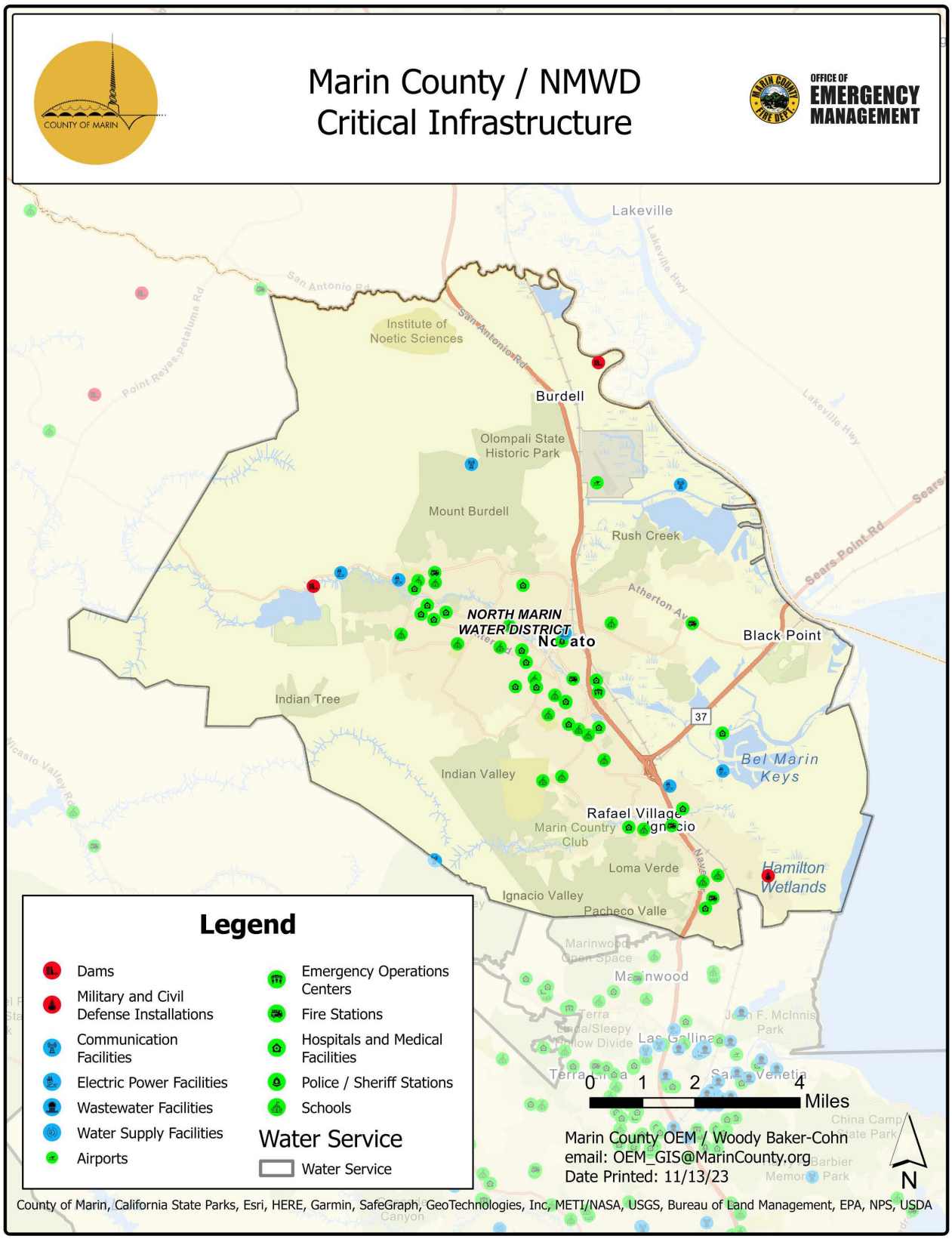


Figure 359: North Marin Water District Critical Facilities
Source: Marin County OEM

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The North Marin Water District identified hazards that affect the District and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 15 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

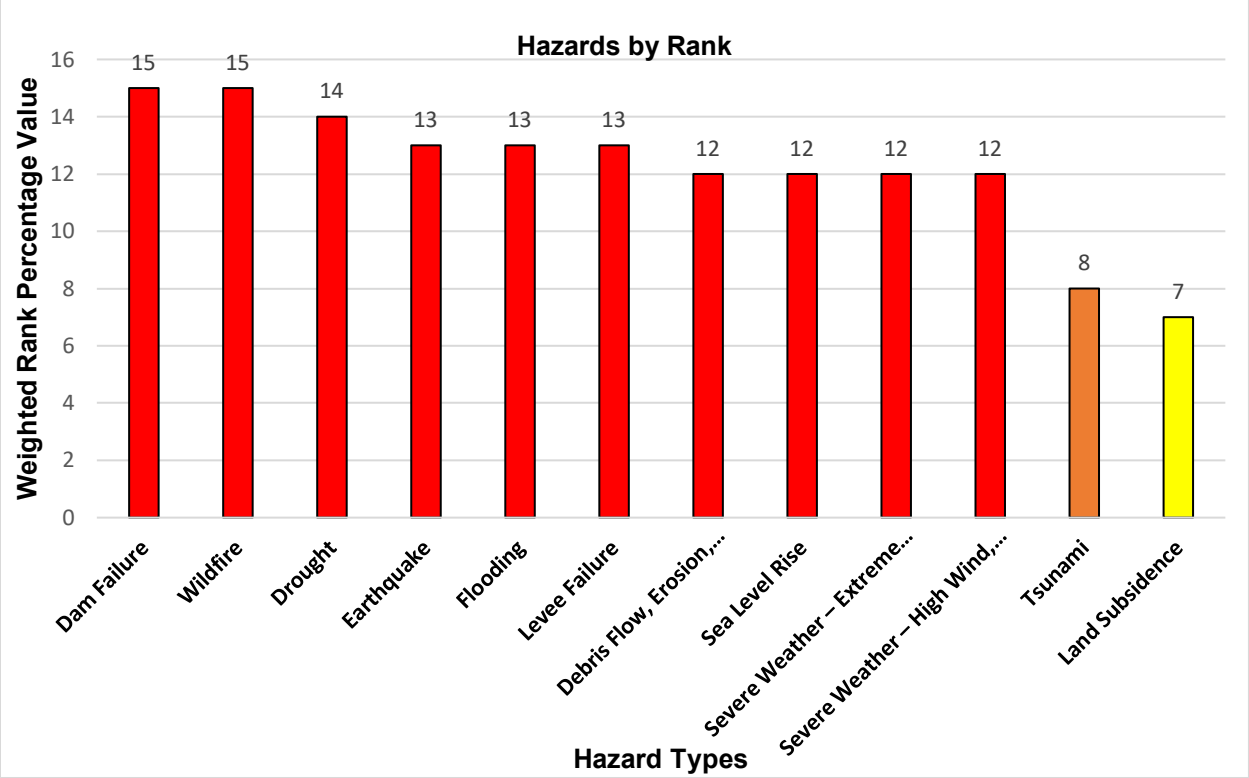


Figure 360: NMWD Risk Assessment – Planning Team Top Hazards

Figure 16: Risk Rank Categorization	
Risk Level	Risk Numerical Score
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 361: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 11: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 181: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

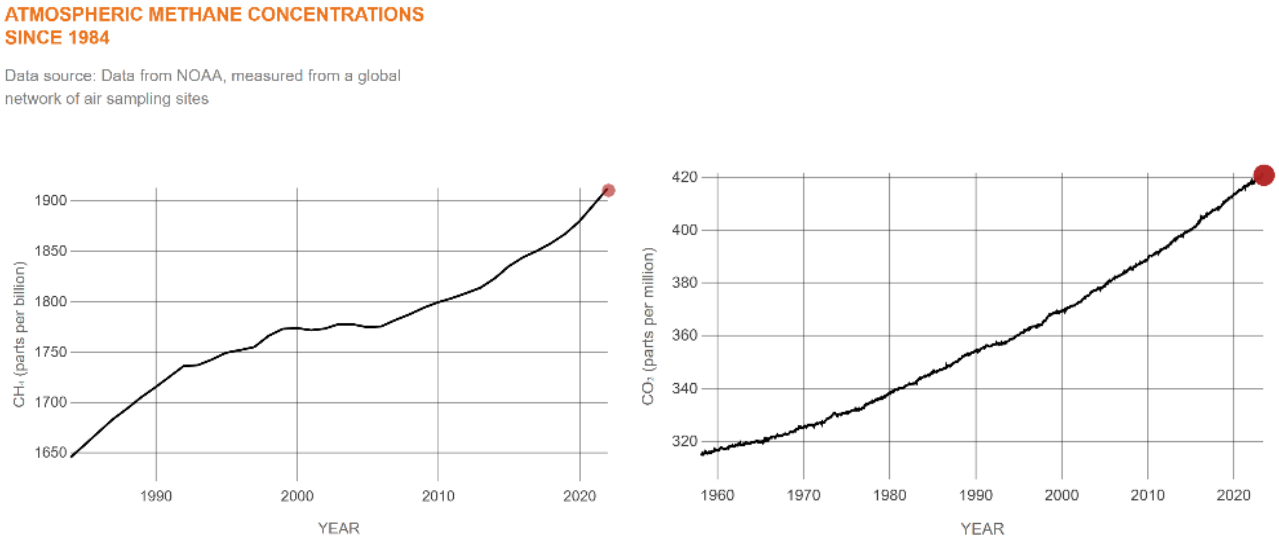


Figure 362: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

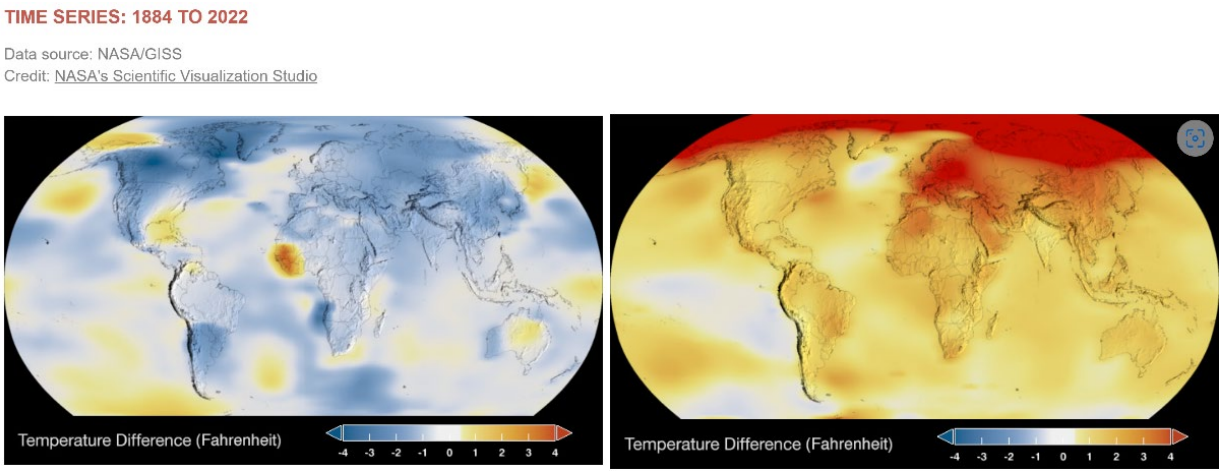


Figure 363: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.

- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

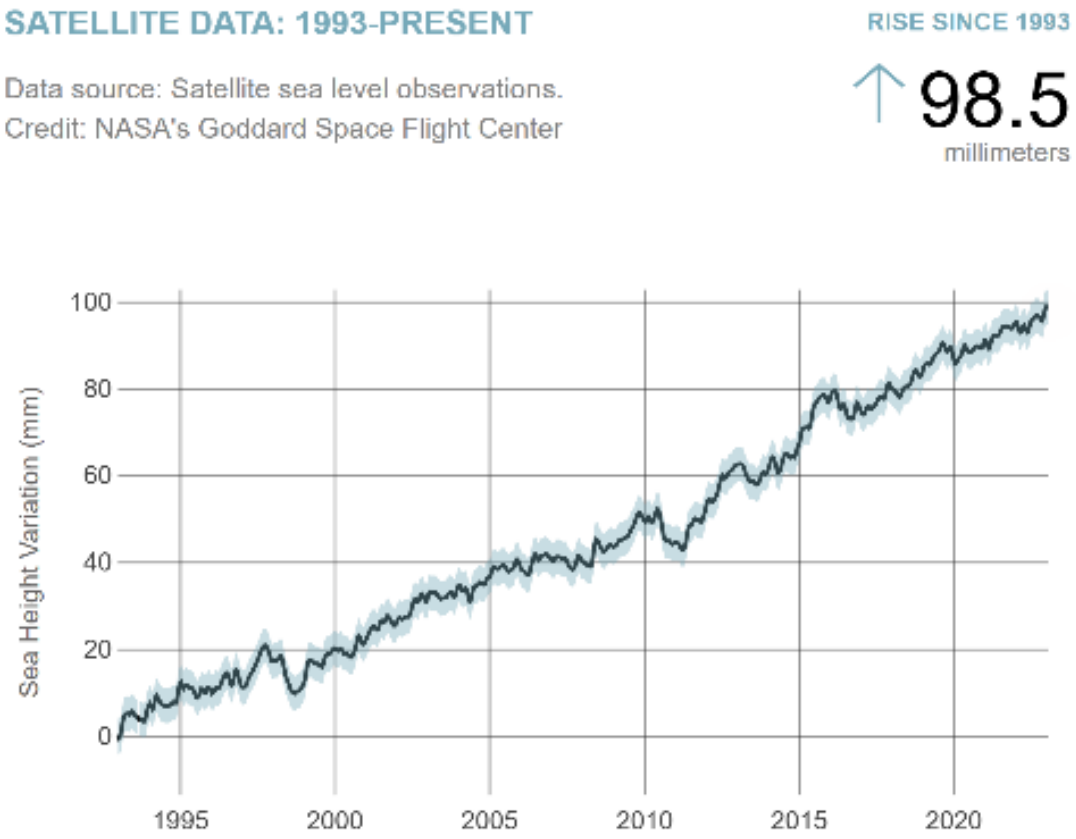


Figure 364: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, increased intensity of rain fall may occur and may become more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California

Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.

- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

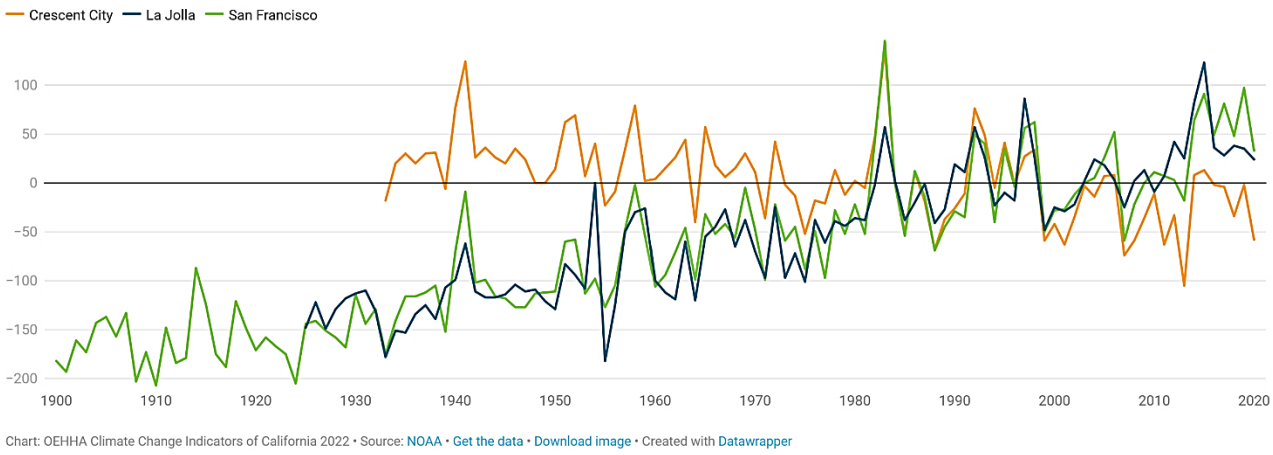


Figure 365: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the North Marin Water District as per the planning team.

Table 12: NMWD Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Extensive	Extreme	High	High	**15.00**
Debris Flow	Occasional	Significant	Moderate	High	Medium	**12.00**
Drought	Occasional	Extensive	Severe	High	Medium	**14.00**
Earthquake	Occasional	Extensive	Extreme	Low	Medium	**13.00**
Flooding	Occasional	Significant	Severe	High	Medium	**13.00**
Land Subsidence (Sinkhole)	Occasional	Negligible	Moderate	Medium	None	**7.00**
Levee Failure	Unlikely	Significant	Extreme	High	Medium	**13.00**
Sea Level Rise	Occasional	Significant	Moderate	High	Medium	**12.00**
Severe Weather – Extreme Heat	Likely	Extensive	Weak	Medium	Medium	**12.00**
Severe Weather – Wind, Tornado	Likely	Extensive	Weak	Medium	Medium	**12.00**
Tsunami	Unlikely	Negligible	Extreme	Low	Low	**8.00**
Wildfire	Occasional	Extensive	Extreme	Medium	High	**15.00**

Table 182: NMWD Hazard Risk Assessment
Source: North Marin Water District

Omitted Hazards

The North Marin Water District does not have any omitted hazards.

Table 13: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 183: County of Marin Hazard Risk Assessment
Source: Marin County

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design
- Improper maintenance

- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

Table 14 shows all the dams in Marin County that could impact the Marin County Operational Area.

Table 14: Dams in Marin County with Potential to Impact to the OA								
Dam Name/ Dam Number	**Hazard Class**	**Latitude**	**Longitude**	**Nearest City/ Distance**	**Population At Risk**	**Capacity (acre-feet)**	**Dam Height**	**Dam Owner**
Alpine 33-0	**High**	37.94	-122.64	Stinson Beach, CA 2.76 miles	10 - 100	8,892	143	Marin Municipal Water District
Big Rock Ranch 437-0	**High**	38.05	-122.63		> 1,000	91	45	Lucasfilm, LTD
Bon Tempe 33-6	**High**	37.96	-122.61	Fairfax, CA 2.49 miles	100 – 1,000	4,300	98	Marin Municipal Water District
Lagunitas 33-2	**Significant**	37.95	-122.60	Kentfield, CA 2.14 miles	100 – 1,000	341	48	Marin Municipal Water District
Novato Creek/ Stafford Lake 88-0	**Extremely High**	38.12	-122.64	Novato, CA 3.76 miles	10 - 100	140	76	North Marin County Water District
Peters 33-7	**High**	38.00	-122.70	Lagunitas, CA 1.00 miles	0	32,900	320	Marin Municipal Water District
Phoenix Lake 33-3	**High**	37.96	-122.58	Kentfield, CA 1.01 miles	10 - 100	612	90	Marin Municipal Water District
Seeger 33-8	**High**	38.08	-122.76		1 - 10	22,400	115	Marin Municipal Water District
Soulajule 33-9	**High**	38.15	-122.78	Inverness, CA 5.26 miles	1 - 10	10,700	122	Marin Municipal Water District
Vonsen 430-0	**High**	38.18	-122.68	Sheep Ranch 6 miles	10 - 100	70	35	Private Property

Table 184: Dams in Marin County with Potential to Impact to the OA
Source: CalOES DSOD

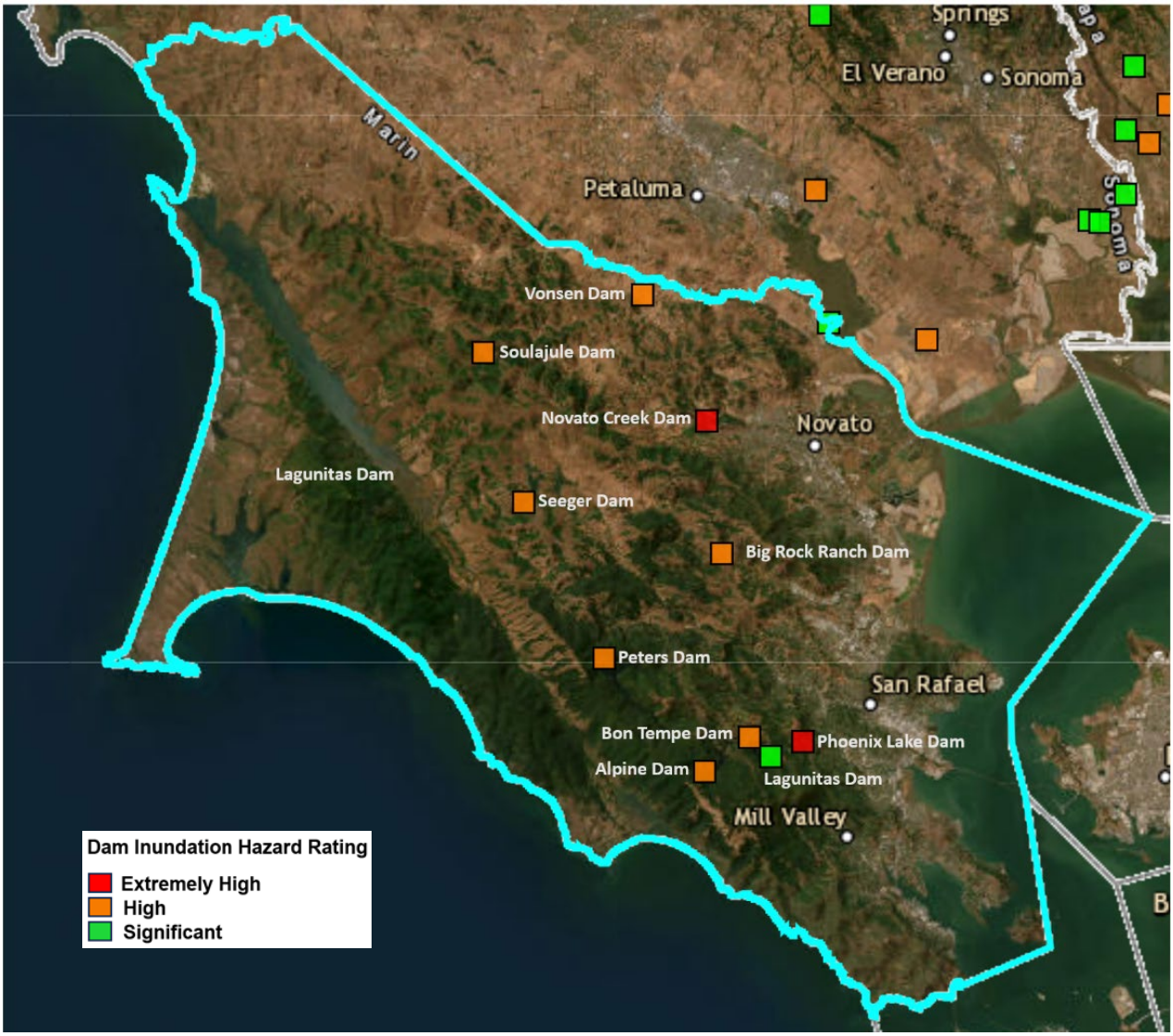


Figure 366: Dams in and around the Marin County OA
Source: Cal OES, Department of Water Resources, DSOD

Figure 22 illustrates the Dam Failure risk to Marin County.

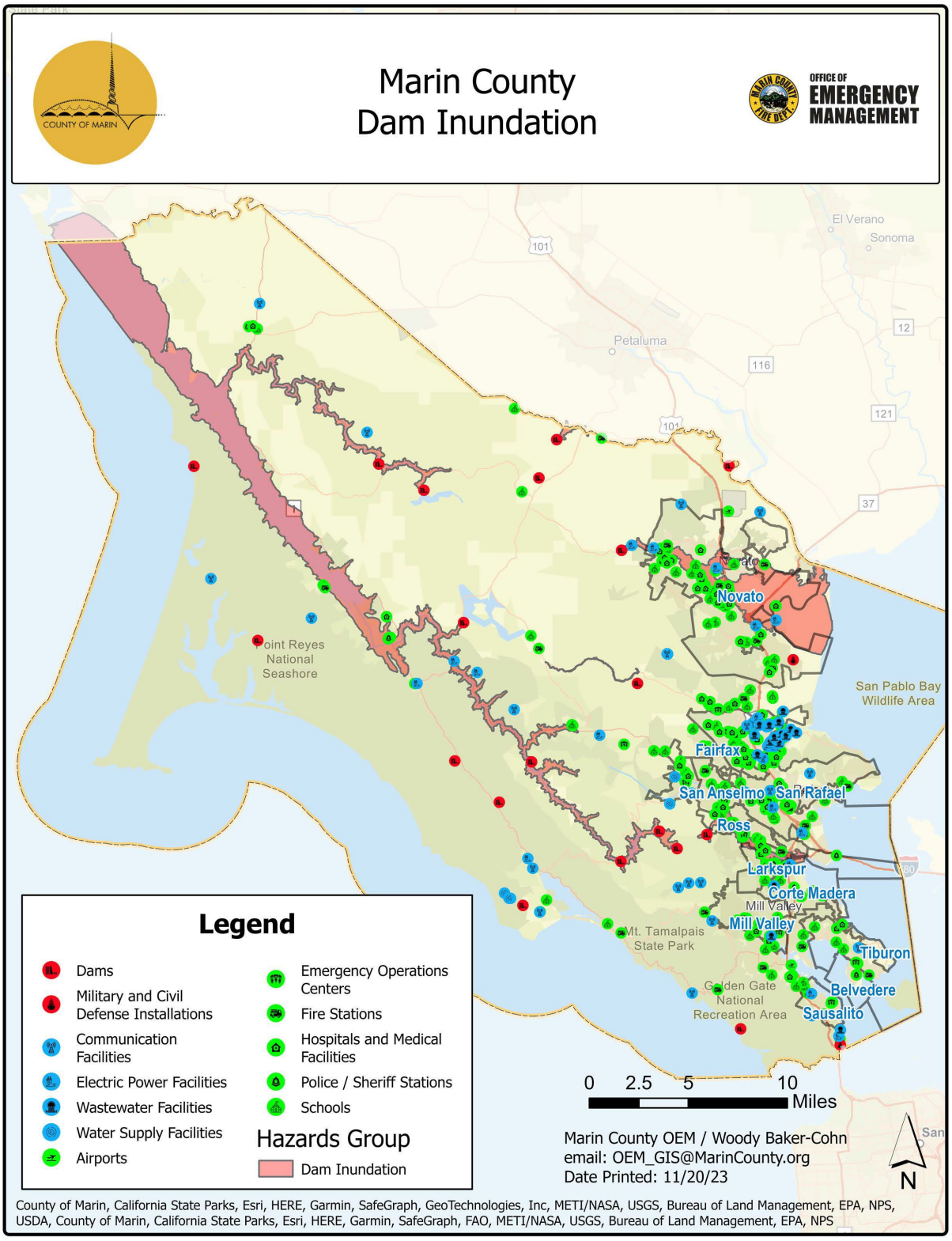


Figure 367: Marin County Dam Inundation Susceptibility to Critical Facilities
Source: Marin County OEM

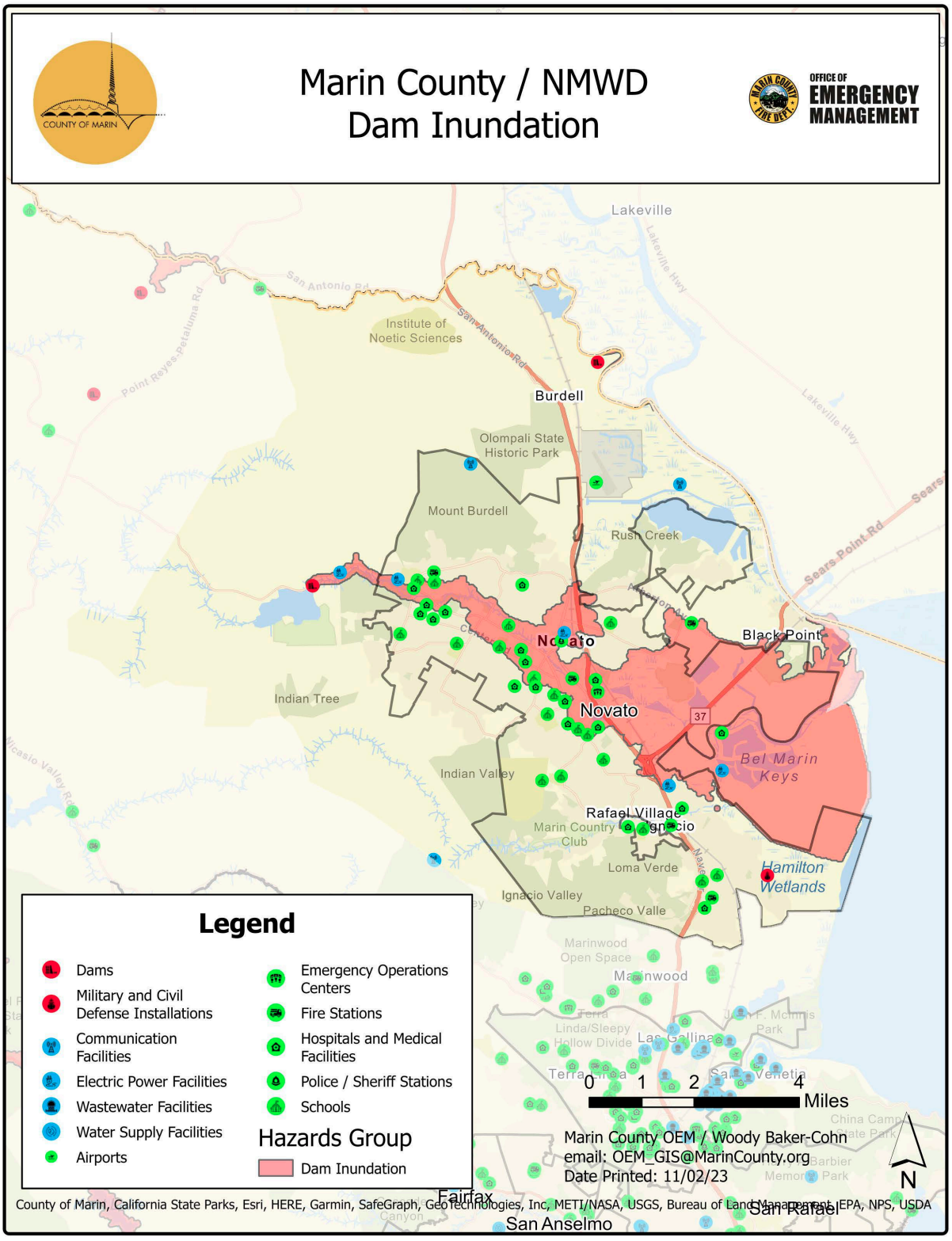


Figure 368: City of Novato Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

Novato Creek/ Stafford Dam

NMWD owns and operates Stafford Lake, Stafford Dam (DSOD Dam No. 88-0, National ID No. CA00321) and the associated treatment plant, which provides approximately 20% of Novato's water. The lake lies four miles west of downtown Novato and collects runoff from 8.3 square miles of watershed property located upstream at the upper tributary reaches of Novato Creek. Water from Stafford Lake is drawn by the intake tower and fed by gravity or by pumping (depending on the lake level) into the treatment plant located just below the dam.

In addition to providing water supply for domestic needs and firefighting purposes, Stafford Dam provides flood protection for the greater Novato area. The Marin County Flood Control and Water Conservation District has partnered with NMWD to share in the cost of obtaining additional flood liability insurance. Stafford Dam (also known as the Novato Creek Dam) is approximately 71 feet tall with a crest length of 650 feet, is classified as an Extremely High Hazard Dam based on its size and potential for loss of life and property should the dam fail.

Failure of the Novato Creek/Stafford Lake Dam with Stafford Lake at full capacity would affect an area that extends approximately five miles down Novato Creek through parts of the unincorporated County and the City of Novato to San Pablo Bay at Bel Marin Keys.

Figure 369: City of Novato - Nonato Creek Dam Inundation Impact
Source: California Department of Water Resources, DSOD

Stafford Lake has capacity of 4,287-acre feet of water that would cascade down Novato Creek through the unincorporated County into the City of Novato and Bel Marin Keys in the unincorporated County before emptying into San Pablo Bay in the event of a sunny-day dam failure. Parts of Ohair Park in the unincorporated County adjacent to the dam and along Novato Creek could be immediately inundated with up to ten feet of water. Novato is approximately 5,000 feet from the dam (see Figure 25). In up to two hours, water would overtop Novato Creek and could extend up to 500 feet on both sides of the creek, potentially inundating dozens of homes, part of the PG&E substation at Stafford, and part of San Marin High School and San Ramon Elementary School in up to ten feet of water in some areas. In two to five hours, water would continue overtopping Novato Creek extending down Novato Boulevard up to 1,000 feet of both sides of the road to the intersection of Diablo Avenue. Hundreds of homes, numerous commercial businesses and medical facilities, the Lu Sutton Elementary School and Our Lady of Loretto Elementary School lie in this area and could be inundated in up to eight feet of water. In the same amount of time, water would continue overtopping Novato Creek to the City boundary. This area includes most of the downtown commercial core of Novato where hundreds of homes, dozens of businesses and shopping centers, numerous medical facilities, the City of Novato Police Department and Town Hall, the Novato Fire Protection District Headquarters and primary Emergency Operations Center for the City, the Novato Fire Protection District #61, Lynwood Elementary School, Hill Middle School, the Marin Christian Academy and the PG&E substation at Novato could be inundated in up to ten feet of water in some areas. Water would also spread northward along Redwood Boulevard into North Novato in two to five hours where flood depths could be deepest, inundating dozens of homes and parts of Old Town in over ten feet of water in some places. The entire inundation area covers numerous major roads and highways in the City including Highway 101, Novato Boulevard and Redwood Boulevard which could hamper ingress and egress throughout much of central Novato. After passing through Novato, floodwaters could reach the Novato RV Park in approximately two hours and some businesses and the Novato Fire Protection District Station 62 along Atherton Avenue in the Green Point area in approximately ten to fifteen hours, inundating them in over ten feet of water. Floodwaters could reach Bel Marin Keys in ten to fifteen hours. While most homes in Bel Marin Keys should be protected from floodwaters, some homes could be flooded up to several feet. Parts of Bel Marin Keys Boulevard could become flooded in several feet of water, possibly turning Bel Marin Keys into an island temporarily. A PG&E substation at Hamilton Wetlands along with the Bel Marin Gardens Hospital could be inundated with several feet of water.

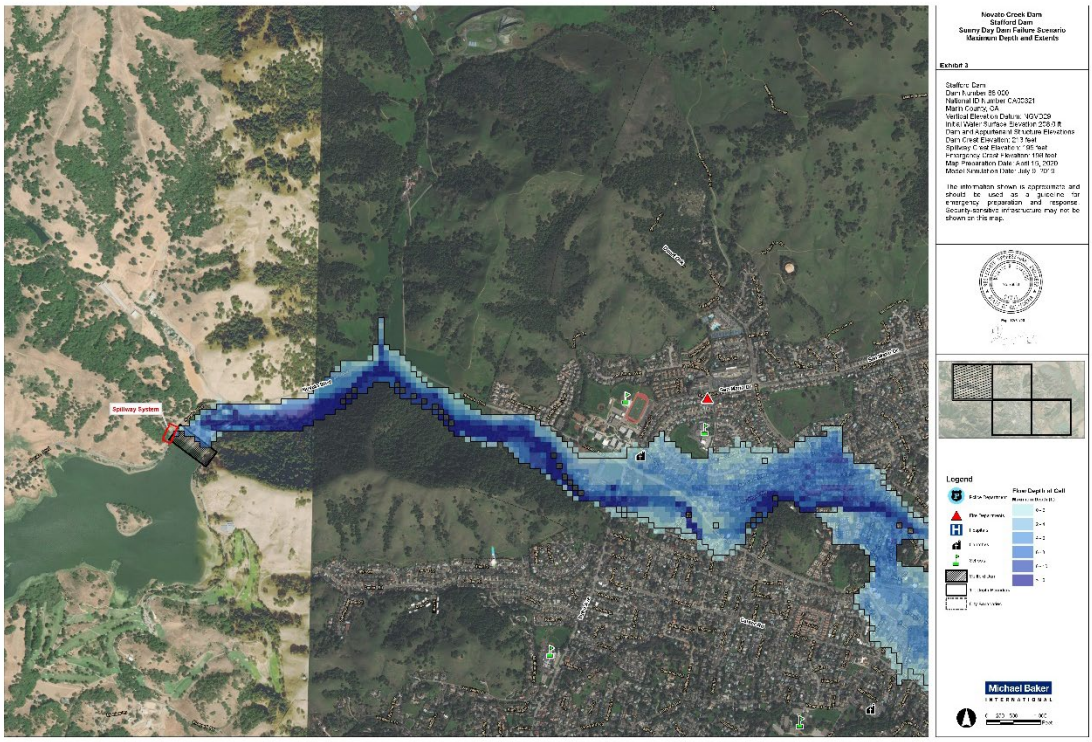


Figure 370: City of Novato - Novato Creek Dam Inundation Impact – West Novato
Source: California Department of Water Resources, DSOD

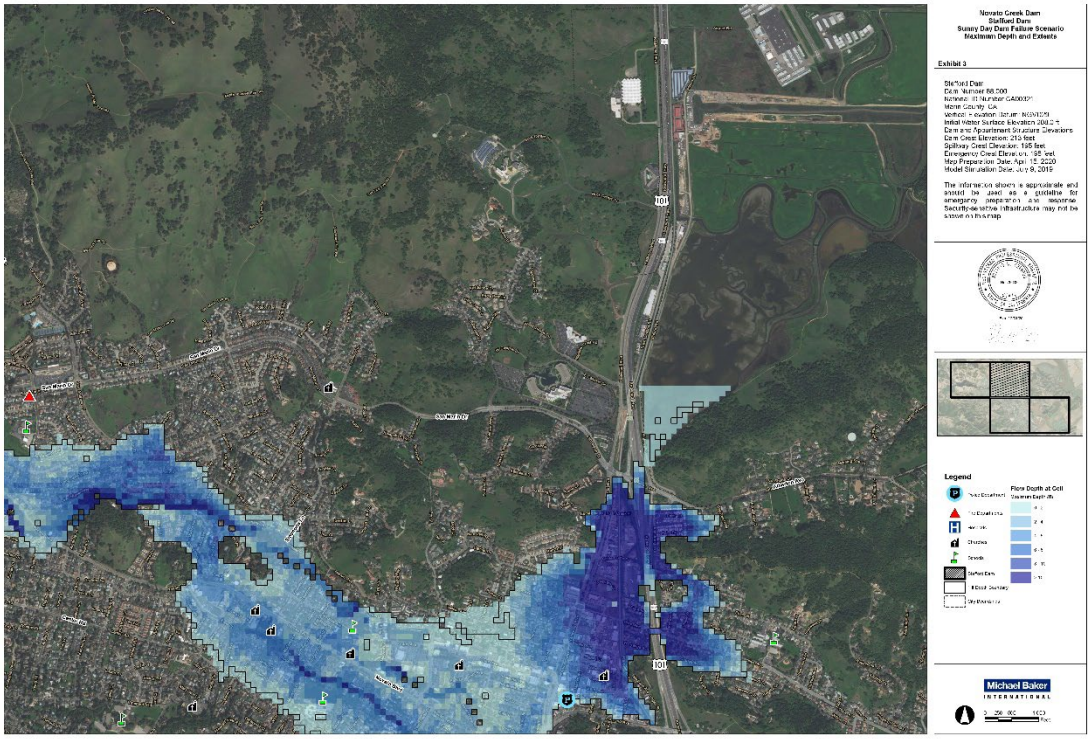


Figure 371: City of Novato - Novato Creek Dam Inundation Impact – North Novato
Source: California Department of Water Resources, DSOD

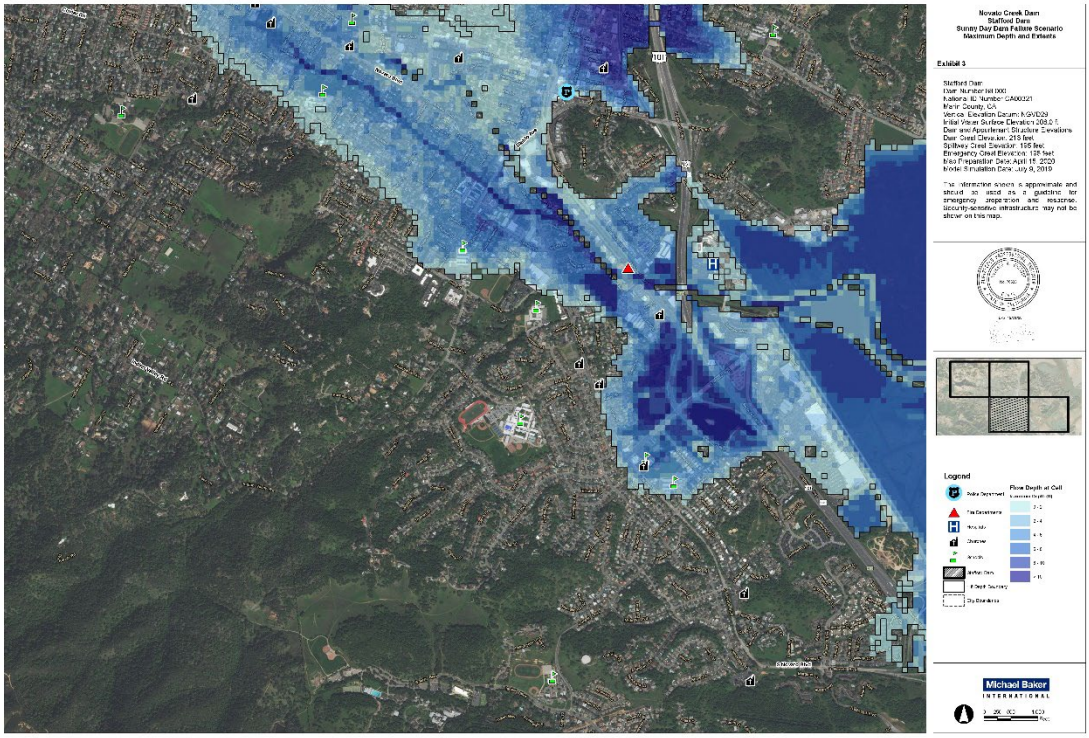


Figure 372: City of Novato - Novato Creek Dam Inundation Impact – Central Novato
Source: California Department of Water Resources, DSOD

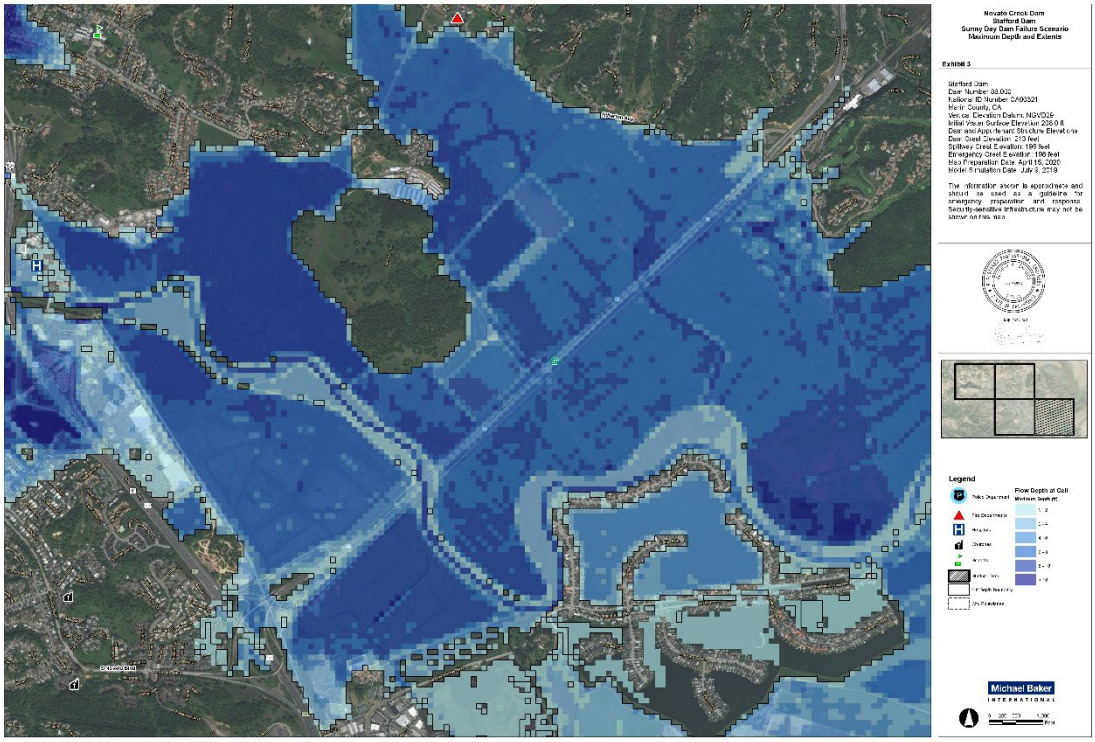


Figure 373: City of Novato - Novato Creek Dam Inundation Impact – East Novato
Source: California Department of Water Resources, DSOD

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Phoenix Lake Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of the NMWD. Future development along Novato Creek and in the lowland areas of Novato and around the unincorporated communities of Bel Marin Keys and Black Point-Grenn Point could expose additional people and structures to risk of a dam failure.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes

and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 29 shows landslide susceptibility classes.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

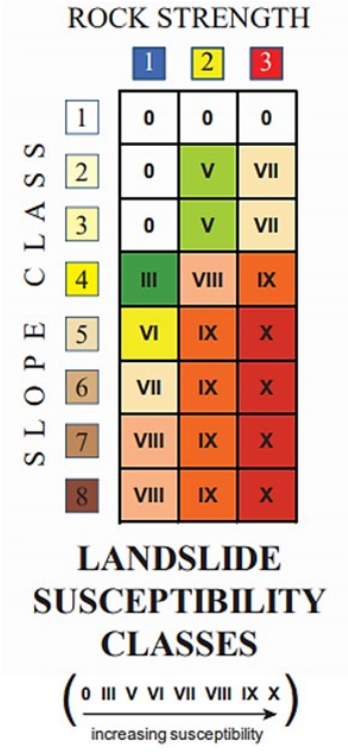


Figure 374: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a

movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 30 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

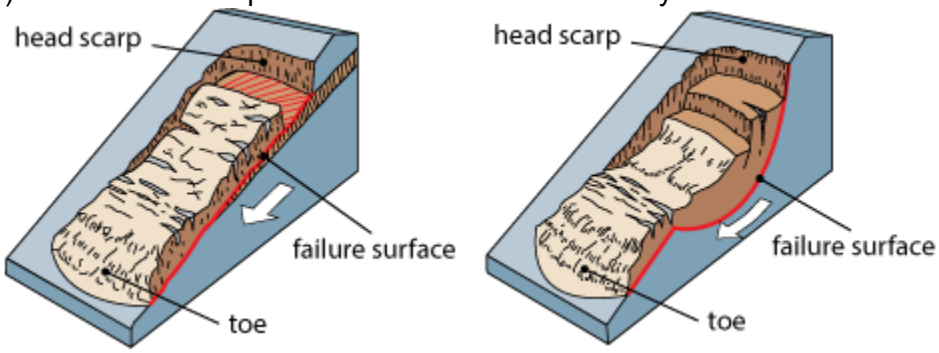


Figure 375: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation.
- Areas where landslides have occurred before.
- Steep slopes and areas at the bottom of slopes or canyons.
- Slopes that have been altered for construction of buildings and roads.
- Channels along streams and rivers.
- Areas where surface runoff is directed.

A landslide in the NMWD service area would likely occur in steeper terrain areas due to higher susceptibility of hill-side slope material movement. These areas in the district include the northern and southern sides of the City of Novato and the unincorporated communities of Indian Valley, Loma Verde and Black Point-Green Point where the terrain is steeper and is more susceptible to movement of soil. These areas are primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. Residences in or on the fringes of open space areas including the Mount Burdell Open Space Preserve, Miwok Park, Cherry Hill, South Marin Park, the Indian Valley Preserve, the Rush Creek Open Space Preserve and Novato Heights have moderate to high susceptibility to a landslide. There are hundreds of residences in these areas. Of particular concern are

communities in southern Novato south of Novato Boulevard. A landslide impacting Ignacio Boulevard and/or Sunset Parkway could impact ingress and egress into communities in this area that are at high susceptibility of a landslide. Highway 101 also has high landslide susceptibility in this area near Pacheco Hill, and a landslide on the highway could cause significant transportation challenges that could impact the city. The College of Marin-Indian Valley Campus, the Loma Verde Elementary School, the Novato Station #65, the Good Shepherd Lutheran School, Novato High School and the Olive Elementary School all lie in areas of moderate to high landslide susceptibility. The main commercial areas of the city, including the downtown area, have little to no landslide susceptibility. The unincorporated community of Indian Valley has hundreds of homes that have moderate to high susceptibility of a landslide and could be vulnerable to a debris flow from any of the creeks that originate in the mountains. The western side of the Black Point-Green Point area has high landslide susceptibility while the eastern side is more moderately susceptible with pockets of high susceptibility. The entire area is primarily residential and hundreds of homes along with a school have some vulnerability to landslides.

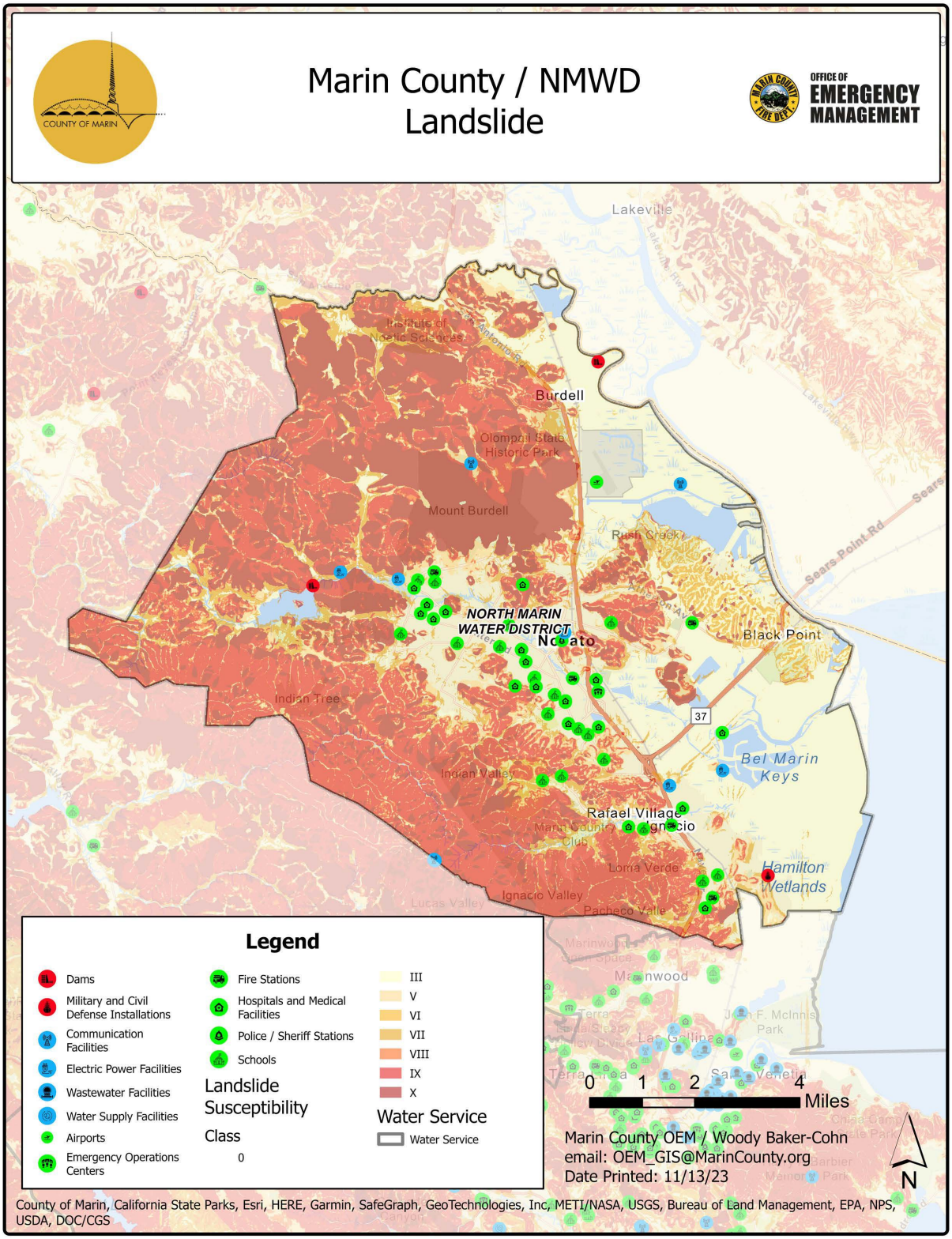


Figure 376: NMWD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

An earthquake has the potential to cause landslides throughout areas of landslide susceptibility. A wildfire and subsequent rain event could cause a landslide in any of the open spaces in and surrounding Novato, including in the Mount Burdell Open Space Preserve, Ohair Park, the Verissimo Hills Preserve, the Indian Tree Open Space Preserve, the Indian Valley Preserve, the Ignacio Valley Preserve, the Loma Verde Preserve and the Rush Creek Open Space Preserve. A debris flow down Novato Creek could impact the city with mud and water that damage bridges and other infrastructure.

Landslides, mudslides, and debris flows can move fast enough to damage or destroy homes or other structures in their path, block roadways (including evacuation routes), and injure or kill people caught in them. Marin County OA populations that are most vulnerable to the effects of landslides, debris flows, and post-fire debris flows include:

- Low-income households
- Households in poverty
- Renters
- Persons living in mobile homes
- Persons living on single access roads
- Persons without access to transportation or telecommunications
- Outdoor workers
- Houseless population
- Persons with disabilities

The most vulnerable populations are those that may be unable to evacuate due to limited mobility, lack of access to a vehicle, or language barriers that may prevent awareness of emergency notifications. Those living on single-access roadways in the hilly areas of the County or those living in less resilient housing may lose access to their homes if roadways or the structures are damaged or destroyed by a landslide.

NMWD maintains and operates approximately 340 miles of pipeline, 42 tanks totaling over 37 million gallons of storage, and associated pump stations, hydropneumatic systems, and regulator valves. NMWD evaluates water supply and consumer consumption on a 5-year cycle via its Urban Water Management Plan (UWMP) and associated Water Shortage Contingency Plan (WSCP) in accordance with state Department of Water Resources (DWR) guidelines and requirements.

On 03/21/23, heavy rains caused a mudslide in Novato severely damaged and buckled a 100-foot section of Redwood Blvd. adjacent State Highway 101, forcing the closure of a nearby state park. The mudslide damaged a section of the NMWD potable water transmission main that is located below the frontage road of Redwood Boulevard, in the area of the mudslide.

Figure 377: Mudflow damage to Redwood Blvd. March 21, 2023
Source: Olompali State Historic Park

12/31/2005 - A mudslide came down on Pacheco Creek Drive, depositing over 2,000 cubic yards of mud and damaging several homes. Novato declared a state of emergency. Nobody was hurt, but mud poured into each home, forcing the residents to evacuate.

2/27/2017 – Heavy rain caused a landslide at Miwok Park along the southeast side of Novato Creek, destroying about 100 feet of a trail that connects the neighborhoods east and west of Miwok Park.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[24], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of the NMWD including the City of Novato and the unincorporated communities of Indian Valley, Loma Verde and Black Point-Green Point that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in NMWD could be susceptible to post-fire debris flows. This includes areas along Novato Creek, Arroyo San Jose and south of the Mount Burdell Open Space Preserve. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

[24] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.

Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in the NMWD and have a profound effect on the delivery of potable water to the 62,655 population served by the district. Drought can reduce the available water in the Novato Creek/Stafford Lake Dam and other areas of the district reducing the available supply potable water to customers , which will also reduce revenue for the district which is used to operate the water delivery systems to these customers.

West Marin Water consumption was down 25% from the prior fiscal year. The $136,000 net loss compares to a budgeted net income of $165,000 and to a net loss of $8,000 from the prior fiscal year. NMWD evaluates water supply and consumer consumption on a 5-year cycle via its Urban Water Management Plan (UWMP) and associated Water Shortage Contingency Plan (WSCP) in accordance with state Department of Water Resources (DWR) guidelines and requirements.

Drought conditions throughout the District would also be felt in the mountainous areas where the risk of wildfire would increase, including in the City of Novato and in the unincorporated County communities of Indian Valley, Loma Verde and Black Point-Green Point. The wetland areas of Novato and the unincorporated Black Point-Green Point area, particularly the marshlands along San Francisco Bay, could become drier during prolonged period of drought and experience marshland fires that could impact local businesses and residences in the area. Dry trees in public spaces like Novato's City Park can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including NMWD may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the NMWD, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around NMWD. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including the NMWD service area in the unincorporated County and City of Novato where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of the NMWD, including in the unincorporated County and the City of Novato, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of NMWD could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including NMWD can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 33).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 378: Modified Mercalli Intensity Scale
Source: USGS

Figure 34 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 379: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 35). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 380: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around the NMWD, including the unincorporated County and the City of Novato, due to the number of active faults within and near Marin County. The NMWD is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts on the infrastructure of the district.

NMWD maintains and operates approximately 340 miles of pipeline, 42 tanks totaling over 37 million gallons of storage, and associated pump stations, hydropneumatic systems, and regulator valves.

There is increased risk of shaking and liquefaction in the district from an earthquake, particularly in the central and eastern lowland areas where superficial deposits and fill are more prevalent.

Earthquake Shake Intensity

The colors on Figures 36 and 37 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

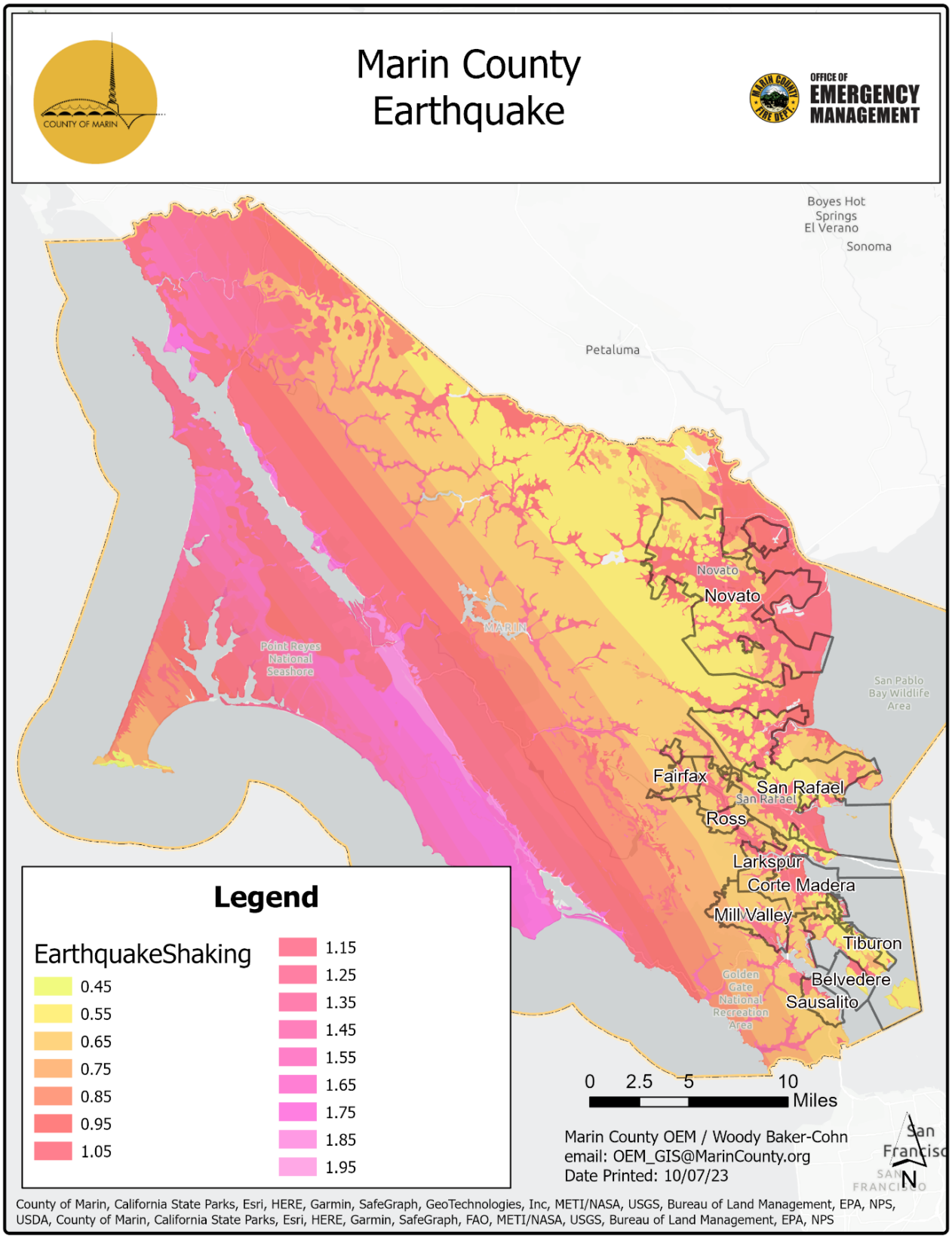


Figure 381: Marin County Earthquake Impact
Source: Marin County OEM

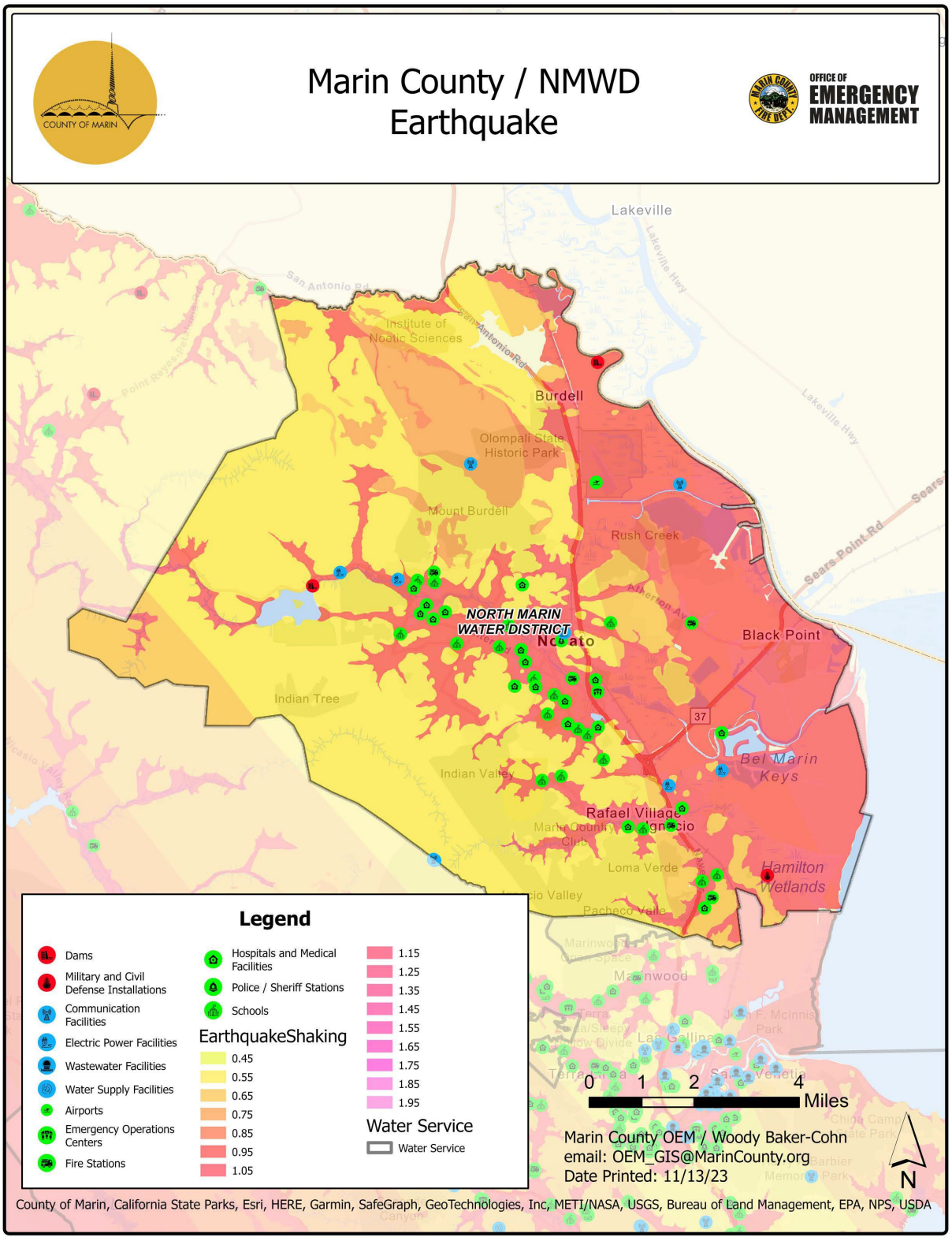


Figure 382: NMWD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point. There is increased risk of shaking and liquefaction in these areas from an earthquake, including in the central and eastern lowland areas of Novato and in the unincorporated communities of Bel Marin Keys and Black Point-Green Point where superficial deposits and fill are more prevalent. This area of Novato includes the primary commercial area of the city along the Highway 101 corridor, and numerous residential neighborhoods and commercial areas with schools and other critical facilities. All of the City's critical facilities with the exception of the Novato Fire Station #63 lie in an area of moderate earthquake shaking potential. The PG&E Substation at Hamilton Wetlands and the Novato Fire Station #62 in the unincorporated County also lie in an area of moderate earthquake shaking potential. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the city and the unincorporated county in the NMWD could be impacted by an earthquake. Earthquakes could also cause landslides in the western areas of Novato with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Marin County, including the Novato area, was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Novato.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including NMWD, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[25], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including NMWD. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the areas of the NMWD service area in the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps,

[25] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2% chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs because of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 38.

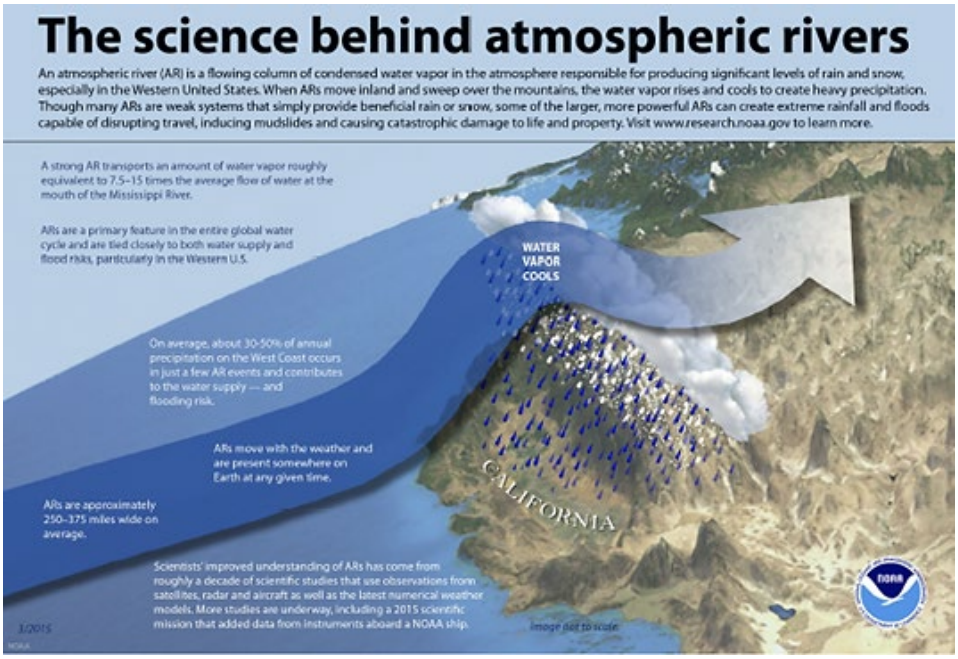


Figure 383: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and

stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the stormdrains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in the NMWD, including in the unincorporated County and the City of Novato, generally results from a combination of high tides from San Pablo Bay and creek flooding from Novato Creek in low-lying areas. Most of the lowland areas in the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point are in the 100-year floodplain, with several areas in the 500-year floodplain.

The 100-year floodplain extends mostly along Novato Creek from Stafford Lake to San Pablo Bay, including a large area along Novato Boulevard for approximately two miles where hundreds of homes, numerous commercial buildings and shopping plazas, several medical facilities, Our Lady of Loretto School and Lynwood Elementary School could be susceptible to flooding. The 100-year floodplain also extends along some of the smaller tributaries in the City include parts of Warner Creek, Vineyard Creek, Wilson Creek, Arroyo Avichi Creek and Rush Creek. There are dozens of residences along these creeks that could be susceptible to flooding. The 100-year floodplain along Vineyard Creek extends through the middle of Sinaloa Middle School and the 100-year floodplain along Arroyo Avichi Creek runs along the edge of the Rancho Elementary School. Other areas with high flood danger include Ignacio and Arroyo San Jose, as well as the Bahia area. The area around Scottsdale Pond that includes a section of Highway 101 and the area north of Bel Marin Keys that includes several miles of State Route (SR) 37 lie in the 100-year floodplain and could be susceptible to flooding, which could cause transportation challenges for the city. The 500-year floodplain also follows Novato Creek for its length through most of the city and is interspersed with the 100-year floodplain. A large section of the 500-year floodplain lies north of downtown and extends along a mile of Redwood Boulevard, including the SMART railroad tracks which could be susceptible to flooding. The 500-year floodplain in Novato includes hundreds of homes, numerous commercial buildings and shopping plazas, Novato Fire Station #1, the PG&E substation at Novato and the Old Town area of downtown that could be susceptible to flooding. Most of downtown Novato, including the Novato Police Department and Novato City Hall, lie outside of the 100 and 500-year floodplains.

Part of the County Redwood Landfill and all of the Marin County airport, including the access road, lie in the 100-year floodplain and could be susceptible to flooding. This area is mostly marshland that could experience coastal flooding. Most of the Green Point-Black Point area lies outside the 100-year floodplain though there are several homes in the Black Point area near marshland that lie in the 100-year floodplain and could be susceptible to flooding.

Numerous homes in Bel Marin Keys and sections of Bel Marin Keys Boulevard lie in the 100-year floodplain and could be susceptible to flooding. A flooding event could affect ingress and egress to Bel Marin Keys.

San Antonio Creek forms part of the boundary between Marin and Sonoma Counties from the area around Chileno Valley Road east to the Petaluma River and there are several homes along it that lie in the 100-year floodplain and that could be susceptible to flooding. There are also several road bridges that cross the creek in the 100-year floodplain and that could be susceptible to flooding.

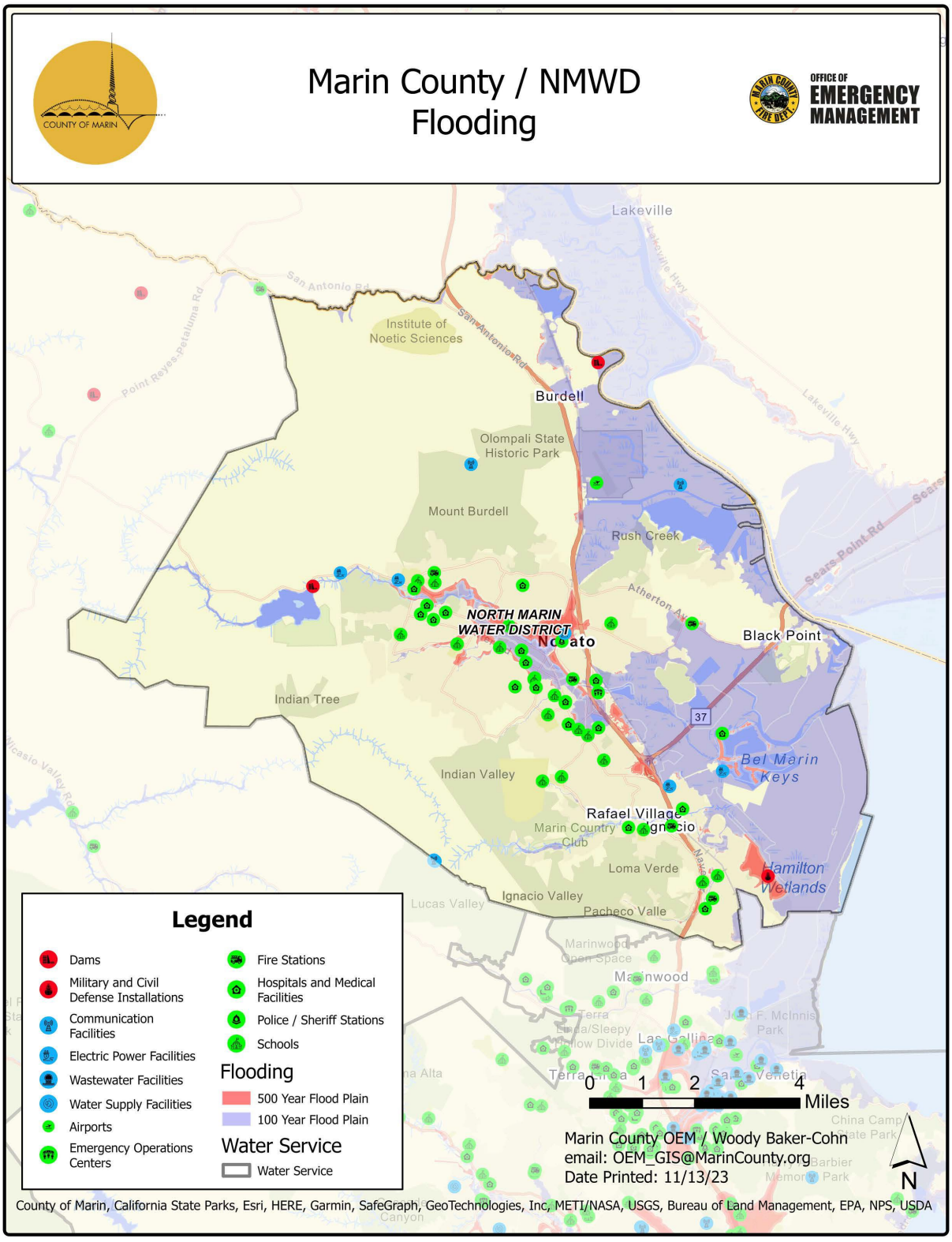


Figure 384: NMWD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 15 shows the number of North Marin Water District critical facilities by flood zone.

Table 15: NMWD Critical Facilities by Flood Zone			
Category	Name	Address	Flood Zone
Critical Facilities			
District Building	NMWD Headquarters: Administration, Laboratory, and Corporation Yard	999 Rush Creek Place Novato, CA 94945	500-year flood plain (Zone X)
District Building	Stafford Water Treatment Plant	3500 Novato Blvd. Novato, CA 94945	n/a
District Building	Point Reyes Water Treatment Plant	101 Commodore Webster Dr. Point Reyes Station, CA 94956	100-year flood plain (Zone AE)
High Potential Loss Facilities			
DAM	Novato Creek Dam	3500 Novato Blvd. Novato, CA 94945	n/a
Critical Infrastructure			
Water	North Marin Aqueduct, 30"-42" water transmission pipeline	Linear utility –generally paralleling US 101	n/a
Water	San Marin Pump Station	APN 125-411-25	n/a
Water	Lynwood Pump Station	Intersection of S. Novato Blvd & Sunset Parkway, Novato, CA 94945	n/a
Water	Cherry Hill Pump Station	APN 143-421-33	n/a
Water	School Road Pump Station	Intersection of School Road & Sunset Trail, Novato, CA 94945	n/a
Water	Black Point @ Hwy 37 Regulating Station	Intersection of Harbor Drive & Hwy 37 Eastbound On-Ramp, Novato, CA 94945	AE
Water	Black Point @ Grandview Avenue Regulating Station	Intersection of Harbor Drive & Grandview Avenue, Novato, CA 94945	AE
Water	Coast Guard Wells (No. 2 & 4)	101 Commodore Webster Dr. Point Reyes Station, CA 94956	AE
Water	Gallagher Well No. 1	APN 119-050-12	AE
Water	Gallagher Well No. 2	APN 119-050-17	AE
Water	Olema Pump Station	APN 166-220-10	AE
Water	Bear Valley Pump Station	APN 166-350-10	n/a
Water	Inverness Park Pump Station	APN 114-294-33	n/a
Water	Paradise Ranch Estates Pump Station No. 1	APN 114-111-19	n/a
Water	Paradise Ranch Estates Pump Station No. 2	APN 114-100-89	n/a
Water	Paradise Ranch Estates Pump Station No. 3	APN 114-100-91	n/a
Water	Paradise Ranch Estates Tank No. 1	APN 114-111-19	n/a
Water	Paradise Ranch Estates Tank No. 2	APN 114-100-89	n/a
Wastewater	Tahiti Way Lift Station	APN 100-261-47	n/a
Wastewater	Oceana Marin Wastewater Storage and Treatment Ponds	APN 100-100-56	n/a

Table 185: North Marin Water District Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within San Pablo Bay have the potential to significantly impact the Novato storm drain system. Novato already sees flooding from king tides in San Pablo Bay and this is only expected to increase with sea level rise and climate change. A failure of the Stafford Lake/Novato Creek dam could contribute to flooding in the lowland areas the NMWD service area in the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point.

On 1/14/2023, a storm flooded SR-37 in Novato, including the U.S. 101 connector ramps. SR-37 had to close in both directions near Atherton Avenue for the weekend. The storm also flooded Armstrong Avenue.

On 2/14/2019, Novato police closed several streets and issued at least one shelter-in-place order in the City at Paper Mill Court due to flooding across the City in the midst of a severe winter storm. South Novato Boulevard between Nave and Lark courts, Simmons Lane from San Marin Drive to Lesse Lane and all of Commercial Boulevard were closed.

On 1/19/2019, a storm flooded the westbound lanes of SR-37 in Novato, causing a three-day partial closure of the road.

On 1/22/2017, a storm flooded three miles of SR-37 between Highway 101 and Atherton Avenue with five feet of water, closing it for three days.

On 12/11/2014, a storm flooded several neighborhoods in Novato, including on Garden Court and Chase Street. SR-37 flooded and the westbound lanes had to close.

On 12/31/2005-1/1/2005, a strong storm caused a mobile home park to flood with up to 4 feet of water, forcing the evacuation of about 100 stranded residents.

On 1/3-1/4/1982, torrential rains caused massive power outages, landslides, numerous injuries and over $14 million in damages throughout Novato. More than 9 inches of rain fell in 36 hours causing water to rush over Stafford Dam, ultimately flooding neighborhoods and roadways including Grant Avenue, Center Road and Novato Boulevard. Flooding shut down the railroad for nearly a month. Novato was declared a disaster area and was soon followed by the largest cleanup effort in the city's history.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[26] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA

[26] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

including the NMWD. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including the NMWD will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of the NMWD. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of the NMWD would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development in the marshland area of the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point would expose additional people and infrastructure in the NMWD service area to flooding as marshlands act as a natural buffer to storm surge. Development along Novato Creek, Arroyo San Jose, and other creeks in Novato in the 100 and 500-year floodplain would expose more people, structures and infrastructure including major roads in the NMWD service area to creek flooding and storm surge from Novato Creek as a result of climate change.

2.2.6 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 40 for a picture and description of how dissolution sinkholes form.

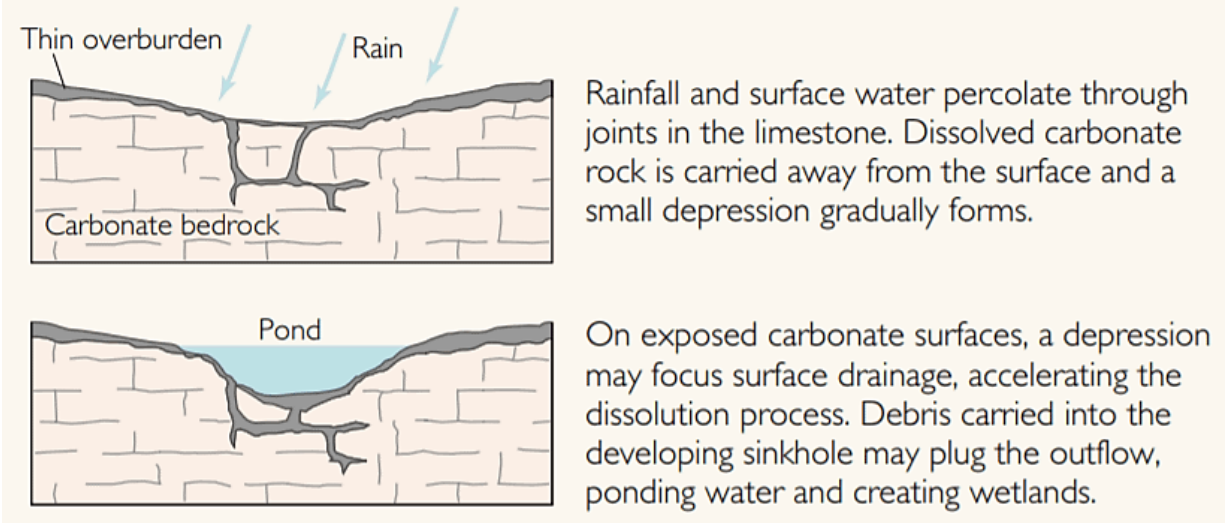


Figure 385: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 41 for a picture and description of how cover-subsidence sinkholes form.

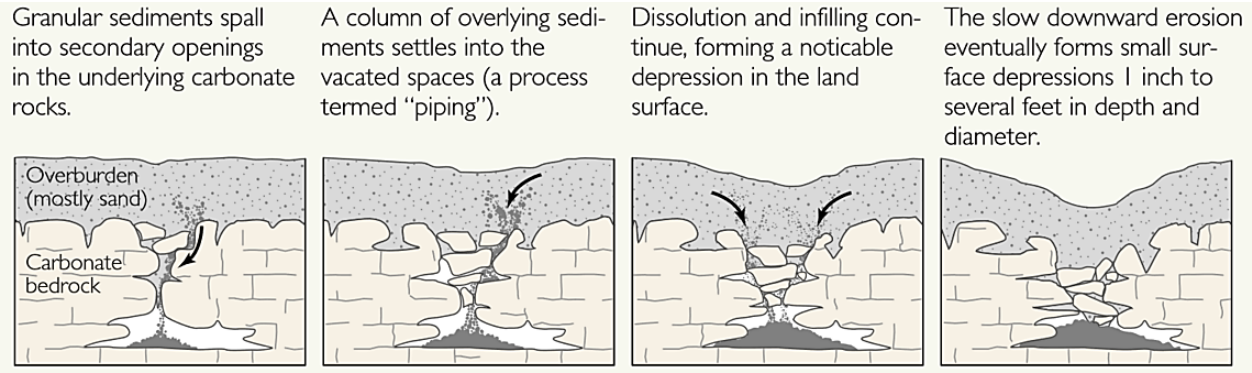


Figure 386: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 42 for a picture and description of how cover-collapse sinkholes form.

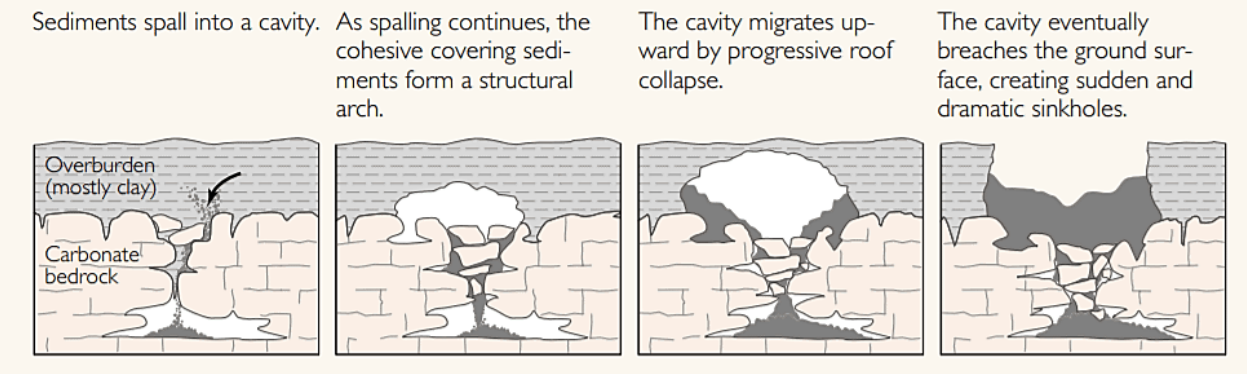


Figure 387: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

The areas of the Marin County OA most vulnerable to land subsidence are those underlain with the younger Holocene unconsolidated alluvial and colluvial sediments, and even more so the younger bay muds. In general, Marin County OA shoreline properties are the most exposed and vulnerable to subsidence. Land subsidence and sinkholes would most likely occur in the central and eastern lowland areas of the NMWD including the City of Novato and the unincorporated communities Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point where superficial deposits and fill are more prevalent. This includes the primary commercial area of the City of Novato along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Bel Marin Keys was built on bay fill and mud, and already experiences subsidence. Land subsidence could have numerous impacts for the district, including the settling of district facilities and infrastructure as well as the shifting of roadways and utility infrastructure that run through the district including in the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point. Transportation facilities along the OA's coastline are also vulnerable to subsidence. Increased subsidence could warp the buildings and runways at Marin County Airport in North Novato.

There have been no major sinkholes recorded in the district including the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point, though sinkholes have occurred in neighboring jurisdictions including San Anselmo and San Rafael.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including the NMWD, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of the NMWD as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in the NMWD could increase with future development in the lowland populated areas of the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point where land subsidence is more likely to occur.

2.2.7 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating

deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 43 shows a levee and the multiple ways it can fail.

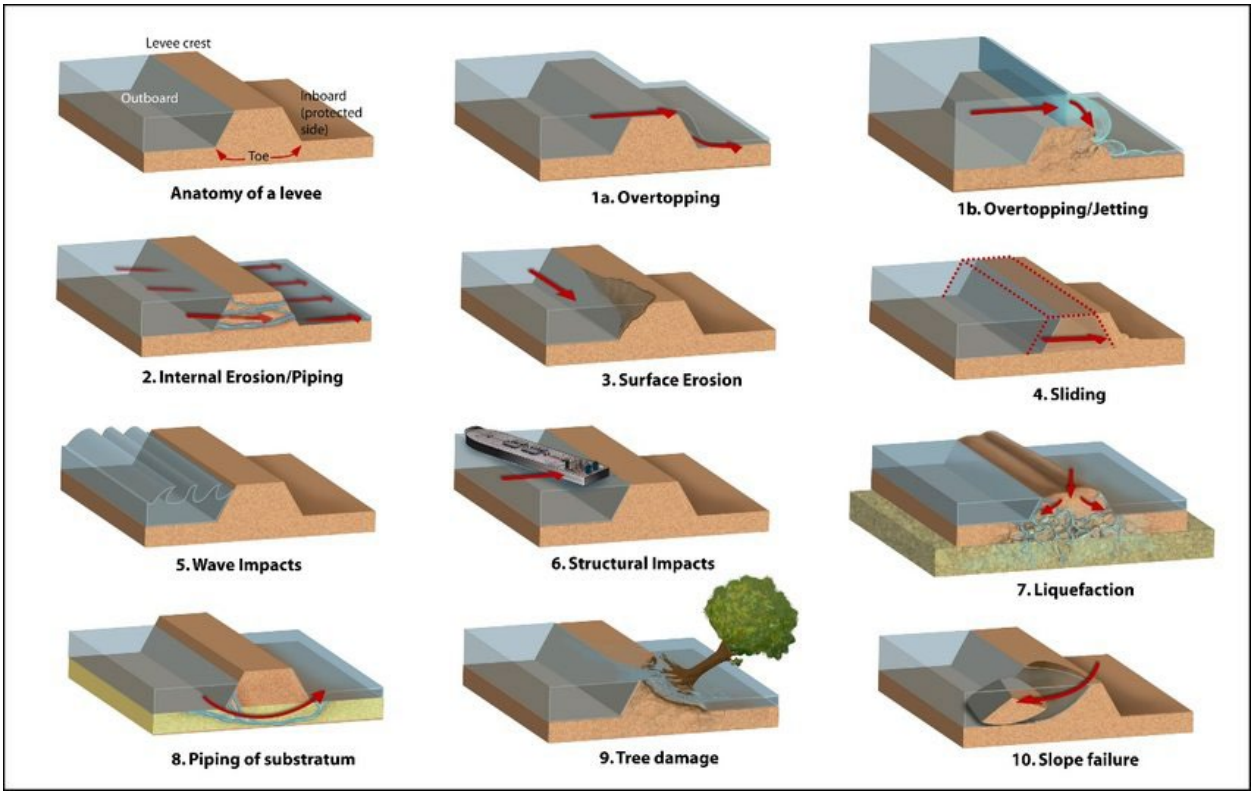


Figure 388: Levee Failure Mechanisms
Source: University of California

Levees are typically earthen embankments designed to contain, control, or divert the flow of water to provide some level of protection from flooding. No levee system provides full protection from all flooding events to the people and structures located behind it. Some level of flood risk exists in the levee- affected areas. Except for one levee system in Novato-Hamilton, none of the County's levees are FEMA-accredited. Many were built many decades ago (non-engineered) by farmers or developers and material may have been added over the years.

The NMWD service area, including the City of Novato and the unincorporated County are protected by several levee systems, as shown in Figure 44.

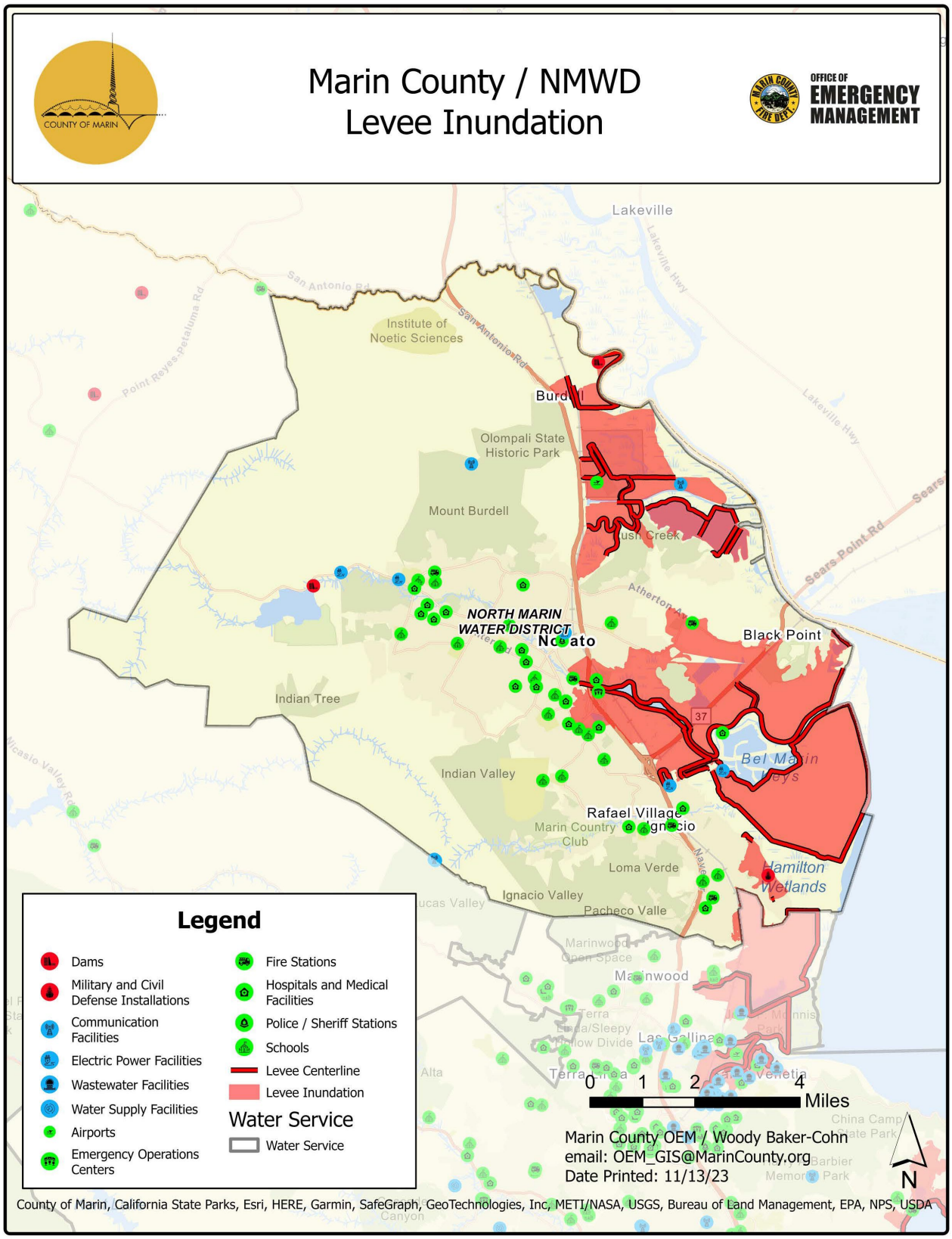


Figure 389: NMWD Levee Inundation Map
Source: Marin County OEM

Two levee systems are located around the Marin County Airport. The State Fish and Game Levee surrounds the Airport property and neighboring wetlands on three sides to the north, south, and east. The Gnoss Airport Levee consists of two sections that intersect the airport property. One section is 2.59 miles long with an undocumented height and the other section is 0.43 miles long with an undocumented height. Figures 45 and 46 show the levee systems and levee failure inundation areas around the Marin County Airport and North Marin.

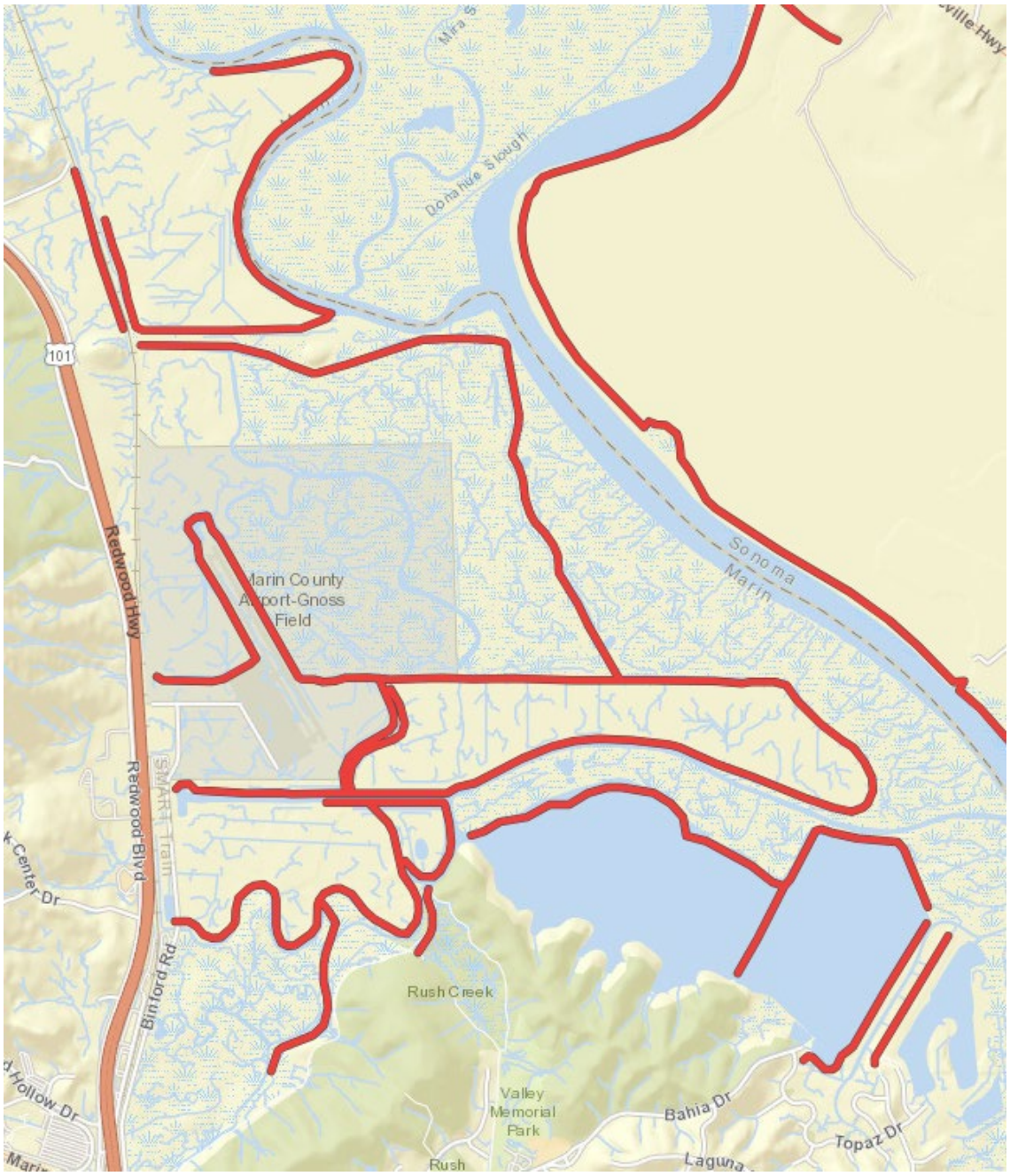


Figure 390: Levees Around the Marin County Airport
Source: U.S. Army Corps of Engineers

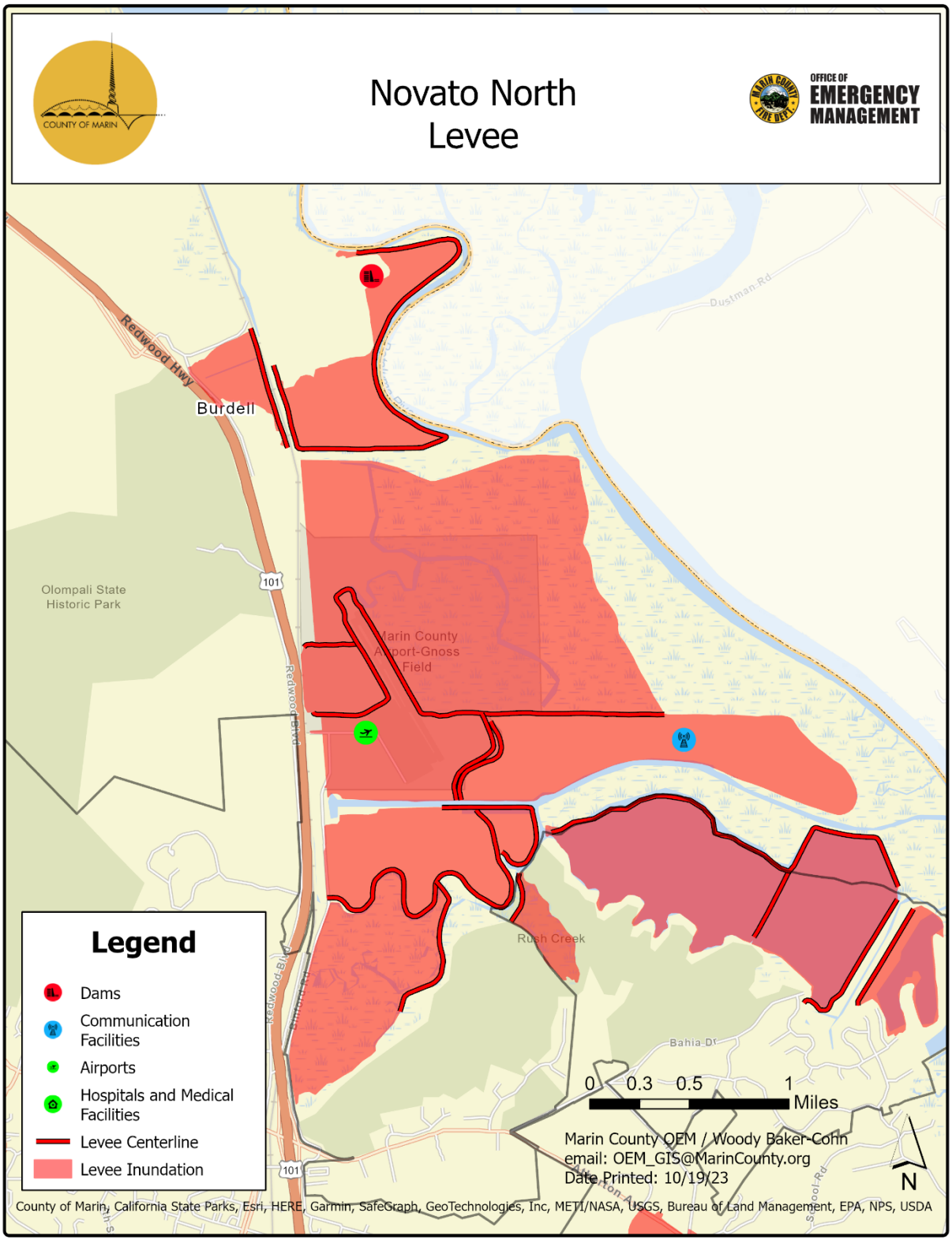


Figure 391: NMWD - Novato North Levee Inundation Map
Source: Marin County OEM

The City of Novato is protected by non-accredited levees along both sides of Novato Creek in the southern part of Novato near Bel Marin Key. The Novato Creek LB Upper Levee on the north side of the Creek is 2.11 miles long with no documented height. Approximately 1,468 people and 265 buildings with a property value of $361 million are at risk of a failure of the Novato Creek LB Upper Levee, including the Novato Community Hospital and part of Highway 101. The Novato Creek Levee on the south side of the Creek is 1.71 miles long with no documented height. Approximately 3,080 people and 214 buildings with a property value of $526 million are at risk of failure of the Novato Creek Levee, including several commercial areas and part of Highway 101. The Novato Creek RB Lower levee on the south side of the Creek is 1.1.7 miles long with no documented height. One building at the Ignacio Treatment Plant with a property value of $1.68 million is at risk from a failure of the Novato Creek RB Lower levee. The Novato Creek LB Lower Levee on the north side of the creek is 4.11 miles long with no documented height. Approximately 12 people and six buildings with a property value of $6.93 million are at risk of failure of the Novato Creek LB Lower levee. Marin County Levee 10 is a 1.04-mile-long levee with an undocumented height that primarily protects part of the Ignacio Treatment Plant. Marin County Levee 7 and Marin County Levee 3 are two unaccredited levees south of SR-37 on the east and west sides of a small tributary. Marin County Levee 7 is 0.53 miles long with no documented height. There is no risk to populations or property from failure of Marin County Levee 7. Marin County Levee 23 is 0.55 miles long with no documented height. Approximately three people and one building with a property value of $1.36 million is at risk of failure of the Marin County Levee 23. The Hamilton Levee along the Hamilton Wetlands is an accredited levee that is 1.09 miles long with 0.26 miles of embankment and no documented height. Approximately 1,786 people and 621 buildings with a property value of $470 million in the Hamilton neighborhood are at risk of failure of the Hamilton Levee. The Las Galinas Valley Sanitary District Levee is a non-accredited levee that is 3.63 miles long with no documented height. Approximately 19 people and nine buildings with a property value of $9.74 million are at risk of failure of the Las Galinas Valley Sanitary District Levee. The Novato Creek Levee Evaluation Project was created to evaluate the feasibility of increasing the level of flood protection for residences and businesses within Novato Creek's 100-year floodplain, and to work towards having the levees become FEMA accredited. A failure of any of the levees around Novato during a high rain event could cause flooding into residential neighborhoods and commercial areas of Novato, with property and infrastructure within the 100-year floodplain being most susceptible.

Several levee systems exist around Bel Marin Keys and the Black Point area, but their failure does not present a risk to the communities. Figure 47 shows the Novato and Bel Marin Keys levee failure inundation area.

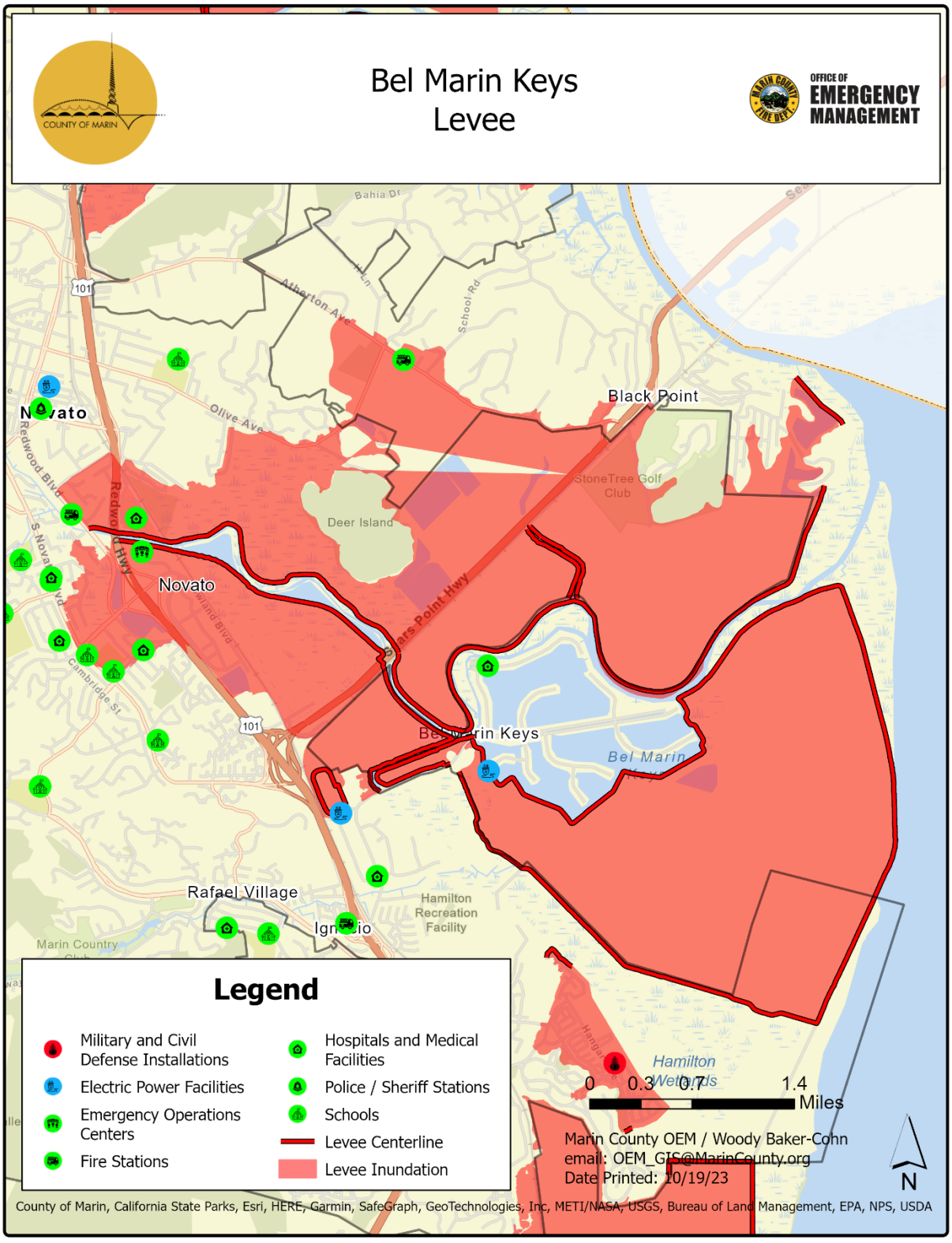


Figure 392: NMWD – Bel Marin Keys Levee Inundation Map
Source: Marin County OEM

On 2/14/2019, a levee was breached in two places near SR 37, washing out railroad tracks and threatening to inundate the roadway with water. A second levee near Pacheco Pond in the City of Novato was flowing over the top of the barrier, though the levee did not appear to have been breached. The largest breach, along Highway 37 and Harbor Drive, caused a swollen Novato Creek to spill over onto a field south of the highway.

On 12/31/2005-1/1/2006 a strong storm caused a levee breach behind Novato Community Hospital. Workers had to build a road out to the levee before they could begin repairs. The area being flooded was mostly wetlands and a park, and repairs were made before any homes were threatened.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in the NMWD, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in the NMWD, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of the NMWD protected by its levees, particularly along Novato Creek and around its marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.8 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury,

damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called “storm surge.” The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

There are areas within the NMWD service area including the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point that are at a lower elevation than many of the coastal areas in Marin County as shown in Figure 48. As such, these areas are particularly vulnerable to sea level rise and could experience between one and six feet of inundation as shown in Figure 49.

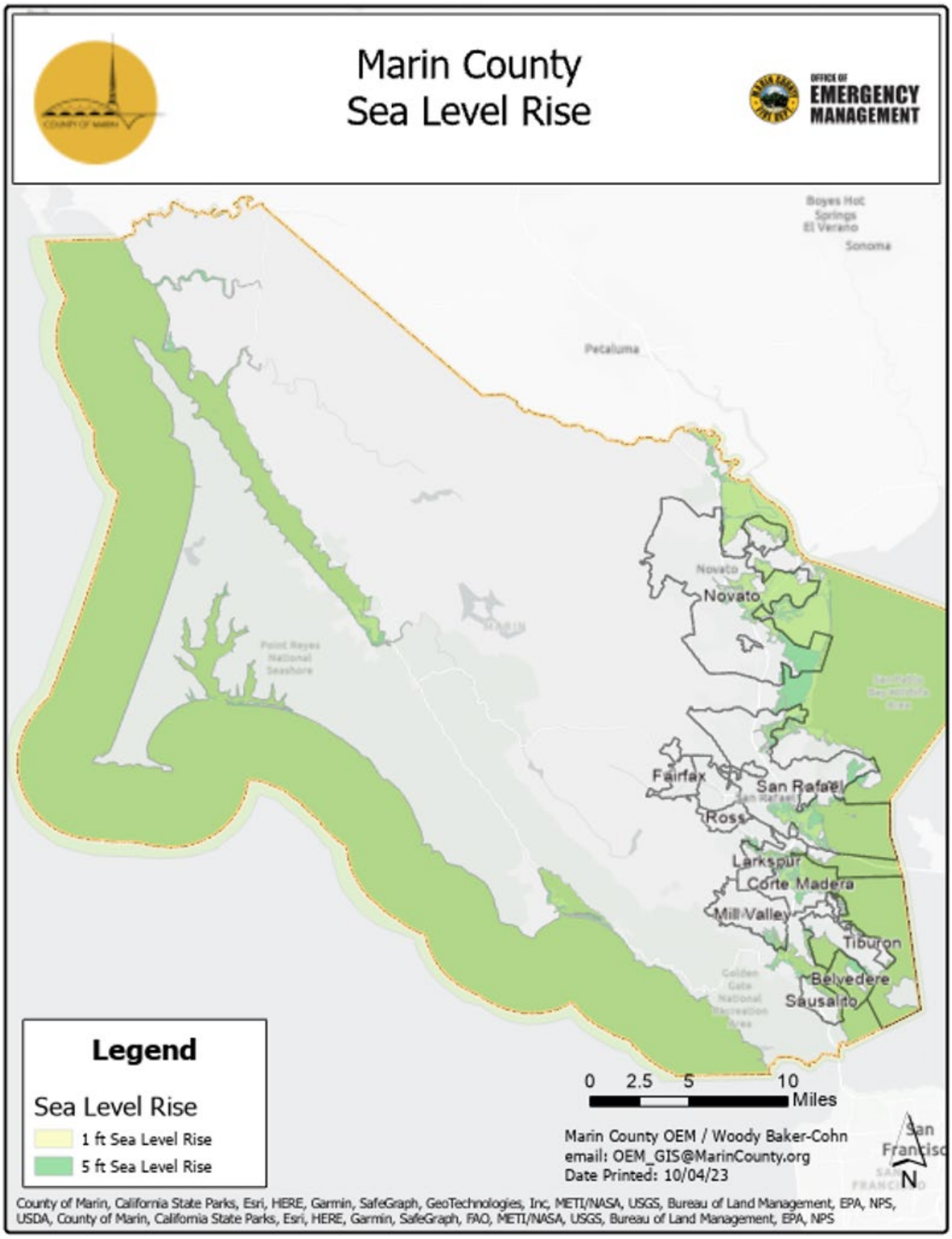


Figure 393: Marin County Sea Level Rise Impact
Source: Marin County OEM

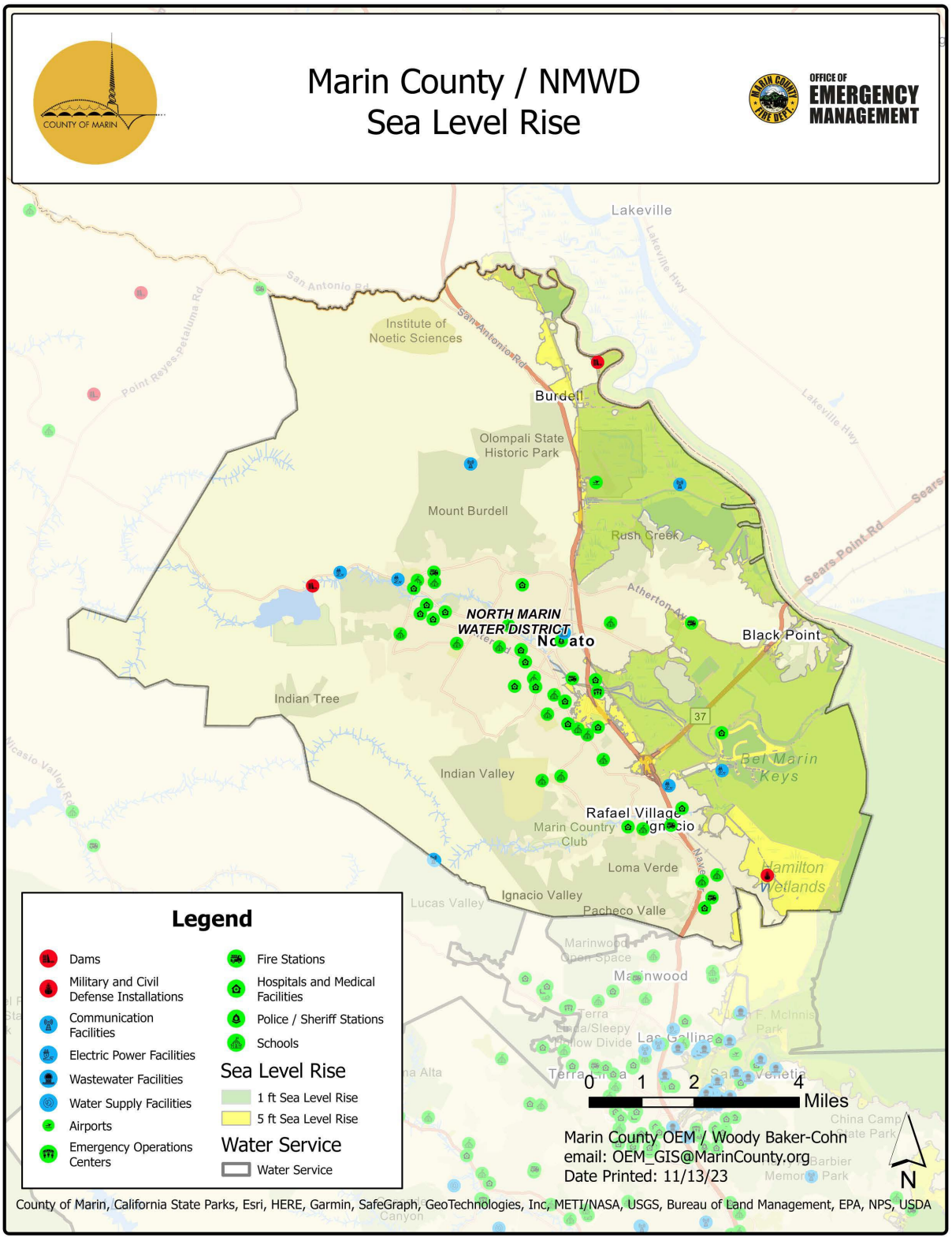


Figure 394: NMWD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

The lowland areas in the City of Novato are particularly vulnerable to sea level rise and could experience between one and five feet of inundation. Development in the city is largely inland with a few buildings fronted by tidal marshes and the bay. Much of the community is fronted by unincorporated areas, managed stormwater, agricultural, utility, and marsh lands. These lands could buffer the city from San Pablo Bay for several decades; thus, the majority of assets may not experience saltwater flooding until the end of the century. A considerable number of parcels could flood, compromising their existing land uses and human activities. In addition, because of the city's size and the existence of several smaller neighborhoods, complex levee systems, and extensive marsh land, much of the impacted developed land is dispersed into pockets of flooding.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades). The following are key issues related to the City of Novato sea level rise and a 100-year storm surge:

- The Hamilton neighborhood could anticipate the FEMA certified levee overtopped in the long term. This would flood hundreds of homes and numerous professional workspaces.
- The Vintage Oaks Shopping Center could anticipate storm surge impacts in the medium term and tidal impacts in the long-term.
- Development east of US Highway 101 at the Bel Marin Keys and Rowland Boulevards.
- Buildings and marshes in Bahia, along Davidson Drive, and on Olive Avenue are vulnerable to sea level rise.
- SR 37 to Sonoma and Napa is vulnerable in the near-term in several locations along its route. This road provides access to several publicly accessible natural resource assets.
- Tidal and storm surge flooding could impair travel on US Highway 101 in the long-term.
- Sonoma Marin Area Regional Transit rail tracks could be vulnerable in the near-term. Train cars could also be damaged by saltwater exposure.
- The Novato Sanitary District wastewater treatment could expect long-term impacts to several critical buildings.
- The Novato Fire Station 62 is vulnerable in the medium-term, and flooded, in part, in the long term. In addition, the Fire Protection District and the Novato Professional Fire Fighter's Association office off Rowland Boulevard could be vulnerable.
- Most vulnerable parks are in Hamilton and are exposed in the long-term.
- Marsh lands are vulnerable in Hamilton, Deer Island and the surrounding diked baylands, and Bahia.

The most vulnerable assets are the wastewater treatment plant, SR 37, and Northern Marin Water District. In the long-term, the Hamilton neighborhood could also be vulnerable to levee overtopping. Due to Novato's inland development, very little of the community is directly impacted. Nevertheless, those dependent on the US Highway 101 corridor will be impacted. In addition, those who use the Novato Sanitary District treatment plant could experience wastewater disruptions.

The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that the City of Novato could anticipate impacts to over 51,000 people over 1,100 living units with $1 billion in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. Structures throughout the city can become damaged extensively with their foundations compromised over time. Of particular concern are those structures and infrastructure that have not been elevated to projected sea level rise heights over the next century, including Highway 101 and SR 37 which could become more isolated due to sea level rise flooding. Sea level rise in the city has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into adjacent neighborhoods. Sea level rise can also cause increased subsidence along the city's shoreline, which may damage underground water and wastewater pipelines and disrupt services. The city's marshland would eventually turn into open water as a result of sea level rise, eliminating a natural barrier that protects the city from increased storm surge. The city would begin to experience seasonal, king tide, and storm surge flooding more frequently in the future.

The most vulnerable assets in the unincorporated County area of the NMWD from sea level rise in the medium-term are portions of Bel Marin Keys, which could face impacts. In the long-term, Black Point and North Novato could anticipate damaging impacts. In the medium-term timeframe, regular high tide tidal flooding could adversely impact the same locations tidally flooded in the near-term, though more severely. Storm surge flooding could be 10 inches with a 100-year storm surge and extend further inland beyond the marshy areas of North Novato. In the long-term (second half of this century and beyond), regular tidal flooding could adversely impact the same locations impacted in the near- and medium-terms (within the next two or three decades) and significant portions of what would have previously only flooded from the 100-year storm surge. The additional areas that would tidally flood at 60 inches of sea level rise are:

- Bel Marin Keys northern and southern lagoon areas
- Hamilton, Vintage Oaks, and pockets of development east of US Highway 101 at Rowland Boulevard and State Route 37 in Novato, and
- North Novato at US Highway 101 and Binford Road.

In the near-term, tidal flooding at 10 inches of sea level rise with an additional 100-year storm surge would flood out and smaller public and private marinas and boat launches along the bay in Bel Marin Keys and Black Point, rendering them unusable. Storm surges can be powerful enough to damage and sink boats. Most concerning, however, is the potential inability of emergency professionals and vehicles to access people in or through flooded areas. Most levees south of the City of Novato could be overtopped as they are not designed to withstand this level of flooding.

In the medium-term, tidal flooding at 20 inches of sea level rise with an additional 100-year storm surge would cause pipelines under vulnerable roads and lateral pipes to vulnerable properties to become squeezed between rising groundwater and the confining roadway. This could cause pipes to bend and break and could even damage roadways. Impacts to the NMWD service area would impact water service in Bel Marin Keys and unincorporated County area around the City of Novato. Vulnerable substations, electrical transmission towers and lines, and underground natural gas pipelines along the shoreline would be compromised by flooding and subsidence. Disruptions or failures in this network could also have far reaching impacts in

transportation, sanitary service, stormwater management facilities, food storage, communications, and general public safety.

In the long-term, tidal flooding at 60 inches of sea level rise with an additional 100-year storm surge would cause roads to degrade more quickly, or if flood waters are deep enough, become impassable. Lane miles could be more than double this figure. Breakdowns in the transportation network would have major impacts on the economy and daily life functions. In addition, significant safety hazards could cause injury or loss of life. Flooding at the Novato Sanitary Wastewater Treatment Plants is a significant vulnerability that could arise, potentially disrupting hundreds of thousands of people. Much of the low-lying shoreline sanitary sewer and stormwater infrastructure could be flooded out. By the end of the century, sea level rise could have direct impacts to the Novato Atherton Avenue Fire Station.

Beaches, estuaries, marshes, wetlands, and intertidal areas on the Marin County OA coast, including in the unincorporated area, are vulnerable to sea level rise and storms. Sea level rise may push coastal habitats inland where possible, flooding tidal areas more frequently and inundating new inland areas with saltwater. On the bayside, the marshlands that buffer the shoreline communities from high tides and storm surges could begin to experience transitions in habitat. Northern Marin marshes would become increasingly tidally influenced, with tide water reaching US Highway 101 in Bel Marin Keys and North Novato up the Petaluma River. Typically, freshwater marshes west of US Highway 101 could also expect damaging salinity impacts. Tidal marsh lands may increase in Northern Marin if they are not prevented from migrating inland. Approximately 1,358 acres on 30 agricultural parcels could be vulnerable to sea level rise and storm conditions. Another 3,000 acres are public agency lands near Bel Marin Keys, Hamilton Field, and the Novato Sanitary District that are leased for agricultural use. Higher high tides could push brackish conditions inland, reducing grazing, manure spreading, and cultivation area. Marin County OA populations in the NMWD that are most vulnerable to the effects of sea level rise include:

- Low-income households
- Households in poverty

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

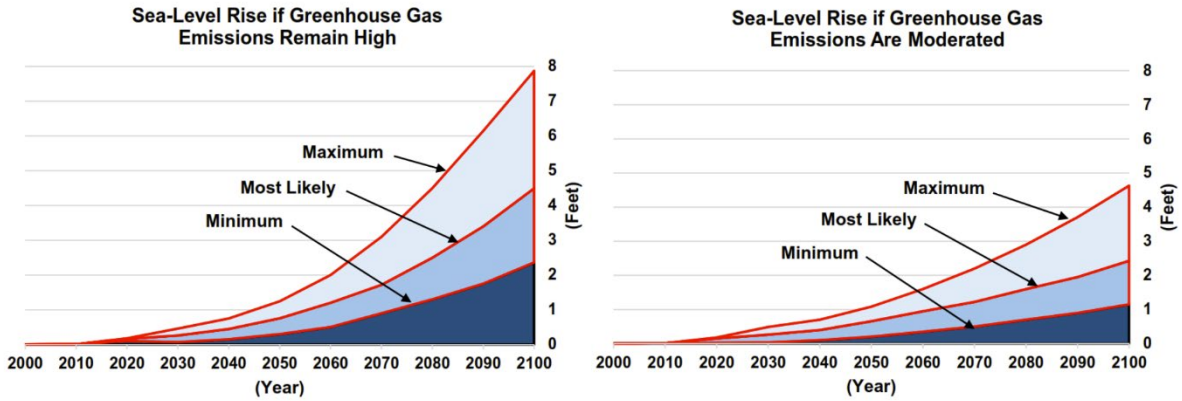


Figure 395: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around the NMWD already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including the NMWD with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around the NMWD will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of the NMWD including the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across the NMWD will continue to become inundated.

2.2.9 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 51):

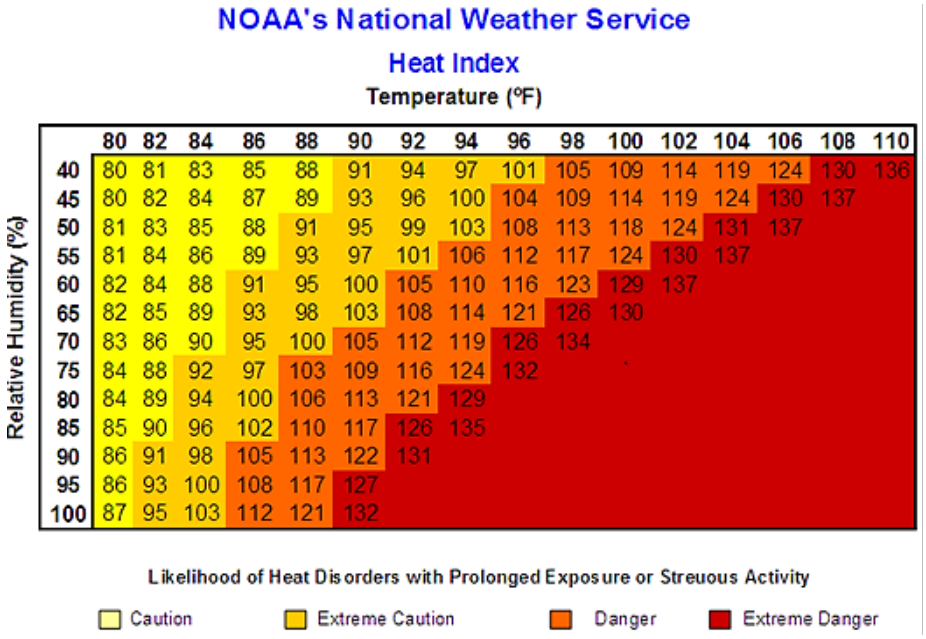


Figure 396: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of the NMWD, including the City of Novato and the unincorporated County, and would be felt more at lower elevations in the central areas of the district. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can impact district employees who are exposed to high temperatures while working outside in the heat.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

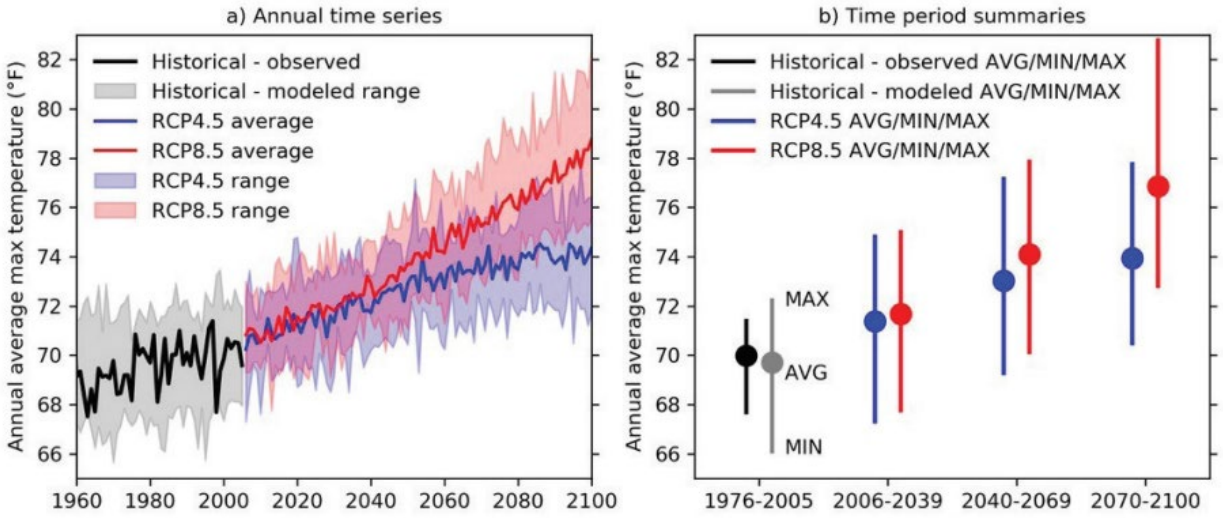


Figure 397: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in the NMWD. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of the NMWD including the lowland areas of the City of Novato and the unincorporated communities of Bel Marin Keys, Indian Valley, Loma Verde and Black Point-Green Point where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including the NMWD could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including the NMWD as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of the NMWD where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around the NMWD could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.10 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 53).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 398: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 54) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 399: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 400: Waterspout Formation
Source: MarineInsights

All of the NMWD including the City of Novato and the unincorporated County is susceptible to storms and damage from wind and tornadoes, though the mountainous areas on the western side of the district have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind,

causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

On 3/14/2023 a strong storm with heavy winds caused a tree to fall onto a home in the City of Novato. There were no injuries.

On 12/16/2017 heavy winds knocked down a tree in the City of Novato, causing a power outage for 2,440 customers. A wind gust of 44 mph was recorded.

On 4/14/2009 high winds caused a tree to fall onto a power line on Pine Street in the City of Novato causing a small fire and knocking out power along the street.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and the NMWD. Significant wind events and tornadoes can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in the NMWD as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of the NMWD including in the mountainous residential areas throughout the City of Novato and the unincorporated communities of Indian Valley, Loma Verde and Black Point-Green Point will increase the effects of severe wind events.

2.2.11 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by the NMWD would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the district. Much of the eastern area of the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point are at a lower elevation and lie in a tsunami hazard area. The tsunami inundation zone in the City of Novato does not include any structures or populations. The two areas in the city in a tsunami inundation zone include the Hamilton Wetlands in southern Novato and the wetlands north of the Rush Creek Open Space Preserve. The Hamilton Levee protects the Hamilton neighborhood of the city from a tsunami and could be tested in a tsunami event. While most of Bel Marin Keys lies outside of a tsunami inundation zone, the far eastern side has several homes that lie inside a tsunami inundation zone and could be susceptible to a tsunami. The Hamilton Wetlands PG&E substation could also be susceptible to a tsunami, as it lies on the fringe of a tsunami inundation zone. Parts of the Black Point area close to the Petaluma River Marsh lie on the edge of a tsunami inundation zone and could be susceptible to a tsunami. There are several homes in this area that mostly lie at the end of cul de sacs.

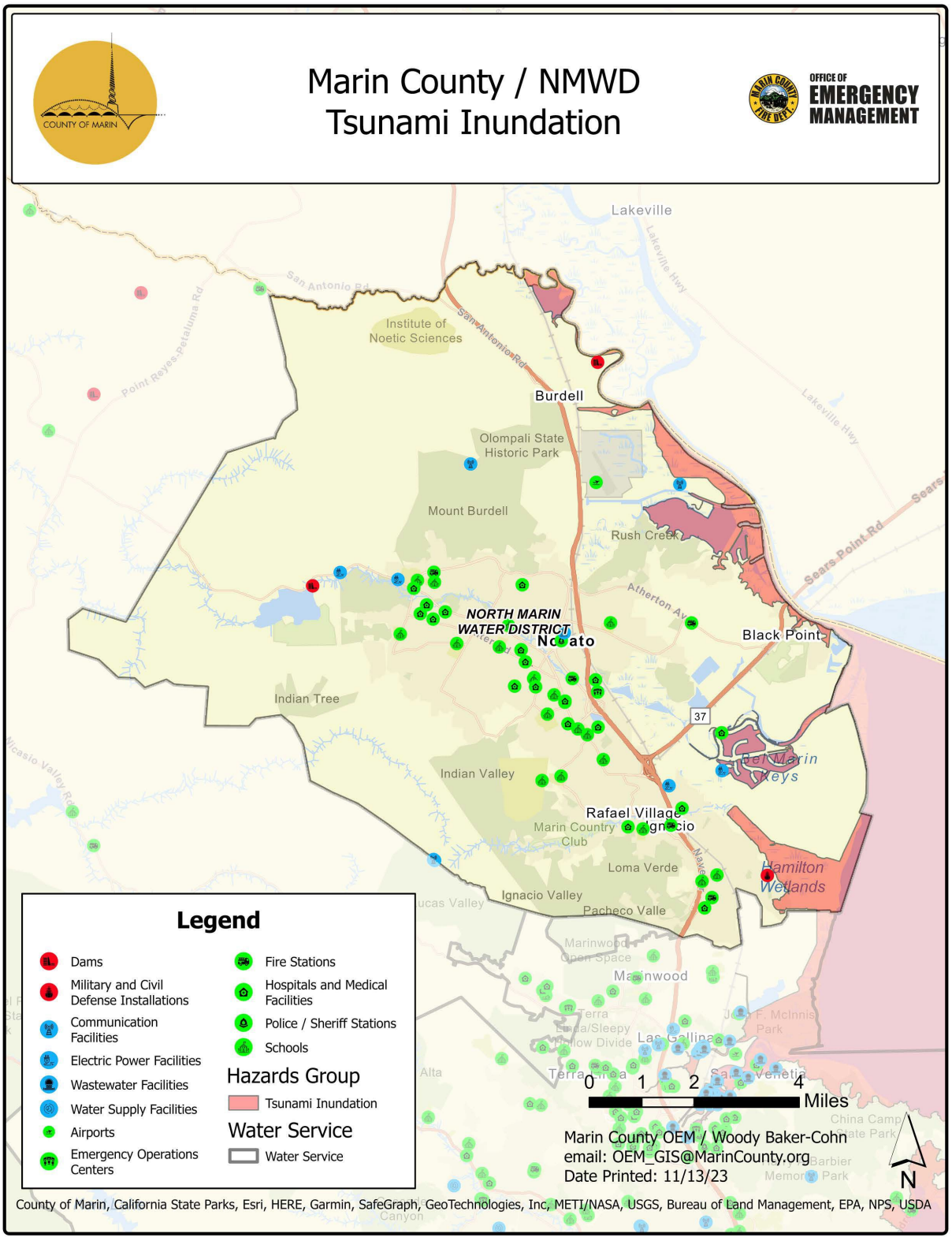


Figure 401: NMWD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

The NMWD service area including the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point has never experienced a tsunami. Given its proximity to the San Francisco Bay, however, parts of the District are within a tsunami inundation zone and could potentially experience the impacts of one.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including the NMWD, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the district including the City of Novato and the unincorporated communities of Bel Marin Keys and Black Point-Green Point. This is particularly true along Novato Creek and around the marshland areas where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the district as tsunami inundation areas expand with climate change. Development in marshland in the district would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Novato Creek and along the marshlands and shoreline of the district as a result of high wave heights associated with a more significant tsunami.

2.2.12 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages

can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services

to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 57 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

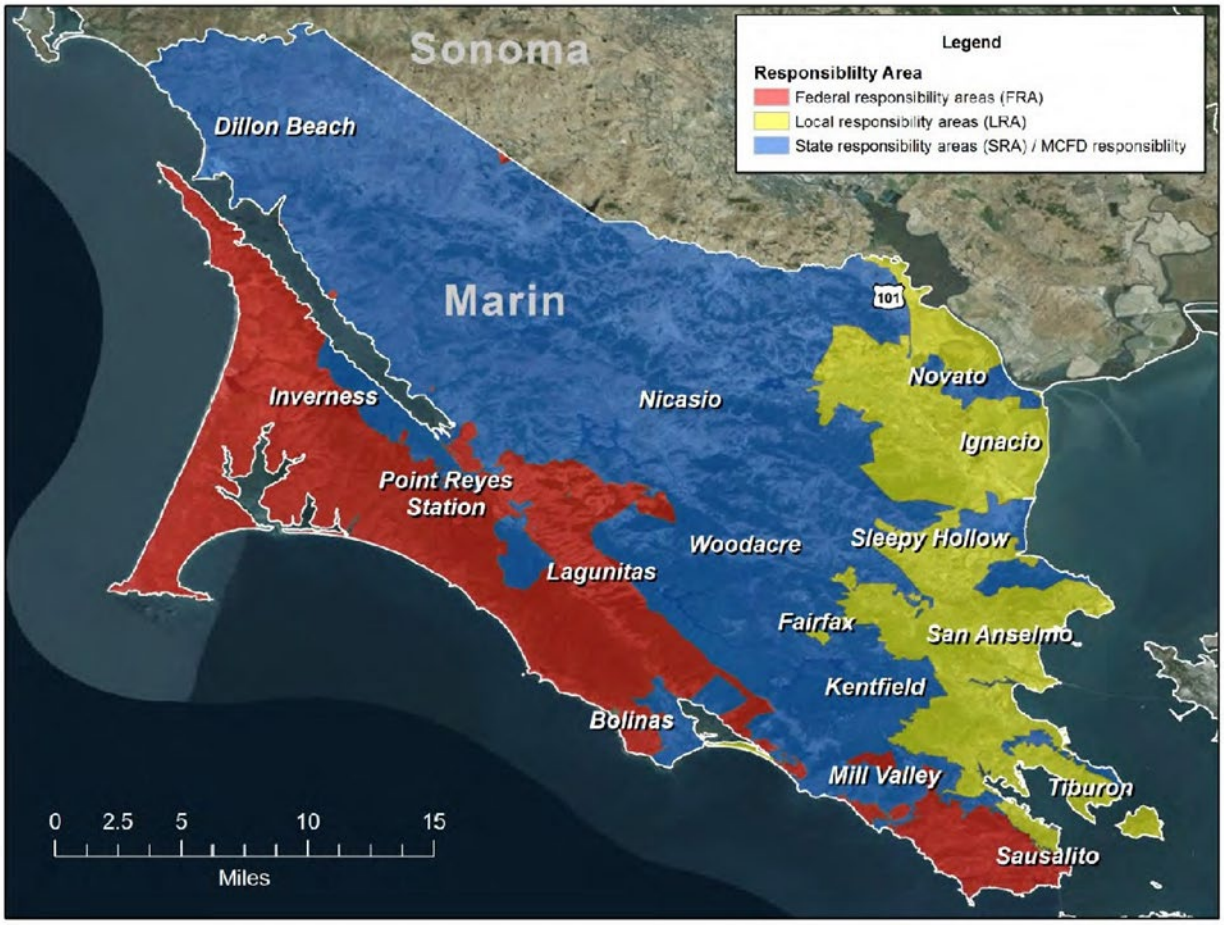


Figure 402: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet

winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak,

California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

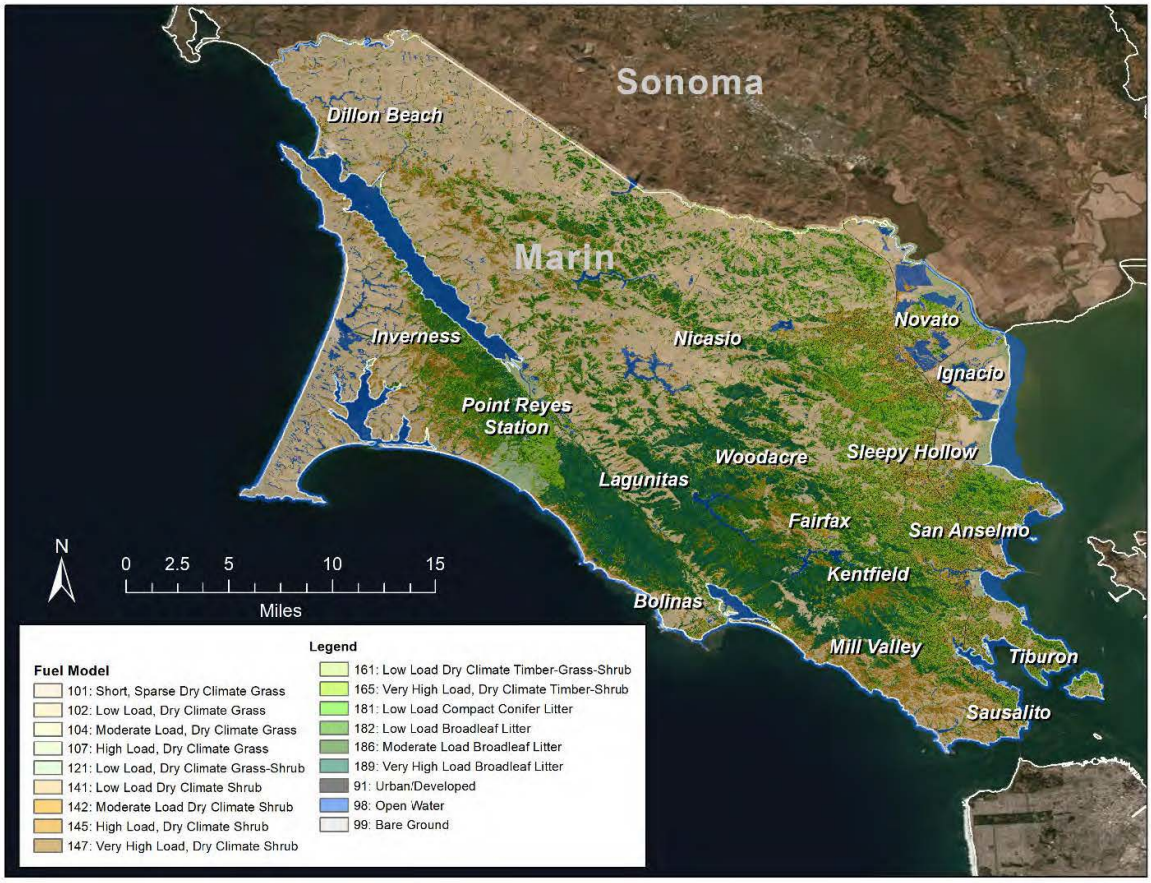


Figure 403: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young

Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite nearby vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA.

PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in the NMWD would most likely occur in the areas of the district where there is more forested terrain, including around the City of Novato and in the unincorporated communities of Indian Valley, Loma Verde and Black Point-Green Point. These areas are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by wildfire. A wildfire could also occur in the marshland areas of the district including in the City of Novato and around the unincorporated communities of Bel Marin Keys and Black Point-Green Point. Of particular concern are those communities in the southern area of the City of Novato near the Indian Valley, Ignacio Valley, and Loma Verde Preserves that are located in a Very High FHSZ. There are hundreds of residences, the Novato High School, the San Jose Middle School, the Loma Verde Elementary School and the Hamilton Elementary School that lie in this area and could be susceptible to a wildfire. This area also has few major thoroughfares, which could impede evacuation in a wildlife. This area and the other areas surrounding the city including the Mount Burdell Open Space Preserve, Ohair Park, the Verissimo Hills Preserve, the Indian Tree Open Space Preserve and the Rush Creek Open Space Preserve are located in Moderate to High FHSZs. This area includes thousands of residences, numerous commercial buildings and medical facilities, San Marin High School, Pleasant Valley Elementary School, Hill Middle School, the College of Marin – Indian Valley Campus, the Good Shepherd Lutheran School, Olive Elementary School, Our Lady of Loretto School, Novato Fire Station #62, Novato Fire Station #63, Novato Fire Station #64 and Novato Fire Station #65 that could be susceptible to a wildfire. The unincorporated County in the District service area lies mostly in a High FHSZ. There are hundreds of homes in this area that could have a high susceptibility to wildfire. The Loma Verde area, which includes dozens of homes and the Loma Verde Elementary School, lies in a Very High and High FHSZ and could have higher susceptibility to wildfire. This area is bordered to the south by a Very High FHSZ in the City of Novato. Most of the Black Point-Green Point area lies in a High FHSZ. There are dozens of homes, several businesses, and the Novato Fire Protection District Station #62 that lie in this area and could have a high susceptibility to wildfire. A smaller section south of the Rush Creek Marsh Wildlife Area lies in a Moderate FHSZ. There are numerous homes and businesses in this area that could be susceptible to wildfire.

The NMWD maintains and operates approximately 340 miles of pipeline, 42 tanks totaling over 37 million gallons of storage, and associated pump stations, hydropneumatic systems, and regulator valves. The NMWD sizes its storage tanks to meet operational, firefighting and emergency requirements. Storage requirements for both the City of Novato and West Marin Service Areas are updated on a 5-year cycle and are based in part on input provided by Novato Fire Protection District and Marin County Fire Department. The NMWD evaluates water supply and consumer consumption on a 5-year cycle via its Urban Water Management Plan (UWMP) and associated Water Shortage Contingency Plan (WSCP) in accordance with state Department of Water Resources (DWR) guidelines and requirements.

All of the NMWD could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As wildland areas around the district become drier due to climate change, the risk of a wildfire occurring and impacting the district will continue to increase. Brush fires in the district may increase over time as marshlands, parks, and other open spaces experience drier conditions.

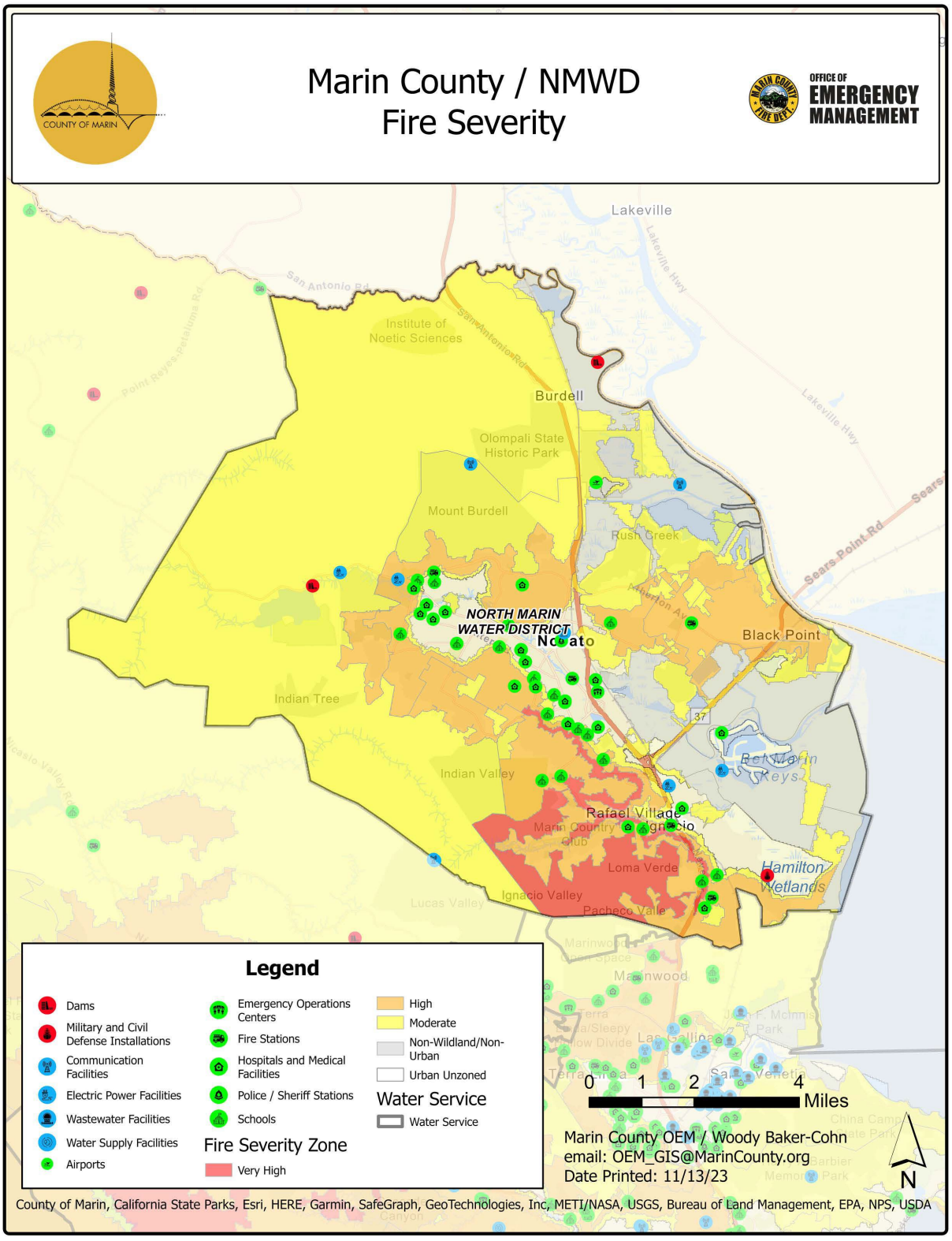


Figure 404: NMWD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

The NMWD including the City of Novato and the unincorporated County has experienced a major wildfire.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

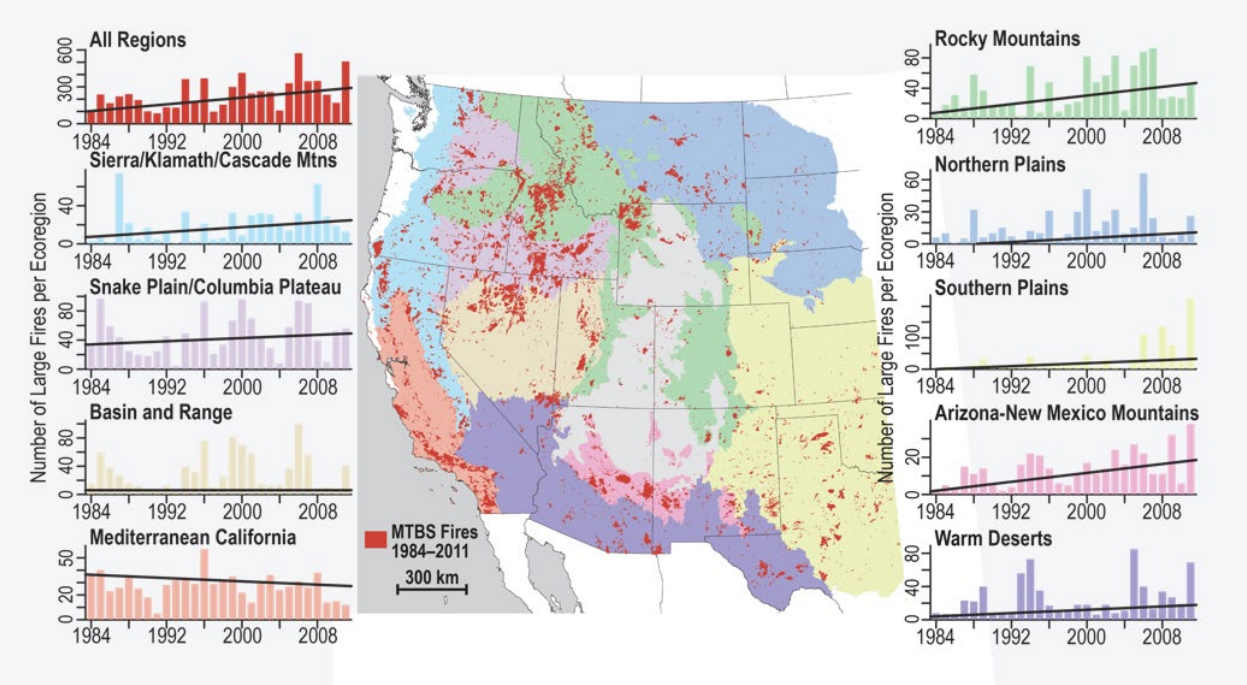


Figure 405: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including the NMWD is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around the NMWD. Future development in the WUI throughout the NMWD will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the NMWD WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the NMWD marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

In 2006 the Restructured Agreement for Water Supply with Sonoma County Water Agency (SCWA) was executed, authorizing SCWA to construct facilities to increase North Marin's water delivery entitlement to meet Novato's future needs consistent with community general plans in place. North Marin's aqueduct capacity entitlement in the Restructured Agreement is now 19.9 MGD. Also in 2006, reconstruction of the Stafford Water Treatment Plant concluded. At the time, the $16 million project was the largest ever undertaken in the District's history, and enables Stafford Lake water to meet anticipated future water quality standards.

North Marin constructed the Deer Island recycled water treatment facility in 2007 where highly-treated recycled water is produced and delivered to irrigate Stone Tree Golf Course. In cooperation with Novato Sanitary District, recycled water is also now produced and distributed to irrigate landscape in North Novato including the Fireman's Fund business park, Valley Memorial Park cemetery, Olive School playing fields and private and public landscape along the recycled water pipeline route.

North Marin also completed infrastructure improvements in coordination with Novato Sanitary District to produce and distribute recycled water for landscape irrigation in Central Novato which serves Novato Community Hospital, Vintage Oaks Shopping Center, Caltrans US101 right of way, Lynwood School playing fields and Marin Country Club Golf Course, plus private and public landscape along the recycled water pipeline route. In South Novato, North Marin worked with Las Gallinas Valley Sanitary District to deliver recycled water for landscape irrigation into the Hamilton Field area including Hamilton School playing fields, HOA common areas, and other public and private landscape along the recycled water pipeline route. Recycled water currently offsets approximately 10% of the annual potable water demand in Novato.

In the mid 2000's, as Caltrans planned its' Marin-Sonoma Narrows US101 highway widening project, North Marin began planning the Aqueduct Energy Efficiency Project. The AEEP, completed in 2015, enlarged 5 miles of the North Marin Aqueduct which was relocated due to the Caltrans project. The enlarged aqueduct enables continued Russian River Water delivery of up to 18 MGD by gravity and eliminates the need for the Kastania Pump station in South Petaluma, reducing energy costs and green-house gas emissions. Two-thirds of the $22M project cost was paid by Caltrans and one-half of North Marin's remaining share is paid by Marin Municipal Water District.

North Marin's water conservation efforts continue to be focused on reducing summer water demand, which is principally outdoor irrigation. The WaterLine newsletter is published in the spring and fall. The spring edition includes tips on how to reduce summer water demand and describes North Marin's current water conservation programs. North Marin has implemented tiered rates, known as the Conservation Incentive Rate (CIR), where single-family residential customers using over three times the typical summer use, and the Conservation Incentive Tier Rate (CITR), where single-family residential customers using more than one but less than three times the typical summer use, pay a surcharge on the rate to encourage water conservation. Water use restrictions for new development are stringent, requiring interior plumbing fixtures and appliances to meet high-efficiency standards.

North Marin also provides water service to the West Marin communities of Point Reyes Station, Olema, Bear Valley, Inverness Park, and Paradise Ranch Estates. The water supply for these communities comes from groundwater wells located adjacent to Lagunitas Creek. Two wells

are located behind the former Coast Guard Housing facility in Point Reyes Station, while another two wells are located about a mile and a half east of Point Reyes Station. This supply is of excellent quality but it requires treatment to remove iron and manganese which can affect the color of the water and result in staining. Treatment consists of adding an oxidant to precipitate the iron and manganese and then filtering the water through pressure filters which are capable of removing the iron and manganese and any excess oxidant. After filtration a small amount of chlorine is added to keep this water pure in the pipeline.

The West Marin water distribution system is small but complex, consisting of 13 different water storage tanks, 6 pump stations, 4 source water wells, and 1 water treatment plant. Development is scarce in these communities, so existing capacity is adequate to serve the current projected growth. Two of the 13 water storage tanks are redwood which represents a vulnerability to wildfire. The other 11 water storage tanks have been replaced with concrete or welded steel tanks.

3.2 Capability Assessment

The North Marin Water District did participate in the 2018 MJHMP. The strategies in which to support the overall District priorities are reflected in the sections below. Several actions were added to coincide with the priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the North Marin Water District General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the District's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the NMWD an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Community Wildfire Protection Plan:** The District plans to take an active role in mitigation actions to enhance wildfire protection.
- **StormReady certification and Firewise Communities certification:** The District will consider participation in these programs.

Table 16: North Marin Water District Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Strategic Plan	Yes 2018	The Strategic Plan is NMWD's highest-level planning document. It represents the Board's direction for the future and the staff's work plan for implementing that direction. It identifies NMWD's mission, vision, and values, while providing a set of goals and objectives that becomes a framework for all decision making. The Strategic Plan is reviewed and updated approximately every 5 years. The Strategic Plan does not explicitly address hazards, but it is used to identify goals that often align with mitigating impacts of hazards.
5-Year Master Plan	Yes Varies	NMWD uses Master Plans for guiding decisions related to infrastructure maintenance, capacity improvements, and resiliency to hazards. NMWD has three separate Master Plans, one for each service area, 1) Novato, 2) West Marin, and 3) Oceana Marin. Each Master Plan is reviewed and updated approximately every 5 years. Projects identified in the Master Plans are high-level and are often intended to mitigate impacts from hazards, development, or address resiliency/redundancy in general.
Capital Improvements Plan (CIP)	Yes 2023	The CIP is a document the guides near-term decisions related to NMWD's capital assets. High-level projects identified in the Master Plans are programed into the CIP based on available funding. NMWD uses a 3-year planning horizon to develop the CIP, and the CIP is updated annually concurrent with the District's full budget cycle. The Board of Directors reviews and approves CIP funding on an annual basis, which supports implementation of projects that often mitigate impacts from hazards, development, or address resiliency/redundancy in general.
Local Emergency Operations Plan	Yes 2019	NMWD's Emergency Operations Plan (EOP) is District specific and its purpose is to provide a plan of action to respond to various emergencies and/or hazards that may involve District facilities. The EOP does not identify specific projects to mitigate impacts of hazards.
Local Water Supply Enhancement Study (LWES)	Yes 2022	The LWES was prepared with the intent of assisting NMWD in making informed and prudent decisions towards expanding the local water supply in the Novato service area. Although the LWSES does not explicitly address

		hazards, it identifies viable water alternatives which would inherently provide resiliency and redundancy that could mitigate impacts of certain hazards.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	N	N/A
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	N/A
Fire department ISO rating:	N	N/A
Site plan review requirements	N	N/A
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
District Code	Yes	Yes, District participates with Novato or Marin County on plan reviews.
Zoning ordinance	Yes	Yes, District participates with Novato or Marin County on plan reviews.
Subdivision ordinance	N	
Floodplain ordinance	Yes	Yes, District participates with Novato or Marin County on plan reviews.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Yes, District participates with Novato or Marin County on plan reviews.
Flood insurance rate maps	Yes	Yes, District participates with Novato or Marin County on plan reviews.
Elevation Certificates	Yes	Yes, District participates with Novato or Marin County on plans.
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Yes	Yes, District participates with Novato or Marin County on plan reviews.

Table 186: NMWD Legal and Regulatory Capabilities
Source: North Marin Water District

North Marin Water District Comprehensive Plan or Master Plan

North Marin Water District boundaries overlap unincorporated areas of Marin County and the City of Novato, both of which are required to have a General Plan or Master Plan per California Government Code 65300. Please see their respective General Plan or Master Plan for details.

Table 17: North Marin Water District Comprehensive Plan or Master Plan	
Goal/Policy/ Program	**Explanation**
Policy	NMWD is an independent special district governed by a five-member Board of Directors elected By-District for four-year terms.
Policy	NMWD is a public agency of the State of California established under the County Water District Law (Division 12 of the California Water Code). Policies and regulations have been adopted by the Board of Directors of NMWD pursuant to Water Code Section 31024 and establish the procedures under which NMWD operates, including the terms and conditions under which facilities will be installed and water will be supplied to users and the charges and rates for such service.

Table 187: NMWD Comprehensive Plan or Master Plan
Source: North Marin Water District

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the District personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 18: North Marin Water District Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Administration / Finance Department	Yes	The Administrative Department is comprised of the Administrative Services, Consumer Services, Finance and Information System. Consumer Services is responsible for managing water use data, responding to customer calls for service and assistance with their water services, creation and distribution of water bills, and answering customer questions regarding their bill or water use. Finance is responsible for general accounting and budgeting, payroll, purchasing, financial investments, risk management and information systems.
Construction / Maintenance	Yes	The Construction/Maintenance Department has a variety of duties, principally related to the installation, repair and replacement of water main pipelines, their appurtenances and performs all “underground” maintenance for the District. The Construction/Maintenance Department also assists other departments to upkeep structures, grounds, storage tanks and pumping facilities.
Operations / Maintenance	Yes	The Operations/Maintenance Department manages the supply, distribution and water quality for the City of Novato and the West Marin communities, and performs all “above-ground” maintenance for the District.
Mutual aid agreements	Yes	NMWD has mutual aid agreements with the City of Novato and the Novato Sanitary District for staff, equipment, and materials. These agreements are reviewed and updated.

Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services	Yes	NMWD plans increase participation in the Alert Marin System through Marin OEM and explore options for increased cybersecurity.
Emergency Manager	Yes	NMWD has a Safety Manager on staff that serves in this role by definition. They lead the management team in emergency scenarios and coordinates with other local agencies throughout the year to include quarterly meetings.
Civil Engineer	Yes	NMWD has a Chief Engineer that oversees the Engineering Department and enforces District design and construction standards. They have training on emergency procedures and they coordinate with County and City officials as needed.
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Yes	The Engineering Department consists of a small professional and technical staff that oversees the planning, permitting, design, construction and project management of water supply, treatment, transmission and distribution facilities necessary to serve NMWD's customers. Engineering functions for wastewater-related facilities are also provided by the Engineering Department to support the NMWD wastewater collection, treatment, and disposal system in Oceana Marin (Dillon Beach area).
Grant writing	No	NMWD does not have in-house staff with expertise in writing grant applications. NMWD has historically used consultant support for grant writing purposes.

Table 188: NMWD Administrative and Technical Capabilities
Source: **North Marin Water District**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 19: North Marin Water District Fiscal Capabilities		
Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Yes	The Board of Directors reviews and approves CIP funding on an annual basis, which supports implementation of projects that often mitigate impacts from hazards, development, or address resiliency/redundancy in general.
Fees for water, sewer, gas, or	Yes	NMWD's main source of revenue comes from rate payers

electric services		of the three different service areas. Rate revenue is used to fund District operations, maintenance, capital improvements, debt service, staff salaries and benefits, and various other expenses. When mitigation projects are identified in the various Master Plans and the Capital Improvement Plan, rate revenue can be adopted with the annual CIP budget to fund projects that have a hazard mitigation component.
Impact fees for new development	Yes	NMWD assesses Facility Reserve Charges (FRCs) to developments within the various service areas that need new or increased water use entitlement. FRC revenue can be used to fund future capital improvement projects that have a hazard mitigation component.
Incur debt through general obligation bonds and/or special tax bonds	Yes	NMWD has incurred debt through bonds that were used to fund larger capital improvement projects, some of which had a hazard mitigation component.
Federal funding programs	Yes	Federal grant program funding could be used to fund hazard mitigation projects, such as sea-level rise and drought contingency. Regional coordination through California Office of Emergency Services (Cal OES) was used to secure a federal grant through the Federal Emergency Management Authority's (FEMA) Hazard Mitigation Grant Program for a project to rehabilitate the District's Oceana Marin Wastewater Treatment and Storage Ponds
State funding programs	Yes	State grant program funding could be used to fund hazard mitigation projects, such as sea-level rise and drought contingency. Regional coordination through the Department of Water Resources (DWR) was used to secure a state grant through the State's Small Community Drought Relief Program for a project to drill a new well outside of the 100-year sea-level rise boundary in the District's west Marin service area.

Table 189: NMWD Fiscal Capabilities
Source: **North Marin Water District**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the North Marin Water District and the North Marin Water District partnerships utilized to promote those programs.

Table 20: North Marin Water District Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	NMWD is committed to ongoing public education surrounding water conservation and water-waste reduction. The District has an active online presence through social media and provides frequent updates on the website.

Table 190: NMWD Community Outreach
Source: **North Marin Water District**

3.2.5 PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

As a Special District the North Marin Water District does not participate in the national flood insurance program (NFIP). However, the City of Novato and the County of Marin do participate in the NFIP and have profiled their flood risk in the Flood Profile in this Annex, the Marin County OA MJHMP, and the City of Novato Annex. Repetitive loss and severe repetitive loss structures are also addressed in the NFIP portion of the Marin County OA MJHMP, and the City of Novato Annex. The NMWD does have any facilities within a flood plain and that vulnerability is addressed in the Flooding profile. The NMWD does not have any repetitive loss and severe repetitive loss structures are defined as a structures covered under an NFIP flood insurance policy (44 CFR § 77.2(i)).

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 21 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 21: NMWD Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Stafford Dam (Novato Creek Dam) Mitigation – Upstream Face Armoring			X		X
Oceana Marin Force Main Replacement and Main Pump Station Upgrade/Relocation		X			X
Olema Domestic Water Pump Station Flood Protection			X		X
Eastern Marin County Creek Crossing Upgrades (Rush, Novato, Leveroni, Vineyard)			X		X
Oceana Marin Treatment and Storage Pond Repair		X			X
Oceana Marin Cliff-side Sewer Lining			X		X

Table 191: NMWD Status of Previous Hazard Mitigation Actions
Source: NMWD

3.5 Hazard Mitigation Actions

The 2023 Marin County MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the North Marin Water District based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires District Board of Directors regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

Although, the overall hazard or community priorities have not changed from the 2018 plan the hazard action priorities have changed. As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 22 lists the Current Hazard Mitigation Actions for the North Marin Water District.

Table 22: North Marin Water District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
NMWD-1	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies or risk.	All Hazards 1, 2, 3, 4, 5	North Marin Water District/ Marin County	New (2023)	Cost: General Funds	1 -2 Years/ High	
NMWD-2	Stafford Dam (Novato Creek Dam) Mitigation – Upstream Face Armoring	Dam, Debris Flow 1, 2, 3, 4, 5	North Marin Water District	Existing (2018)	$1,000,000 (Rate Revenue, HMGP, BRIC, CDAA Grants)	3-5 years Medium	Not started (identify and correct vulnerabilities along the upstream face of Stafford Dam)
NMWD-3	West Marin Water Supply Resiliency Project	All Hazards 1, 2, 4, 5	North Marin Water District	New (2023)	$2,000,000 (Federal and State HMGP, BRIC, CDAA, Grants)	1-3 years High	Not Started (identify and establish source(s) of additional water supply to enhance system redundancy)
NMWD-4	Novato Water System Enhanced Master Plan	All Hazards - Earthquake, Fire, Flood 1, 2, 3, 4, 5	North Marin Water District	New (2023)	$300,000-$500,000 (Rate Revenue)	1-15 years High	Ongoing (A combination infrastructure and hazard mitigation plan, including seismic evaluations of all critical facilities, wildfire, flood hazards, etc.)
NMWD-5	West Marin Water System Enhanced Master Plan	All Hazards - Earthquake, Fire, Flood 1, 2, 3, 4, 5	North Marin Water District	New (2023)	$300,000-$500,000 (Rate Revenue)	1-15 years High	Ongoing (A combination infrastructure and hazard mitigation plan, including seismic evaluations of all critical facilities, wildfire, flood hazards, etc.)
NMWD-6	Emergency Operations Plan (EOP) Update	All Hazards 1, 2, 3, 4, 5	North Marin Water District	New (2023)	Cost TBD (Rate Revenue)	1-3 years High	Not Started (update to NMWD's 2019 EOP)
NMWD-7	Community and Individual Emergency Preparedness	All Hazards 1, 2, 3, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-3 years High	Ongoing (circulate information and educate about risks associated with living within the inundation zone of Stafford Dam)
NMWD-8	Emergency Generator(s)	Fire & Wind/ 1, 2, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA,	1-5 years High	Develop redundant power during wind and fire events.

Table 22: North Marin Water District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
					Private Local Grants		facilities such as HQ and backbone pump stations
NMWD-9	Stafford Dam Mitigation – Remote Instrumentation including piezometers, inclinometers and accelerometers, weather station	Dam Failure/ 1,2,4, 5, 6	North Marin Water District	New (2023)	$1,000,000 (Rate Revenue, Federal and State Grants)	1-3 years High	Not Started (install new technology to monitor ground water, seepage, movement within Stafford Dam to allow real-time information gathering)
NMWD-10	Educate Residents on Water Saving during extreme heat & drought.	Drought, Heat/ 1, 2, 3, 4, 5	North Marin Water District	New (2023)	North Marin Water District	1-3 years High	Educate citizens regarding water use during extreme heat.
NMWD-11	Oceana Marin Force Main Replacement and Main Pump Station Upgrade/Relocation	Flooding, Tsunami, Sea Level Rise/ 1, 2, 4, 5	North Marin Water District	Existing (2018)	$2,500,000 (Federal and State Grants)	1-5 years High	Ongoing (design phase underway for replacement of the first phase of the OM force main, no work started related to pump station upgrade)
NMWD-12	Olema Domestic Water Pump Station Flood Protection	Flooding/ 1, 2, 4, 5	North Marin Water District	Existing (2018)	$1,500,000 (Federal and State Grants)	3-5 years Medium	Not started (raise or relocate the Olema pump station out of the flood plain)
NMWD-13	Eastern Marin County Creek Crossing Upgrades (Rush, Novato, Leveroni, Vineyard)	Flooding, Land Subsidence, Debris Flow, Earthquake/ 1, 2, 4, 5	North Marin Water District	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-5 years Medium	Not started (identify vulnerabilities at creek crossings and design/implement appropriate changes to enhance resiliency to flooding & earthquake)
NMWD-14	Western Marin County Creek Crossing Upgrades (Olema, Lagunitas, Fish Hatchery, Haggerty Gulch, Silver Hills, Tomasini, and Bear Valley)	Flooding, Land Subsidence, Debris Flow, Earthquake/ 1, 2, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1-5 years Medium	Not started (identify vulnerabilities at creek crossings and design/implement appropriate changes to enhance resiliency to flooding & earthquake)
NMWD-15	Stafford Dam Mitigation – Spillway Hardening	Flooding/ 1, 2, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3-5 years Medium	Not started (identify and correct vulnerabilities along the Stafford Dam spillway)

Table 22: North Marin Water District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
NMWD-16	Stafford Dam Enhancements – Spillway Adjustable Weir Gate	Flooding/ 1, 2, 4, 5	North Marin Water District	New (2023)	$1,250,000 (Rate Revenue)	1-3 years High	In Progress (Preliminary design underway for installation of an adjustable gate at the control notch of the Stafford Dam spillway)
NMWD-17	North Marin Water District Headquarters and Corporation Yard Flood Mitigation Project	Flooding/ 1, 2, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3-5 years Medium	Not Started (identify and mitigate flooding of District HQ building from adjacent Rush Creek to allow operations during flood events)
NMWD-18	Wooden Tank Replacement – Paradise Ranch Estates Tanks No. 1 & 2	Wildfire/ 1, 2, 4, 5	North Marin Water District	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3-5 years Medium	Not Started (remove and replace two wooden tanks in the West Marin system with steel or concrete tanks)
NMWD-19	Oceana Marin Treatment and Storage Pond Repair	Severe Weather-Wind, Flooding/ 1,2,4,5	North Marin Water District	Existing (2018)	$1,800,000 (FEMA HMGP)	In Progress Design complete, construction in 2024. High	High winds or flooding create waves that erode the banks of the two ponds that serve the community's waste water. The project will armor the banks.
NMWD-20	Oceana Marin Cliff-side Sewer Lining	Severe Weather-Wind, Tsunami, Debris Flow/ 1,2,4,5	North Marin Water District	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	3-5 years Medium	These hazards degrade the slopes that hold a slip line sewer lines along the steep cliffs to prevent raw sewage spills into the ocean.

Table 192: NMWD Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the North Marin Water District. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 21 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the North Marin Water District identified and prioritized the mitigation actions as detailed in Table 22, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as master planning, strategic planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where the 2023 MJHMP will be used for further integration.

The planning team for the North Marin Water District will maintain this plan and will serve as a lead staff for grant project applications on District projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the North Marin Water District will use existing plans and/or programs to implement hazard mitigation actions both directly within the District and through the coordinated efforts with the Cities and Towns they serve.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the North Marin Water District and the Cities and Towns they serve already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

District Master & Strategic Plans - Integrates hazard mitigation through the consideration of hazards most likely to impact the district.

District Emergency Action Plans – Integrates hazard mitigation through the consideration of the District's planned response to hazards most likely to impact the district.

District Dam Emergency Plans – Integrates hazard mitigation through the consideration of the District's planned response to an Emergency Dam incident most likely to impact the district or surrounding community.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

19. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
20. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
21. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

Development within North Marin's service areas are managed through the Marin County and/or the City of Novato planning and development departments. North Marin participates in development efforts by reviewing applications and providing will-service notices during the planning phase. These will-serve notices acknowledge that North Marin is capable of providing water (or sanitary sewer) services to the proposed development.

North Marin's 2020 Urban Water Management Plan (Plan) incorporated estimated water use demands by applying projected population and employment growth rates. Additionally, the Plan incorporated planned developments within the District service areas, including new housing required per the Associate of Bay Area Government's (ABAG) Regional Housing Needs Allocation (RHNA) to verity that account growth projections consider all currently anticipated growth. Compliance with the ABAG RHNA is a requirement imposed on local government agencies (Cities and Counties) rather than utility providers and/or special districts.

North Marin's Plan indicates that the District has adequate supply and distribution capacity under normal water year conditions. However, the Plan also indicates that as soon as 2035, based on City and County development projections, North Marin will not have adequate supply and distribution capacity under "dry year" conditions. A dry year is defined as one with below average precipitation, which leads to lower water levels in local reservoirs and a reduction in available water supply. Most recently, North Marin experienced dry year conditions in three consecutive years, from 2020 to 2022.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the North Marin Water District.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying North Marin Water District Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and NMWD plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The NMWD is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The NMWD Public Works Director will monitor and update the NMWD Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan

requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the NMWD, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the NMWD, to evaluate the plan after each update meeting.

4.4 Plan Update

The NMWD General Manager will monitor and update the NMWD Annex to the Marin County OA MJHMP. During the five-year update cycle, the NMWD and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency

Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

List of Figures

Figure 1: Marin County OEM MJHMP and NMWD Website 8-18
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 8-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 8-20
Figure 4: Hazard Mitigation Plan Survey 8-22
Figure 5: Map of the North Marin Water District 8-25
Figure 6: Map of the North Marin Water District and Jurisdictions 8-26
Figure 7: Map of the North Marin Water District within Marin County 8-27
Figure 8: The North Marin Water District Precipitation and Monthly Temperatures 8-30
Figure 9: City of Novato Social Vulnerability Map Census Tract 1022.03 8-32
Figure 10: City of Novato Social Vulnerability Map Census Tract 10320.00 8-33
Figure 11: City of Novato Social Vulnerability Map Census Tract 1012.00 8-34
Figure 12: City of Novato Social Vulnerability Map Census Tract 1022.02 8-35
Figure 13: City of Novato Social Vulnerability Map Census Tract 1041.02 8-36
Figure 14: North Marin Water District Critical Facilities 8-40
Figure 15: NMWD Risk Assessment – Planning Team Top Hazards 8-41
Figure 16: Hazard Risk Categorization 8-41
Figure 17: NASA Global Temperature Change CO2 Gas 8-45
Figure 18: NASA Global Temperature Change 1884 to 2022 8-45
Figure 19: NASA Global Temperature Change Sea Level 8-46
Figure 20: Annual Mean Sea Level Trends 8-48
Figure 21: Dams in and around the Marin County OA 8-55
Figure 22: Marin County Dam Inundation Susceptibility to Critical Facilities 8-56
Figure 23: City of Novato Dam Inundation Critical Facilities and Infrastructure 8-57
Figure 24: City of Novato - Nonato Creek Dam Inundation Impact 8-58
Figure 25: City of Novato - Novato Creek Dam Inundation Impact – West Novato 8-60
Figure 26: City of Novato - Novato Creek Dam Inundation Impact – North Novato 8-60
Figure 27: City of Novato - Novato Creek Dam Inundation Impact – Central Novato 8-61
Figure 28: City of Novato - Novato Creek Dam Inundation Impact – East Novato 8-61
Figure 29: Landslide Susceptibility Classes 8-63
Figure 30: Mud Flow Areas 8-64
Figure 31: NMWD Debris Flow Critical Facilities and Infrastructure 8-66
Figure 32: Mudflow damage to Redwood Blvd. March 21, 2023 8-68
Figure 33: Modified Mercalli Intensity Scale 8-71
Figure 34: Mercalli Scale vs. Magnitude 8-71
Figure 35: Soil Types 8-72
Figure 36: Marin County Earthquake Impact 8-74
Figure 37: NMWD Earthquake Critical Facilities and Infrastructure 8-75
Figure 38: Diagram of an Atmospheric River Event 8-78
Figure 39: NMWD Flooding Critical Facilities and Infrastructure 8-80
Figure 40: Dissolution Sinkhole Formation 8-84
Figure 41: Cover-Subsidence Sinkhole Formation 8-84
Figure 42: Cover-Collapse Sinkhole Formation 8-84
Figure 43: Levee Failure Mechanisms 8-86

Figure 44: NMWD Levee Inundation Map 8-87
Figure 45: Levees Around the Marin County Airport 8-88
Figure 46: NMWD - Novato North Levee Inundation Map 8-89
Figure 47: NMWD – Bel Marin Keys Levee Inundation Map 8-91
Figure 48: Marin County Sea Level Rise Impact 8-94
Figure 49: NMWD Sea Level Rise Impact on Critical Facilities 8-95
Figure 50: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 8-99
Figure 51: Heat Index 8-100
Figure 52: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 8-101
Figure 53: Beaufort Wind Scale 8-102
Figure 54: Enhanced Fujita Scale 8-103
Figure 55: Waterspout Formation 8-103
Figure 56: NMWD Tsunami Critical Facilities and Infrastructure 8-105
Figure 57: Federal, State and Local Responsibility Areas in the Marin County OA 8-108
Figure 58: Fuel Model Map for the Marin County OA 8-112
Figure 59: NMWD Wildfire Critical Facilities and Infrastructure 8-116
Figure 60: Trends in the Annual Number of Large Wildfires in the United States 8-117

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 8-8
Table 2: 2023 MJHMP Planning Team Members 8-12
Table 3: North Marin Water District & Marin County MJHMP Planning Meetings 8-16
Table 4: NRI Hazards and Marin County MJHMP Hazards 8-31
Table 5: NRI Hazard Type Risk Index for Novato Census Tract 1022.03 8-32
Table 6: NRI Hazard Type Risk Index for Novato Census Tract 1032.00 8-33
Table 7: NRI Hazard Type Risk Index for Novato Census Tract 1012.00 8-34
Table 8: NRI Hazard Type Risk Index for Novato Census Tract 1022.02 8-35
Table 9: NRI Hazard Type Risk Index for Novato Census Tract 1041.02 8-36
Table 10: North Marin Water District Critical Facilities 8-39
Table 11: Select Hazards Magnitude/ Severity Scale or Index 8-42
Table 12: NMWD Hazard Risk Assessment 8-50
Table 13: County of Marin Hazard Risk Assessment 8-51
Table 14: Dams in Marin County with Potential to Impact to the OA 8-54
Table 15: North Marin Water District Critical Facilities in the Flood Zones 8-81
Table 16: NMWD Legal and Regulatory Capabilities 8-121
Table 17: NMWD Comprehensive Plan or Master Plan 8-122
Table 18: NMWD Administrative and Technical Capabilities 8-123
Table 19: NMWD Fiscal Capabilities 8-124
Table 20: NMWD Community Outreach 8-125
Table 21: NMWD Status of Previous Hazard Mitigation Actions 8-128
Table 22: NMWD Current Hazard Mitigation Actions 8-132

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

9. City of Novato Community Profile

CITY OF NOVATO
CALIFORNIA

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The City of Novato and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required and without their commitment; this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of Novato more disaster resistant and sustainable.

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TABLE OF CONTENTS

CITY OF NOVATO COMMUNITY PROFILE 9-1
Acknowledgements 9-3
Table of Contents 9-5
Section 1.0: Introduction 9-7
1.1 Introduction 9-7
1.2 Planning Process 9-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 9-8
1.2.2 Steering Committee Planning Process 9-9
1.2.3 Coordination with stakeholders and agencies 9-9
1.2.4 Public Engagement 9-16
1.3 Overview and History 9-24
1.4 Government 9-28
1.5 Weather and Climate 9-28
1.6 Demographics 9-29
1.7 Social Vulnerability and Risk 9-32
1.8 Economy and Tax Base 9-39
1.9 Critical Facilities 9-40
1.10 Historical Properties 9-43
2.0: Hazard Identification and Risk Assessment 9-46
2.1 Climate Change 9-48
2.2 Hazards 9-55
2.2.1 Dam Failure 9-56
2.2.2 Debris Flows 9-62
2.2.3 Drought 9-68
2.2.4 Earthquake 9-69
2.2.5 Flooding 9-75
2.2.6 Land Subsidence/Sinkholes 9-85
2.2.7 Levee Failure 9-87
2.2.8 Sea Level Rise 9-90
2.2.9 Severe Weather – Extreme Heat 9-94
2.2.10 Severe Weather – High Wind and Tornado 9-95
2.2.11 Tsunami 9-98
2.2.12 Wildfire 9-100

Section 3.0: Mitigation Strategy 9-109
3.1 Changes in Development 9-109
3.2 Capability Assessment 9-110
3.2.1 Regulatory Capabilities 9-111
3.2.2 Administrative and Technical Capabilities 9-117
3.2.3 Fiscal Capabilities 9-120
3.2.4 Community Outreach 9-121
3.2.5 Participation in the National Flood Insurance Program 9-122
3.3 Mitigation Goals 9-127
3.4 Status of Previous Mitigation Actions 9-129
3.5 Hazard Mitigation Actions 9-130
3.6 Progress in Local Mitigation Efforts 9-138
3.7 Plan Integration 9-138
3.8 Future Development Trends 9-139
Section 4.0: Plan Review, Evaluation, and Implementation 9-142
4.1 Plan Adoption 9-142
4.2 Plan Monitoring 9-142
4.3 Plan Evaluation 9-143
4.4 Plan Update 9-143
Figures and Tables 9-145
Acronyms/Abbreviations 9-147

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of Novato, Community Profile has been prepared in conjunction with the Marin County OA Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of Novato.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County OEM, would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the City of Novato involved additional internal planning team to support the broader planning process. The City of Novato jurisdictional representatives for the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
David Dammuller, Engineering Services Mgr.
Telephone: 415-899-8953
E-mail Address: ddammuller@novato.org

Alternate Point of Contact
Dave Jeffries, Consultant/JPSC
Telephone: 707-483-1098
E-mail Address: Dave@jeffriespsc.com

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: City of Novato Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Novato	David Dammuller	Engineering Services Mgr.	415-899-8953	ddammuller@novato.org
Novato	Dave Jeffries	Consultant/JPSC	707-483-1098	dave@jeffriespsc.com
Novato	Jim Correa	Police Captain/ Novato PD	415-897-4361	jcorrea@novato.org
Novato	Sasha D'Amico	Police Captain/ Novato PD	415-897-4361	sdamico@novato.org
Novato	Gerald McCarthy	Fire Deputy Chief/ Novato Fire District	415-878-2690	gmccarthy@novatofire.org
Novato	John Dicochea	Fire Deputy Chief/ Novato Fire District	415-878-2690	jdicochea@novatofire.org
Novato	Chris DeGabriele	Public Works	415-899-8283	cdegabriele@novato.org
Novato	Lyle Waite	Public Works	415-899-8283	lwaite@novato.org
Novato	Vicki Parker	Community Development Director	415-899-8989	vparker@novato.org

Table 193: City of Novato Local Hazard Mitigation Planning Team Members

This 2023 Marin County OA MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of the unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the City of Novato. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.

- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of Novato Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation

activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of Novato communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of Novato Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of Novato and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-Five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	DPW
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 194: 2023 MJHMP Local Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Novato's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained

on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of Novato & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview

Table 3: City of Novato & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website.

Table 3: City of Novato & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps

Table 3: City of Novato & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 195: City of Novato & Marin County OA MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The

public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site for the public review period. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

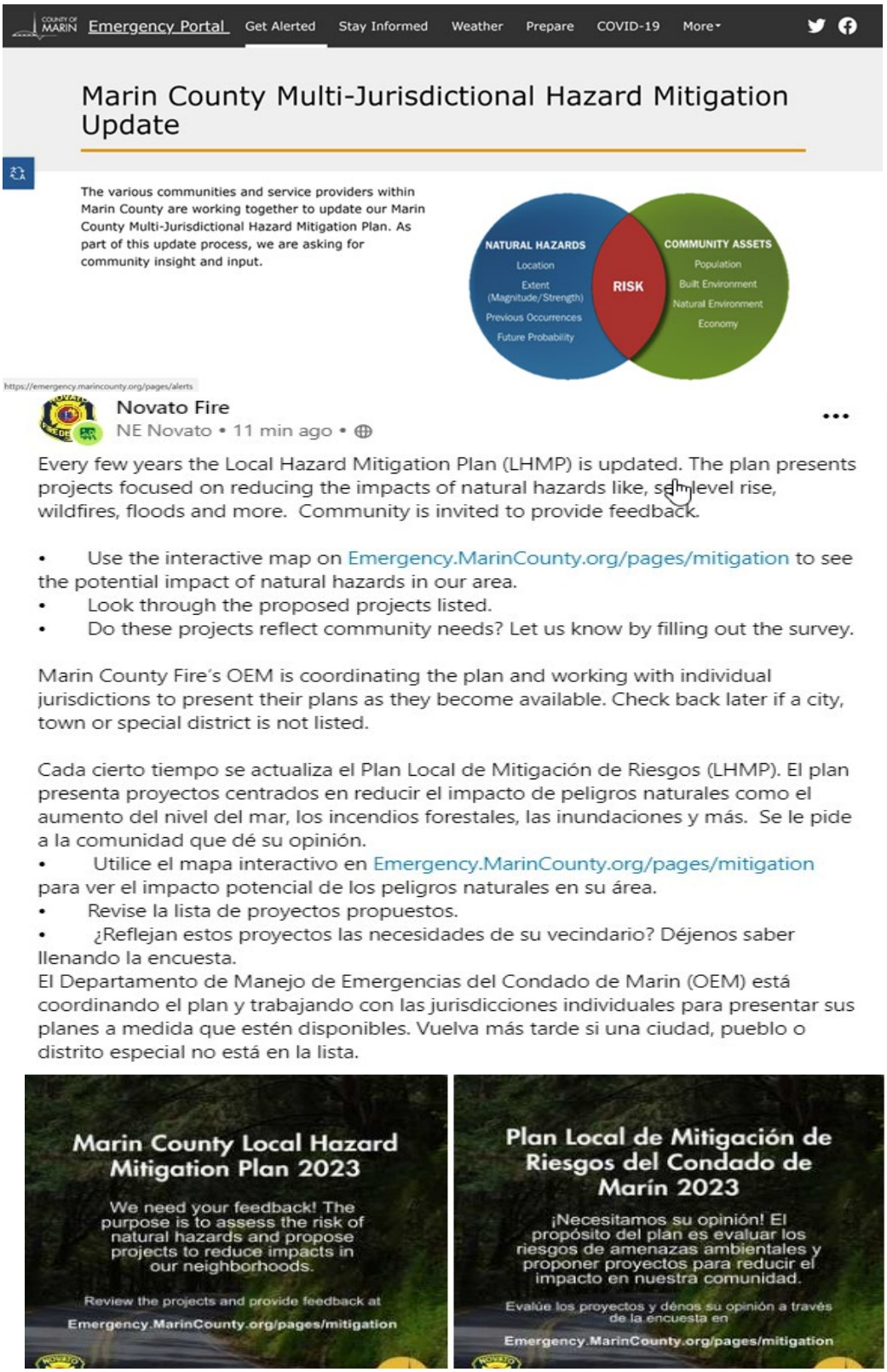


Figure 406: Marin County OEM MJHMP Website and City of Novato Link

PUBLIC MEETINGS

Two separate Marin County OA MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in to 28 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 407: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

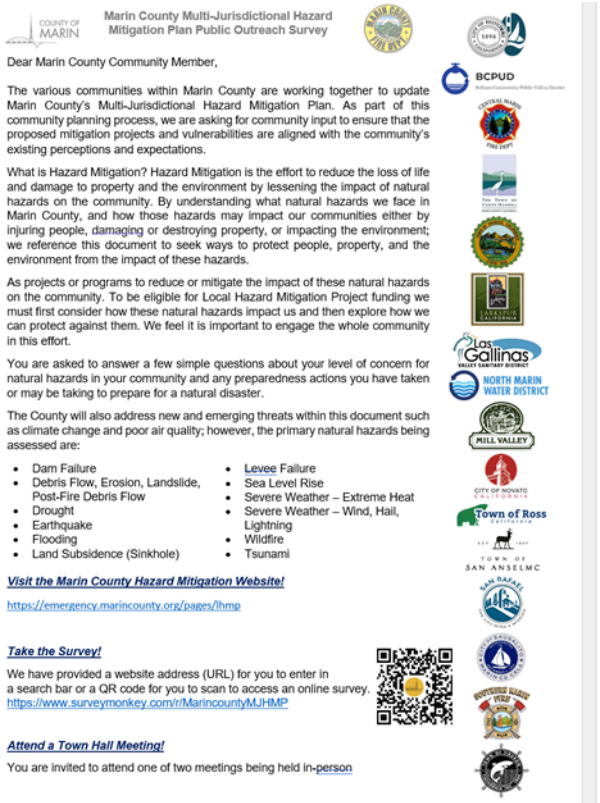
The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

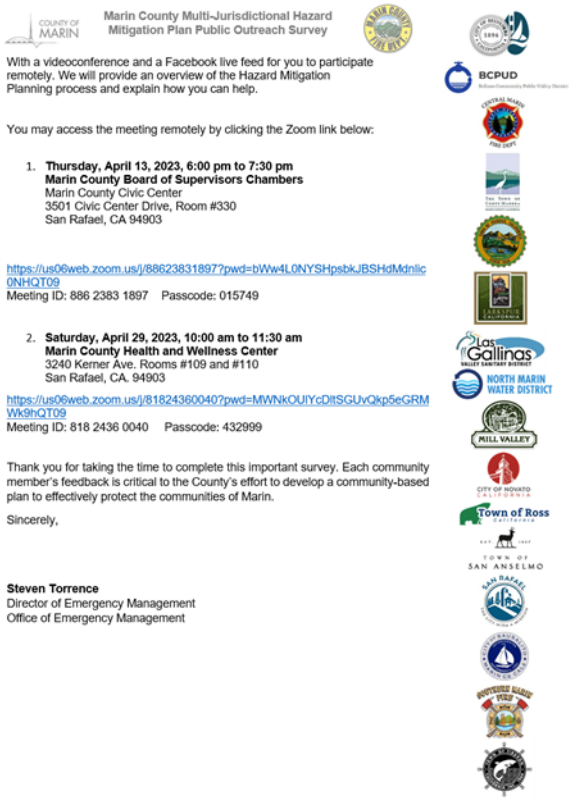
https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey.
https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 408: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 409: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of Novato had an additional comment period for the City of Novato Community Profile where their profile was advertised on social media with a link to it's posting on the Marin OEM Hazard Mitigation website for final public comment from December 13, 2023 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The City of Novato distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

What is now Novato was originally the site of several Coast Miwok villages: Chokecherry, near downtown Novato; Puyuku, near Ignacio; and Olómpali, at the present-day Olompali State Historic Park.

In 1839, the Mexican government granted the 8,876-acre (35.92 km2) Rancho Novato to Fernando Feliz. The rancho was named after a local Miwok leader who had probably been given the name of Saint Novatus at his baptism.[10] Subsequently, four additional land grants were made in the area: Rancho Corte Madera de Novato, to John Martin in 1839; Rancho San Jose, to Ignacio Pacheco in 1840; Rancho Olómpali, awarded in 1843 to Camilo Ynitia, son of a Coast Miwok chief; and Rancho Nicasio, by far the largest at 56,621 acres (229.1 km2), awarded to Pablo de la Guerra and John B.R. Cooper in 1844

Following the American Conquest of California and the Treaty of Guadalupe Hidalgo, Novato, along with the rest of California, became part of the United States on February 2, 1848. Early pioneers included Joseph Sweetser and Francis De Long who bought 15,000 acres (61 km2) in the mid-1850s and planted orchards and vineyards.

The original town was located around Novato Creek at what is now South Novato Boulevard. A railroad was built in 1879, connecting Novato to Sonoma County and San Rafael. The area around the train depot became known as New Town, and forms the edge of what today is Old Town Novato. The Novato Flatiron Building was built in 1908.

The Great Depression of the 1930s had a marked effect on the area, as many farmers lost their land. After World War II, Novato grew quickly with the construction of tract homes and a freeway. As the area was unincorporated, much of the growth was unplanned and uncontrolled.

Novato was finally incorporated as a city on January 20,1960. Novato is the northernmost city in the Marin County OA, California, and is located approximately 29 miles north of San Francisco and 37 miles northwest of Oakland. Novato, which covers 28 square miles, has a population of nearly 55,813 —a density about one-half of San Rafael, and nearly one-third of Petaluma or Vallejo. Novato has a rural atmosphere largely because of its low population density and the high amount of open space and parks in and near the City.

The City of Novato had an estimated population of 55,813 in 2020, with 22,290 housing units in the City. The median income for a household in the City was $101,629, and the per capita income for the City was $55,813. Approximately 4.0 percent of families and 6.4 percent of the population were below the poverty line (2020 data, U.S. Census Bureau).

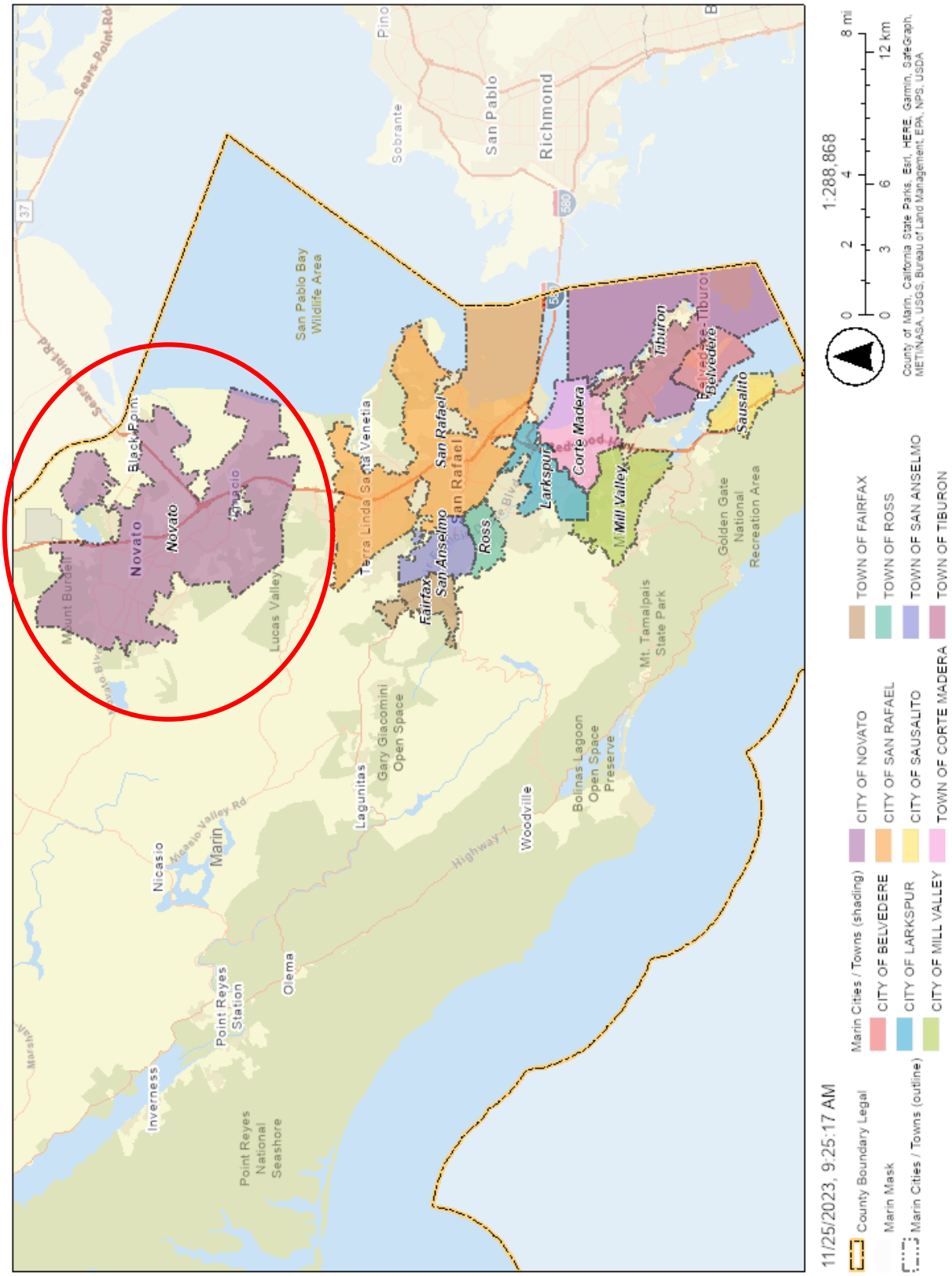


Figure 410: Map of City of Novato in Marin County
Source: Marin County OEM

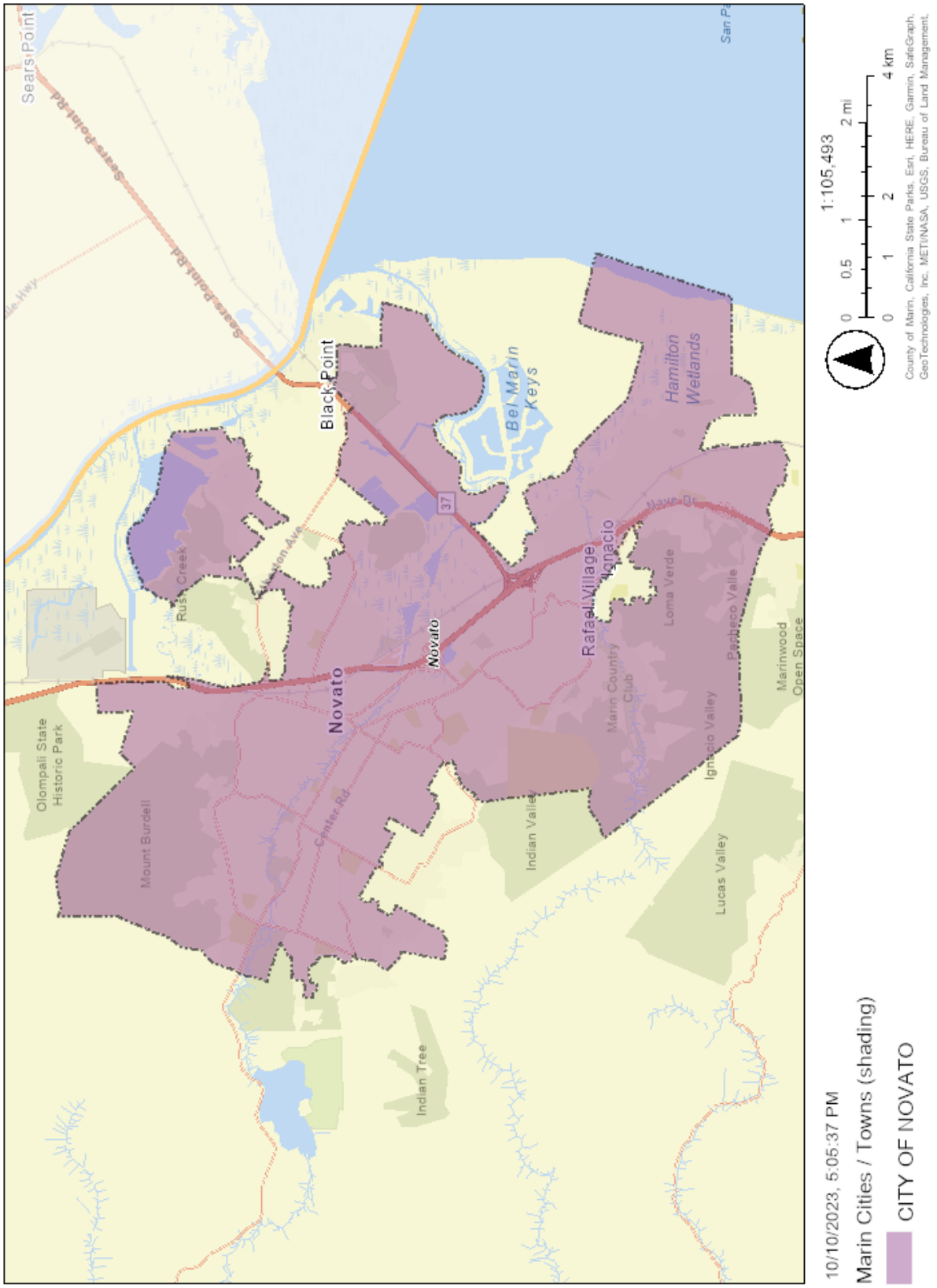


Figure 411: Map of the City of Novato
Source: Marin County OEM

1.4 GOVERNMENT

The City of Novato is governed by a five-person City Council. The city council elects mayor and mayor pro tem each year from its membership, the executive head of the City; and appoints a City Manager, the administrative head of the City. The city consists of 6 departments: the Administration, Community Development, Finance, Parks, Recreation, and Community Services Police, and Public Works.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

The Novato Fire Protection District established on July 6, 1926, as an independent Special District of the State of California. The purpose of the District is to provide all-risk emergency and non-emergency services to the City of Novato and the surrounding 71 square miles of unincorporated area serving an estimated population of 65,000.

The Novato Police Department is a full time police department, Novato Police provides a professional and proactive response through Patrol, Investigations, Traffic, Narcotics Enforcement, a 9-1-1 dispatch center, and disaster emergency services. The department is divided into the Operations and the Administrative Services Division. There are approximately 80 staff members that work for the department, including 60 sworn personnel and a volunteer program.

1.5 WEATHER AND CLIMATE

The City of Novato lies 30 feet above sea level. In Novato, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 41.8°F to 74.7°F and is rarely below 41°F or above 75°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month of highest relative humidity is February (79 %). The month with the lowest relative humidity is June (65 %). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	8.9 °C (48.1) °F	9.7 °C (49.5) °F	11 °C (51.8) °F	12.2 °C (53.9) °F	14.4 °C (57.9) °F	16.8 °C (62.2) °F	17.1 °C (62.8) °F	17.3 °C (63.1) °F	17.2 °C (63) °F	15.4 °C (59.7) °F	11.9 °C (53.3) °F	9.1 °C (48.5) °F
Min. Temperature °C (°F)	5.5 °C (41.8) °F	6.2 °C (43.1) °F	7.3 °C (45.1) °F	8.2 °C (46.8) °F	10.1 °C (50.1) °F	11.8 °C (53.3) °F	12.4 °C (54.4) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.2 °C (52.1) °F	8.2 °C (46.7) °F	5.9 °C (42.6) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	16 °C (60.8) °F	17.5 °C (63.4) °F	20 °C (68.1) °F	23.2 °C (73.8) °F	23.6 °C (74.5) °F	23.7 °C (74.7) °F	23.9 °C (75.1) °F	21.4 °C (70.6) °F	16.8 °C (62.3) °F	13.5 °C (56.2) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	79%	76%	70%	68%	65%	70%	71%	68%	68%	74%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

Figure 412: The City of Novato Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the City of Novato since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The City of Novato had an estimated population of 54,036 in the 2018 plan. 2020 U.S. Census Survey estimated the City's population at 53,225. However, revised estimates for 2022 estimate the population to decrease to 52,441 population.

Table 4: City of Novato Estimated Jurisdictional Population				
Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
City of Novato	52,441	53,225	54,036	-2.95%

Table 196: City of Novato Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The City of Novato is 53,225 as of 2020. Table 5 shows the population growth comparison of the State of California, County of Marin and the City of Novato between 2010 – 2020.

Table 5: Population Change of The City of Novato				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
Novato, City	51,904	53,225	1,321	-2.95%

Table 197: Population Change of The City of Novato
Source: City of Novato Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the City of Novato.

Table 6: Languages Spoken in Novato	
Primary Language Spoken	% of Population
English only	73.2%
Spanish	16.5%
Other Indo-European languages	5.7%
Asian and Pacific Islander languages	3.8%
Other languages	0.9%

Table 198: Languages Spoken in Novato
Source: US Census Bureau (2020)

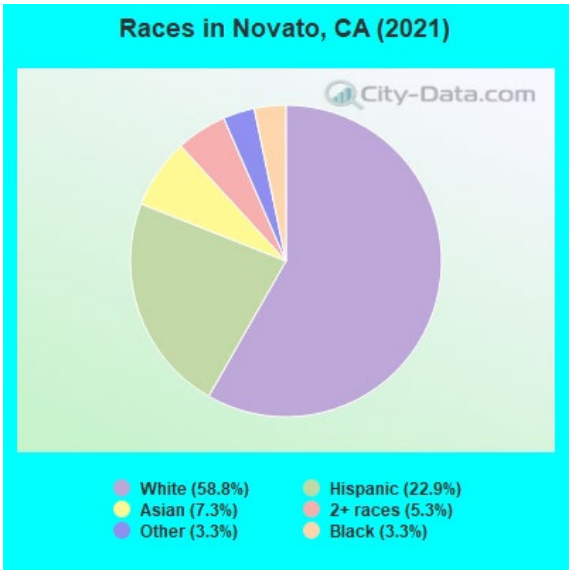


Figure 413: Races in Novato
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of Novato							
2022	Number	21,337	12,465	3,395	1,362	3,572	543
	Percent	100.00%	58.42%	27.24%	40.12%	262.26%	15.20%
2018	Number	21,448	12,581	3,427	1,335	3,557	548
	Percent	100.00%	58.66%	27.24%	38.96%	266.44%	15.41%

Table 199: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

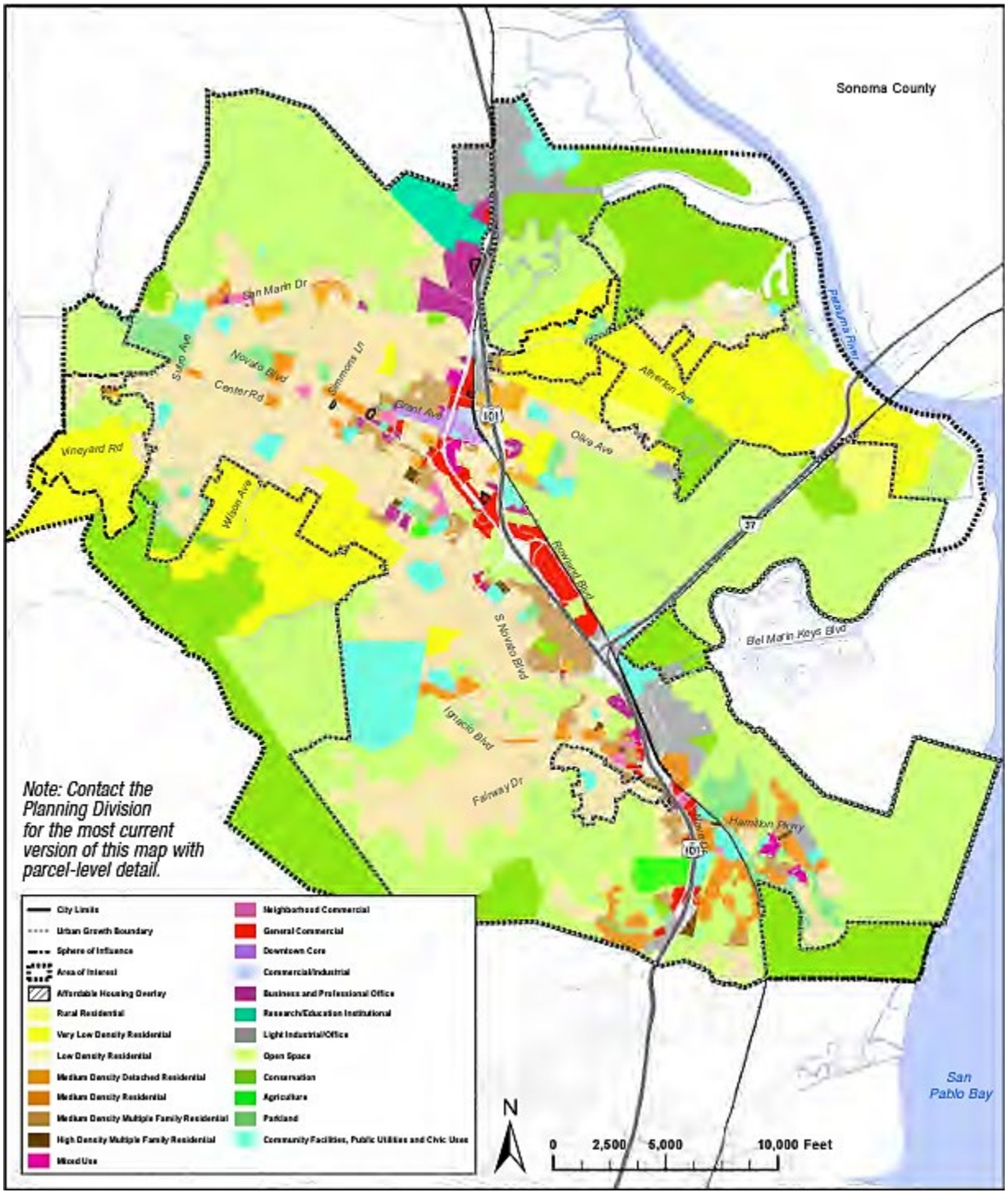


Figure 414: City of Novato Land Use Map
Source: City of Novato General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards

NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Hail, Lightning

Table 200: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Table 9 illustrates the NRI Hazard Type Risk Index for Novato Census Tract 1022.03.

Tables 9 - 13 illustrate the Social Vulnerability Map for Novato Census Tracts.

Table 9: NRI Hazard Type Risk Index for Novato Census Tract 1022.03

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,722,258	Relatively High	Very High	1.35	$3,686,835	98.6
Riverine Flooding	$183,359	Relatively High	Very High	1.35	$248,329	92.9
Heat Wave	$8,084	Relatively High	Very High	1.35	$10,949	53.2
Tornado	$3,889	Relatively High	Very High	1.35	$5,267	12.6
Landslide	$2,470	Relatively High	Very High	1.35	$3,345	84.4
Strong Wind	$264	Relatively High	Very High	1.35	$357	11.5
Wildfire	$68	Relatively High	Very High	1.35	$92	35.4
Coastal Flooding	$0	Relatively High	Very High	1.35	$0	0
Drought	$0	Relatively High	Very High	1.35	$0	0
Tsunami	$0	Relatively High	Very High	1.35	$0	0

Table 201: NRI Hazard Type Risk Index for Novato Census Tract 1022.03
Source: FEMA National Risk Index 2023

Figure 10 - 14 illustrate the Social Vulnerability Map for Novato Census Tracts.

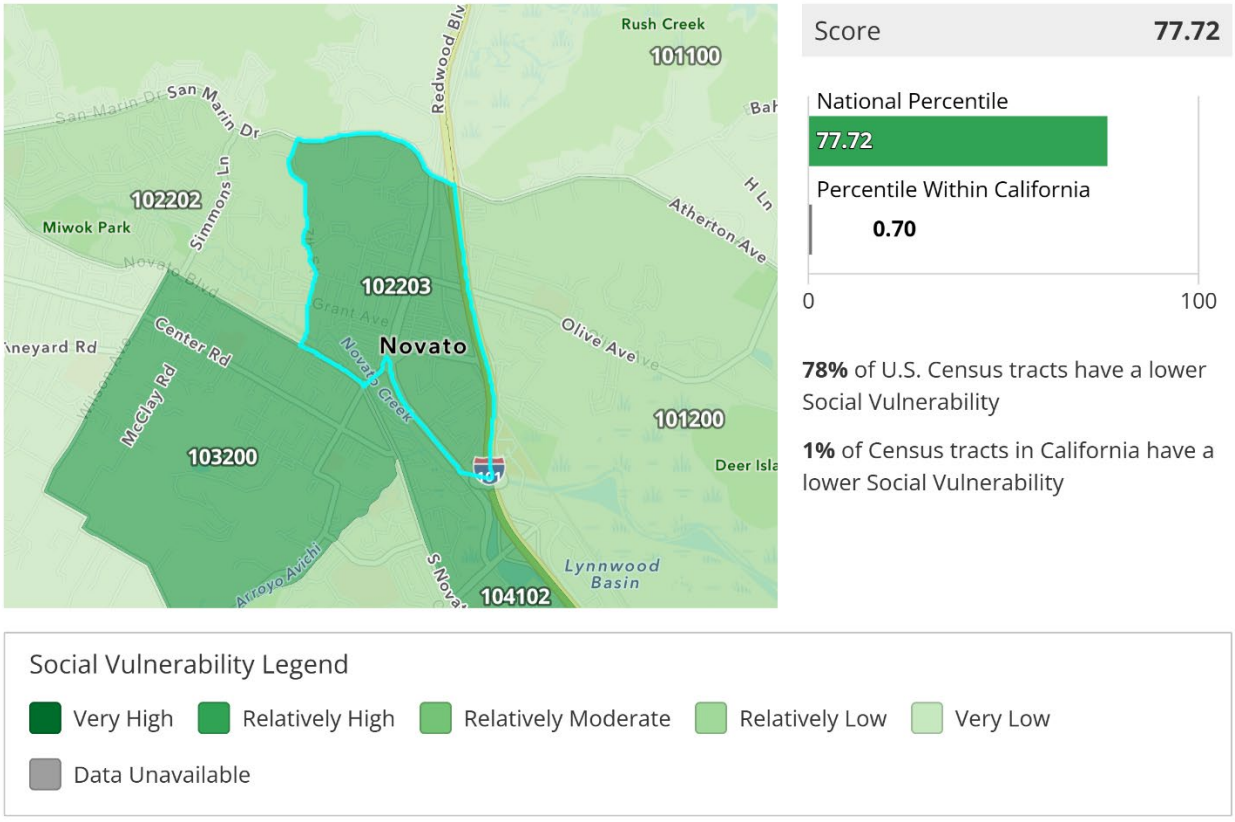


Figure 415: City of Novato Social Vulnerability Map Census Tract 1022.03
Source: FEMA National Risk Index 2023

Table 10: NRI Hazard Type Risk Index for Novato Census Tract 1032.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,889,584	Relatively High	Very High	1.37	$2,597,248	97.5
Riverine Flooding	$1,697,035	Relatively High	Very High	1.37	$2,332,588	99.4
Wildfire	$43,948	Relatively High	Very High	1.37	$60,407	91.9
Heat Wave	$10,500	Relatively High	Very High	1.37	$14,432	58.7
Tornado	$5,050	Relatively High	Very High	1.37	$6,941	16.8
Landslide	$3,209	Relatively High	Very High	1.37	$4,411	88.3
Strong Wind	$342	Relatively High	Very High	1.37	$471	13.8
Coastal Flooding	$0	Relatively High	Very High	1.37	$0	0
Drought	$0	Relatively High	Very High	1.37	$0	0
Tsunami	$0	Relatively High	Very High	1.37	$0	0

Table 202: NRI Hazard Type Risk Index for Novato Census Tract 1032.00
Source: FEMA National Risk Index 2023

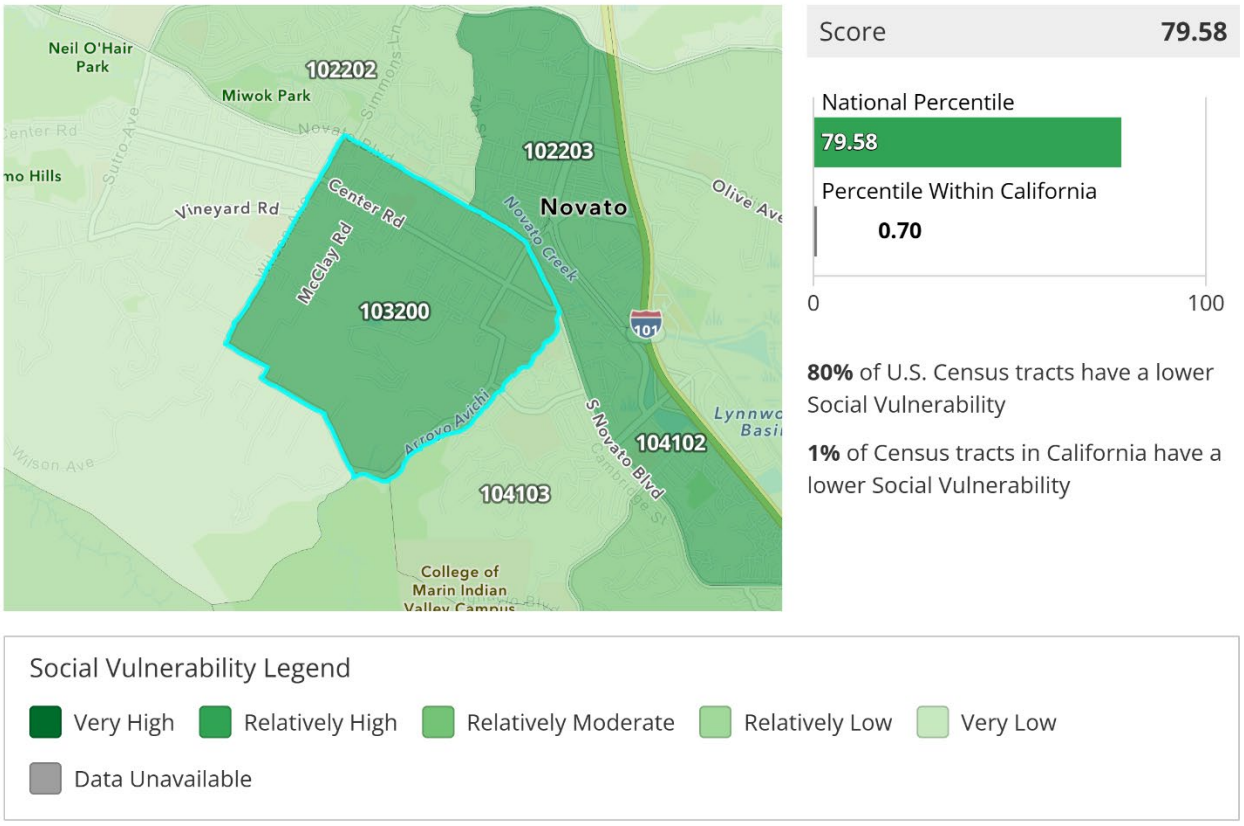


Figure 416: City of Novato Social Vulnerability Map Census Tract 10320.00
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for Novato Census Tract 1012.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,569,756	Relatively Low	Very High	0.88	$2,272,662	96.8
Riverine Flooding	$154,980	Relatively Low	Very High	0.88	$137,063	88.1
Coastal Flooding	$64,204	Relatively Low	Very High	0.88	$56,781	95
Drought	$44,177	Relatively Low	Very High	0.88	$39,070	95.8
Heat Wave	$4,569	Relatively Low	Very High	0.88	$4,041	36.7
Wildfire	$4,251	Relatively Low	Very High	0.88	$3,760	79
Tornado	$3,094	Relatively Low	Very High	0.88	$2,736	6.3
Landslide	$2,521	Relatively Low	Very High	0.88	$2,230	77.9
Strong Wind	$168	Relatively Low	Very High	0.88	$148	6
Tsunami	$0	Relatively Low	Very High	0.88	$0	0

Table 203: NRI Hazard Type Risk Index for Novato Census Tract 1012.00
Source: FEMA National Risk Index 2023

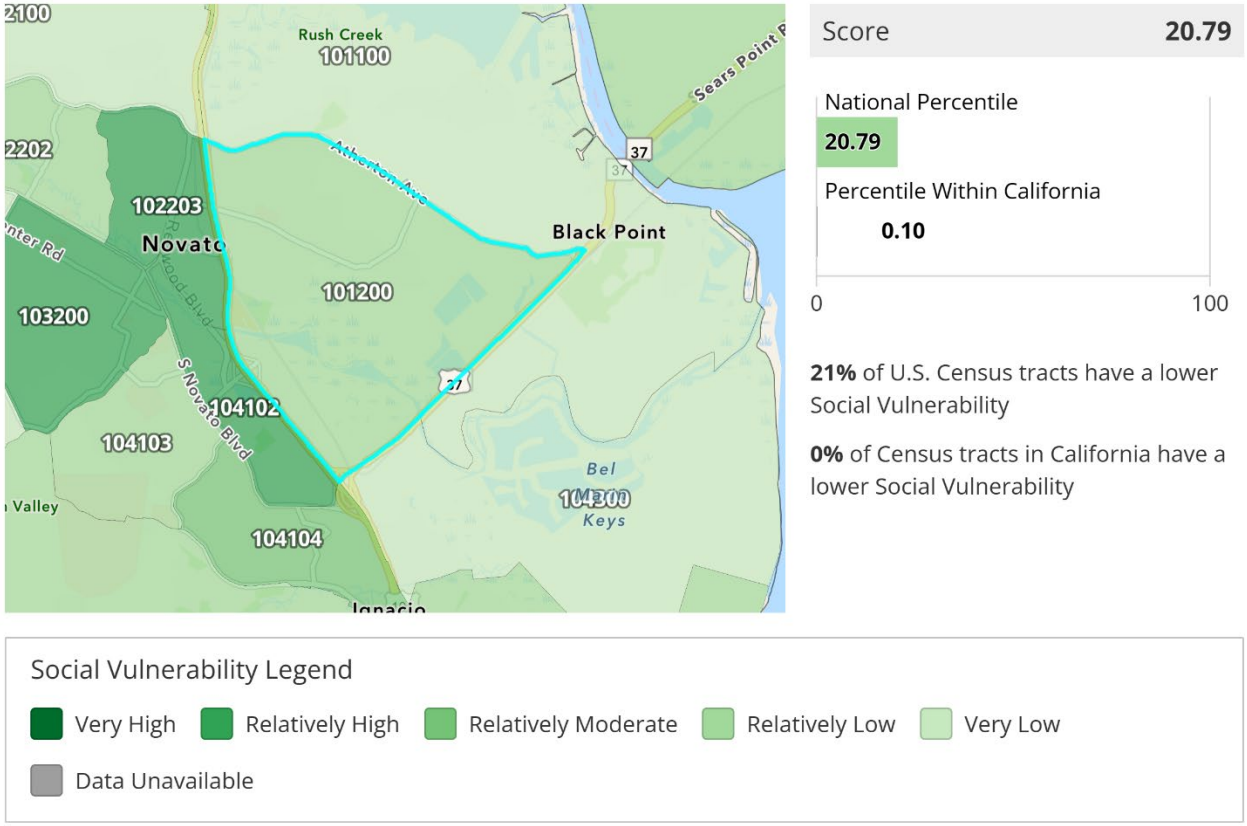


Figure 417: City of Novato Social Vulnerability Map Census Tract 1012.00
Source: FEMA National Risk Index 2023

Table 12: NRI Hazard Type Risk Index for Novato Census Tract 1022.02

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,255,306	Relatively Low	Very High	0.94	$1,177,508	92.4
Riverine Flooding	$375,636	Relatively Low	Very High	0.94	$352,356	94.9
Heat Wave	$9,379	Relatively Low	Very High	0.94	$8,798	49.2
Tornado	$3,991	Relatively Low	Very High	0.94	$3,744	8.7
Landslide	$3,696	Relatively Low	Very High	0.94	$3,467	85
Wildfire	$1,511	Relatively Low	Very High	0.94	$1,417	69.9
Strong Wind	$295	Relatively Low	Very High	0.94	$277	9.6
Coastal Flooding	$0	Relatively Low	Very High	0.94	$0	0
Drought	$0	Relatively Low	Very High	0.94	$0	0
Tsunami	$0	Relatively Low	Very High	0.94	$0	0

Table 204: NRI Hazard Type Risk Index for Novato Census Tract 1022.02
Source: FEMA National Risk Index 2023

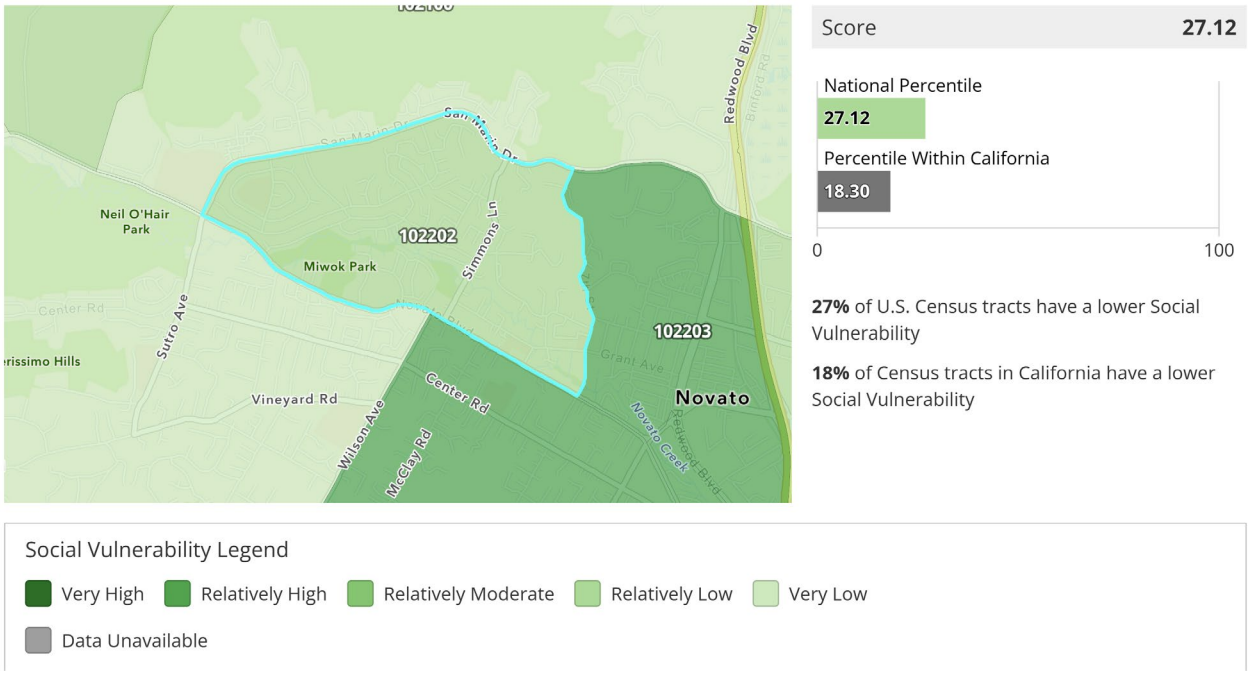


Figure 418: City of Novato Social Vulnerability Map Census Tract 1022.02
Source: FEMA National Risk Index 2023

Table 13: NRI Hazard Type Risk Index for Novato Census Tract 1041.02

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,540,791	Relatively High	Very High	1.19	$1,837,291	95.6
Riverine Flooding	$690,513	Relatively High	Very High	1.19	$823,391	98
Heat Wave	$8,314	Relatively High	Very High	1.19	$9,914	51.4
Coastal Flooding	$5,903	Relatively High	Very High	1.19	$7,038	88.3
Tornado	$3,151	Relatively High	Very High	1.19	$3,757	8.8
Landslide	$2,413	Relatively High	Very High	1.19	$2,878	82.1
Wildfire	$282	Relatively High	Very High	1.19	$337	49.7
Strong Wind	$254	Relatively High	Very High	1.19	$303	10.2
Drought	$0	Relatively High	Very High	1.19	$0	0

Table 205: NRI Hazard Type Risk Index for Novato Census Tract 1041.02
Source: FEMA National Risk Index 2023

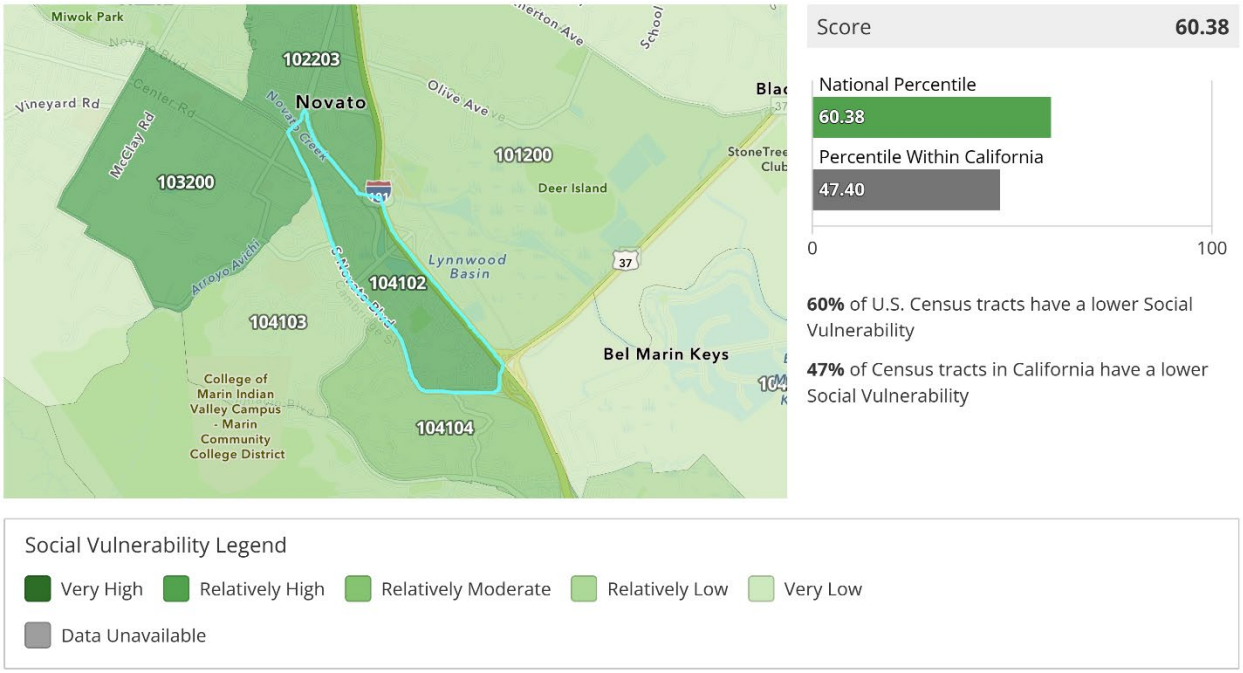


Figure 419: City of Novato Social Vulnerability Map Census Tract 1041.02
Source: FEMA National Risk Index 2023

Social Vulnerability in Novato and the Marin County OA

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, the Marin County OA is considered to have a “very high” ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show the Marin County OA as a whole to have "Relatively High" risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category ("Very High Risk"), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

However, Marin City is ranked as "Very Low" risk for the National Risk Index. Previous discussion highlighted why the Expected Annual Loss was low, but further discussion is required. As a County, we know Marin City should not be classified as "Very Low" on the NRI. Marin City residents, for example, only have one way in and out of their community and this road floods frequently, making it unsafe to cross and leave the community for work, school, medical resources. Additionally, there is only one "grocery" store, a Target, in Marin City. Both of these elements contribute to the vulnerability of residents as they may be unable to leave or return home and have limited access to groceries, relying on a single store's supply chain. At the local elementary school in Marin City, 47% of students are eligible for free and reduced-price meals (2022 – 2023 school year), a reflection of the financial capacity of local families. All this means, we can expect the social and built capacity of Marin City to be limited.

1.8 Economy and Tax Base

The City of Novato is one of the Marin County OA's primary retail, service, and commercial center. Table 14 shows income by household in The City of Novato as of 2019.

Table 14: Household Income for The City of Novato as of 2021

Household Income	Number	Percent
Total Households	20,682	-
Less than $10,000	600	2.9
$10,000 to $14,999	517	2.5
$15,000 to $24,999	972	4.7
$25,000 to $34,999	972	4.7
$35,000 to $49,999	1,551	7.5
$50,000 to $74,999	2,689	13.0
$75,000 to $99,999	2,399	11.6
$100,000 to $149,999	3,495	16.9
$150,000 to $199,999	2,792	13.5
$200,000 or more	4,695	22.7
Median household income (dollars)	$107,975	
Mean household income (dollars)	$142,676	

Table 206: Household Income for The City of Novato as of 2019
Source: US Census Bureau American Community Survey 2021 Estimates

Table 15 shows the percentage of people in The City of Novato over the age of 16 employed by industry.

Table 15: City of Novato Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	1503	-
Agriculture, forestry, fishing and hunting, and mining	9	0.60 %
Construction	124	8.25%
Manufacturing	128	8.52%
Wholesale trade	0	0%
Retail trade	249	16.57%
Transportation and warehousing, and utilities	33	2.20%
Information	0	0
Finance and insurance, and real estate and rental and leasing	45	2.99%
Professional, scientific, and management, and administrative and waste management services	130	8.65%
Educational services, and health care and social assistance	388	25.81%
Arts, entertainment, and recreation, and accommodation and food services	221	14.70%
Other services, except public administration	45	2.99%
Public administration	131	8.72%

Table 207 City of Novato Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the City of Novato to fulfill the requirements of its mission during an emergency:

Table 16: City of Novato Critical Facilities				
Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire	Fire: Novato Fire Protection District (NOV) / Headquarters & Primary EOC	95 Rowland Way, Novato, CA 94945	N/A	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 61	7025 Redwood Blvd Novato, CA 94945	N/A	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 62	450 Atherton Ave, Novato, CA 94945	High	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 63	65 San Ramon Way, Novato, CA 94945	Moderate	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 64	319 Enfrente Rd, Novato, CA 94949	High	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 65	5 Bolling Dr, Novato, CA 94945	High	X

Law/EOC	Novato Police Dept / Alternative EOC	909 Machin Ave Novato, CA 94945	N/A	X
Local Government	Novato City Hall	922 Machin Ave Novato, CA 94945	N/A	X
Local Government	Margaret Todd Senior Center/Evacuation Shelter	1560 Hill Road Novato, CA 94947	High	X
Local Government	Novato DPW - Corporation Yard	550 Davidson Street Novato, CA 94945	N/A	X
Health / Medical	Novato Community Hospital	180 Rowland Way Novato, CA 94945	N/A	X
Health / Medical	Novato Healthcare Center	1565 Hill Rd Novato, CA 94947	High	X
Health / Medical	Miles - Center Road House	1649 Center Rd Novato, CA 94947	N/A	AO
Health / Medical	Rae Lane House	858 Rae Ln Novato, CA 94947	N/A	X
Health / Medical	Lifehouse - Stonehaven	2 Stonehaven Ct Novato, CA 94947	N/A	X
Health / Medical	Atria Tamalpais Creek	853 Tamalpais Ave Novato, CA 94947	N/A	AO
Health / Medical	Oakmont of Novato	1465 S. Novato Blvd. Novato, CA 94947	N/A	X
Health / Medical	Creekwood	830 Tamalpais Ave. Novato, CA 94947	N/A	AO
Health / Medical	Novato Residential Support Services	1333 Seventh Street Novato, CA 94947	High	X
Health / Medical	Anton Pointe, The	1470 South Novato Blvd., Novato, CA 94941	N/A	X
Health / Medical	Young at Heart	37 Mendocino Lane Novato, CA 94947	N/A	X
Health / Medical	Cedars Dante	1914 Novato Blvd Novato, CA 94945	N/A	X
Health / Medical	Wildflowers I	256 Sunset Parkway Novato, CA 94947	N/A	AE
Health / Medical	Lifehouse - Bolling Circle	464 Bolling Circle Novato, CA 94949	High	X
Health / Medical	Buckelew Programs	201 Alameda del Prado Novato, CA 94949	High	X
Health / Medical	Canyon Manor	655 Canyon Road Novato, CA 94947	High	X
Health / Medical	Lifehouse - 271 Captain Nurse Circle	271 Captain Nurse Circle Novato, CA 94949	High	X
Health / Medical	Lifehouse - 400 Palm Drive	400 S. Palm Dr. Apt 201, Novato CA, 94949	N/A	X
Health / Medical	Yumi House	810 Eucalyptus Ave Novato, CA 94947	N/A	X
Health / Medical	Lifehouse - Sherwood Place	5 Sherwood Place Novato, CA 94945	High	X
Health / Medical	Cornerstone Community Homes - Brown's	36 Brown Drive Novato, CA 94947	High	X
Health / Medical	Cornerstone Community Homes - San Luis	365 San Luis Way Novato, CA 94945	High	X
Health / Medical	Cypress House	856 Cypress Ave Novato, CA 94947	N/A	AO
Health / Medical	Lynwood Home	1212 Lynwood Dr. Novato, CA 94947	Moderate	X
Health / Medical	Casa Allegra - San Felipe	4 San Felipe Way Novato, CA 94945	N/A	X
Health / Medical	Casa Allegra - Tamalpais	778 Tamalpais Avenue Novato, CA 94945	N/A	X

Health / Medical	Cedars of Marin - 2nd Street	1120 Second St. Novato, CA 94945	N/A	X
Health / Medical	Avery Lane	685 Atherton Avenue Novato, CA 94945	Moderate	X
Health / Medical	Elegance Hamilton Hill	1 Hamilton Hill Drive Novato, CA 94949	Moderate	X
Health / Medical	Cornerstone Community Homes - Cambridge	1420 Cambridge St. Novato, CA 94947	Moderate	X
Health / Medical	Buckelew RSS Novato	1333 7th Street Novato, Ca 94947	High	X
Health / Medical	Lifehouse - 251 Captain Nurse Circle	251 Captain Nurse Circle Novato, CA 94949	High	X
Health / Medical	Homeward Bound of Marin - New Beginnings Center	1399 N. Hamilton Parkway Novato, CA 94949	Moderate	X
Health / Medical	Homeward Bound - Transition to Wellness	385 North Hamilton Parkway Novato, CA 94949	Moderate	X
Health / Medical	Shalamo Home	200 Daryl Ave. Novato, CA 94947	High	X
School	Novato Unified School District – Admin Office	1015 7th Street Novato, CA 94945	High	X
School	Hamilton Meadow Park School – Middle/Elementary	5530 Nave Drive Novato, CA 94949	Very High	X
School	Loma Verde Elementary (Unincorporated Novato)	399 Alameda de la Loma Novato, CA 94949	Very High	X
School	Lu Sutton Elementary	1800 Center Road Novato, CA 94947	Moderate	X
School	Lynwood Elementary	1320 Lynwood Drive Novato, CA 94947	Moderate	AE
School	Olive Elementary	620 Olive Avenue Novato, CA 94945	High	X
School	Pleasant Valley Elementary	755 Sutro Avenue Novato, CA 94947	High	X
School	Rancho Elementary	1430 Johnson Street Novato, CA 94947	N/A	X
School	San Ramon Elementary	45 San Ramon Way Novato, CA 94949	N/A	X
School	San Jose Middle School	1000 Sunset Parkway Novato, CA 94949	High	X
School	Sinaloa Middle School	2045 Vineyard Road Novato, CA 94947	N/A	X
School	Novato High School	625 Arthur Street Novato, CA 94947	High	X
School	San Marin High School	15 San Marin Drive Novato, CA 94945	Moderate	X
School	Hill Education Center / Marin Oaks High School	720 Diablo Avenue Novato, CA 94947	Moderate	X
School	Novato Charter School	940 “C” Street Novato, CA 94949	Moderate	X
School	Our Lady of Loretto School	1811 Virginia Avenue Novato, CA 94945	Moderate	AO
School	Marin Christian Academy	1370 South Novato Boulevard Novato, CA 94947	Moderate	AE
School	Good Shepherd Lutheran School	1180 Lynwood Drive Novato, CA 94947	High	X
School	North Bay Christian Academy	6965 Redwood Boulevard Novato, CA 94945	N/A	X

Evacuation Shelter	Margaret Todd Senior Center	1560 Hill Rd, Novato	High	X
High Potential Loss Facilities				
Military/Civil Defense	US Coast Guard – Pacific Coast Strike Team	450 Hangar Ave. Novato, CA 94949	N/A	X
DAM	Novato Creek Dam	3500 Novato Blvd. Novato, CA 94945	Moderate	X
Critical Infrastructure				
Water/ Wastewater	DPW Pump Station (zone 1) - Cheda	38.0876595793068, -122.535515921059	Moderate	AE
Water/ Wastewater	DPW Pump Station (zone 1) - Farmers	38.0889709965199, -122.534793113191	N/A	AE
Water/ Wastewater	DPW Pump Station (zone 1) - Lynwood	38.0923793901915, -122.548345546799	N/A	AE
Water/ Wastewater	Hamilton Storm Pumps - Pizarro	134 Pizarro Avenue Novato, CA 94945	N/A	X
Water/ Wastewater	Hamilton Storm Pumps - San Pablo	115 San Pablo Avenue Novato, CA 94945	N/A	X
Water/ Wastewater	Novato Sanitary District	500 Davidson St. Novato, CA 94945	N/A	X
Water/ Wastewater	Sanitary District - Bel Marin Keys	425 Bel Marin Keys Blvd. Novato, CA 94949	N/A	X
Power Utility	PG&E - Machin	878 Sweetser Ave. Novato, CA 94945	N/A	X
Power Utility	PG&E - Stafford	38.119685, -122.614187	High	X
Power Utility	PG&E Substation - Ignacio	137 Hamilton Dr. Novato, CA 94949	N/A	AE
Communications	MERA Antenna Site - Mt Burdell	38.1449, -122.5941	Moderate	X
Communications	MERA Antenna Site – Big Rock Ridge	38.0591, -122.6039	Moderate	X
Communications	KCBS Transmitter site (EAS Alerting provider)	8198 Binford Rd. Novato, CA 94945	N/A	AE
Transportation	Golden Gate Transit: Bus Dispatch, Fuel, Maintenance	4 Golden Gate Place Novato, CA 94945	N/A	X

Table 208: City of Novato Critical Facilities
Source: City of Novato

1.10 HISTORICAL PROPERTIES

The City of Novato has four registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of Novato Chamber of Commerce.
- City of Novato website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA). There is a list of numerous other potentially historically significant structures listed in Appendix B of the City's General Plan.

Table 17: Historic Sites In The City of Novato

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Camilo Ynitia Adobe (210)		X	X		Novato
Fashion Shop and Stephen Porcella House	X			6/25/1980	Novato
Hamilton Army Air Field Discontiguous Historic District	X			11/20/1998	Novato

Table 209: Historic Sites In The City of Novato
Source: California Office of Historic Preservation and the National Register of Historic Places

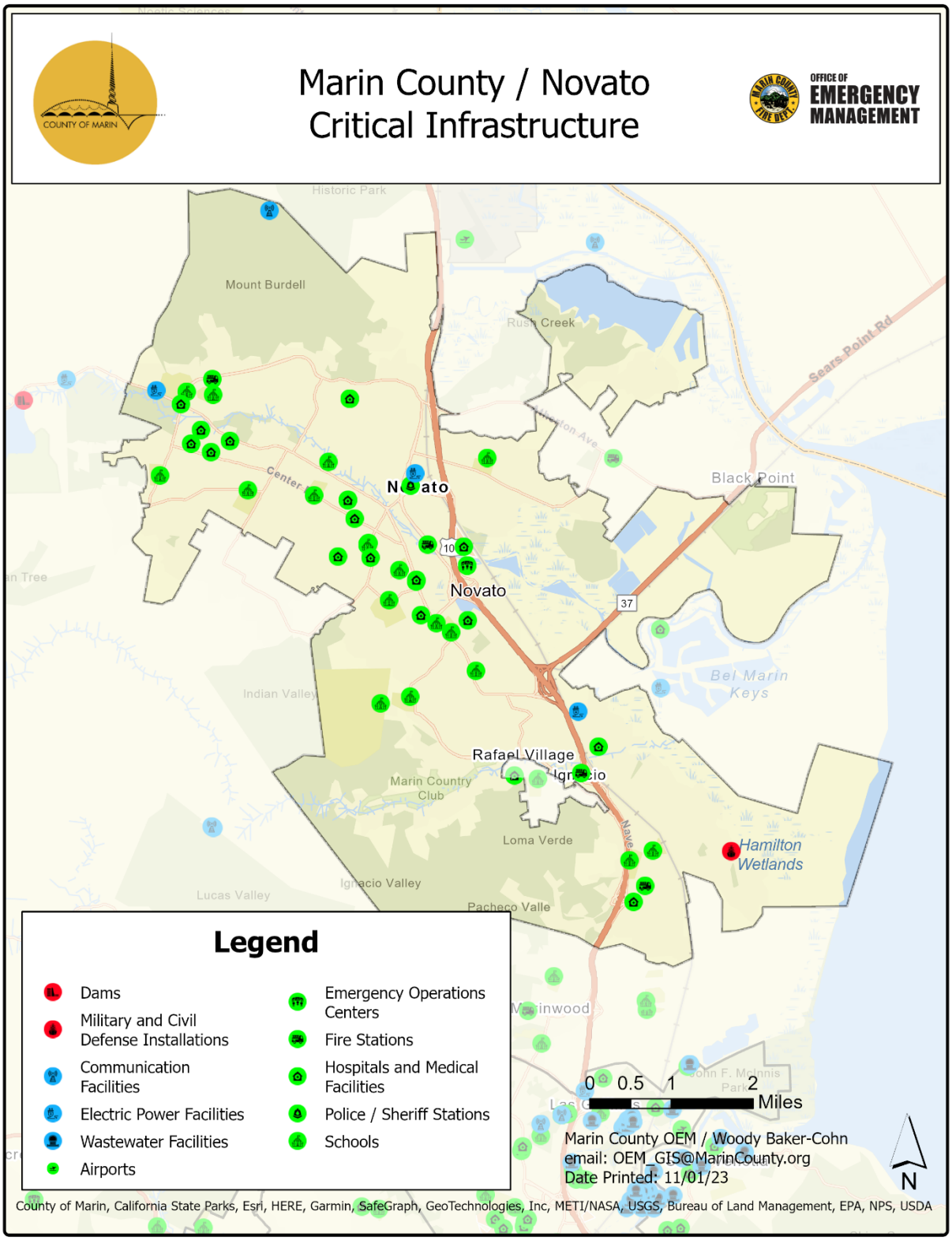


Figure 420: City of Novato Critical Facilities and Infrastructure
Source: Marin County OEM

2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of Novato identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 16 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

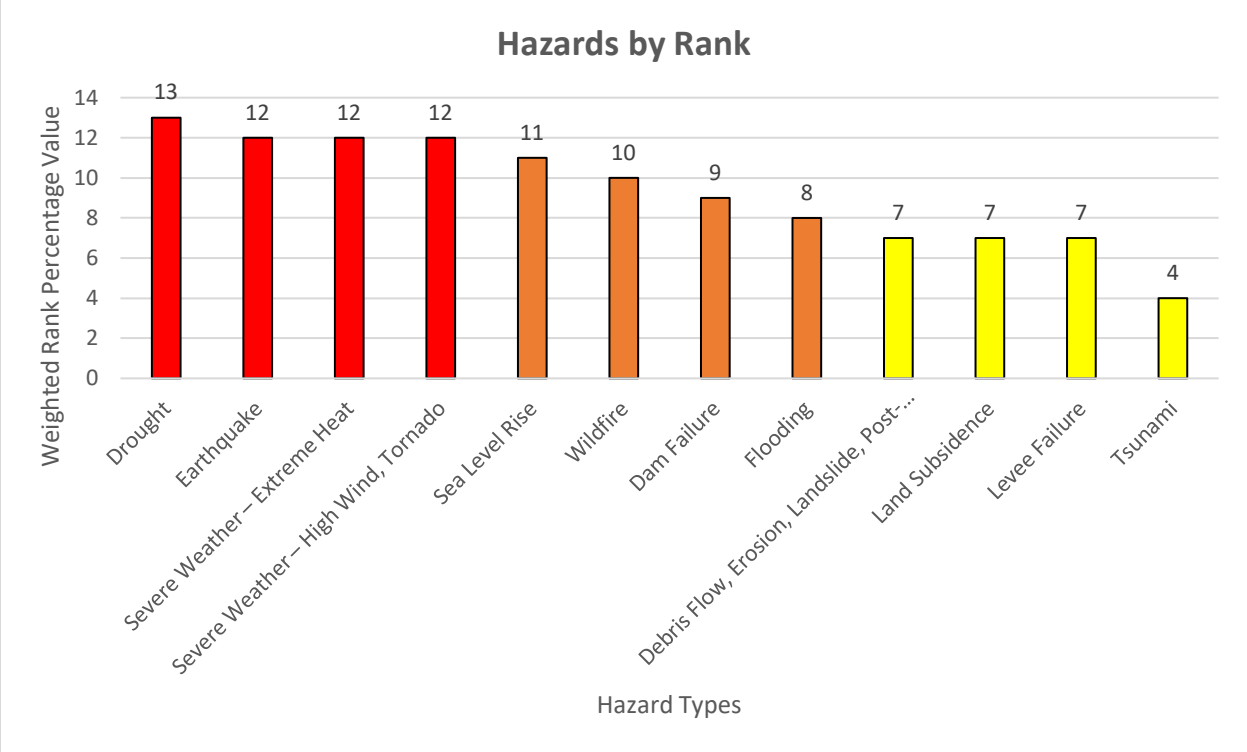


Figure 421: Marin County & City of Novato Risk Assessment – Planning Team Top Hazards

Figure 17: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 422: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 18: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 210: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

AR6 WGI Headline Statements from the Summary for Policymakers (ipcc.ch)

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

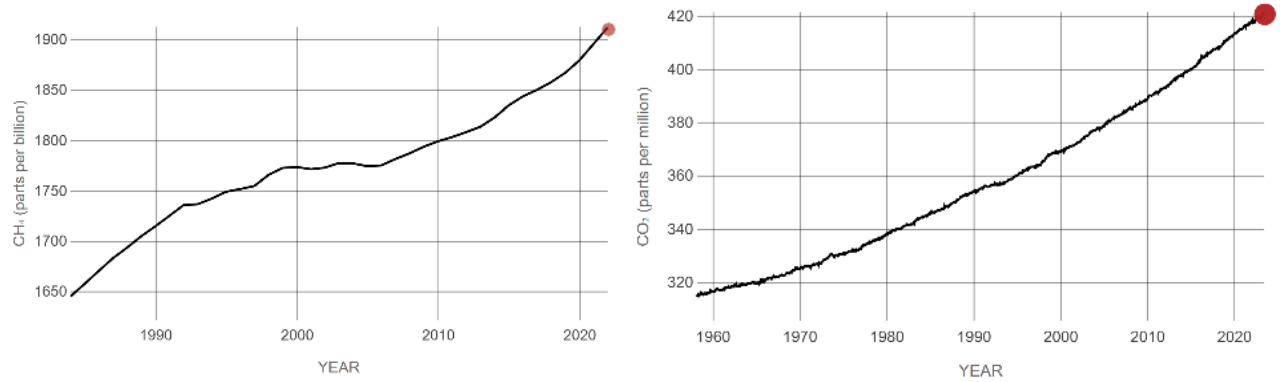


Figure 423: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

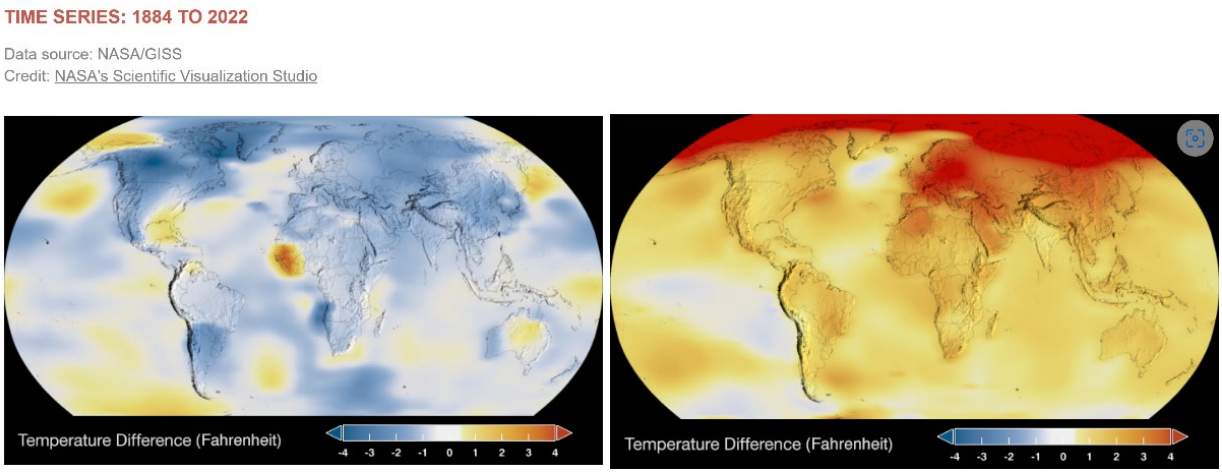


Figure 424: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.

- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

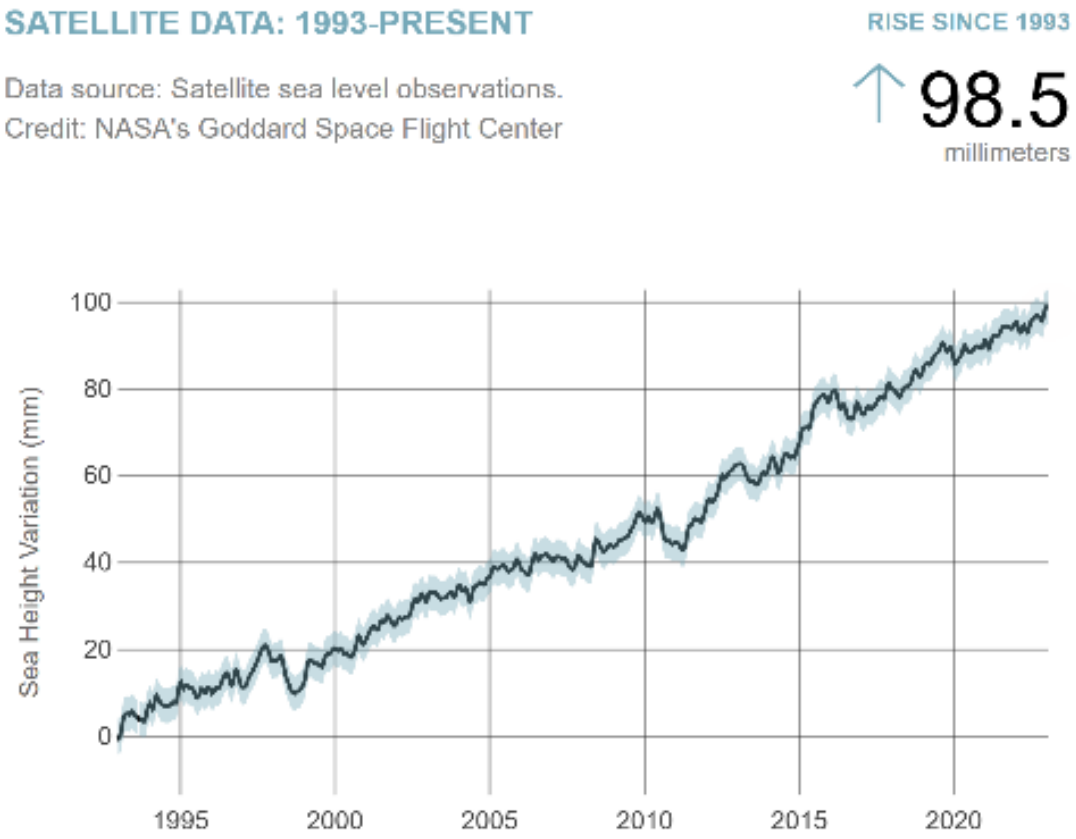


Figure 425: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, seal level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California

Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals,

workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.

- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

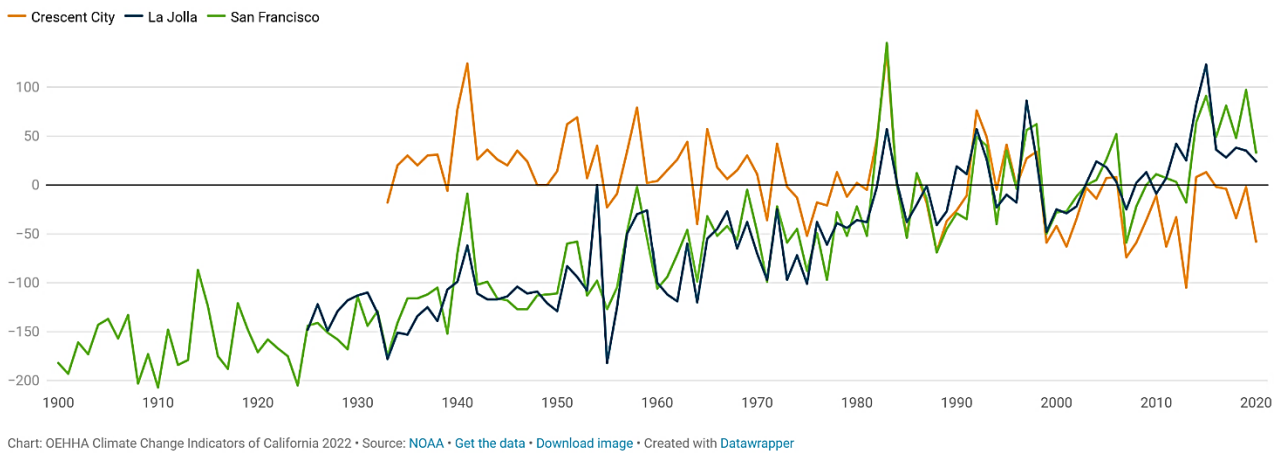


Figure 426: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate changes and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program including numerous Marin County jurisdictions, the County of Marin, and regional agencies, adopted a model Climate Action Plan (CAP) that is intended to support countywide strategic efforts and is currently being used to update or establish climate action plans for additional jurisdictions within Marin County. The adopted Climate Action Plan serves as the adopted plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and reports on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In October 2022, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2020. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change

mitigation programs and initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the City of Novato as per the planning team.

Table 19: City of Novato Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Significant	Severe	Low	Low	**9.00**
Debris Flow	Likely	Negligible	Weak	Low	Low	**7.00**
Drought	Likely	Extensive	Weak	High	Medium	**13.00**
Earthquake	Occasional	Extensive	Extreme	None	Medium	**12.00**
Flooding	Likely	Negligible	Weak	Medium	Low	**8.00**
Land Subsidence	Likely	Negligible	Weak	Low	Low	**7.00**
Levee Failure	Occasional	Negligible	Weak	Medium	Low	**7.00**
Sea Level Rise	Occasional	Limited	Moderate	High	Medium	**11.00**
Severe Weather – Extreme Heat	Likely	Extensive	Weak	Medium	Medium	**12.00**
Severe Weather – High Wind/Tornado	Likely	Extensive	Weak	Medium	Medium	**12.00**
Tsunami	Unlikely	Negligible	Weak	None	Low	**4.00**
Wildfire	Likely	Limited	Weak	Medium	Medium	**10.00**

Table 211: City of Novato Hazard Risk Assessment
Source: City of Novato

Omitted Hazards

Novato does not have any omitted hazards.

Table 20: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 212: Hazard Risk Assessment
Source: County of Marin

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design

- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

While there are no dams located within Novato, the City could be impacted by a failure of the Stafford/Novato Creek Dam which is located in the unincorporated County of Marin approximately 5,000 feet from the City's western boundary (see Figure 22). The dam has storage of 140-acre feet of water that would cascade down Novato Creek through the City of Novato and Bel Marin Keys in the unincorporated County of Marin before emptying into San Pablo Bay in the event of a sunny-day dam failure. In up to two hours, water would overtop Novato Creek and could extend up to 500 feet on both sides of the creek, potentially inundating dozens of homes, part of the PG&E substation at Stafford, and part of San Marin High School and San Ramon Elementary School in up to ten feet of water in some areas. In two to five hours, water would continue overtopping Novato Creek extending down Novato Boulevard up to 1,000 feet of both sides of the road to the intersection of Diablo Avenue. Hundreds of homes, numerous commercial businesses and medical facilities, the Lu Sutton Elementary School and Our Lady of Loretto Elementary School lie in this area and could be inundated in up to eight feet of water. In the same amount of time, water would continue overtopping Novato Creek to the City boundary. This area includes most of the downtown commercial core of Novato where hundreds of homes, dozens of businesses and shopping centers, numerous medical facilities, the City of Novato Police Department and Town Hall, the Novato Fire Protection District Headquarters and primary Emergency Operations Center for the City, the Novato Fire Protection District #61, Lynwood Elementary School, Hill Middle School, the Marin Christian Academy and the PG&E substation at Novato could be inundated in up to ten feet of water in some areas. Water would also spread northward along Redwood Boulevard into North Novato in two to five hours where flood depths could be deepest, inundating dozens of homes and parts of Old Town in over ten feet of water in some places. The entire inundation area covers numerous major roads and highways in the City including Highway 101, Novato Boulevard and Redwood Boulevard which could hamper ingress and egress throughout much of central Novato.

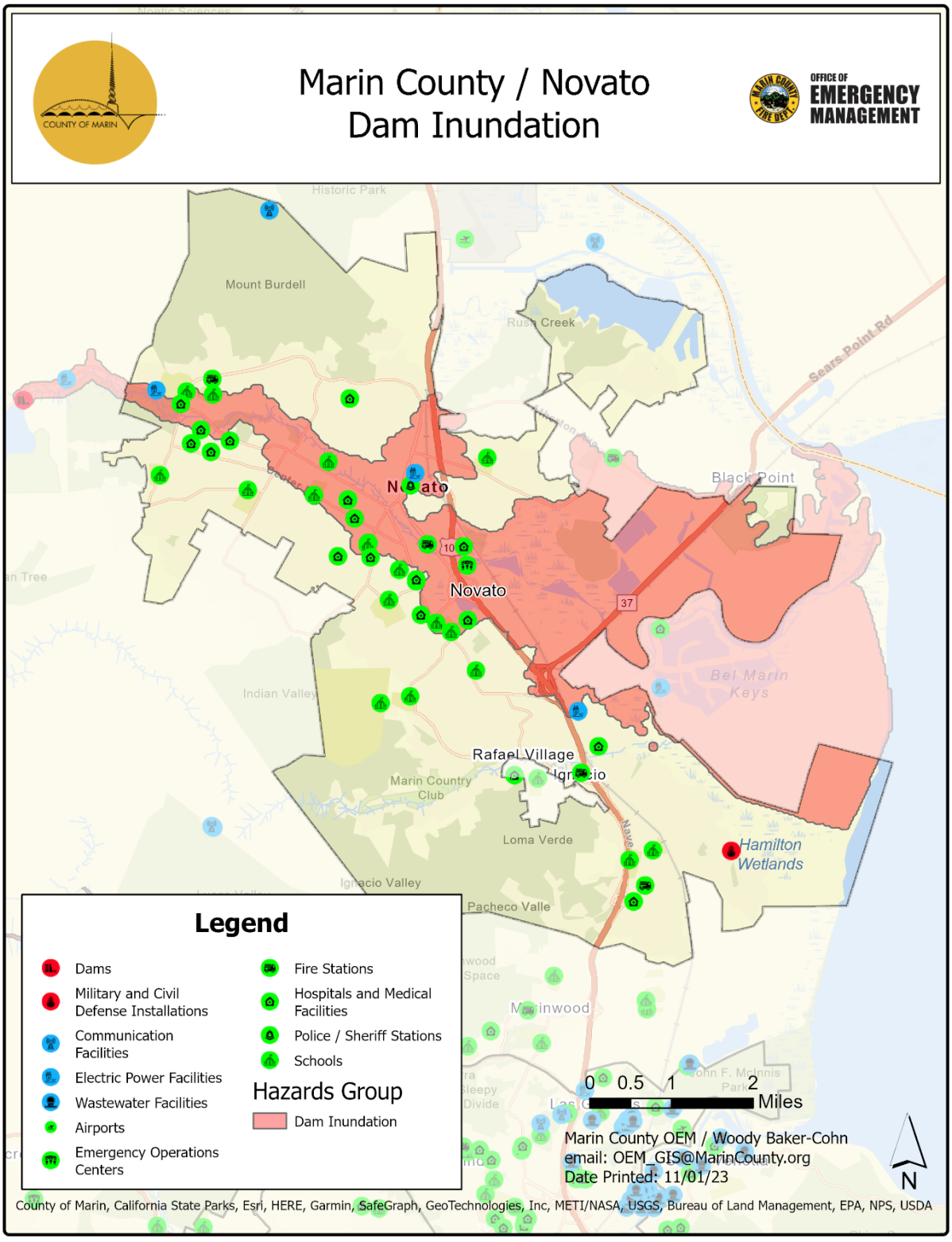


Figure 427: City of Novato Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

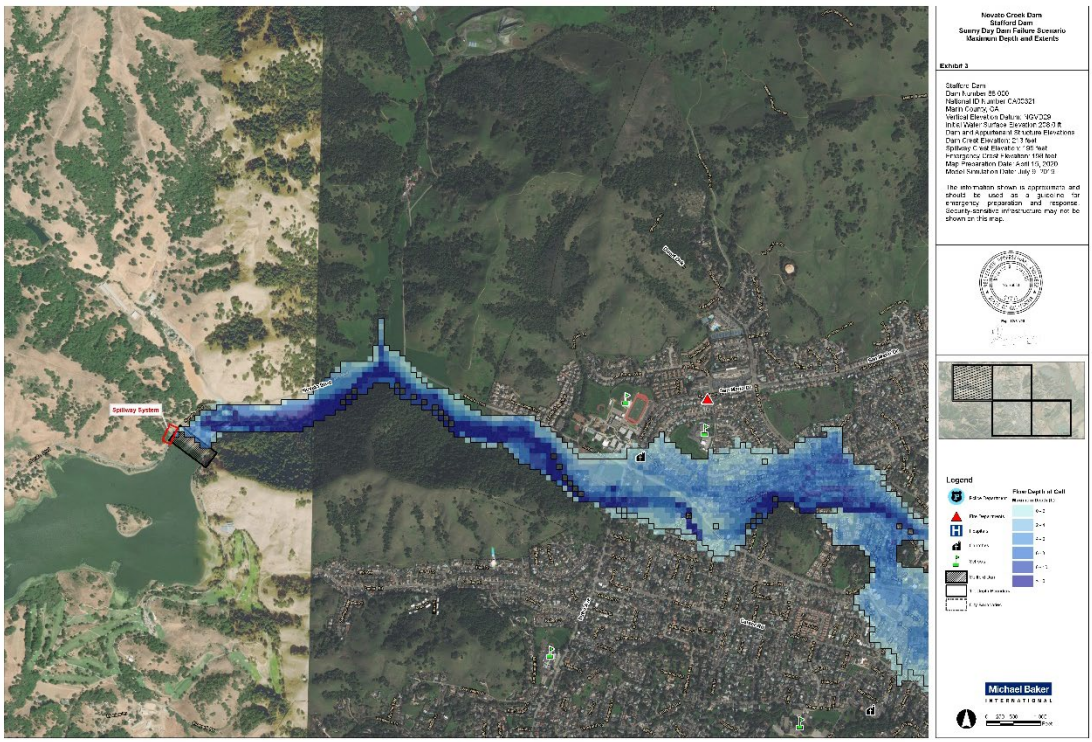


Figure 428: City of Novato - Novato Creek Dam Inundation Impact – West Novato
Source: California Department of Water Resources, DSOD

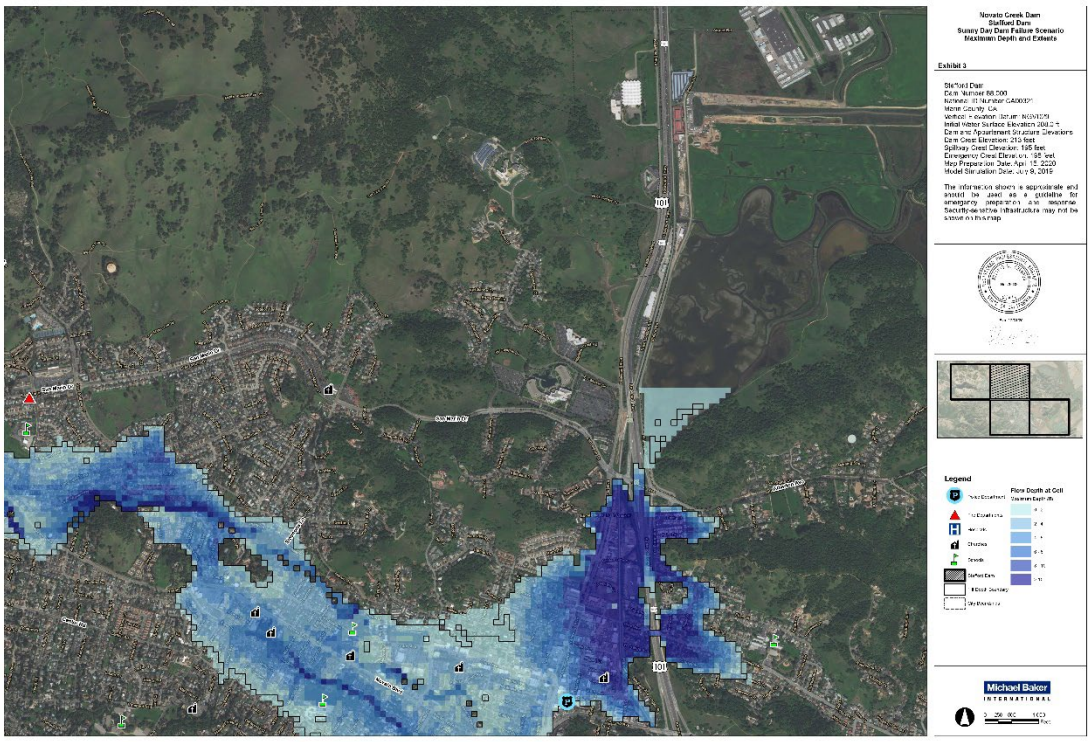


Figure 429: City of Novato - Novato Creek Dam Inundation Impact – North Novato
Source: California Department of Water Resources, DSOD

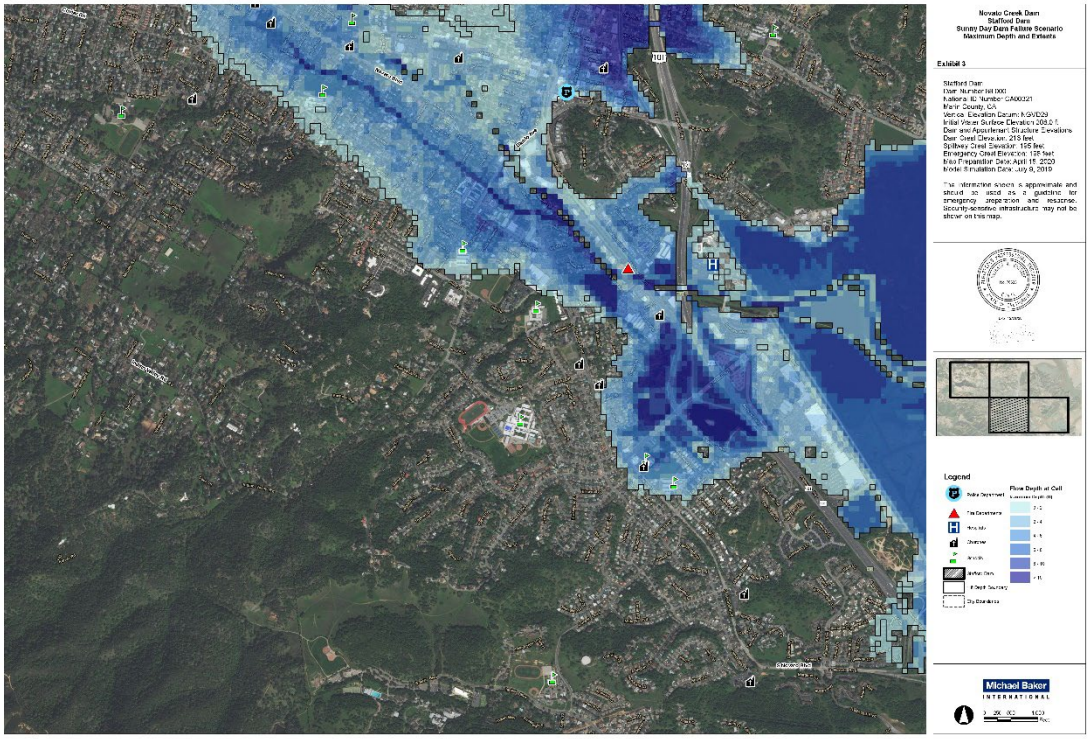


Figure 430: City of Novato - Novato Creek Dam Inundation Impact – Central Novato
Source: California Department of Water Resources, DSOD

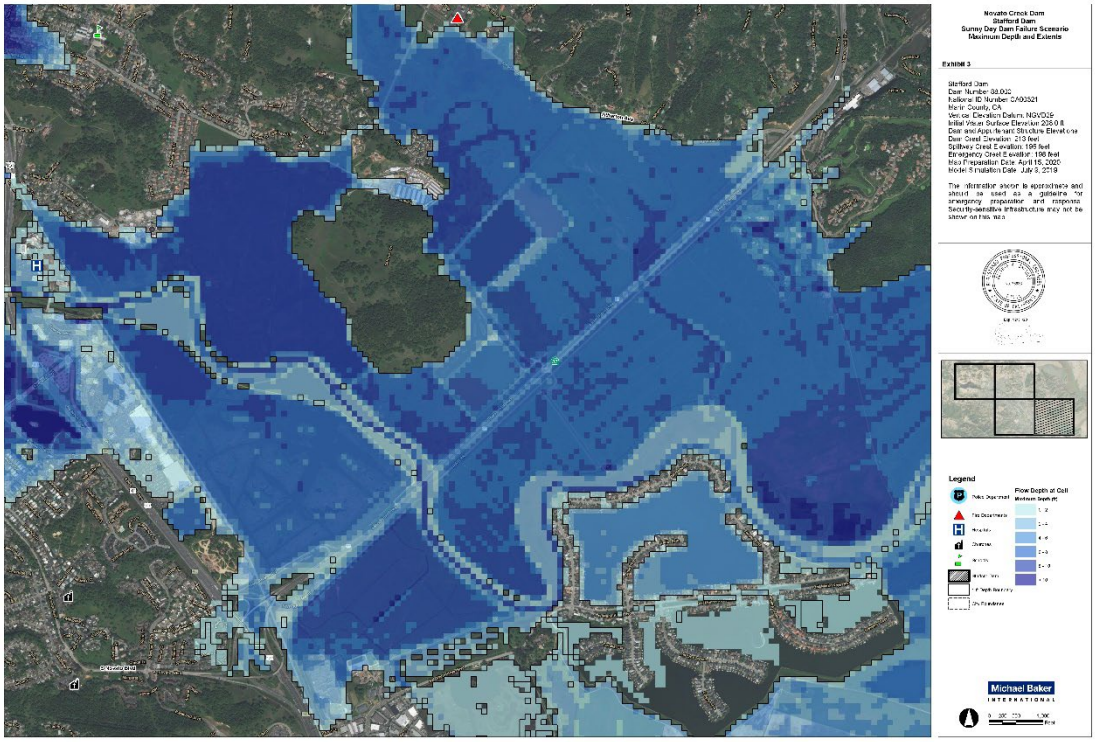


Figure 431: City of Novato - Novato Creek Dam Inundation Impact – East Novato
Source: California Department of Water Resources, DSOD

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States are over 90 years old. The Novato Creek Dam is over 70 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Novato Creek Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of the Novato. Future development along Novato Creek could expose additional people and structures to risk of a dam failure.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes

and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 27 shows landslide susceptibility classes.

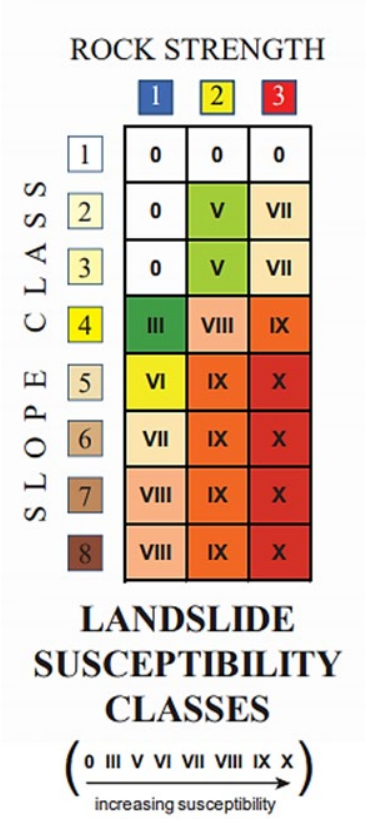


Figure 432: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 28 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

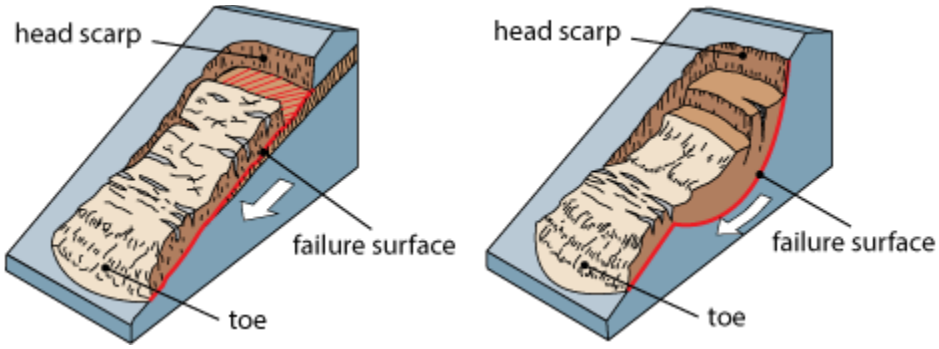


Figure 433: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in Novato would most likely occur on the northern and southern sides of the City where the terrain is steeper and is more susceptible to movement of soil. This area of Novato is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. Residences in or on the fringes of open space areas including the Mount Burdell Open Space Preserve, Miwok Park, Cherry Hill, South Marin Park, the Indian Valley Preserve, the Rush Creek Open Space Preserve and Novato Heights have moderate to high susceptibility to a landslide. There are hundreds of residences in these areas. Of particular concern are communities in southern Novato south of Novato Boulevard. A landslide impacting Ignacio Boulevard and/or Sunset Parkway could impact ingress and egress into communities in this area that are at high susceptibility of a landslide. Highway 101 also has high landslide susceptibility in this area near Pacheco Hill, and a landslide on the highway could cause significant transportation challenges that could impact the City. The College of Marin-Indian Valley Campus, the Loma Verde Elementary School, the Novato Station #65, the Good Shepherd Lutheran School, Novato High School and the Olive Elementary School all lie in areas of moderate to high landslide susceptibility. The main commercial areas of the City, including the downtown area, have little to no landslide susceptibility.

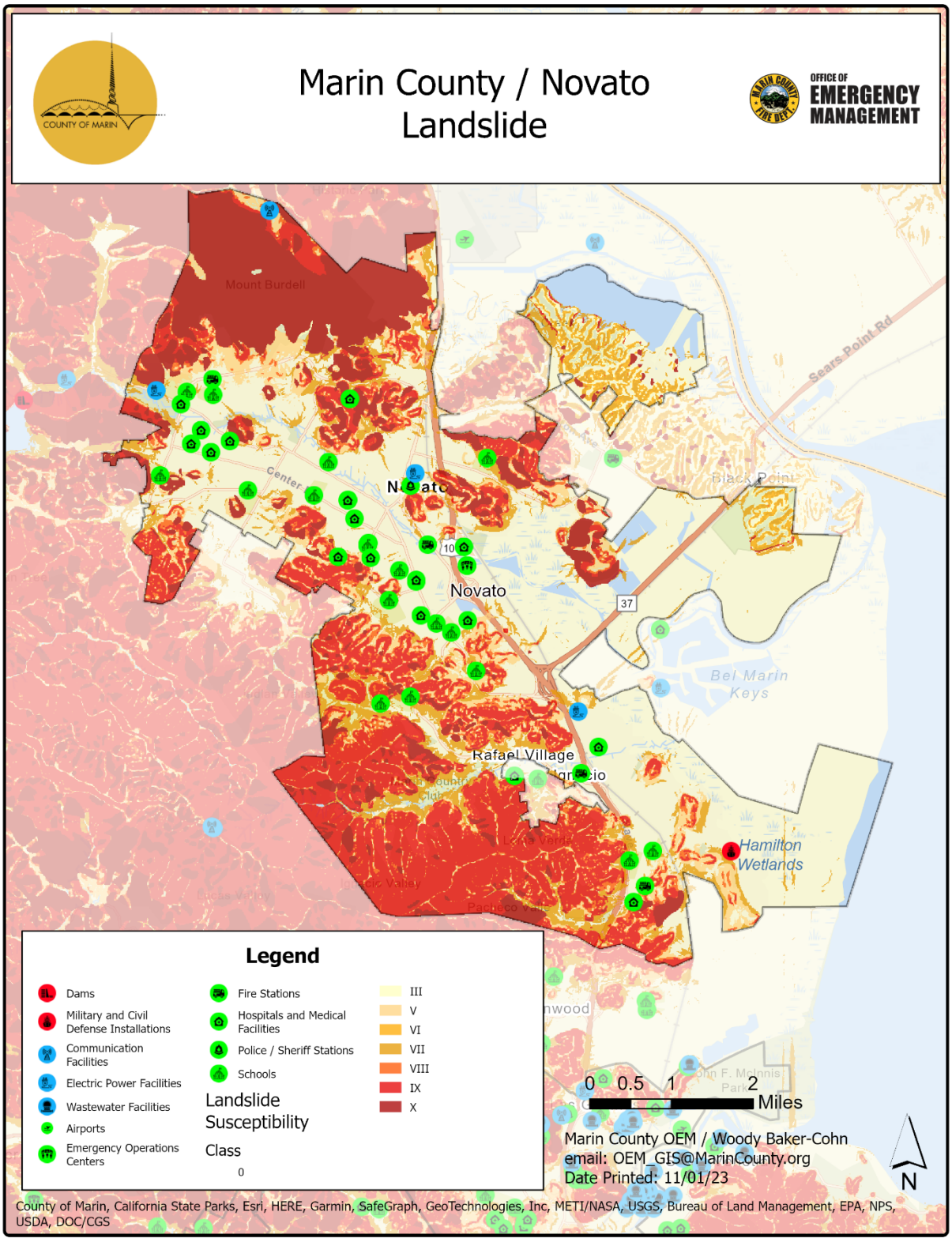


Figure 434: City of Novato Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

An earthquake has the potential to cause landslides throughout areas of landslide susceptibility in Novato. A wildfire and subsequent rain event in any of the open spaces in and surrounding Novato, including in the Mount Burdell Open Space Preserve, Ohair Park, the Verissimo Hills Preserve, the Indian Tree Open Space Preserve, the Indian Valley Preserve, the Ignacio Valley Preserve, the Loma Verde Preserve and the Rush Creek Open Space Preserve. A debris flow down Novato Creek could impact the City with mud and water that damage bridges and other infrastructure.

12/31/2005 - A mudslide came down on Pacheco Creek Drive, depositing over 2,000 cubic yards of mud and damaging several homes. Novato declared a state of emergency. Nobody was hurt, but mud poured into each home, forcing the residents to evacuate.

2/27/2017 – Heavy rain caused a landslide at Miwok Park along the southeast side of Novato Creek, destroying about 100 feet of a trail that connects the neighborhoods east and west of Miwok Park.

There have been no recorded debris flows in Novato since the last plan update, though a landslide on 3/22/2023 just north of Novato severely damaged Redwood Boulevard near Olompali State Park. The slide threatened two major utility lines serving the County of Marin OA.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[27], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas around Novato that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Novato could be susceptible to post-fire debris flows. This includes areas along Novato Creek, Arroyo San Jose and south of the Mount Burdell Open Space Preserve. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

[27] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.

Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Novato, though it's effects would be most felt in the mountainous areas around the City where the risk of wildfire would increase. The wetland areas of Novato, particularly the marshlands along San Pablo Bay, could become drier during prolonged period of drought and experience marshland fires that could impact local businesses and residences in the area. Dry trees in public spaces like Novato's Miwok Park and Marin Highlands Park can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Novato may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Novato, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops

in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces around Novato. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Novato where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Novato, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of Novato could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Novato can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 30).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 435: Modified Mercalli Intensity Scale
Source: USGS

Figure 31 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 436: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 32). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 437: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Novato due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity

The colors on Figures 33 and 34 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

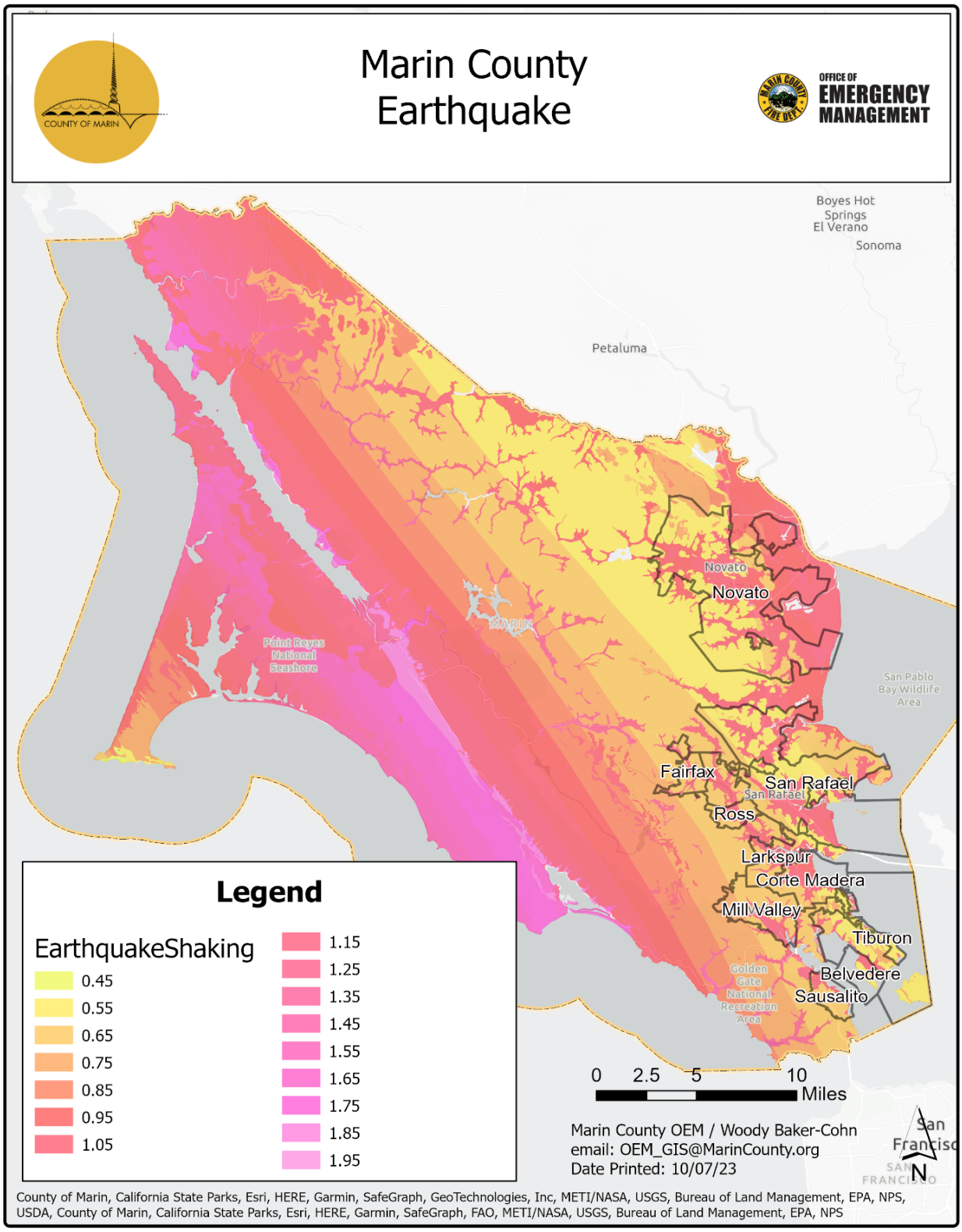


Figure 438: Marin County OA Earthquake Impact and Fault Lines
Source: Marin County OEM

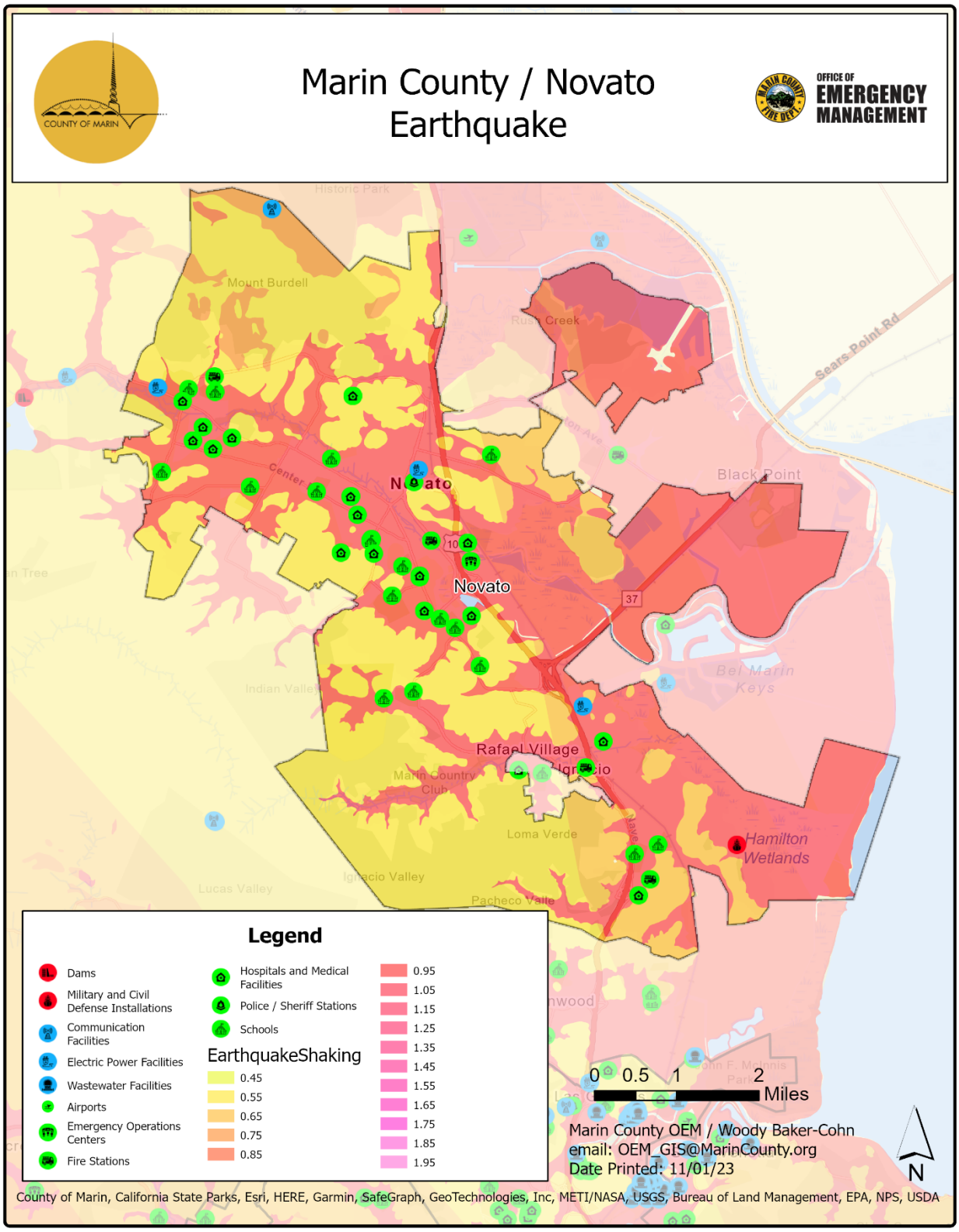


Figure 439: City of Novato Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Novato is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the City. There is increased risk of shaking and liquefaction in Novato from an earthquake, particularly in the central and eastern lowland areas where superficial deposits and fill are more prevalent. This includes the primary commercial area of City along the Highway 101 corridor, and numerous residential neighborhoods and commercial areas with schools and other critical facilities. All of the City's critical facilities with the exception of the Novato Fire Station #63 lie in an area of moderate earthquake shaking potential. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the City could be impacted by an earthquake.

Earthquakes could also cause landslides in the open space areas in and surrounding Novato with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Novato hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Novato.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Novato, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[28], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Novato. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Novato downtown and along its creek beds, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or

[28] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow are the most damaging.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure

flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 35.

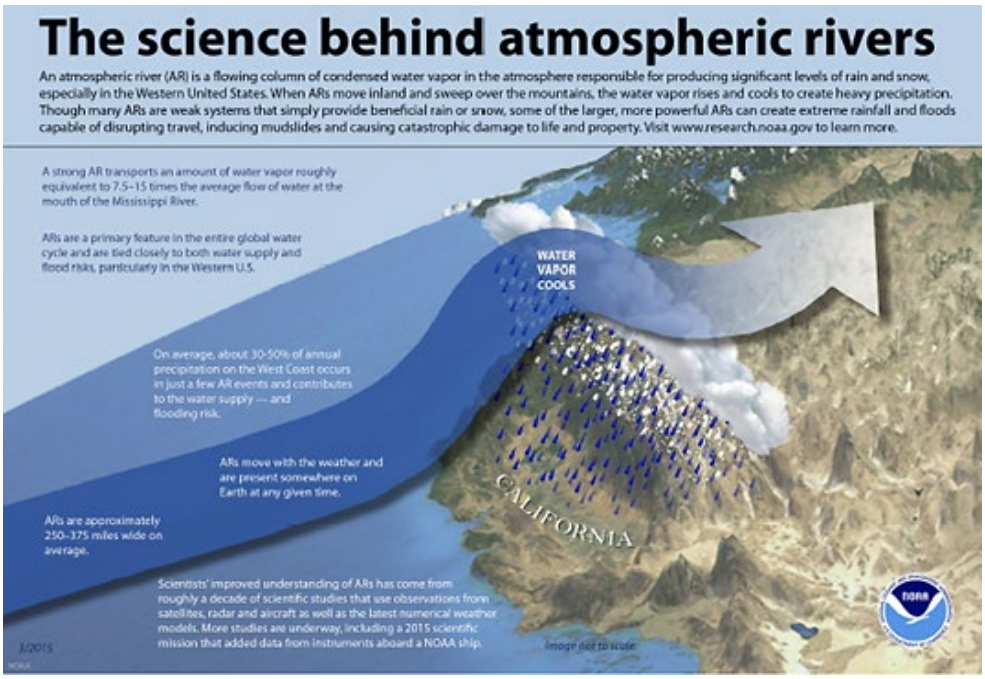


Figure 440: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the stormdrains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in Novato generally results from a combination of high tides from San Pablo Bay and creek flooding from Novato Creek in low-lying areas. Local flooding in Novato is exacerbated where the storm water drainage network has inadequate capacity for peak flows.

Most of the lowland areas in Novato are in the 100-year floodplain, with several areas in the 500-year floodplain. The 100-year floodplain extends mostly along Novato Creek from Stafford Lake to San Pablo Bay, including a large area along Novato Boulevard for approximately two miles where hundreds of homes, numerous commercial buildings and shopping plazas, several medical facilities, Our Lady of Loretto School and Lynwood Elementary School could be susceptible to flooding. The 100-year floodplain also extends along some of the smaller tributaries in the City include parts of Warner Creek, Vineyard Creek, Wilson Creek, Arroyo Avichi Creek and Rush Creek. There are dozens of residences along these creeks that could be susceptible to flooding. The 100-year floodplain along Vineyard Creek extends through the middle of Sinaloa Middle School and the 100-year floodplain along Arroyo Avichi Creek runs along the edge of the Rancho Elementary School. Other areas with high flood danger include Ignacio and Arroyo San Jose, as well as the Bahia area. The area around Scottsdale Pond that includes a section of Highway 101 and the area north of Bel Marin Keys that includes several miles of State Route (SR) 37 lie in the 100-year floodplain and could be susceptible to flooding, which could cause transportation challenges for the City. The 500-year floodplain also follows Novato Creek for its length through most of the City and is interspersed with the 100-year floodplain. A large section of the 500-year floodplain lies north of downtown and extends along a mile of Redwood Boulevard, including the SMART railroad tracks which could be susceptible to flooding. The 500-year floodplain in Novato includes hundreds of homes, numerous commercial buildings and shopping plazas, Novato Fire Station #1, the PG&E substation at Novato and the Old Town area of downtown that could be susceptible to flooding. Most of downtown Novato, including the Novato Police Department and Novato City Hall, lie outside of the 100 and 500-year floodplains.

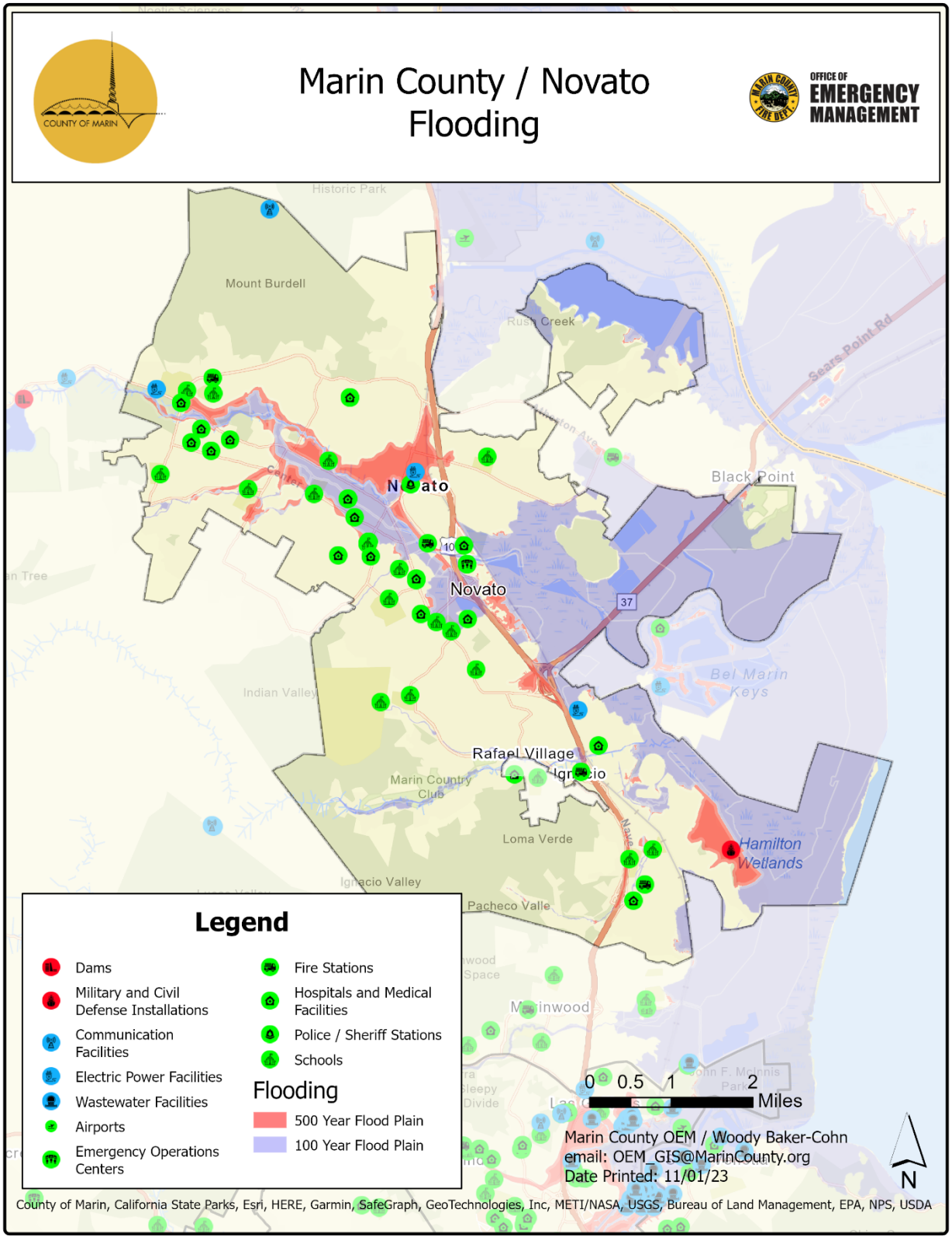


Figure 441: City of Novato Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 21 shows the number of City of Novato critical facilities by flood zone.

Table 21: City of Novato Critical Facilities by Flood Zone

Category	Name	Address	Flood Zone
Critical Facilities			
Fire	Fire: Novato Fire Protection District (NOV) / Headquarters & Primary EOC	95 Rowland Way, Novato, CA 94945	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 61	7025 Redwood Blvd Novato, CA 94945	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 62	450 Atherton Ave, Novato, CA 94945	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 63	65 San Ramon Way, Novato, CA 94945	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 64	319 Enfrente Rd, Novato, CA 94949	X
Fire	Fire: Novato Fire Protection District (NOV) / Station 65	5 Bolling Dr, Novato, CA 94945	X
Law/EOC	Novato Police Dept / Alternative EOC	909 Machin Ave Novato, CA 94945	X
Local Government	Novato City Hall	922 Machin Ave Novato, CA 94945	X
Local Government	Margaret Todd Senior Center/Evacuation Shelter	1560 Hill Road Novato, CA 94947	X
Local Government	Novato DPW - Corporation Yard	550 Davidson Street Novato, CA 94945	X
Health / Medical	Novato Community Hospital	180 Rowland Way Novato, CA 94945	X
Health / Medical	Novato Healthcare Center	1565 Hill Rd Novato, CA 94947	X
Health / Medical	Miles - Center Road House	1649 Center Rd Novato, CA 94947	AO
Health / Medical	Rae Lane House	858 Rae Ln Novato, CA 94947	X
Health / Medical	Lifehouse - Stonehaven	2 Stonehaven Ct Novato, CA 94947	X
Health / Medical	Atria Tamalpais Creek	853 Tamalpais Ave Novato, CA 94947	AO
Health / Medical	Oakmont of Novato	1465 S. Novato Blvd. Novato, CA 94947	X
Health / Medical	Creekwood	830 Tamalpais Ave. Novato, CA 94947	AO
Health / Medical	Novato Residential Support Services	1333 Seventh Street Novato, CA 94947	X
Health / Medical	Anton Pointe, The	1470 South Novato Blvd., Novato, CA 94941	X
Health / Medical	Young at Heart	37 Mendocino Lane Novato, CA 94947	X
Health / Medical	Cedars Dante	1914 Novato Blvd Novato, CA 94945	X
Health / Medical	Wildflowers I	256 Sunset Parkway Novato, CA 94947	AE
Health / Medical	Lifehouse - Bolling Circle	464 Bolling Circle Novato, CA 94949	X
Health / Medical	Buckelew Programs	201 Alameda del Prado Novato, CA 94949	X

Health / Medical	Canyon Manor	655 Canyon Road Novato, CA 94947	X
Health / Medical	Lifehouse - 271 Captain Nurse Circle	271 Captain Nurse Circle Novato, CA 94949	X
Health / Medical	Lifehouse - 400 Palm Drive	400 S. Palm Dr. Apt 201, Novato CA, 94949	X
Health / Medical	Yumi House	810 Eucalyptus Ave Novato, CA 94947	X
Health / Medical	Lifehouse - Sherwood Place	5 Sherwood Place Novato, CA 94945	X
Health / Medical	Cornerstone Community Homes - Brown's	36 Brown Drive Novato, CA 94947	X
Health / Medical	Cornerstone Community Homes - San Luis	365 San Luis Way Novato, CA 94945	X
Health / Medical	Cypress House	856 Cypress Ave Novato, CA 94947	AO
Health / Medical	Lynwood Home	1212 Lynwood Dr. Novato, CA 94947	X
Health / Medical	Casa Allegra - San Felipe	4 San Felipe Way Novato, CA 94945	X
Health / Medical	Casa Allegra - Tamalpais	778 Tamalpais Avenue Novato, CA 94945	X
Health / Medical	Cedars of Marin - 2nd Street	1120 Second St. Novato, CA 94945	X
Health / Medical	Avery Lane	685 Atherton Avenue Novato, CA 94945	X
Health / Medical	Elegance Hamilton Hill	1 Hamilton Hill Drive Novato, CA 94949	X
Health / Medical	Cornerstone Community Homes - Cambridge	1420 Cambridge St. Novato, CA 94947	X
Health / Medical	Buckelew RSS Novato	1333 7th Street Novato, Ca 94947	X
Health / Medical	Lifehouse - 251 Captain Nurse Circle	251 Captain Nurse Circle Novato, CA 94949	X
Health / Medical	Homeward Bound of Marin - New Beginnings Center	1399 N. Hamilton Parkway Novato, CA 94949	X
Health / Medical	Homeward Bound - Transition to Wellness	385 North Hamilton Parkway Novato, CA 94949	X
Health / Medical	Shalamo Home	200 Daryl Ave. Novato, CA 94947	X
School	Novato Unified School District – Admin Office	1015 7th Street Novato, CA 94945	X
School	Hamilton Meadow Park School – Middle/Elementary	5530 Nave Drive Novato, CA 94949	X
School	Loma Verde Elementary (Unincorporated Novato)	399 Alameda de la Loma Novato, CA 94949	X
School	Lu Sutton Elementary	1800 Center Road Novato, CA 94947	X
School	Lynwood Elementary	1320 Lynwood Drive Novato, CA 94947	AE
School	Olive Elementary	620 Olive Avenue Novato, CA 94945	X
School	Pleasant Valley Elementary	755 Sutro Avenue Novato, CA 94947	X
School	Rancho Elementary	1430 Johnson Street Novato, CA 94947	X
School	San Ramon Elementary	45 San Ramon Way Novato, CA 94949	X
School	San Jose Middle School	1000 Sunset Parkway Novato, CA 94949	X

School	Sinaloa Middle School	2045 Vineyard Road Novato, CA 94947	X
School	Novato High School	625 Arthur Street Novato, CA 94947	X
School	San Marin High School	15 San Marin Drive Novato, CA 94945	X
School	Hill Education Center / Marin Oaks High School	720 Diablo Avenue Novato, CA 94947	X
School	Novato Charter School	940 "C" Street Novato, CA 94949	X
School	Our Lady of Loretto School	1811 Virginia Avenue Novato, CA 94945	AO
School	Marin Christian Academy	1370 South Novato Boulevard Novato, CA 94947	AE
School	Good Shepherd Lutheran School	1180 Lynwood Drive Novato, CA 94947	X
School	North Bay Christian Academy	6965 Redwood Boulevard Novato, CA 94945	X
Evacuation Shelter	Margaret Todd Senior Center	1560 Hill Rd, Novato	X
High Potential Loss Facilities			
Military/Civil Defense	US Coast Guard – Pacific Coast Strike Team	450 Hangar Ave. Novato, CA 94949	X
DAM	Novato Creek Dam	3500 Novato Blvd. Novato, CA 94945	X
Critical Infrastructure			
Water/ Wastewater	DPW Pump Station (zone 1) - Cheda	38.0876595793068, -122.535515921059	AE
Water/ Wastewater	DPW Pump Station (zone 1) - Farmers	38.0889709965199, -122.534793113191	AE
Water/ Wastewater	DPW Pump Station (zone 1) - Lynwood	38.0923793901915, -122.548345546799	AE
Water/ Wastewater	Hamilton Storm Pumps - Pizarro	134 Pizarro Avenue Novato, CA 94945	X
Water/ Wastewater	Hamilton Storm Pumps - San Pablo	115 San Pablo Avenue Novato, CA 94945	X
Water/ Wastewater	Novato Sanitary District	500 Davidson St. Novato, CA 94945	X
Water/ Wastewater	Sanitary District - Bel Marin Keys	425 Bel Marin Keys Blvd. Novato, CA 94949	X
Power Utility	PG&E - Machin	878 Sweetser Ave. Novato, CA 94945	X
Power Utility	PG&E - Stafford	38.119685, -122.614187	X
Power Utility	PG&E Substation - Ignacio	137 Hamilton Dr. Novato, CA 94949	AE
Communications	MERA Antenna Site - Mt Burdell	38.1449, -122.5941	X
Communications	MERA Antenna Site – Big Rock Ridge	38.0591, -122.6039	X
Communications	KCBS Transmitter site (EAS Alerting provider)	8198 Binford Rd. Novato, CA 94945	AE
Transportation	Golden Gate Transit: Bus Dispatch, Fuel, Maintenance	4 Golden Gate Place Novato, CA 94945	X

Table 213: City of Novato Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within San Pablo Bay have the potential to significantly impact the Novato storm drain system. Novato already sees flooding from king tides in San Pablo Bay and this is only expected to increase with sea level rise and climate change. A failure of the Stafford Lake/Novato Creek dam could contribute to flooding in the lowland areas of Novato.

On 1/14/2023, a storm flooded SR-37 in Novato, including the U.S. 101 connector ramps. SR-37 had to close in both directions near Atherton Avenue for the weekend. The storm also flooded Armstrong Avenue.

On 2/14/2019, Novato police closed several streets and issued at least one shelter-in-place order in the City at Paper Mill Court due to flooding across the City in the midst of a severe winter storm. South Novato Boulevard between Nave and Lark courts, Simmons Lane from San Marin Drive to Lesse Lane and all of Commercial Boulevard were closed.

On 1/19/2019, a storm flooded the westbound lanes of SR-37 in Novato, causing a three-day partial closure of the road.

On 1/22/2017, a storm flooded three miles of SR-37 between Highway 101 and Atherton Avenue with five feet of water, closing it for three days.

Figure 442: SR 37 Flooding in Novato - 2017
Source: The Santa Rosa Press Democrat

On 12/11/2014, a storm flooded several neighborhoods in Novato, including on Garden Court and Chase Street. SR-37 flooded and the westbound lanes had to close.

On 12/31/2005-1/1/2005, a strong storm caused a mobile home park to flood with up to 4 feet of water, forcing the evacuation of about 100 stranded residents.

On 1/3-1/4/1982, torrential rains caused massive power outages, landslides, numerous injuries and over $14 million in damages throughout Novato. More than 9 inches of rain fell in 36 hours causing water to rush over Stafford Dam, ultimately flooding neighborhoods and roadways including Grant Avenue, Center Road and Novato Boulevard. Flooding shut down the railroad for nearly a month. Novato was declared a disaster area and was soon followed by the largest cleanup effort in the city's history.

Figure 443: 1982 Novato Flood
Source: The City of Novato

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[29] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Novato. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Novato will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of Novato. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland area of Novato would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along Novato Creek, Arroyo San Jose, and other

[29] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

creeks in Novato in the 100 and 500-year floodplain would expose more people, structures and infrastructure including major roads to creek flooding and storm surge from Novato Creek as a result of climate change.

2.2.6 LAND SUBSIDENCE/SINKHOLES

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 39 for a picture and description of how dissolution sinkholes form.

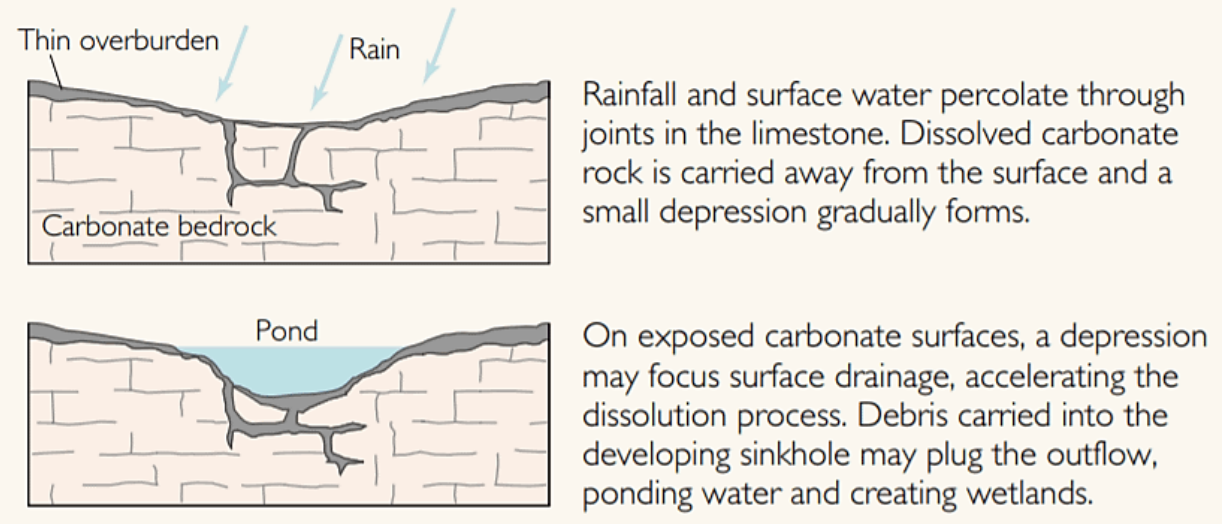


Figure 444: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 40 for a picture and description of how cover-subsidence sinkholes form.

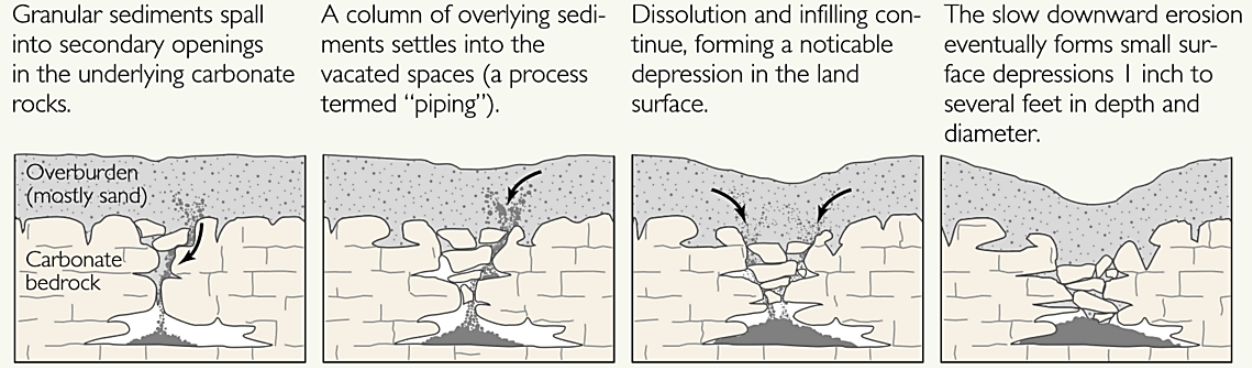


Figure 445: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 41 for a picture and description of how cover-collapse sinkholes form.

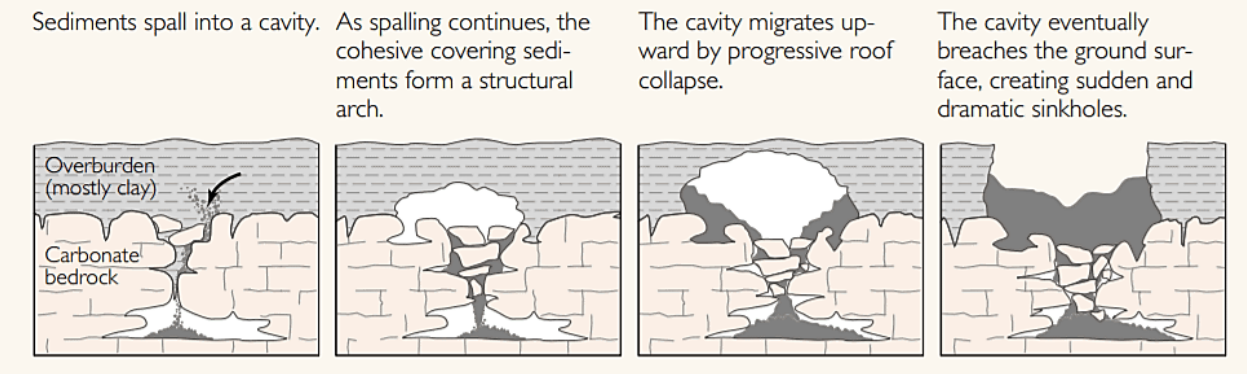


Figure 446: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central and eastern lowland areas of Novato where superficial deposits and fill are more prevalent. This includes the primary commercial area of the City along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities. Land subsidence could have numerous impacts for Novato, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

In 1/2016, a sinkhole formed at the Rotary Manor Senior Community as a result of a collapsed culvert that fed into San Rafael Creek. The complex garden was destroyed when the sinkhole appeared.

On 1/22/2010, a 1-2 foot sinkhole formed in a private driveway in the Bahia area of Novato due to a break in a storm drain pipe. There was no major damage.

On 1/22/2021 a 2-3 ft sinkhole formed along the frontage of 2 Lauren Ave. The cause was not determined. There was no major damage.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Novato, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Novato as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Novato could increase with future development in the lowland populated areas of the city where land subsidence is more likely to occur.

2.2.7 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 42 shows a levee and the multiple ways it can fail.

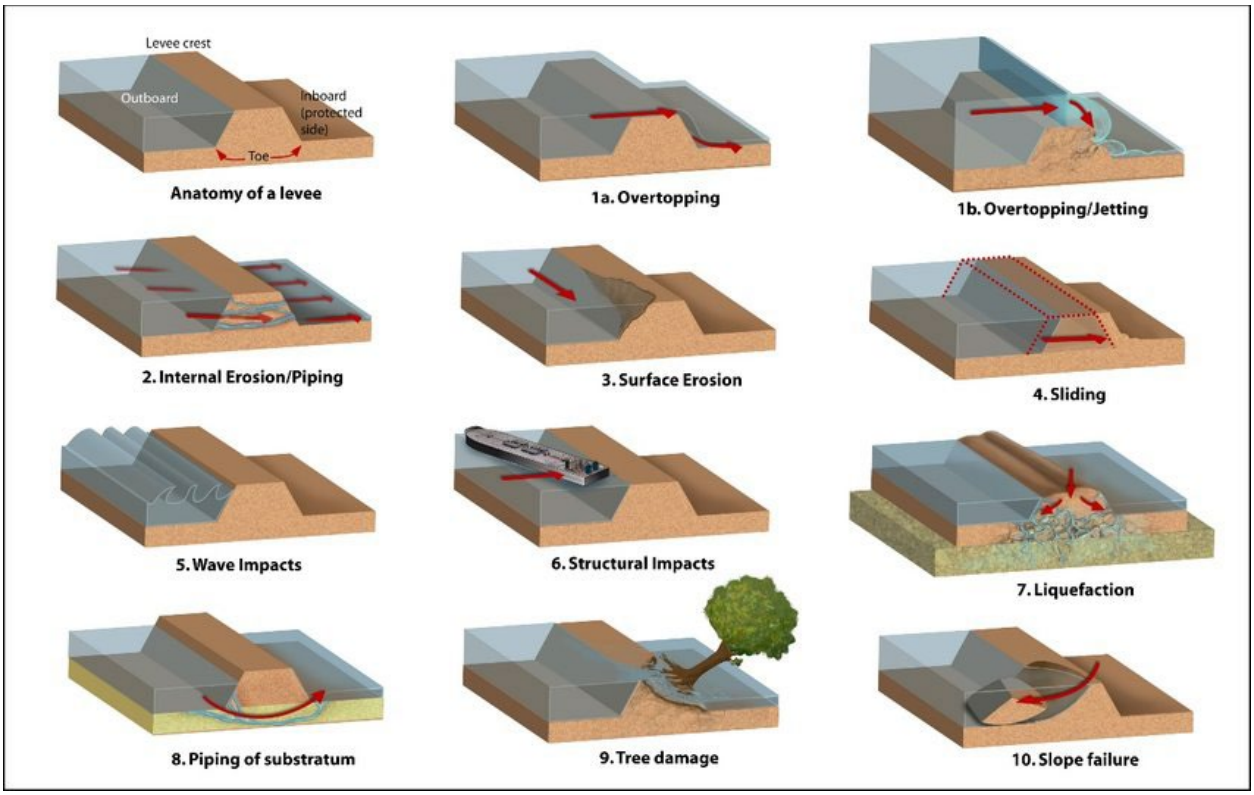


Figure 447: Levee Failure Mechanisms
Source: University of California

Novato is protected by non-accredited levees along both sides of Novato Creek in the southern part of Novato near Bel Marin Key. The Novato Creek LB Upper Levee on the north side of the Creek is 2.11 miles long with no documented height. Approximately 1,468 people and 265 buildings with a property value of $361 million are at risk of a failure of the Novato Creek LB Upper Levee, including the Novato Community Hospital and part of Highway 101. The Novato Creek Levee on the south side of the Creek is 1.71 miles long with no documented height. Approximately 3,080 people and 214 buildings with a property value of $526 million are at risk of failure of the Novato Creek Levee, including several commercial areas and part of Highway 101. The Novato Creek RB Lower levee on the south side of the Creek is 1.1.7 miles long with no documented height. One building at the Ignacio Treatment Plant with a property value of $1.68 million is at risk from a failure of the Novato Creek RB Lower levee. The Novato Creek LB Lower Levee on the north side of the creek is 4.11 miles long with no documented height. Approximately 12 people and six buildings with a property value of $6.93 million are at risk of failure of the Novato Creek LB Lower levee. Marin County Levee 10 is a 1.04-mile-long levee with an undocumented height that primarily protects part of the Ignacio Treatment Plant. Marin County Levee 7 and Marin County Levee 3 are two unaccredited levees south of SR-37 on the east and west sides of a small tributary. Marin County Levee 7 is 0.53 miles long with no documented height. There is no risk to populations or property from failure of Marin County Levee 7. Marin County Levee 23 is 0.55 miles long with no documented height. Approximately three people and one building with a property value of $1.36 million is at risk of failure of the Marin County Levee 23. The Hamilton Levee along the Hamilton Wetlands is an accredited levee that is 1.09 miles long with 0.26 miles of embankment and no documented height. Approximately 1,786 people and 621 buildings with a property value of $470 million in the

Hamilton neighborhood are at risk of failure of the Hamilton Levee. The Las Galinas Valley Sanitary District Levee is a non-accredited levee that is 3.63 miles long with no documented height. Approximately 19 people and nine buildings with a property value of $9.74 million are at risk of failure of the Las Galinas Valley Sanitary District Levee. The Novato Creek Levee Evaluation Project was created to evaluate the feasibility of increasing the level of flood protection for residences and businesses within Novato Creek's 100-year floodplain, and to work towards having the levees become FEMA accredited. A failure of any of the levees around Novato during a high rain event could cause flooding into residential neighborhoods and commercial areas of Novato, with property and infrastructure within the 100-year floodplain being most susceptible.

Novato

On 2/14/2019, a levee was breached in two places near SR 37, washing out railroad tracks and threatening to inundate the roadway with water. A second levee near Pacheco Pond in Novato was flowing over the top of the barrier, though the levee did not appear to have been breached. The largest breach, along Highway 37 and Harbor Drive, caused a swollen Novato Creek to spill over onto a field south of the highway.

Figure 448: 2014 Levee Failure in Novato
Source: San Francisco Gate

On 12/31/2005-1/1/2006 a strong storm caused a levee breach behind Novato Community Hospital. Workers had to build a road out to the levee before they could begin repairs. The area being flooded was mostly wetlands and a park, and repairs were made before any homes were threatened.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Novato, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Novato, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Novato protected by its levees, particularly along Novato Creek and around its marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.8 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

The lowland areas in Novato are particularly vulnerable to sea level rise and could experience between one and five feet of inundation. Development in Novato is largely inland with a few buildings fronted by tidal marshes and the bay. Much of the community is fronted by unincorporated areas, managed stormwater, agricultural, utility, and marsh lands. These lands could buffer Novato from San Pablo Bay for several decades, thus, the majority of assets may not experience saltwater flooding until the end of the century. A considerable number of, parcels could flood, compromising their existing land uses and human activities. In addition, because of Novato's size and the existence of several smallerneighborhoods(?), complex levee systems, and extensive marsh land, much of the impacted developed land is dispersed into pockets of flooding.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).The following are key issues related to Novato sea level rise and a 100-year storm surge:

- The Hamilton neighborhood could anticipate the FEMA certified levee overtopped in the long term. This would flood hundreds of homes and numerous professional workspaces.
- The Vintage Oaks Shopping Center could anticipate storm surge impacts in the medium term and tidal impacts in the long-term.
- Development east of US Highway 101 at the Bel Marin Keys and Rowland Boulevards.
- Buildings and marshes in Bahia, along Davidson Drive, and on Olive Avenue are vulnerable to sea level rise.
- SR 37 to Sonoma and Napa is vulnerable in the near-term in several locations along its route. This road provides access to several publicly accessible natural resource assets.
- Tidal and storm surge flooding could impair travel on US Highway 101 in the long-term.
- Sonoma Marin Area Regional Transit rail tracks could be vulnerable in the near-term. Train cars could also be damaged by saltwater exposure.
- The Novato Sanitary District wastewater treatment could expect long-term impacts to several critical buildings.
- The Novato Fire Station 62 is vulnerable in the medium-term, and flooded, in part, in the long term. In addition, the Fire Protection District and the Novato Professional Fire Fighter's Association office off Rowland Boulevard could be vulnerable.
- Most vulnerable parks are in Hamilton and are exposed in the long-term.
- Marsh lands are vulnerable in Hamilton, Deer Island and the surrounding diked baylands, and Bahia.

The most vulnerable assets are the wastewater treatment plant, SR 37, and Northern Marin Water District. In the long-term, the Hamilton neighborhood could also be vulnerable to levee overtopping. Due to Novato's inland development, very little of the community is directly impacted. Nevertheless, those dependent on the US Highway 101 corridor will be impacted. In

addition, those who use the Novato Sanitary District treatment plant could experience wastewater disruptions.

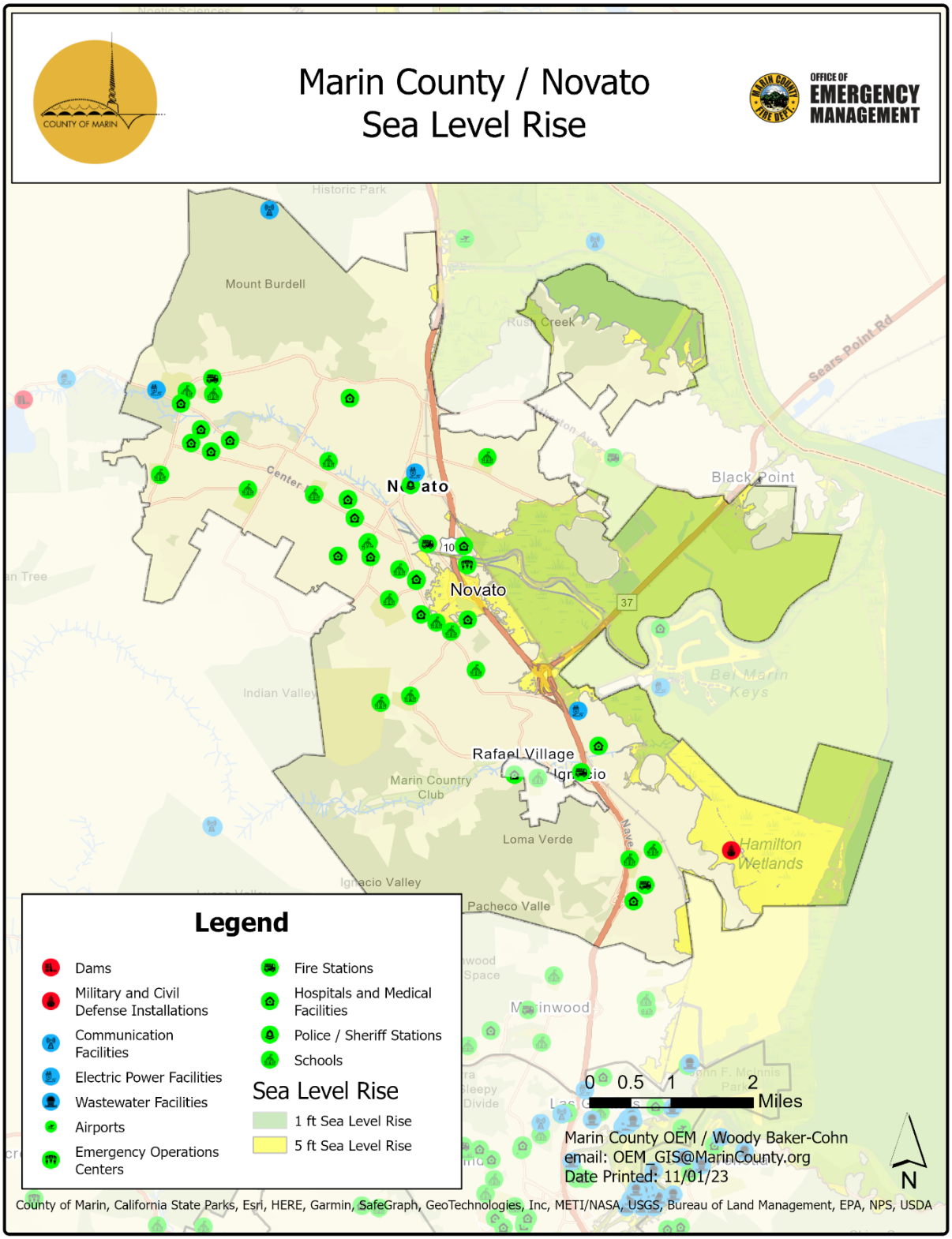


Figure 449: City of Novato Sea Level Rise Impact
Source: Marin County OEM

The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that Novato could anticipate impacts to over 51,000 people over 1,100 living units with $1 billion in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. Structures throughout the City can become damaged extensively with their foundations compromised over time. Of particular concern are those structures and infrastructure that have not been elevated to projected sea level rise heights over the next century, including Highway 101 and SR 37 which could become more isolated due to sea level rise flooding. Sea level rise in Novato has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into adjacent neighborhoods. Sea level rise can also cause increased subsidence along Novato's shoreline, which may damage underground water and wastewater pipelines and disrupt services. Novato's marshland would eventually turn into open water as a result of sea level rise, eliminating a natural barrier that protects the City from increased storm surge. Novato would begin to experience seasonal, king tide, and storm surge flooding more frequently in the future.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

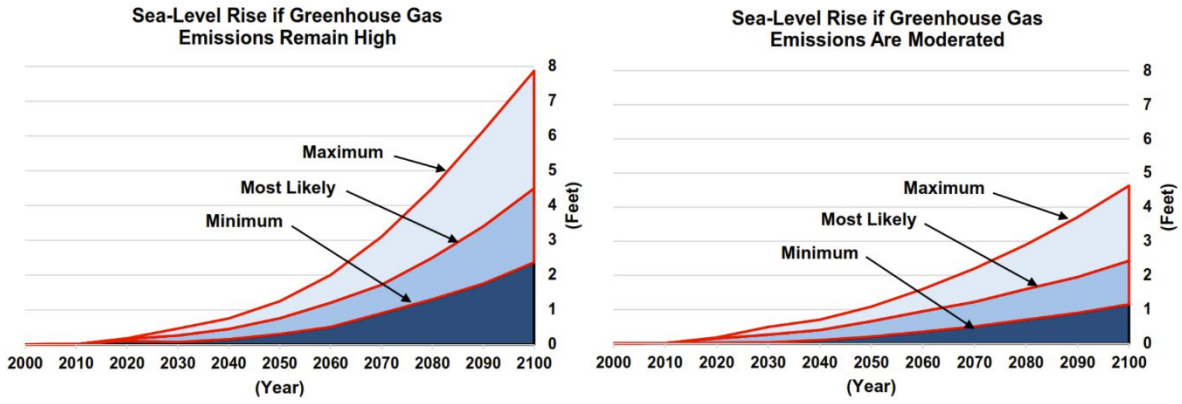


Figure 450: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Novato already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Novato with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Novato will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be

magnified with rising seas. Future development in the coastal and lowland areas of Novato will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across Novato will continue to become inundated.

2.2.9 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 46):

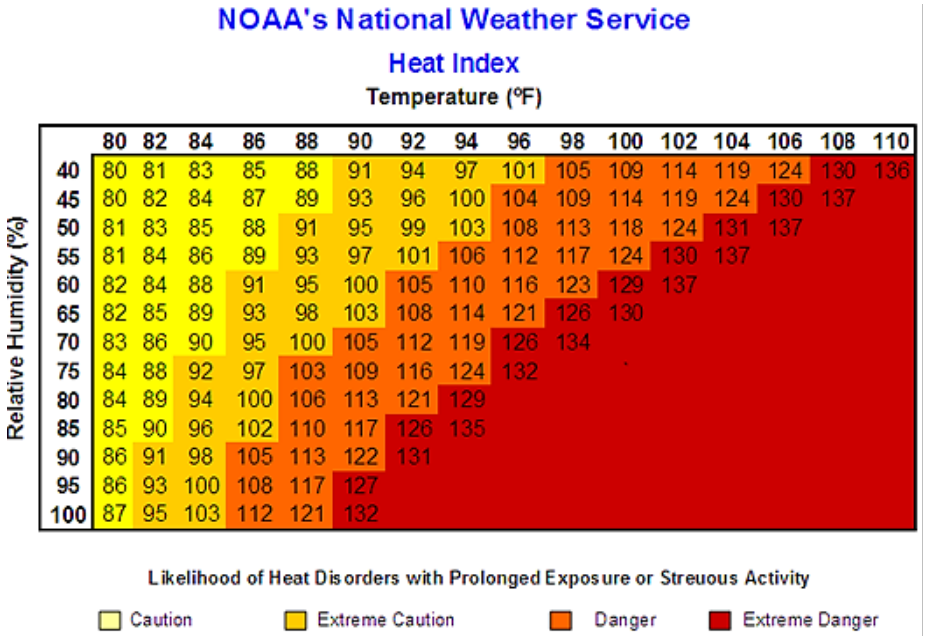


Figure 451: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Novato and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city. There are dozens of residences in this area. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the City of Novato experienced an Extreme Heat Event with temperatures exceeding 113 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase

by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

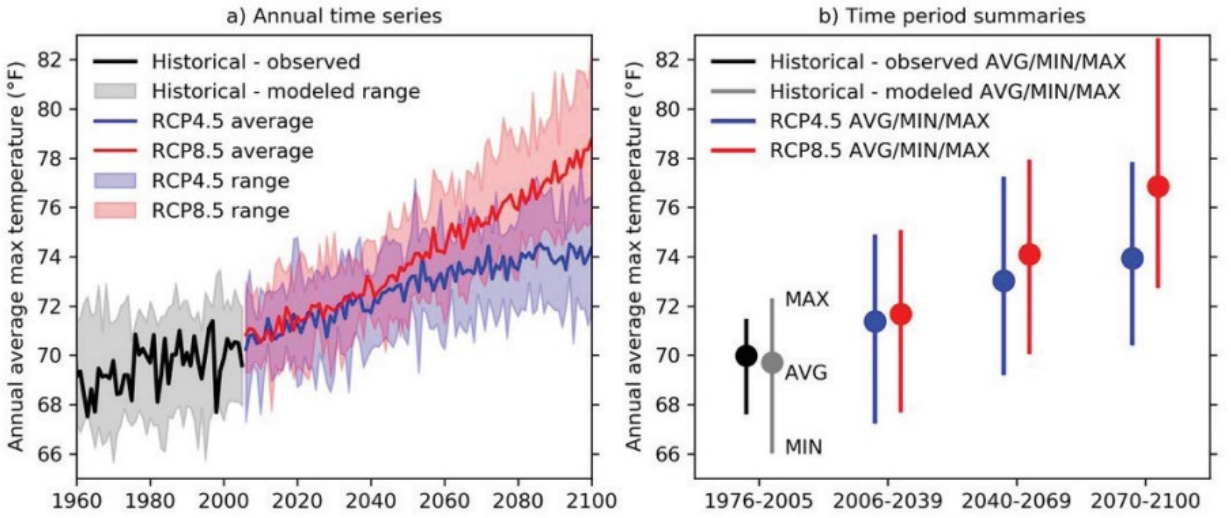


Figure 452: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Novato. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Novato where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Novato could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Novato as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of Novato where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Novato could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.10 Severe Weather – High Wind and Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 48).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 453: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 49) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 454: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

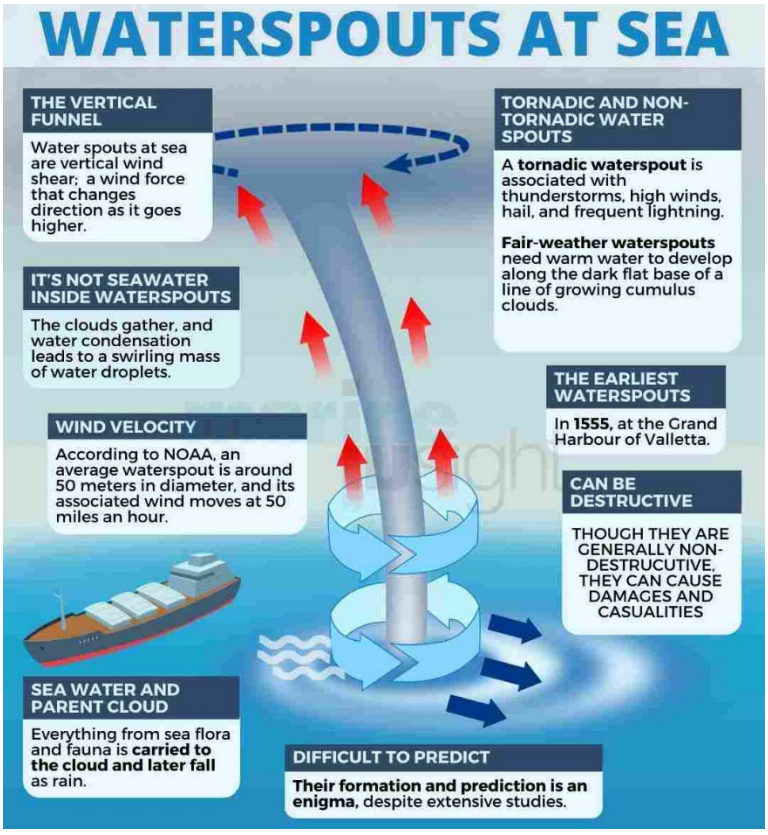


Figure 455: Waterspout Formation
Source: MarineInsights

All of Novato is susceptible to storms and damage from wind and tornadoes, though the mountainous areas surrounding the City and the parks inside the City have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

On 3/14/2023 a strong storm with heavy winds caused a tree to fall onto a home. There were no injuries.

On 12/16/2017 heavy winds knocked down a tree, causing a power outage for 2,440 customers. A wind gust of 44 mph was recorded.

On 4/14/2009 high winds caused a tree to fall onto a power line on Pine Street causing a small fire and knocking out power along the street.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Novato. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Novato as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Novato with high tree cover including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.11 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

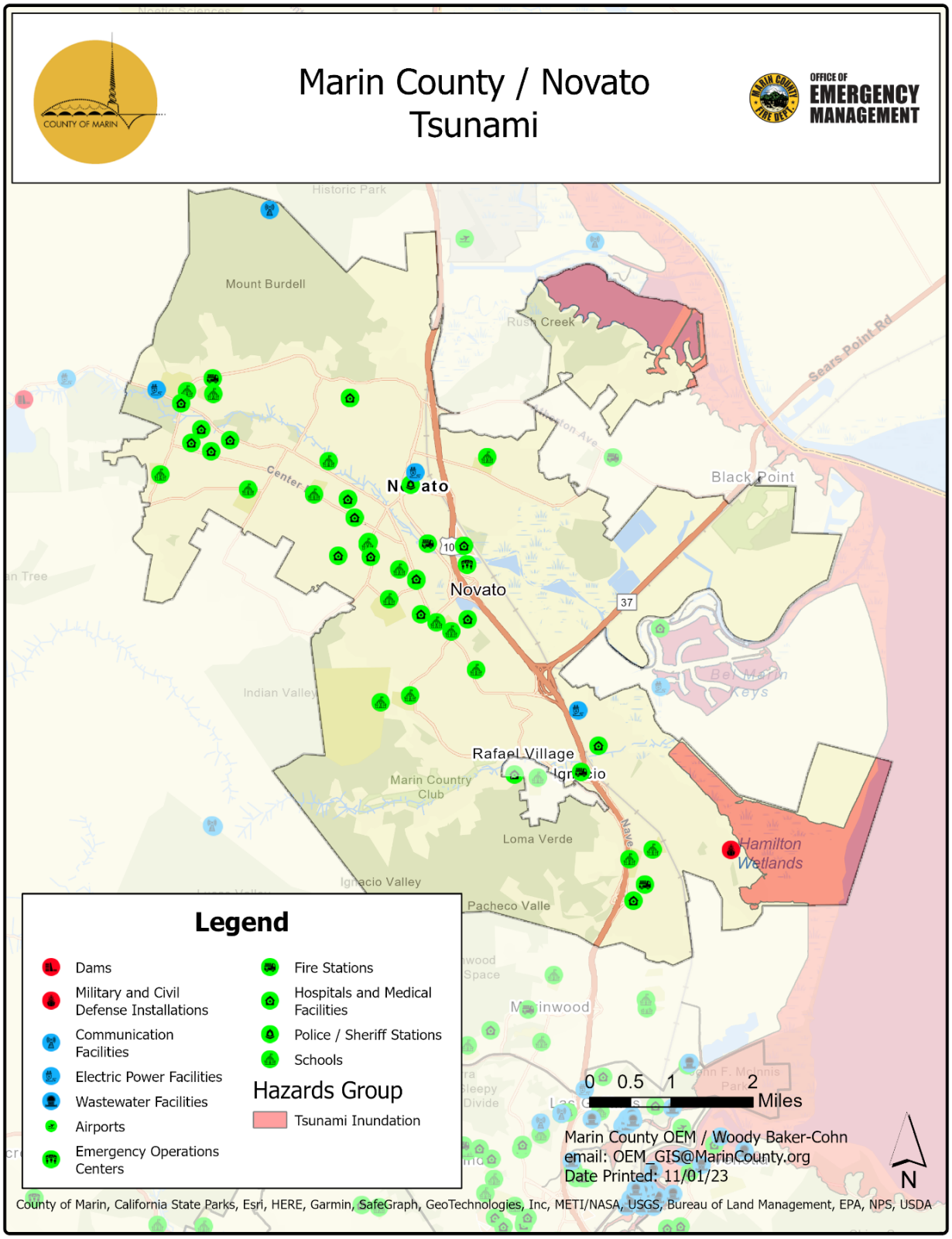


Figure 456: City of Novato Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

A tsunami experienced by Novato would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the City. Much of the eastern half of Novato is at a lower elevation, though the tsunami inundation zone in Novato does not include any structures or populations. The two areas in Novato in a tsunami inundation zone include the Hamilton Wetlands in southern Novato and the wetlands north of the Rush Creek Open Space Preserve in Novato. The Hamilton Levee protects the Hamilton neighborhood of Novato from a tsunami and could be tested in a tsunami event.

Novato has never experienced a tsunami.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Novato, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Novato. This is particularly true along Novato Creek and around the marshland areas of Novato where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Novato would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Novato Creek and along the marshlands and shoreline of Novato as a result of high wave heights associated with a more significant tsunami.

2.2.12 WILDFIRE

Most areas of the Novato Fire Protection District are susceptible to a vegetation/wildland fire. Vegetation/wildland fire risk factors include vegetative fuel types and configuration, weather, topography, prior service demand, water supply, mitigation measures, and vegetation fire service capacity. Wildland Fire Hazard Severity Zones CAL FIRE designates wildland Fire Hazard Severity Zones (FHSZs) throughout the state based on analysis of multiple wildland fire hazard factors and modeling of potential wildland fire behavior. For State Responsibility Areas (SRAs) where CAL FIRE has fiscal responsibility for wildland fire protection, CAL FIRE designates Moderate, High, and Very High FHSZs by county.

Figure 52 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

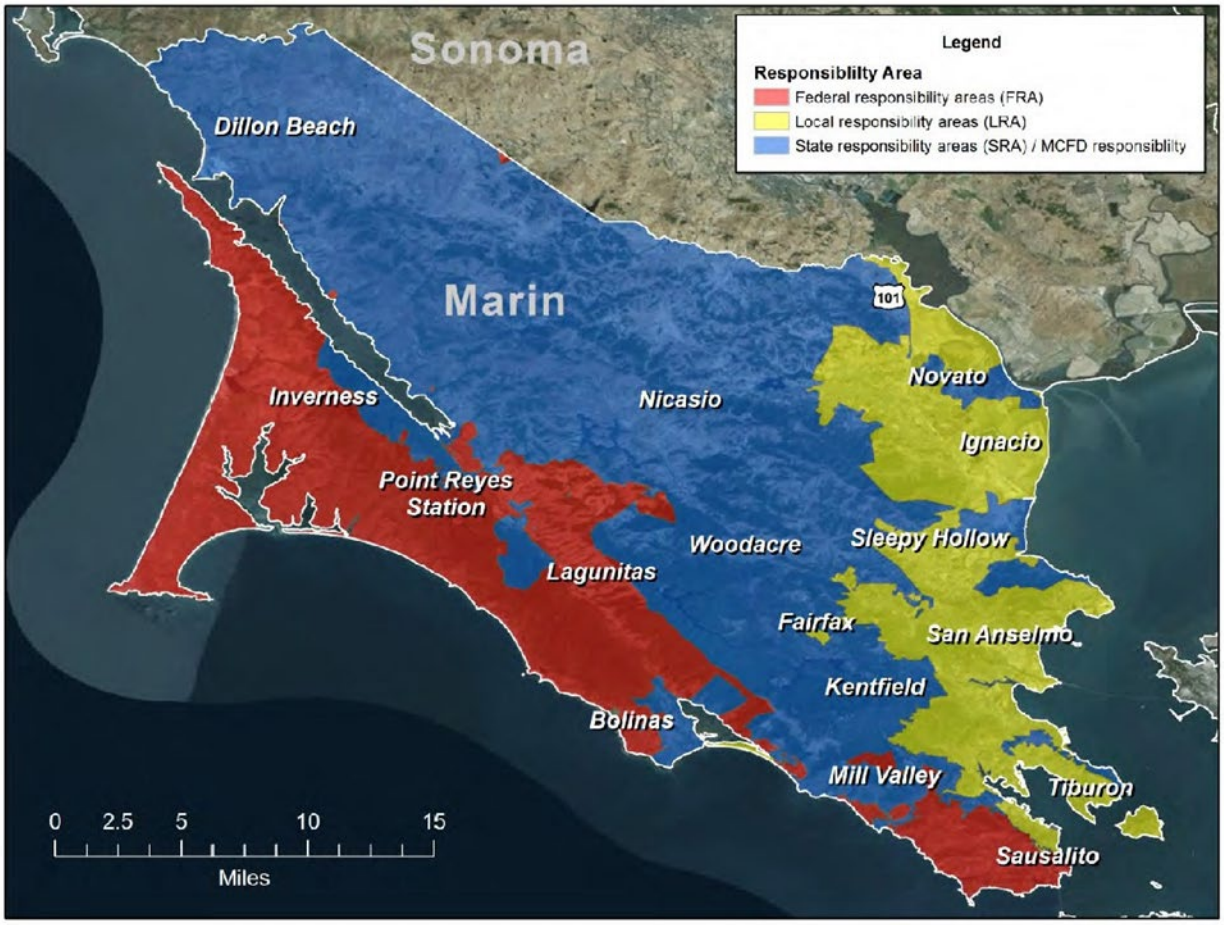


Figure 457: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

Both Moderate and High wildland FHSZs surround most of the District. Novato Fire Protection District (see Standards of Coverage Analysis Appendix A—Risk Assessment page 19). CAL FIRE also identifies recommended Very High FHSZs for Local Responsibility Areas, where a local jurisdiction is responsible for wildland fire protection, including incorporated cities. Wildland–Urban Interface (WUI) are areas where urban development meets undeveloped lands at risk of wildfires. These areas typically pose a significant threat due to the mix and density of structures and natural vegetative fuels combined with limited access/egress routes. Approximately 18 percent of the total land area is within the WUI. Of note is the extensive WUI within the District including higher building densities.

In addition to decorative landscape species, vegetative fuels within the District's service area vary from dense stands of mostly hardwood tress, including coastal live oak, California bay, Pacific madrone, and other oak species, to chapparal vegetation and native and non-native annual and perennial grass and plant species. Once ignited, vegetation fires can burn intensely and contribute to rapid fire spread under the right fuel, weather, and topographic conditions.

Figure 53 indicates the Fuel Model Map for the Marin County OA.

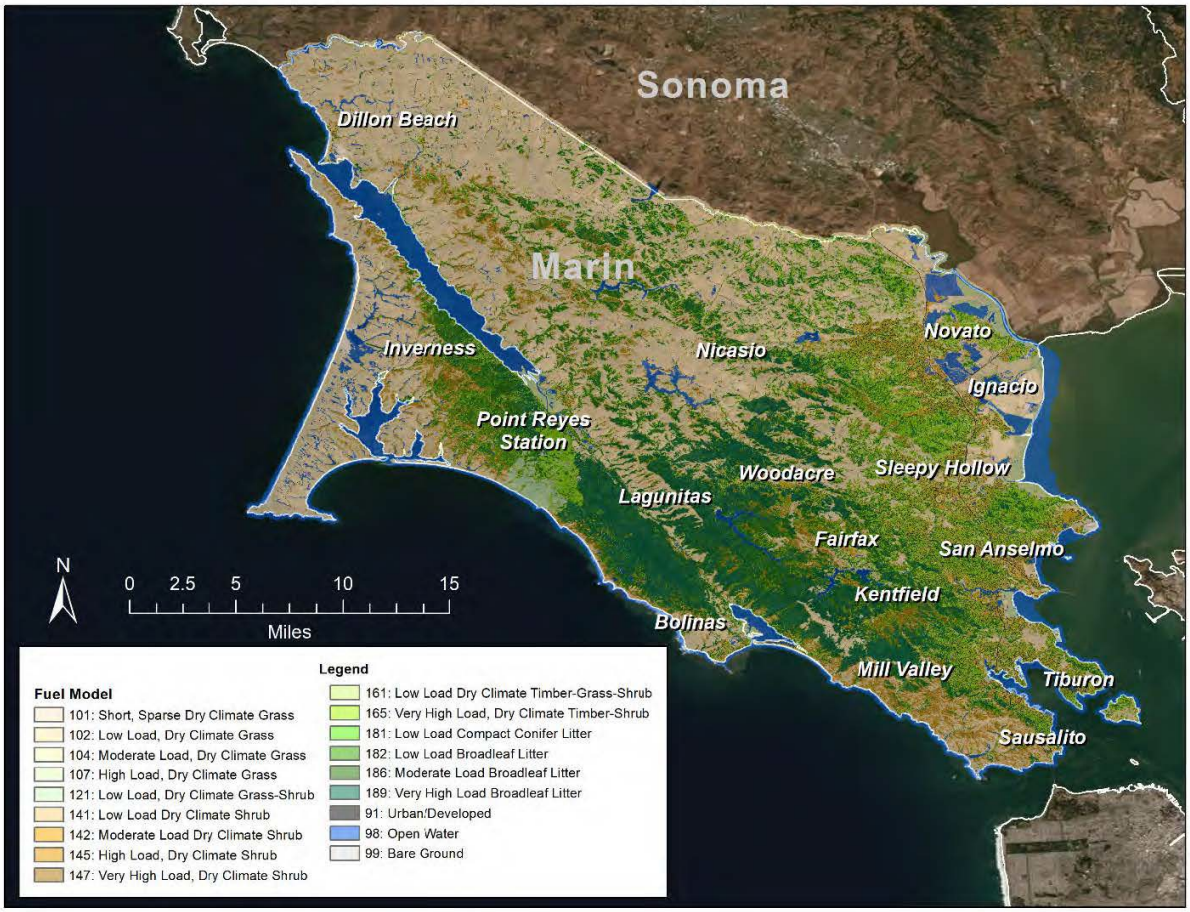


Figure 458: Fuel Model Map for the Marin County OA
Source: Unknown

Weather elements, including temperature, relative humidity, wind, and lightning, also affect vegetation/wildland fire potential and behavior. High temperatures and low relative humidity dry out vegetative fuels, creating a situation where fuels will more readily ignite and burn more intensely. Wind is the most significant weather factor influencing vegetation/wildland fire behavior, with higher wind speeds increasing fire spread and intensity. Wildland fire season, when vegetation fires are most likely to occur due to fuel and weather conditions, occurs from approximately June through October in Marin County. Summer weather within the service area typically includes cool mornings, warm afternoons and evenings, and west/northwest breezes that can reach 15 to 25 miles per hour. Occasional summer gradients can produce temperatures in the high 90s to low 100s, low relative humidity, and offshore winds as high as 40 miles per hour. These less frequent and transient weather patterns, as well as complex topography and annual variability of weather patterns, elevate the potential for a large, damaging wildfire.

Vegetation/wildland fires tend to burn more intensely and spread faster when burning uphill and up-canyon, except for a wind-driven downhill or down-canyon fire. Terrain within the District's service area varies from flat to steep slopes, which can contribute significantly to wildfire behavior and spread. Another significant vegetation fire impact severity factor is water supply immediately available for fire suppression. According to North Marin Water District staff,

available fire flow is at least 500 gpm in the rural areas of the District, and the District also has a water tender available to provide an augmented water supply as needed.
Figure 54 shows Critical Facilities in the City of Novato overlaid on Fire Severity Zones.

Wildland Fire History: Since the early 1900s, there have been several large wildland fires in Marin County, including the 1923 fire that burned from Ignacio in Novato to Woodacre (approximately 40,000 acres), the 1972 Kent Woodlands Fire, the 1976 Sorich Park Wildfire, and the 1995 Vision Fire (12,354 acres). In addition to the fire hazard service capacity, the areas of the District outside the City of Novato are within the SRA where CAL FIRE has fiscal responsibility for wildland fire protection. As such, all of CAL FIRE's wildland suppression resources, including engines, fire crews, bulldozers, and aircraft, are available for wildland fires within those areas of the District. In addition, as a CAL FIRE contract county, the Marin County Fire Department provides initial SRA wildland fire response within the County with six Type-3 wildland engines, one bulldozer, and one 12-person fire crew from approximately June 1 through October 31. Vegetation/Wildland Fire Hazard Mitigation refers to specific actions or measures taken to prevent a hazard from occurring or to minimize the severity of resultant impacts. While none of the hazards can be entirely prevented, measures can be taken to minimize the impacts when those hazards do occur.

The 2020 Marin Community Wildfire Protection Plan (CWPP) identifies the following wildfire hazard mitigation strategies to minimize the risk of a catastrophic wildfire within the WUI:

- Public education and community outreach
- Wildfire preparedness and planning
- Reducing structural ignitability
- Defensible space
- Non-residential vegetation management
- Evacuation planning and preparation

The CWPP further identifies 20 priority mitigation projects for the District to focus on:

- Creating and maintaining shaded fuel breaks
- Conducting wildfire mitigation home assessments
- Improving evacuation routes
- Creating/improving defensible space
- Reducing wildland fuel loading
- Reducing structural ignitability
- Increasing public education/information

With the passing of Measure C in 2020, the Marin Wildfire Prevention Authority (MWPA) was formed and funded at $20 million per year for 10 years to develop and implement a comprehensive Countywide wildfire prevention and emergency preparedness plan, to include:

- Vegetation management
- Wildfire detection and evacuation program improvements
- Grants
- Public education
- Defensible space evaluations
- Local wildfire prevention mitigation

The MWPA is a Countywide Joint Powers Authority with 17 member agencies, including cities, towns, the County, and special districts. The MWPA's mission is to lead "the development of fire adapted communities using sound scientific, financial, programmatic, ecological practices, vegetation management, community education, evacuation and warning systems with the support of its member and partner agencies."

In addition to being an MWPA member agency, the District requires fire resistive construction materials and methods in high fire hazard severity zones and WUI areas, has an annual weed abatement program, inspects and enforces defensible space requirements, and investigates all fire hazard complaints, taking appropriate actions as authorized by the City of Novato and District ordinances and regulations to eliminate or mitigate identified fire hazards.

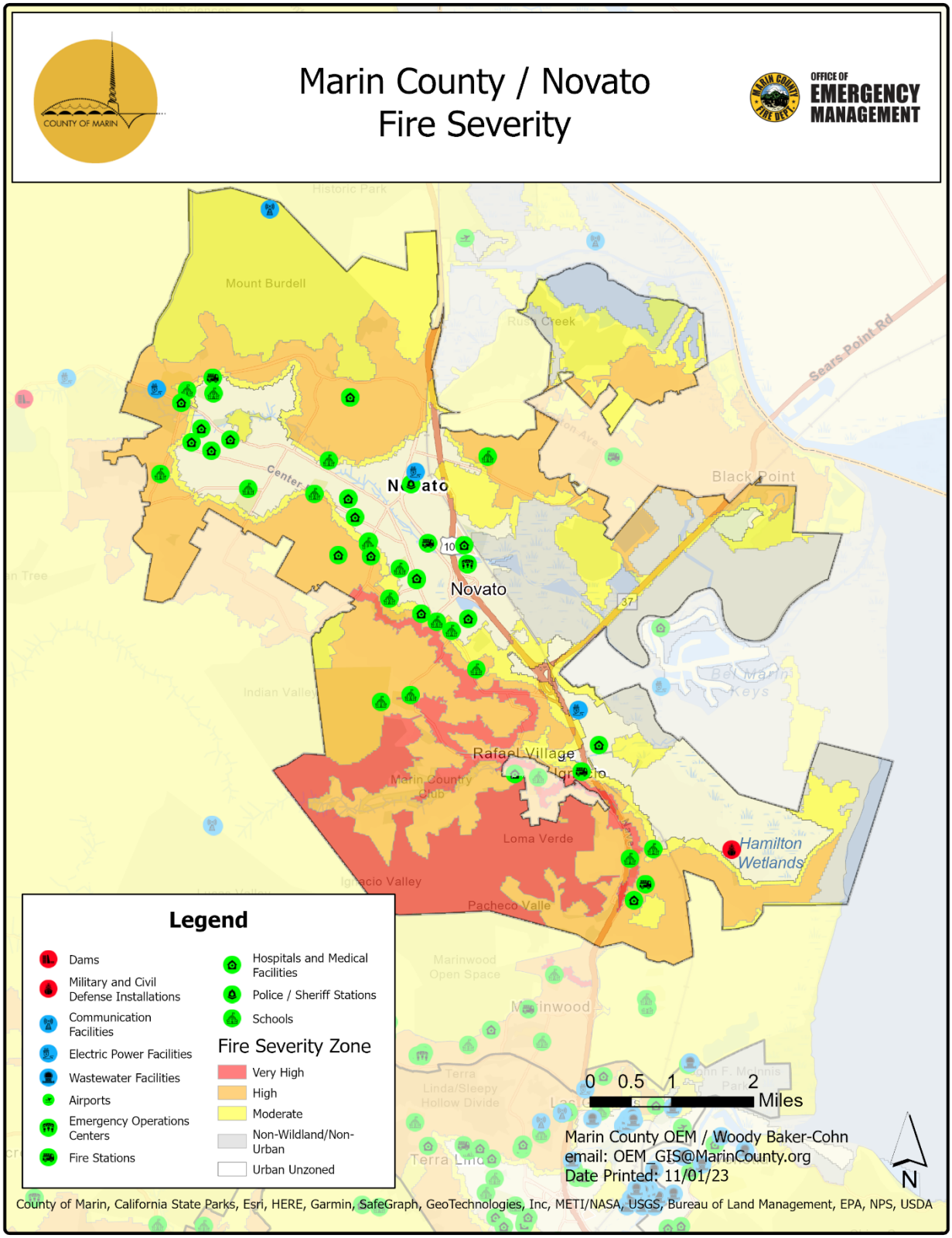


Figure 459: City of Novato Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin County OA) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 the Marin County OA including the Town of Ross experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA.

A wildfire in Novato would most likely occur from any of the open spaces surrounding the City where there is more forested terrain. A brush fire could also occur in any of the wetlands to the east of the City. The mountainous areas of Novato are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a wildfire.

Of particular concern are those communities in southern Novato near the Indian Valley, Ignacio Valley, and Loma Verde Preserves that are located in a Very High FHSZ. There are hundreds of residences, the Novato High School, the San Jose Middle School, the Loma Verde Elementary School and the Hamilton Elementary School that lie in this area and could be susceptible to a wildfire. This area also has few major thoroughfares, which could impede evacuation in a wildlife. This area and the other areas surrounding Novato including the Mount Burdell Open Space Preserve, Ohair Park, the Verissimo Hills Preserve, the Indian Tree Open Space Preserve and the Rush Creek Open Space Preserve are located in Moderate to High FHSZs. This area includes thousands of residences, numerous commercial buildings and medical facilities, San Marin High School, Pleasant Valley Elementary School, Hill Middle School, the College of Marin – Indian Valley Campus, the Good Shepherd Lutheran School, Olive Elementary School, Our Lady of Loretto School, Novato Fire Station #62, Novato Fire Station #63, Novato Fire Station #64 and Novato Fire Station #65 that could be susceptible to a wildfire.

All of Novato could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Novato become drier due to climate change, the risk of a wildfire occurring and impacting the City will continue to increase. Brush fires in the City may increase over time as marshlands, parks, and other open spaces experience drier conditions.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

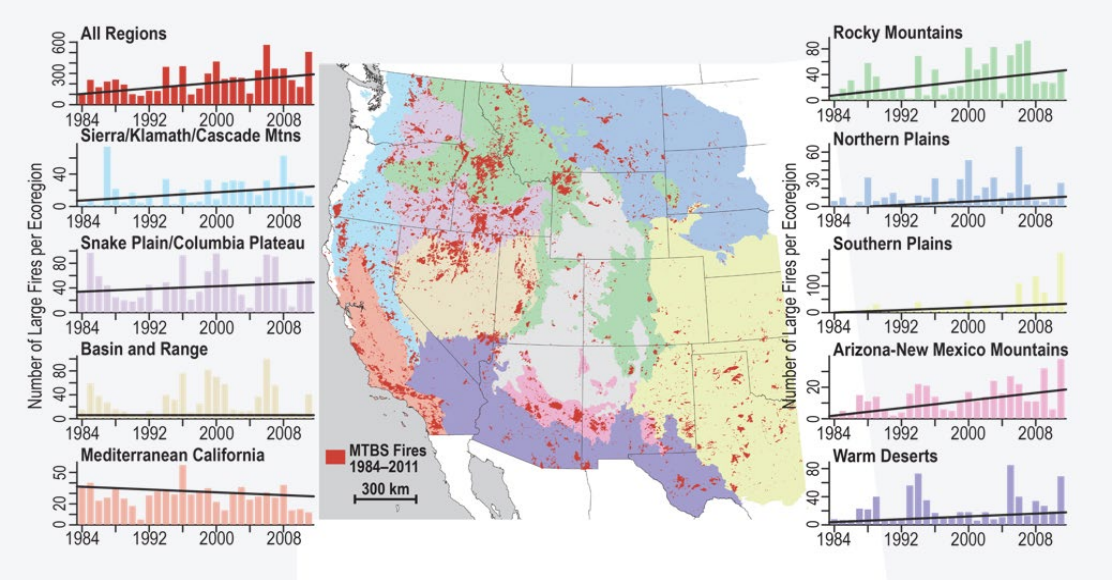


Figure 460: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Novato is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Novato. Future development in the WUI throughout Novato will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Novato WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Novato marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County OA's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character.

Since the last plan update in 2018, planning for the State's 6th Cycle housing allocations has occurred. The county-wide combined number for Marin was 14,405 new housing units. Of that total, Novato must accommodate 2,090 units. All jurisdictions must ensure that their general plans can accommodate their allocation, or they must update the General Plan to accommodate the growth.

Since 2018, there has been a moderate amount of development within the City of Novato, most of the new development has been residential. All of the development has been designed and/or conditioned to comply with general plan and zoning standards as well as compliance with the building code. These standards include setbacks from waterways, habitable spaces elevated about flood levels and fire-wise construction when located in the Wildland-Urban Interface.

Though new housing laws at the state level have exempted much residential development from the CEQA process; those laws have preserved all life safety requirements of the building and fire codes. When not usurped by State law, future land use and growth strategies in the City of Novato will be consistent with priorities detailed in the 2023 Marin County OA MJHMP and aim to concentrate future development in already developed areas and away from locations where natural characteristics should be avoided such as steep slopes and sensitive habitats. Priority areas for development are those that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and avoidance of conflicting uses.

The best indicator of future growth areas is the location of currently proposed development projects and locations identified in the 2023 Housing Element update as either potential sites or sites identified to be rezoned for residential development. Those sites are listed in the following table. Unit counts are either those proposed/approved through the development review process, or the maximum number allowed under current or proposed zoning.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Novato has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 22 City of Novato Projected Growth Areas						
Project Location	**# of Units**	**# of Parcels**	**Application Status**	**Acres**	**Fire Severity Zone**	**Flood Zone**
200 San Marin Drive	6	1	Approved	0.56	None	X
8161 Redwood Blvd.	80	1	Approved	13.5	None	AE, X
777 San Marin Drive	1300	3	In Review	65	None	X
North Redwood & Pinkston	122	2	In Review	37.6	WUI Only	X
1787 Grant Avenue	35	2	In Review	2.1	None	AE, AO, X
1316-1320 Grant Avenue	227	1	In Review	1.2	None	X
1212-1214 Grant Avenue	67	2	In Review	0.37	None	X
1107-1119 Grant Avenue	198	2	In Review	0.85	None	X, AE
7530 Redwood Blvd.	178	2	In Review	5.85	None	X
Bahia Dr & Topaz Dr	5	1	Approved	6.87	WUI Only	X
101 Landing Court	32	1	Approved	1.98	None	X
115 San Pablo Avenue	91	2	In Design	10	None	X
826 State Access Road	50	1	Construction	2.64	None	X
970 C Street	32	1	In Review	2.67	None	AE, X
1110 Olive Avenue	9	1	n/a	0.49	None	X
1017 4th Street	3	1	n/a	0.17	None	X
Vallejo Ave & 1st Street	6	1	n/a	0.31	None	X
Meadow Crest Rd & Wood Hollow	20	1	n/a	8.36	None	X
1682 Novato Blvd.	22	1	n/a	1.41	None	AO
200 Landing Court	41	1	n/a	3.44	WUI Only	X
Total	**2524**	**28**		**165.37**		

Table 214: City of Novato Future Growth Areas
Source: City of Novato

3.2 Capability Assessment

The overall priorities in the City of Novato have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the City of Novato General Plan to include the Public Safety Element, Land Use Element, and Housing

Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the City of Novato an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Local Emergency Operations Plan and Continuity of Operations Plan**: Additional Training and exercises for City Staff to carryout the Emergency Operations Plan.
- **Continuity of Operations Plan**: Develop a Citywide Continuity of Operations Plan to enhance resiliency.

Table 23: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y 2020	The City finalized an update to its General Plan in 2020, which serves as a basis for decisions that affect the City's growth and development such as transportation, land use, streets and infrastructure, parks, housing and neighborhoods, recreation and community facilities, downtown, the environment, public health and safety, and flooding. The General Plan is a strategic and long-term document identifying goals and polices that guides and directs the City in terms of implementing policies, programs and resources. As required by State law, the City of Novato's General Plan includes seven chapters, or "elements": land use, circulation, housing, conservation, open space, noise and safety.
Strategic Plan	No	
Capital Improvements Plan	Y Annual	Every year, City staff develops a Five-Year Capital Improvement Program (CIP) for council consideration, which serves as a multi-year planning tool to coordinate the financing and scheduling of major projects to improve and maintain its infrastructure.

		The CIP directs construction activities for City owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure.
Economic Development Plan	No	
Local Emergency Operations Plan	YES 2022	In conjunction with the County of Marin, the City of Novato and Novato Fire District developed a revised Emergency Operations Plan in 2022 that is pending approval.
Continuity of Operations Plan	NO	
Flood Mitigation Plan (FMP)		Included in Hazard Mitigation Plan
Engineering Studies for Streams	Yes	Stream studies are included in the FEMA Community Rating System (CRS) program and Flood Insurance Studies. The City of Novato Storm Drain Master Plan also includes hydrologic and hydraulic studies of the City storm drain system.
Open Space Management Plan	No	
Regional Transportation Plan (RTP)	No	
Stormwater Management Plan/Program	Yes 2022	The City Storm Drain Master Plan was adopted in 2022.
Community Wildfire Protection Plan	Yes	Stream studies are included in the FEMA Community Rating System (CRS) program and Flood Insurance Studies. The City of Novato Storm Drain Master Plan also includes hydrologic and hydraulic studies of the City storm drain system.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y 2020	The CWPP does address local hazards, identifies projects to include in the mitigation strategy and can be used in the implementation of mitigation actions.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	**Y**	The development standards in Chapter 5 of the Municipal Code are authorized by the California Government Code which allows local government controls in building, planning and subdivision. The City development standards enforce disaster-resistant development to minimize risk from natural hazards.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	The purpose of the Building and Housing code is to establish rules and regulations governing building activity in the city and to safeguard life, health, property, and public welfare by providing minimum fire retardancy requirements for new roof coverings. This information is also needed to assist the city in compiling information on the use, location, and condition of properties within the jurisdiction of the City of Novato and provides for the abatement of unsafe

		buildings. By agreement, for health and safety reasons, the city may share this information or resultant vital statistics with other governmental agencies. The City has also adopted the most recent State of California approved Building Code, Mechanical Code, Seismic Safety Code, and National Electrical Code which contain structural requirements for existing and new buildings. The codes are designed to ensure structural integrity during seismic and other hazardous events and prevent personal injury, loss of life and substantial structural damage. The City is prepared to adopt new codes and standards as passed by the State of California.
Fire department ISO rating:	Y	The City of Novato Building Code Effectiveness Grading Classification in 3.
Site plan review requirements	Y	ISO 1 Rating
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Municipal Code includes several sections that address hazard mitigation.
Zoning ordinance	Y	The City's Zoning Ordinance establishes various zoning districts and implements the goals and policies of the Novato general plan by classifying and regulating the uses of land and structures within the City of Novato. In addition, it protects and promotes the public health, safety, and general welfare of residents, and preserve and enhance the aesthetic quality of the city. When lots are subdivided, the developer is required to provide adequate access for firefighters, flowrates and storage of water for firefighting.
Subdivision ordinance	Y	The City's Subdivision Ordinance is authorized by the Subdivision Map Act of the State of California. The ordinance supplements and implements the Subdivision Map Act of the State of California and sets forth procedures and requirements applicable to subdivisions, land divisions and lot line adjustments.
Flood Damage Prevention Requirements	Y	Chapter 5-31 of the Municipal Code is titled Flood Damage Prevention Requirements. It was adopted to reduce flood hazards in the special flood hazard areas within the City of Novato. It addresses the construction, location, extension, conversion or alteration of structures or land in special flood hazard zones. These regulations apply to both new development and construction and existing structures. By regulating and restricting development in such areas will minimize risks of public and private losses due to flood hazards in these specific areas. The areas of special flood hazards are identified by the Federal Insurance Administration, through the Federal Emergency Management Agency. It is the purpose of this section to promote the public health,

		safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas, and to minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public.
Clean Storm Drain Regulation	Y	This regulation ensures the future health, safety, and general welfare of the citizens of the City of Novato by establishing a funding source to provide enforcement of the city's Urban Runoff Pollution Prevention Ordinance, to provide maintenance and repair of the city's stormwater drainage facilities, to provide capital improvements to the city's storm drainage system, and to provide other clean stormwater activities. It also protects and enhances the water quality of the State's, and the Nation's watercourses, water bodies, and wetlands in a manner pursuant to and consistent with the Clean Water Act.
Adequate Water Supply	Y	Section 5-55 of the Municipal Code requires each permit or approval application affected by this requirement shall include provisions for adequate water supply. The degree of specificity shall relate to the type of permit or approval requested. All affected permit or approval processes shall include provisions for adequate water supply. This insures that the North Marin Water District will provide water to serve the use and/or development upon the establishment of the use or the completion of the development. Each use or development proposal which involves or requires water service (domestic, commercial, industrial, agricultural) either for sanitary use, consumption, production, irrigation or visual amenity, shall provide for such water by agreement with the North Marin Water District.
Drainage Development Requirements	Y	In Section 5-15 of the Municipal Code standards for drainage are defined and are necessary to insure that underground and surface waters are conducted through and away from developments in such a manner as to not detrimentally affect other properties; insure that underground and surface water is not a problem within the completed development; and further, to correct or improve existing underground or surface water problems within the boundaries of the development and within the immediately affected surrounding area.
Hillside and Ridgeline Protection (Erosion or sediment control program)	Y	This ordinance reduces the potential for hazards and environmental degradation related to slope failure, increased erosion, sedimentation, storm water run-off, fire hazards, loss of vegetation, excessive grading, visual intrusion of structures, and potential for traffic hazards. It also provides for proper maintenance and fire management and minimizes public expense for long-term maintenance of slope areas and public improvements in hillside areas.

Waterway and Riparian Protection	Y	Section 7-12 of the Municipal Code provides standards for the protection, maintenance, enhancement and restoration of streams and waterways in a manner which preserves and enhances their ecological integrity and resource functions and value. This ordinance establishes adequate buffer areas along watercourses to avoid flood hazards and maintain or expand storage capacity for flood waters; protect water quality and instream habitat; preserve, enhance and restore riparian habitat and adjacent wetlands and upland buffers; and, provide for continuous wildlife migration corridors connecting habitat areas. This regulation allows development, which is compatible with the important physical, habitat, aesthetic, and recreational functions of waterways, while ensuring that these functions and values are protected in perpetuity.
Fire Safety	Y	The City of Novato recognizes the Novato Fire Protection District as the agency responsible for providing fire prevention and firefighting services to the incorporated area of the City of Novato. Therefore, Chapter 5-21 of the Municipal Code requires all applications for permits or approvals affected by this chapter shall be referred to the Novato Fire Protection District for its review and comment. Fire regulations are adopted to minimize the hazard to life and property due to fire. All affected permit or request for approval applications shall include fire safety provisions. Such as: • Emergency Vehicle Access including but not limited to: Minimum street widths, grades, horizontal and vertical clearances are defined so certain major equipment can properly function on such streets to provide access and egress that is optimal for emergency response vehicles. • Certain developments that include proposed open space dedications or where developments abut existing open space, access for fire equipment to that open space shall be provided. • New developments, and certain types of remodels, proposed in identified fire hazard severity zones or in the defined Wildland Urban Interface (WUI) areas shall use ignition resistant building construction materials and methods to reduce structural ignitability. • Any new development or substantial remodel construction to occur in areas defined by the Novato Fire District Board, and adopted by resolution of the City Council, as Wildland Urban Interface areas shall, prior to final clearance occupancy or use, eliminate certain types of fire prone vegetation, except single specimen shrubs or trees, within 30 feet (or up to 100 feet for extra hazardous conditions upon direction of the fire chief) of all structures.

Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Section 19.26 of the Municipal Code defines hillside and ridgeline protections with the intent to reduce the potential for hazards and environmental degradation related to slope failure, increased erosion, sedimentation, stormwater run-ff, fire hazards, and potential traffic hazards.
Flood insurance rate maps	Y 2016	FIRM Maps are available at the City Administration Offices
Elevation Certificates	Y	Required in the FEMA Community Rating System Program that the City participates in.
Acquisition of land for open space and public recreation uses	Y	Included in development impact fees.
Erosion or sediment control program	Y	Section 5-23 of the Municipal Code provides requirements for erosion control. The City of Novato uses ABAG requirements for all development.

Table 215: City of Novato Legal and Regulatory Capabilities
Source: City of Novato

City of Novato General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of Novato General Plan, adopted in 10/27/2020, was prepared over a 12-year period that included an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

City of Novato specific goals and policies related to mitigation of natural hazards are as follows:

Table 24: City of Novato General Plan	
Goal/Policy/ Program	**Explanation**
Land Use Element (Great Places, A City That Works)	
Goal	Goal LU 1: Manage growth and maintain community character.
Goal	Goal LU 2: Establish clear limits to urban development outside the Novato City Limits.
Conservation and Open Space Element (Environmental Stewardship)	
Goal	Goal ES 1: Preserve, enhance and restore natural areas and features, including Novato's scenic hillsides, water- ways, riparian corridors, wetlands, baylands, and special status species.
Goal	Goal ES 2: Maintain clean, healthful air.
Goal	Goal ES 3: Continue prudent use and conservation of natural resources.
Goal	Goal ES 4: Protect trees and woodlands that provide ecological, economic and aesthetic benefits for Novato.
Goal	Goal ES 5: Engage in environmental stewardship that balances the needs of the environment, the economy and a diverse society to utilize our natural resources in a

Table 24: City of Novato General Plan	
Goal/Policy/ Program	**Explanation**
	sustainable way.
Public Safety (A City That Works)	
Goal	Goal SH 1: Maintain high levels of public safety and emergency preparation.
Public Facilities Element (A City That Works)	
Goal	Goal PF 1: Provide well planned, maintained and adequate public infrastructure, buildings and landscaping.

Table 216: City of Novato General Plan
Source: **City of Novato** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the City personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 25: Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Planning Commission	Y	Planning Commission has regularly scheduled meeting on the 2nd and 4th Monday of each month.
Administrative Services	Y	Maintains insurance on City facilities Operates the City Redevelopment Agency and manages Housing activities Manages internal City communications and computer systems Designated a grant analyst position to develop additional funding opportunities for various projects and programs.
Disaster Council	Y	Established by City Municipal Code, 2-13 Develops and recommends emergency and mutual aid plans and agreements
Hazard Mitigation Planning Committee	Y	The City participates in the Marin County OA Multi-Jurisdictional Hazard Mitigation Planning Committee that meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Maintenance programs are listed in the City CRS program for clearing drainage systems.
Mutual aid agreements	Y	The Novato Police and Fire Departments utilizes mutual aid agreements with local agencies and jurisdictions that provide public safety personnel in times of emergency.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?

Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	Y	
Grant writing	Y	The City acquired a state grant to undertake the Climate Adaptation Assessment.
Hazus analysis	N	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y Full-time	The City of Novato Building Department has 4 full time employees and supplements staff with consultants on an as needed basis. Staff is familiar with hazard mitigation and coordinates with police and fire on a regular basis.
Floodplain Administrator	Y	Assigned to Public Works Director
Emergency Manager	Y	Police Captain
Community Planner	Y	Community Development Department
Civil Engineer	Y	Public Works Department
GIS Coordinator	Y	City IT Department
Community Development Staff	Y/FT	Verifies compliance with Building Code through checking plans, issuing permits, and conduction field inspections. Conducts comprehensive planning activities, including leading preparation of the General Plan Develops zoning regulations Prepares CEQA documents Leads situation analysis, damage assessments and documentation during emergency response Conducts site inspections to enforce permit and code requirements
City Planning, Building, and Public Works Staff	Y/FT	Provides road construction and maintenance services Conducts emergency repair services to transportation and public works infrastructure systems Maintains drainage infrastructure Oversees floodplain management and flood mitigation programs Makes flood elevation determinations Works with water and sewer agencies to maintain surviving utilities, and services and evaluates the safety of public structures and infrastructure during emergency response Designs constructs and maintains city owned buildings

		Manages the Repetitive Loss Program
Police Department Staff	Y/FT	Plans and coordinates response, recovery and mitigation activities Develops emergency operation plans for the City Leads emergency response and coordinates with fire for rescues and hazardous materials response Communicates with federal, state, and other local agencies Coordinates with the County to utilize the Marin Medical Reserve Corps (MMRC), Radio Amateur Civil Emergency Service (RACES) and other volunteer organizations, such as the Community Response Team (CRT) Oversees disaster volunteers Performs emergency response activities, including evacuation and security Utilizes the emergency warning systems through telephone notification utilizing reverse 911 and the EAS system as their primary warning capability.
Fire Protection District Staff	Y/FT	The City of Novato recognizes the Novato Fire Protection District as the agency responsible for providing fire prevention, firefighting services and emergency medical services to the incorporated area of the City of Novato. The district also responds to hazardous material incidents. Coordinates emergency response, including rescues, fire suppression and hazardous materials response. Plans and coordinates response, recovery, and mitigation activities Conducts emergency management and preparedness trainings Provides plan check and inspection services for fire related code compliance Enforces the Vegetation Management Plan which sets clearance distances, type of vegetation for fire fuel breaks around structures. The Novato Fire Protection District participates in the Marin Wildfire Prevention Authority (MWPA) for enhanced wildfire mitigation and prevention efforts. Novato also participates in the use of Zonehaven to support evacuation planning and implementation.

Table 217: City of Novato Administrative and Technical Capabilities
Source: **City of Novato**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 26: Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Projects are funded under the 5 year Capital Improvement Plan which includes project listed in the Storm Drain Master Plan.
Authority to levy taxes for specific purposes	Y	City has the authority to levy taxes within the limitation of Proposition 218.
Fees for water, sewer, gas, or electric services	N	These fees are collected by other agencies.
Impact fees for new development	Y	City has a Development Impact Fee Study and program.
Storm water utility fee	Y	City collects a parcel tax for storm drain maintenance city wide.
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Incur debt through private activities	N	City is a public agency.
Community Development Block Grant	Y	The City of Novato uses the Community Development Block Grant program for affordable housing..
Other federal funding programs	Y	City uses Federal Highway Bridge Program and Federal Highway Safety Improvement Program funding. State Homeland Security Grant Program (SHSGP)
State funding programs	Y	State Gas tax program is used for funding projects.

Table 218: City of Novato Fiscal Capabilities
Source: **City of Novato**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of Novato and the City of Novato partnerships utilized to promote those programs.

Table 27: City of Novato Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Coordinates with the County to utilize the Marin Medical Reserve Corps (MMRC), Radio Amateur Civil Emergency Service (RACES) and other volunteer organizations. Oversees disaster volunteers Community Resource Team (CRT)
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	Novato Fire Foundation – A non-profit organization supported by the Novato Fire Protection District provides enhanced fire and life safety programs, services and education to the Novato community. (https://www.novatofirefoundation.org/) CRT Marin County Resource Conversation District
Natural disaster or safety related school programs	Yes	The CERT program, or Community Emergency Response Team is a national program to train citizens to help fill the gap between a disaster or emergency and the arrival of professional services. Novato participates in providing CERT training in coordination with other Marin County OA agencies. (https://readymarin.org/cert/)
StormReady certification	No	
Firewise Communities certification	Yes	Firewise Neighborhoods: The Firewise USA™ program has empowered neighbors to work together in reducing their wildfire risk. Using a five-step process, communities developan action plan that guides their residential risk reduction activities, while engagingand encouraging their neighbors to become active participants in building a safer place to live. 15 of 30 identified neighborhoods participate in the Novato area.
Community Rating System	Yes	
Public-private partnership initiatives addressing disaster-related issues	Yes	The Get Ready program, developed in the County of Marin, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 219: City of Novato Community Outreach
Source: **City of Novato**

3.2.5 Participation in the National Flood Insurance Program

The City of Novato has participated in the Regular Phase of the NFIP since 1978. Since then, the City of Novato has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. The City of Novato has been in the CRS program since 1995. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, the City of Novato is currently ranked a Class 6 community, which gives a 20 % premium discount to individuals in the City of Novato Special Flood Hazard Area (SFHA), and a 20 % discount to policyholders outside the SFHA.

Presently, the City of Novato manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the City's participation in the NFIP. As well, the City's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the City.

The City of Novato will continue to manage their floodplains in continued compliance with the NFIP. An overview of the City's NFIP status and floodplain management program are discussed in Table 28. Additional information on the City's CRS program follows.

The activities credited by the CRS program provide direct benefits to the Marin County OA and its residents,

including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that City of Novato and the County of Marin implements and receives CRS credits include:

Activity 310 - We maintain Elevation Certificates for new and substantially improved structures in SFHA. There are occasions that homeowners submit their elevation certificates when they are not making any improvements to their property. We post the elevation certificates online and also we keep hard copies in the office in a binder.

Activity 320- We provide basic flood information to inquirers. We also provide additional information like flood depth, Historical flood information and etc.

We also send a Notice to Lending Institutions and Real Estate and Insurance agents letting them know that we can provide them that the City can make a flood zone determination for any particular property within the City.

Activity 330- Outreach program. We send a flyer to all the properties in the flood zone. In the flyer we have some language for the history of flooding, if their property is insured, protection of their property, protection and clean local creeks and stormdrains, build responsibly for flooding and City floodplain information services.

Activity 340- This is Hazard Disclosure. We used to have resale inspection. We were disclosing whether a property was or was not in the flood zone.

Activity 350- Our Public Library maintains flood protection materials. Also, we conduct an annual review and update of the information and links on our flood protection website.

Activity 360- We send a brochure to properties in the flood zone. We provide flood protection advice to inquirers. We provide on-site flood protection assistance to inquirers. We let them know that flooding is not covered by the standard insurance policies whether they are property owners or renters. We also let them know that if they live or work in the Marin County OA they can register and get an alert notification during an emergency situation. We also let them know that they have to have an emergency plan and also how they can protect their property from flooding by cleaning the gutters and downspouts and area drains and making sure if they have a sump pump, the sump pump is working.

Activity 420- This activity is preserving our open space in the floodplain.

Activity 430- We enforce the floodplain management provisions of our zoning, subdivision and building code ordinances. Examples of this activity are requiring the lowest floors of residences to be higher than the base floor elevation. If the cost of improvements or repairs are more than 50% of the building's value, the owner needs to bring the building to compliance. Also, requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings.

Activity 440- We use and update our flood data maintenance system on an annual basis as needed, because we want to make the community floodplain data more accessible, current and useful.

1. We implement digital mapping or paper mapping systems that improve access and quality.
2. We maintain our historical Flood Hazard Boundary Map, FIRMs and Flood Insurance Studies.
3. We maintain benchmarks so surveyors can request obtain them from the City.

Activity 450- This activity is about stormwater management.

We regulate development on a case-by-case basis to ensure we treat runoff before it leaves the site and also ensure that the peak flow of stormwater runoff from each site will not exceed the pre-development. There are instances that the post-development peak flow rates for the developed area have been slightly increased from pre-development conditions however, onsite bio-retention areas or other treatment facilities have been provided to mitigate the increase in flow rate. We enforce regulations to minimize erosion from land disturbance due to construction.

Activity 502- This is about repetitive loss Category- Properties that have had losses and reported to FEMA for these losses. We are in Category B. Category B means we are a community with at least one, but fewer than 50 repetitive loss properties that have not been mitigated. We have a map of the areas. We send a notice every year to those properties letting them know about flood prevention and insurance information. We have 38 repetitive loss properties however we send notices to 65 properties.

Activity 510- Floodplain Management Planning- The City of Novato has adopted the County of Marin Multi-Jurisdictional Hazard Mitigation Plan which has flood related sections like Dam Failure, Severe Storm, Flooding, Repetitive Loss Properties and Safety Warning/Evacuation Systems.

Activity 540- This activity is about drainage system maintenance - Community's drainage system is inspected regularly throughout the year and maintenance is performed as needed. We enforce a regulation prohibiting dumping in the drainage system.

Activity 630- This activity is about the safety of Dams. States provide dam safety information to communities. The Stafford Lake Dam, also known as the Novato Creek Dam, is classified as an Extremely High Hazard Dam. North Marin Water District has an Emergency Action Plan for this Dam. There is also a Dam Failure Inundation Map that we submit and get credit for it.

We maintained a class 6 rating with 2060 points at the last 5 Year Cycle Visit in 2020.

Table 28: City of Novato NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	NFIP insurance data provided by DWR indicates that as of 4/2/2023, there were 1060 policies in force in the City of Novato with $745,659 in premiums, resulting in 281,304,000 of insurance in force.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	There have been 434 closed paid losses totaling $3,263,954.26. 14 of the claims were considered substantial damage losses.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	Per our GIS Consultant who queries GIS for building footprints against the SFHA boundary, there are 2000 buildings in SFHA.
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	Yes

Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Review permit plans for FEMA regulation compliances. Use GIS to find out if the property is in a Flood Zone. Outreach brochure mailed to all properties in SFHA. Inspection is performed as needed.
What are the barriers to running an effective NFIP program in the community, if any?	There is no barrier to run an effective NFIP Program.
Compliance History	
Is the community in good standing with the NFIP?	YES
Are there any outstanding compliance issues (i.e., current violations)?	No. There are no outstanding compliance issues.
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	No
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	1978
Are the FIRMs digital or paper?	We have both digital and paper.
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Yes. This is through development limitations, free board requirement, foundation protection, cumulative substantial improvements. We also have adopted and enforced the International Building Code. We do maintain drainage systems all year around to prevent flooding in different neighborhoods.
Provide an explanation of the permitting process.	Before the applicant submits plans for design review, she/he needs to get some information about her/his property. That is when planning/engineering will have a meeting with them to go over the requirements such as building in the Special Hazard Flood Zone. All projects that will be constructed in the SFHA will be subject to the provisions of Novato Municipal Code 5-31, Flood Damage Prevention Requirements. The finished floor elevation of all the building will need to be at least 1-foot above the base flood elevation. No exception taken.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	CRS Class 6
What categories and activities provide CRS points and how can the class be improved?	All the activities that are performed/accomplished are described above. To improve the class to a higher classification the City needs to expand and do more work towards activities.
Does the plan include CRS planning requirements	Yes

Table 220: City of Novato NFIP Status
Source: FEMA, City of Novato

NFIP Insurance Coverage Details

The City of Novato joined the NFIP in 1978. The City of Novato does participate in the Community Rating System. NFIP insurance data provided by DWR indicates that as of 4/2/2023, there were 1060 policies in force in the City of Novato with $745,659 in premiums, resulting in 281,304,000 of insurance in force. There have been 434 closed paid losses totaling $3,263,954.26. 14 of the claims were considered substantial damage losses. Of these losses, 101 parcels were in AE, A & D zones, 295 parcels were in AO, B, C & X zone. Of the 434 claims, 380 claims were associated with pre-FIRM structures and 16 with post-FIRM structures. There were 44 repetitive loss structures in the City. 34 were in A zones, and 10 were in B, C, or X zones. These repetitive loss structures account for $1,367,467.52 of the total losses in the City of Novato. There were 2 severe repetitive loss properties in the City of Novato $60,698.72.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 44
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 2
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0
- Repetitive Loss Residential Structures:44
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 2
- Severe Repetitive Loss Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 29 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 29: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Continue the code enforcement inspection program for apartments of 3 or more units in the City to find seismic safety, flood and health and safety compliance issues and to identify buildings at risk to specific hazards.		X		X	X
Update the City's Emergency Operations Plan, as needed and update the plan when the State of California and the County of Marin update their Emergency Operations plans.		X		X	X
Refine Open Space mapping to differentiate between city owned and county owned properties.	X				
Participate in the completion of the County's Watershed Stewardship Plan. The plan's projects will address preventative measures to mitigate flood impacts.		X		X	X
Create a comprehensive computerized model of the Novato's basins and produce maps to aid the Clean Storm Water program by completing the Storm Drainage Master Plan. In conjunction with Marin County Flood Control District the GIS database will work to monitor flow at key location(s) within the City's network of storm drains.	X				
Meet annually with all agencies involved in Marin County Flood Control projects to ensure that structural projects are considered and continue to cooperate with Marin jurisdictions in pursuing all available sources of funding to finance improvements to storm drainage facilities.		X		X	X

Table 29: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
Implement action items identified for Novato in the current Marin County Wide Community Wildfire Protection Plan (CWPP).		X		X	X
Articulate and promote the concept of land use planning related to fire risk and individual landowner objectives and responsibilities.				X	X
Coordinate with county and local government staff to integrate Firewise approaches into planning documents and ordinances.				X	X
Consider the creation of transition zones (areas between developed residential areas and open space areas) where additional defensible space clearance is needed.				X	X
Consider the creation of transition zones (areas between developed residential areas and open space areas) where additional defensible space clearance is needed.				X	X
Continue efforts to partner with neighborhoods located in WUI areas to educate them on becoming fire adapted or Firewise communities.		X		X	X
Continue implementation of the countywide fuel break and fire plan implementation.		X		X	X
Work to reduce regulatory barriers that limit hazardous fuels reduction activities (e.g., tree removal process).				X	X

Table 221: Status of Previous Hazard Mitigation Actions
Source: City of Novato

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 Hazard Mitigation Actions

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the City of Novato based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the

general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:
- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 30 lists the Current Hazard Mitigation Actions for the City of Novato.

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Table 30: City of Novato Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
N-1 Continue the code enforcement inspection program for apartments of 3 or more units in the City to find seismic safety, flood and health and safety compliance issues and to identify buildings at risk to specific hazards.	All Hazards/ 1, 2, 3, 4, 5	Novato Community Development	Existing (2018)	TBD: City General Fund	1 – 2 years On-going/ High	
N-2 Update the City's Emergency Operations Plan, as needed and update the plan when the County of Marin updates their Emergency Operations Plan.	All Hazards/ 1, 2, 3, 4, 5	Novato Emergency Management	Existing (2023)	TBD: City General Fund and Fire General Fund	1 – 2 years On-going/ High	Update the City's Emergency Operations Plan, as needed and update the plan when County of Marin updates their Emergency Operations Plan.
N-3 Participate in the completion of the County's Watershed Stewardship Plan. The plan's projects will address preventative measures to mitigate flood impacts.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Novato Public Works	Existing (2018)	TBD: City General Fund	1 – 2 years On-going High	
N-4 Meet annually with all agencies involved in Marin County Flood Control projects to ensure that structural projects are considered and continue to cooperate with Marin jurisdictions in pursuing all available sources of funding to finance improvements to storm drainage facilities.	Dam Failure, Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5,6	Novato Public Works	Existing (2018)	TBD: City General Fund	1 – 2 years On-going High	
N-5 Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential Dam related emergencies or risk.	Dam Failure 1, 2, 3, 4, 5, 6	Novato Emergency Management, NMWD, Marin OEM	New (2023)	TBD: General Funds	1 – 2 years Ongoing/ High	Continue to encourage residents to participate in Alert Marin with an emphasis on properties at risk from dam failure.
N-6 Implement action items identified for Novato in the current Marin	Wildfire/ 1, 2, 4, 5,	Novato Fire District	Existing (2018)	Marin Wildfire Prevention Authority, CDAA,	1 – 2 years High	Currently in year 3 workplan of 10-year commitment to implementation of county

Table 30: City of Novato Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
County Wide Community Wildfire Protection Plan (CWPP).				HMPG, BRIC, grants and Fire General Fund		wide JPA wildfire prevention and mitigation efforts
N-7 Articulate and promote the concept of land use planning related to fire risk and individual landowner objectives and responsibilities.	All Hazards/ 1, 2, 4, 5,	Novato Community Development	Existing (2018)	TBD: City General Fund	1 – 3 years Medium	
N-8 Coordinate with county and local government staff to integrate Firewise approaches into planning documents and ordinances.	Wildfire/ 1, 2, 4, 5,	Novato Fire District and Novato Community Development	Existing (2018)	TBD: Marin Wildfire Prevention Authority, Fire General Fund and City General Fund	1 – 2 years On-going High	
N-9 Consider the creation of transition zones (areas between developed residential areas and open space areas) where additional defensible space clearance is needed.	Wildfire/ 1, 2, 4, 5,	Novato Public Works and Novato Fire District	Existing (2018)	Marin Wildfire Prevention Authority, CDAA, HMGP, BRIC Grants, City General Fund and Fire General Fund	1 – 2 years High	Implement the creation of transition zones (areas between developed residential areas and open space areas) where additional defensible space clearance is needed. Included in 2035 General Plan adopted in 2020. Greater Novato Shaded Fuel Break has been planned, approved and is now being implemented starting July 2023.Vegetation clearance up to 300 ft from the property line of residential and business properties.
N-10 Continue efforts to partner with neighborhoods located in WUI areas to educate them on becoming fire adapted or Firewise communities.	Wildfire/ 1, 2, 4, 5,	Novato Fire District	Existing (2018)	TBD: Marin Wildfire Prevention Authority and Fire General Fund	1 – 2 years On-going High	We have divided the entire community up into 35 neighborhoods and have successfully initiated 13 Firewise designations throughout. We have

Table 30: City of Novato Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
						provided educational materials and support a county wide Ember stomp festival annually to promote fire adaptive communities across Marin.
N-11 Continue implementation of the countywide fuel break and fire plan implementation.	Wildfire/ 1, 2, 4, 5,	Novato Fire District	Existing (2018)	TBD: Marin Wildfire Prevention Authority, City General Fund and Fire General Fund	1 – 2 years On-going High	Greater Novato Shaded Fuel Break has been planned, approved and is now being implemented starting July 2023.Vegetation clearance up to 300 ft from the property line of residential and business properties.
N-12 Work to reduce regulatory barriers that limit hazardous fuels reduction activities (e.g., tree removal process).	Wildfire/ 1, 2, 4, 5,	Novato Community Development	Existing (2018)	TBD: City General Fund	1 – 2 years On-going Medium	Novato Municipal Code re: Tree Permits 17-1.4 *Tree Permits.* e. The director may waive public notice and the appeal process otherwise required by this chapter, and immediately issue the permit with a finding that the tree constitutes a hazard or threat to the public health and safety or property in the vicinity in cases where: 1. The tree (or trees) in question is dying, diseased or has been substantially damaged and will imminently threaten the health, safety, or property improvements in the immediate vicinity and such disease or threat is verified in writing by a licensed tree surgeon, certified arborist,

Table 30: City of Novato Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
						landscape architect or similar licensed professional; 2. The tree (or trees) in question is classified as a pyrophyte, including Monterey Pine, Bishop Pine, Acacia species, and Eucalyptus species; or 3. Tree removal or alteration is by a public agency to provide for the routine maintenance of public land.
N-13 Implement a Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species and replacing them with native, safer vegetation.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	2024	Reduces the chance of a wildland fire igniting a structure(s) by reducing fuels and creating fire breaks. Supports environmental restoration by using native plants resistant to fire, debris flow, drought, heat, and wind.
N-14 Participate in County Wide Evacuation Route Assessment and Mapping Study. Study will be complete this year and will provide the basis for prioritizing addition fuels reduction work along evacuation routes.	Dam Failure, Debris Flow, Flooding, Tsunami, Wildfire/ 1, 2, 4, 5, 6	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	2024	Study is completed and accepted by the MWPA. The data is in the process of being reviewed and future plans and projects to improve ingress and egress will continue to be reviewed, planned and implemented for priority routes.
N-15 Conduct Structure Assessments of all homes and businesses with the NFD jurisdiction for home hardening and defensible space	Wildfire/ 1, 2, 4, 5,	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	2024	12,000 assessments are now complete, and we are working towards 100% of all

Table 30: City of Novato Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
evaluations. Completed 100% of our WUI areas and approximately 2/3 total parcels in Novato.						inspectable parcels in the district.
N-16 Provide matching grant funding for home hardening projects replacing existing combustible construction features with ignition resistant construction features that are California Building code Ch. 7A compliant.	Wildfire/ 1, 2, 4, 5,	Novato Fire District	New (2023)	TBD: Marin Wildfire Prevention Authority	1 – 2 years High	Over 2 million dollars have already been reinvested back into the community specifically for home hardening. The incentives have generated two to three times that amount in total replacement costs.
N-17 Provide matching grant funding for defensible space creation by removing fire prone vegetation within 100ft of structures.	Wildfire/ 1, 2, 4, 5,	Novato Fire District	New (2023)	TBD: Marin Wildfire Prevention Authority	1 – 2 years High	Over 1 million dollars have already been reinvested back into the community specifically defensible space work. The incentives have generated two to three times that amount in total removal costs.
N-18 Create Escape Route vegetation reduction within 10ft of evacuation routes in WUI areas.	Wildfire/ 1, 2, 4, 5,	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	1 – 2 years High	Dozens of miles of roadway have had vegetation modified for both vertical and horizontal clearance
N-19 Conduct ongoing all hazards evacuation Drills in high fire hazard neighborhoods.	All Hazards/ 1, 2, 3, 4, 5,	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	1 – 2 years High	Annual evacuation drill have been conducted for multiple neighborhoods. Most recently 12 Firewise designated neighborhoods participated in a mass evacuation and were directed to an Emberstomp festival which focuses on all aspects of a fire adapted community.
N-20 Participate in the creation and ongoing support of Annual Ember Stomp Event to promote wildfire prevention and	Wildfire/ 1, 2, 3, 4, 5,	Novato Fire District	New (2023)	TBD: Marin Wildfire Prevention Authority	On-going 1 – 2 years High	Maintained an all day presents at the event via a NFD booth to meet and greet the community and share public education materials

Table 30: City of Novato Current Hazard Mitigation Actions							
	Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
	Mitigation efforts county wide. (> 5000 public attended)						and sign homeowners up for free home assessments. Fire Chief gave a lecture to the crowd on fire adaptive community actions.
N-21	**Conduct Sound Study for installation of long-range acoustical devices in neighborhoods to facilitate evacuation notification—Once study is completed, we will begin installing several LRADs in high fire risk neighborhoods on a voluntary basis; as funding permits.**	Dam Failure, Debris Flow, Flooding, Tsunami, Wildfire/ 1, 2, 4, 5, 6	Novato Fire District	New (2023)	Marin Wildfire Prevention Authority	Study – 2023 Install – 2024	Study is complete and the first installation of LRAD set to begin in 2024.
N-22	**Fire code amendments to reduce the damage to structures from earthquake, landslide and fire. Including automatic natural gas shut-off valves and fire sprinklers for new and substantially remodeled structures.**	Earthquake, Debris Flow, Wildfire, Land Subsidence/ 1, 2, 4, 5	Novato Community Development	Existing (2018)	Cost: General Funds	1 – 3 years/ High	

Table 222: City of Novato Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the City of Novato. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 29 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the City of Novato identified and prioritized the mitigation actions as detailed in Table 30, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the City of Novato will maintain this plan and will serve as a lead staff for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the City of Novato will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of Novato already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the City. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

City and District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the City.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

22. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
23. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
24. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

Incorporated in 1960, the City of Novato is the northernmost city in the Marin County OA, California, approximately 29 miles north of San Francisco and 37 miles northwest of Oakland. Novato, which covers 28 square miles, has an estimated population of 53,225, slightly smaller than neighboring San Rafael to the south, at 61,271 and Petaluma to the north (59,776) and about half the population of Vallejo to the east (124,886). Novato has a rural atmosphere largely because of its low population density and large amounts of designated parks and open space in and around the City.

Much of western Novato is comprised of considerable slope and is, therefore, undeveloped or developed at very low densities under the Marin County OA land use regulations. Much of this area has been made into parks and open space for passive recreation. Parks and open space can be seen identified in green in the image below while the City boundary is outlined in a heavy black line.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Novato has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

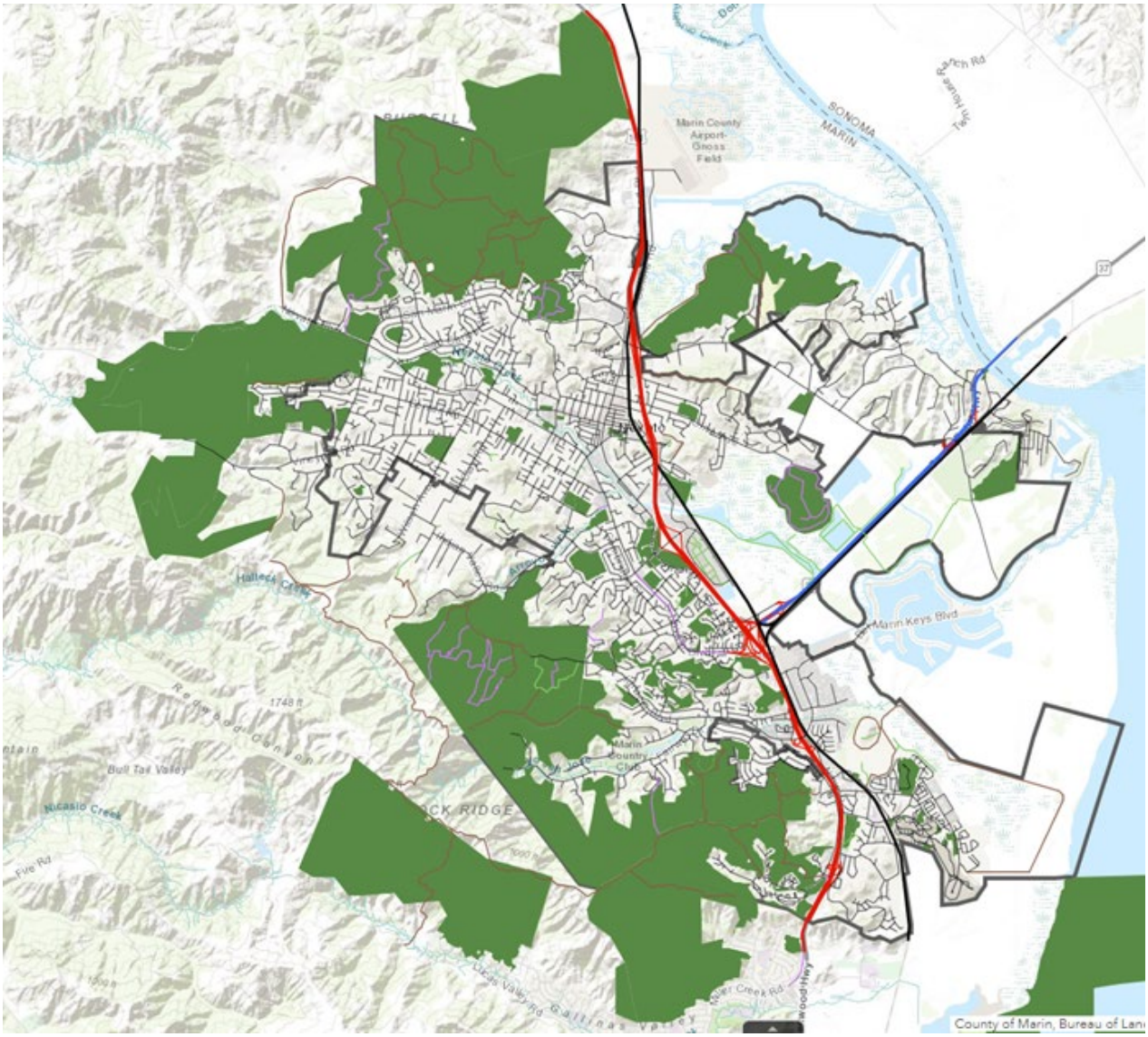

Figure 461: City of Novato Land Use Map – Open Space
Source: City of Novato

A number of creeks run from these slopes on the west to the Baylands on the east. These creeks vary in size and drainage areas so flood zones vary significantly throughout the various basins and are location-specific.

Highway 101, the main freeway connecting San Francisco with the Marin communities and Sonoma County, bisects Novato. The City's most significant growth period was from 1960 (year of incorporation) to 1979. The vast majority of existing housing stock was built in this period. Since 2000, Novato's population has increased by 12.7 percent, averaging about 1.5 percent per year and slightly below the region's average of 14.8 percent. According to the California Department of Finance, the City had a population of 53,702 at the time of the 2020 census.

Housing affordability in the Marin County OA and the Bay Area has become increasingly important. Novato's housing conditions are reflective of many area-wide and even nationwide trends. Over the past several decades, housing costs have skyrocketed out of proportion to

many people's ability to pay, with increasing construction and land costs contributing to the rise in housing prices. In the Bay Area, the high demand for housing pushes prices even higher. This mismatch in household incomes and housing costs has several implications: it becomes more difficult for employers to recruit and retain employees; new residents are pushed farther away from job centers where home prices are less expensive, leading to long traveling distances to work, higher greenhouse gas emissions from vehicles, and increasingly clogged highways; and many young families, longtime residents, their children, and other community members without high incomes relocate because they can no longer afford to live in the community.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of Novato.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of Novato Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of Novato plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of Novato is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of Novato Public Works Director will monitor and update the City of Novato Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
- Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of Novato, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of Novato, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of Novato Public Works Director will monitor and update the City of Novato Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of Novato and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss

revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website and City of Novato Link 9-19
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 9-21
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 9-22
Figure 4: Hazard Mitigation Plan Survey 9-23
Figure 5: Map of City of Novato in Marin County 9-26
Figure 6: Map of the City of Novato 9-27
Figure 7: The City of Novato Precipitation and Monthly Temperatures 9-28
Figure 8: Races in Novato 9-30
Figure 9: City of Novato Land Use Map 9-31
Figure 10: City of Novato Social Vulnerability Map Census Tract 1022.03 9-34
Figure 11: City of Novato Social Vulnerability Map Census Tract 10320.00 9-35
Figure 12: City of Novato Social Vulnerability Map Census Tract 1012.00 9-36
Figure 13: City of Novato Social Vulnerability Map Census Tract 1022.02 9-37
Figure 14: City of Novato Social Vulnerability Map Census Tract 1041.02 9-38
Figure 15: City of Novato Critical Facilities and Infrastructure 9-45
Figure 16: Marin County & City of Novato Risk Assessment – Planning Team Top Hazards 9-46
Figure 17: Hazard Risk Categorization 9-46
Figure 18: NASA Global Temperature Change CO2 Gas 9-50
Figure 19: NASA Global Temperature Change 1884 to 2022 9-50
Figure 20: NASA Global Temperature Change Sea Level 9-51
Figure 21: Annual Mean Sea Level Trends 9-53
Figure 22: City of Novato Dam Inundation Critical Facilities and Infrastructure 9-59
Figure 23: City of Novato - Novato Creek Dam Inundation Impact – West Novato 9-60
Figure 24: City of Novato - Novato Creek Dam Inundation Impact – North Novato 9-60
Figure 25: City of Novato - Novato Creek Dam Inundation Impact – Central Novato 9-61
Figure 26: City of Novato - Novato Creek Dam Inundation Impact – East Novato 9-61
Figure 27: Landslide Susceptibility Classes 9-64
Figure 28: Mud Flow Areas 9-65
Figure 29: City of Novato Debris Flow Critical Facilities and Infrastructure 9-66
Figure 30: Modified Mercalli Intensity Scale 9-70
Figure 31: Mercalli Scale vs. Magnitude 9-70
Figure 32: Soil Types 9-71
Figure 33: Marin County OA Earthquake Impact and Fault Lines 9-73
Figure 34: City of Novato Earthquake Critical Facilities and Infrastructure 9-74
Figure 35: Diagram of an Atmospheric River Event 9-77
Figure 36: City of Novato Flooding Critical Facilities and Infrastructure 9-79
Figure 37: SR 37 Flooding in Novato - 2017 9-83
Figure 38: 1982 Novato Flood 9-84
Figure 39: Dissolution Sinkhole Formation 9-85
Figure 40: Cover-Subsidence Sinkhole Formation 9-86
Figure 41: Cover-Collapse Sinkhole Formation 9-86
Figure 42: Levee Failure Mechanisms 9-88
Figure 43: 2014 Levee Failure in Novato 9-89

Figure 44: City of Novato Sea Level Rise Impact 9-92
Figure 45: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 9-93
Figure 46: Heat Index..... 9-94
Figure 47: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 9-95
Figure 48: Beaufort Wind Scale 9-96
Figure 49: Enhanced Fujita Scale 9-97
Figure 50: Waterspout Formation..... 9-97
Figure 51: City of Novato Tsunami Critical Facilities and Infrastructure 9-99
Figure 52: Federal, State and Local Responsibility Areas in the Marin County OA..... 9-101
Figure 53: Fuel Model Map for the Marin County OA 9-102
Figure 54: City of Novato Wildfire Critical Facilities and Infrastructure..... 9-105
Figure 55: Trends in the Annual Number of Large Wildfires in the United States..... 9-107
Figure 56: City of Novato Land Use Map – Open Space 9-140

List of Tables

Table 1: City of Novato Local Hazard Mitigation Planning Team Members 9-8
Table 2: 2023 MJHMP Local Planning Team Members..... 9-12
Table 3: City of Novato & Marin County OA MJHMP Planning Meetings 9-16
Table 4: City of Novato Estimated Jurisdictional Population 9-29
Table 5: Population Change of The City of Novato 9-29
Table 6: Languages Spoken in Novato..... 9-29
Table 7: Marin County OA Jurisdictional Housing Stock 9-30
Table 8: NRI Hazards and Marin County OA MJHMP Hazards..... 9-32
Table 9: NRI Hazard Type Risk Index for Novato Census Tract 1022.03 9-33
Table 10: NRI Hazard Type Risk Index for Novato Census Tract 1032.00 9-34
Table 11: NRI Hazard Type Risk Index for Novato Census Tract 1012.00 9-35
Table 12: NRI Hazard Type Risk Index for Novato Census Tract 1022.02 9-36
Table 13: NRI Hazard Type Risk Index for Novato Census Tract 1041.02 9-37
Table 14: Household Income for The City of Novato as of 2019 9-39
Table 15 City of Novato Civilian Employed Population 16 years+ by Industry..... 9-40
Table 16: City of Novato Critical Facilities..... 9-43
Table 17: Historic Sites In The City of Novato..... 9-44
Table 18: Select Hazards Magnitude/ Severity Scale or Index..... 9-47
Table 19: City of Novato Hazard Risk Assessment..... 9-55
Table 20: Hazard Risk Assessment..... 9-56
Table 21: City of Novato Critical Facilities in the Flood Zones 9-82
Table 22: City of Novato Future Growth Areas..... 9-110
Table 23: City of Novato Legal and Regulatory Capabilities 9-116
Table 24: City of Novato General Plan 9-117
Table 25: City of Novato Administrative and Technical Capabilities 9-119
Table 26: City of Novato Fiscal Capabilities..... 9-120
Table 27: City of Novato Community Outreach..... 9-121
Table 28: City of Novato NFIP Status 9-125
Table 29: Status of Previous Hazard Mitigation Actions..... 9-130
Table 30: City of Novato Current Hazard Mitigation Actions..... 9-137

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency

CNRA	California Natural Resource Agency
CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance

FMP	Flood Mitigation Plan
FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department

MCOSD	Marin County Open Space District
MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management

OHP	Office of Historic Preservation
OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System

UCERF2	Uniform California Earthquake Rupture Forecast, Version 2
UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

10. Town of Ross Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

Town of Ross

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ACKNOWLEDGEMENTS

The Town of Ross and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required and without their commitment; this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the Town of Ross more disaster resistant and sustainable.

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TABLE OF CONTENTS

10. Town of Ross Community Profile 10-1
Acknowledgements 10-3
Table of Contents 10-5
Section 1.0: Introduction 10-7
1.1 Introduction 10-7
1.2 Planning Process 10-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 10-8
1.2.2 Steering Committee Planning Process 10-9
1.2.3 Coordination with stakeholders and agencies 10-9
1.2.4 Public Engagement 10-16
1.3 Overview and History 10-24
1.4 Government 10-27
1.5 Weather and Climate 10-27
1.6 Demographics 10-28
1.7 Social Vulnerability and Risk 10-31
1.8 Economy and Tax Base 10-34
1.9 Critical Facilities 10-35
1.10 Historical Properties 10-37
Section 2.0: Hazard Identification and Risk Assessment 10-38
2.1 Climate Change 10-40
2.2 Hazards 10-47
2.2.1 Dam Failure 10-48
2.2.2 Debris Flows 10-53
2.2.3 Drought 10-58
2.2.4 Earthquake 10-60
2.2.5 Flooding 10-66
2.2.6 Land Subsidence/Sinkholes 10-73
2.2.8 Severe Weather – Extreme Heat 10-75
2.2.9 Severe Weather – High Wind & Tornado 10-77
2.2.10 Wildfire 10-80
Section 3.0: Mitigation Strategy 10-92
3.1 Changes in Development 10-92

3.2 Capability Assessment 10-94
3.2.1 Regulatory Capabilities 10-95
3.2.2 Administrative and Technical Capabilities 10-100
3.2.3 Fiscal Capabilities 10-101
3.2.4 Community Outreach 10-103
3.2.5 Participation in the National Flood Insurance Program 10-104
3.3 Mitigation Goals 10-108
3.4 Status of Previous Mitigation Actions 10-110
3.5 Hazard Mitigation Actions 10-113
3.6 Progress in Local Mitigation Efforts 10-118
3.7 Project Implementation 10-118
3.8 Future Development Trends 10-119
Section 4.0: Plan Review, Evaluation, and Implementation 10-121
4.1 Plan Adoption 10-121
4.2 Plan Monitoring 10-121
4.3 Plan Evaluation 10-122
4.4 Plan Update 10-122
Figures and Tables 10-124
Acronyms/Abbreviations 10-126

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Town of Ross Community Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Town of Ross.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population, both incorporated and unincorporated, is concentrated in the Eastern portion of the county. There are a total of 11 incorporated jurisdictions within Marin County. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the Town of Ross involved additional internal planning team to support the broader planning process. The Town of Ross jurisdictional

representatives for the coordinated Marin County Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Richard Simonitch, Director of Public Works
Telephone: (415) 453-1453 ext. 115
Email: rsimonitch@townofross.org

Alternate Point of Contact
Roberta Feliciano
(415) 453-1453 ext. 121
Email: rfaliciano@townofross.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Ross	Richard Simonitch	Public Works Director	415-453-1453 ext. 115	rsimonitch@townofross.org
Ross	Roberta Feliciano	Planning	415-453-1453 ext. 121	rfeliciano@townofross.org
Ross	Christa Johnson	Administration	415-453-1454 ext. 107	cjohnson@townofross.org
Ross	Ralph Pata	Ross Police Department	415-453-1453 ext. 101	rpata@townofross.org

Table 223: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the Town of Ross. All participating jurisdictions are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).

- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Town of Ross Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Town of Ross communities and could provide subject matter expertise and relevant information to the planning process

regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Town of Ross Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Town of Ross and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	Public Works Director
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 224: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Town of Ross's planning process.At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Town of Ross & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process

Table 3: Town of Ross & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input

Table 3: Town of Ross & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan	• Individual phone or conference calls with planning jurisdictions and districts to answer specific

Table 3: Town of Ross & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Development Sessions	questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 225: Town of Ross & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook

account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan

development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. The Town of Ross also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

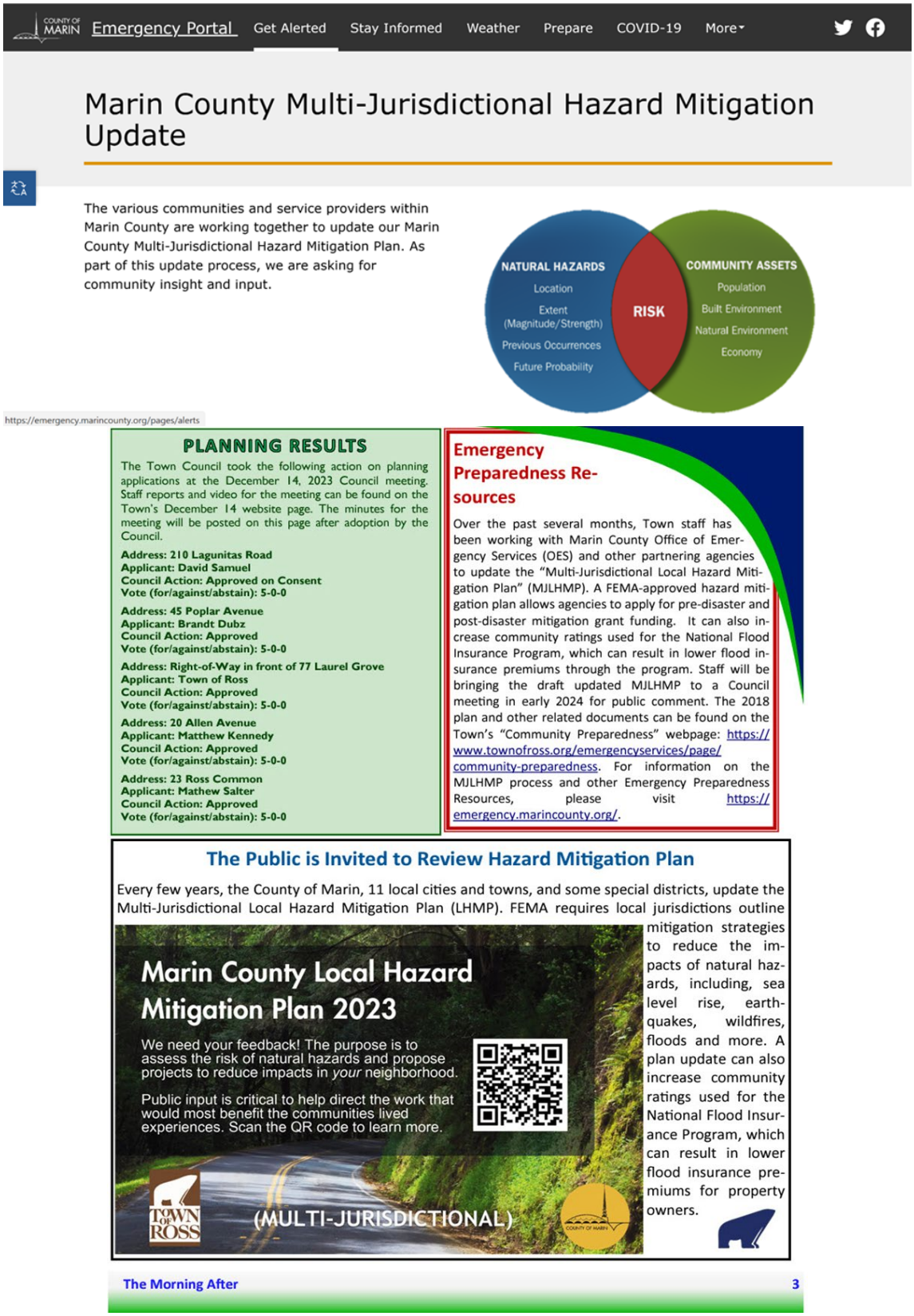


Figure 462: Marin County OEM MJHMP Website and Town of Ross Link

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in to 28 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 463: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

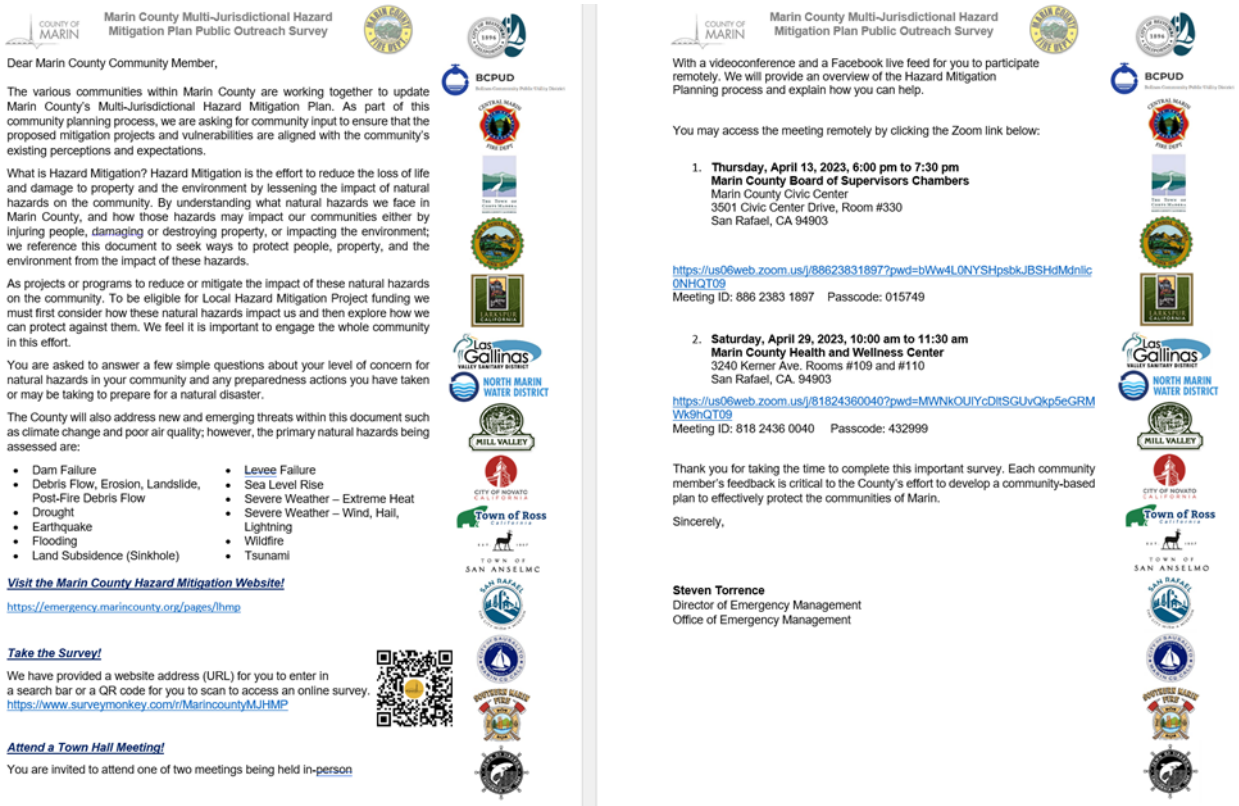
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish. The Town of Ross issued a press release in their monthly newsletter in November, 2023.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 464: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 465: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach

through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The Town of Ross had an additional 14-day comment period for the Town of Ross Community Profile where their profile was posted on the Town website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of Ross distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

Prior to 1800, the Coast Miwok Indians lived and were sustained for thousands of years by the land that is now called Ross Valley. The Coast Miwok revered the land, plants and animals of the Ross Valley through tribal cultural beliefs and practices. European diseases eventually decimated the Indian population. The settlement in 1817 of Mission San Raphael, with its vast land holding, also resulted in further incursions into areas occupied by the Coast Miwok Indians.

After the Mexican Revolution of 1821, the "land grant" system of parceling out land gave rise to what we now know as Marin County. Ross was originally part of an 8,877-acre Mexican land grant to Juan B.R. Cooper in 1840 known as Ranch Punta de Quentin Canada de San Anselmo. The Town of Ross itself was named in honor of James Ross, who purchased the land in 1857 for $50,000. Ross built his home on Redwood Drive and moved there with his wife and three children. When James Ross died in 1862 his wife, Annie Ross, was forced to sell a portion of James Ross' larger land holdings to pay each of their daughters $10,000. The 297 acres she had remaining make up part of the Town of Ross today.

The Town of Ross was incorporated as a town in 1908. The Town of Ross had an estimated population of 2,338 in 2020, with 880 housing units in the Town. The Town has a total area of 1.556 square miles. The median income for a household in the Town is $250,000 and the per capita income for the Town is $128,126. Approximately 0 percent of families and 3.5 percent of the population is below the poverty line (2020 data, U.S. Census Bureau/ 2021 American Community Survey).

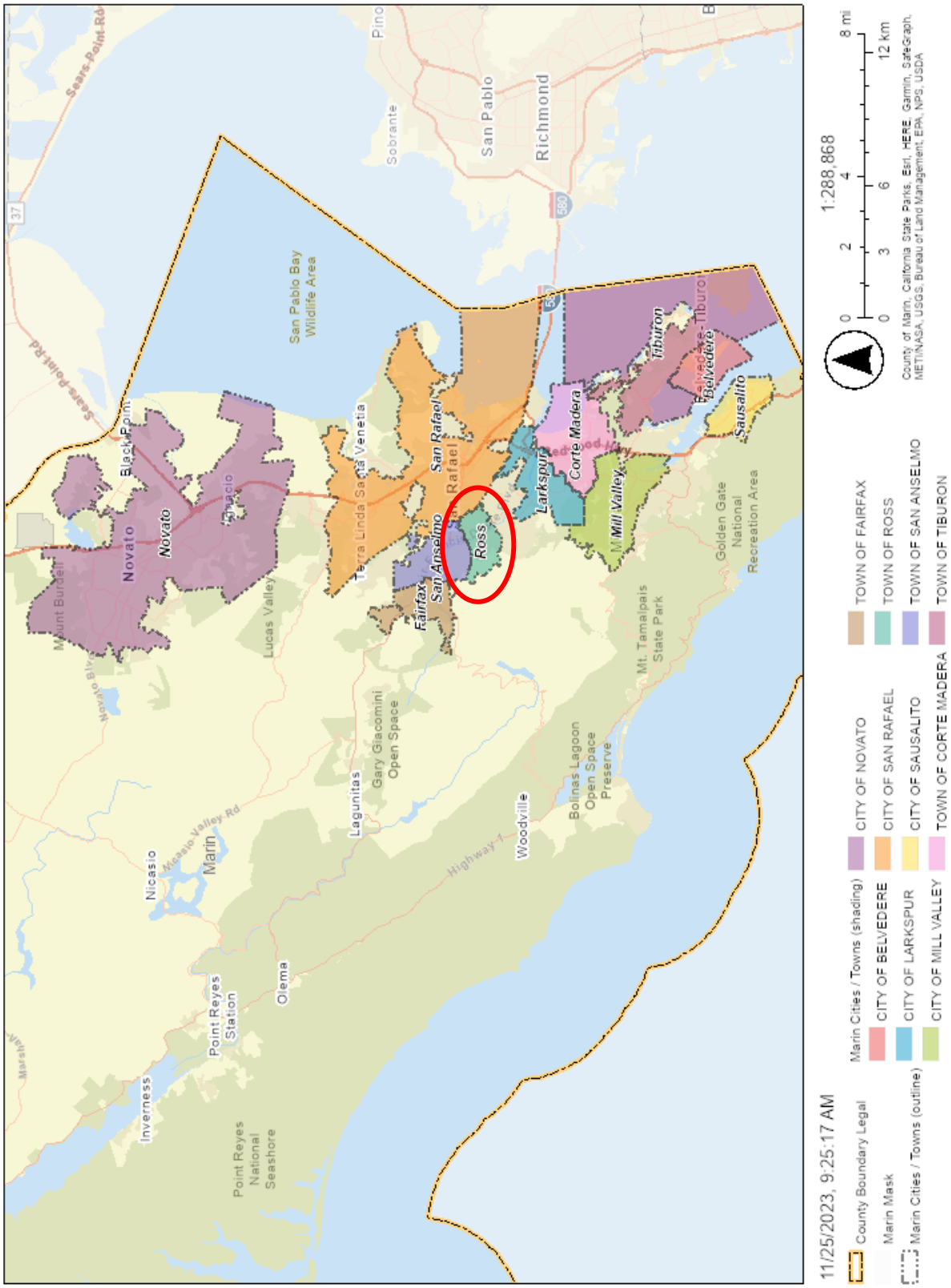


Figure 466: Map of the Town of Ross within Marin County
Source: Marin County OEM

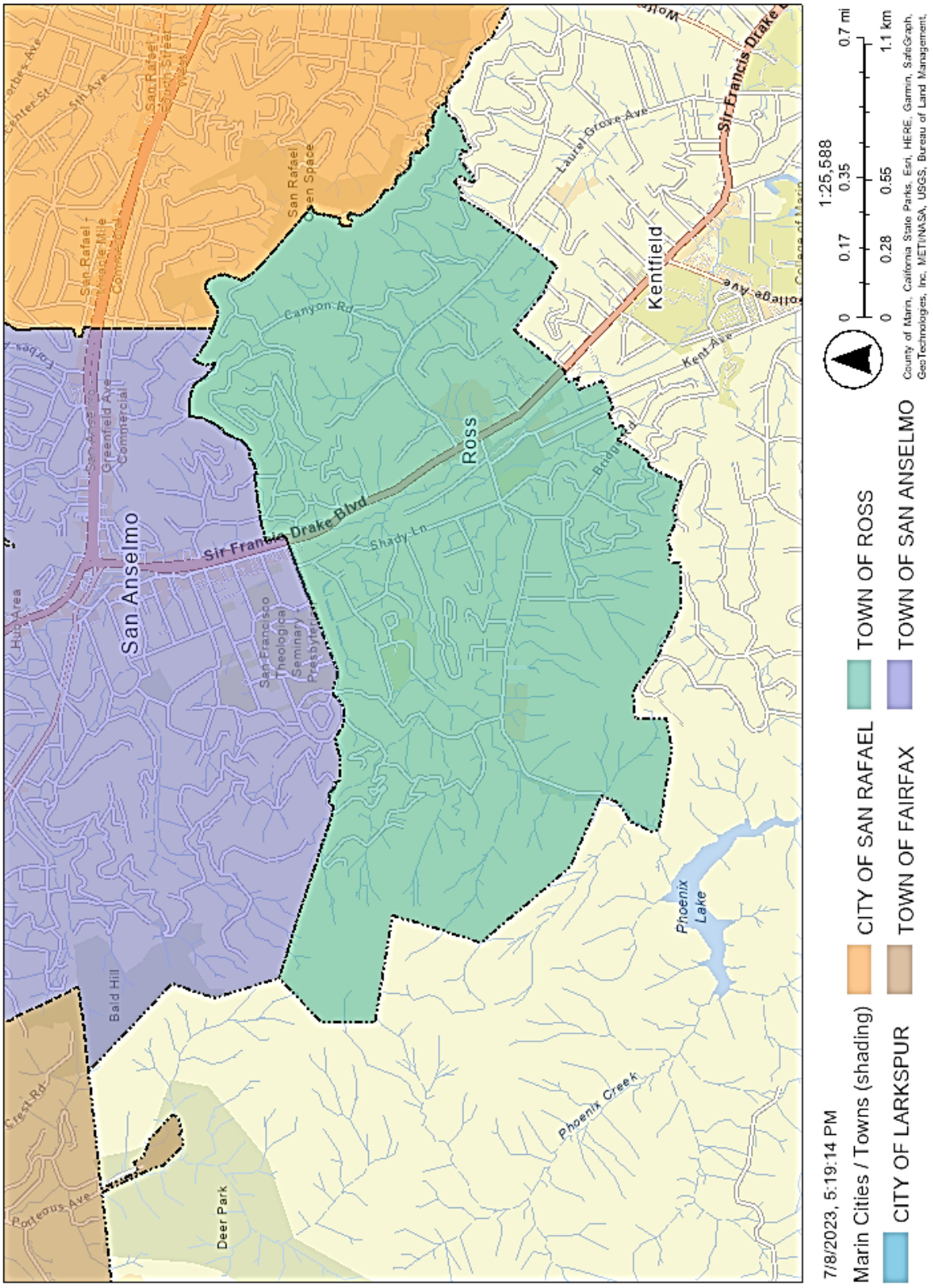


Figure 467: Map of the Town of Ross
Source: Marin County OEM

1.4 GOVERNMENT

The Town of Ross is a general law city which was incorporated in 1908. The Town provides for all municipal services other than non-storm drain related utilities and fire protection services. In 2012 the Town of Ross voted to consolidate with Ross Valley Fire Department, joining San Anselmo, Fairfax, and Sleepy Hollow to provide fire protection to Town of Ross. In 2012, Ross Valley Fire Department's Board of Directors voted to consolidate fire services with the Town of Ross, incorporating the Town of Ross fire station 18 into the Ross Valley Fire Department.

The Ross Police Department provides 24-hour law enforcement services to the Town of Ross. The importance of community involvement and interaction is stressed at every level of the Department.

Ross has a Council/Manager form of government. The five members of the Town Council are elected to staggered four-year terms. The Town Council appoints a Town Manager to manage and direct the day-to-day operations of the Town. The Town consists of 6 departments: Administration (including finance and human resources), Building, Planning, Police, Public Works, and Recreation.

The City Council assumes responsibility for the adoption of this plan; and the Town Manager will oversee its implementation.

1.5 WEATHER AND CLIMATE

The Town of Ross lies 36 feet above sea level. In Ross, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43°F to 71°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month of highest relative humidity is February (79.60 %). The month with the lowest relative humidity is June (69.59 %). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.3 °C (48.7) °F	9.8 °C (49.7) °F	10.9 °C (51.6) °F	11.8 °C (53.2) °F	13.6 °C (56.5) °F	15.6 °C (60.2) °F	16 °C (60.8) °F	16.4 °C (61.4) °F	16.4 °C (61.5) °F	15 °C (58.9) °F	11.9 °C (53.5) °F	9.5 °C (49) °F
Min. Temperature °C (°F)	6.3 °C (43.4) °F	6.9 °C (44.4) °F	7.8 °C (46.1) °F	8.5 °C (47.4) °F	10.1 °C (50.2) °F	11.7 °C (53) °F	12.3 °C (54.2) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.5 °C (52.7) °F	8.9 °C (48) °F	6.8 °C (44.2) °F
Max. Temperature °C (°F)	13.3 °C (56) °F	13.9 °C (57) °F	15.1 °C (59.2) °F	16.2 °C (61.2) °F	18.3 °C (64.9) °F	20.9 °C (69.6) °F	21.2 °C (70.2) °F	21.5 °C (70.8) °F	21.9 °C (71.4) °F	20 °C (68.1) °F	16.2 °C (61.2) °F	13.1 °C (55.7) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	78%	72%	71%	70%	75%	76%	73%	72%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 468: The Town of Ross Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of Marin County and the Town of Ross since the last plan update in 2018. Of the total estimated 257,135 residents of Marin County in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The Town of Ross had an estimated population of 2,566 in the 2018 plan. 2020 U.S. Census Survey estimated the Town's population at 2,338. However, revised estimates for 2022 estimate the population to decrease to 2,301 population.

Table 4: Town of Ross Estimated Jurisdictional Population				
Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County	257,135	262,321	262,179	-1.92%
Town of Ross	2,301	2,338	2,566	-10.33%

Table 226: Town of Ross Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The Town of Ross is 2,338 as of 2020. Between 2018-2020, the Town's growth rate increased at an average annual rate of -10.33%, lower than the historic twenty-year average growth rate of 3.2%. Table 5 shows the population growth comparison of the State of California, County of Marin and the Town of Ross between 2010 - 2020.

Table 5: Population Change of The Town of Ross				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County	252,409	262,321	9,912	3.9%
Ross, town	2,566	2,338	228	-10.33%

Table 227: Population Change of The Town of Ross
Source: Town of Ross Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the Town of Ross.

Table 6: Languages Spoken in Ross	
Primary Language Spoken	% of Population
English only	96.2%
Spanish	1.0%
Other Indo-European languages	2.5%
Asian and Pacific Islander languages	0.3%
Other languages	0.0%

Table 228: Languages Spoken in Ross
Source: US Census Bureau (2020)

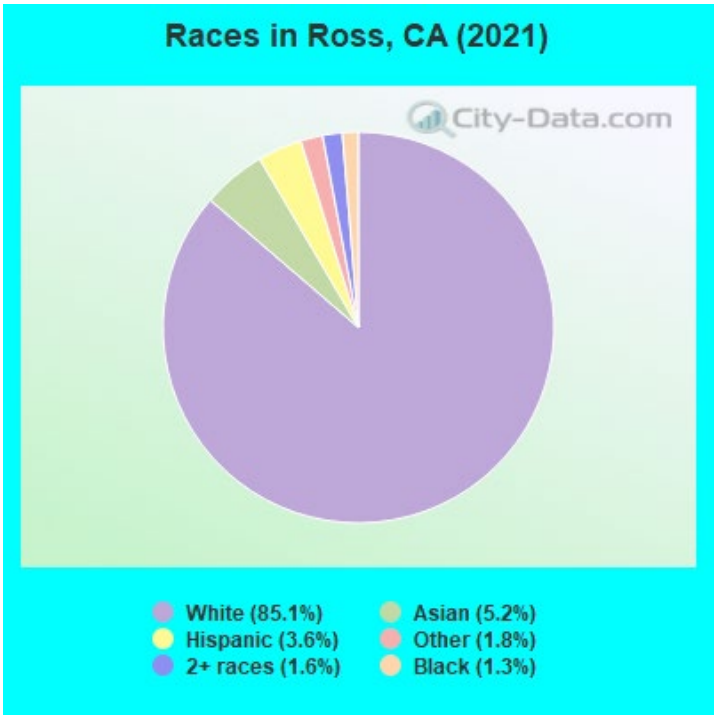


Figure 469: Races in Ross
Source: City-Data.com

Table 7: Marin County Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
Town of Ross							
2022	Number	882	817	17	23	25	0
	Percent	100.00%	92.63%	2.08%	135.29%	108.70%	0.00%
2018	Number	892	831	16	19	26	0
	Percent	100.00%	93.16%	1.93%	118.75%	136.84%	0.00%

Table 229: Marin County Jurisdictional Housing Stock
Source: California Department of Finance

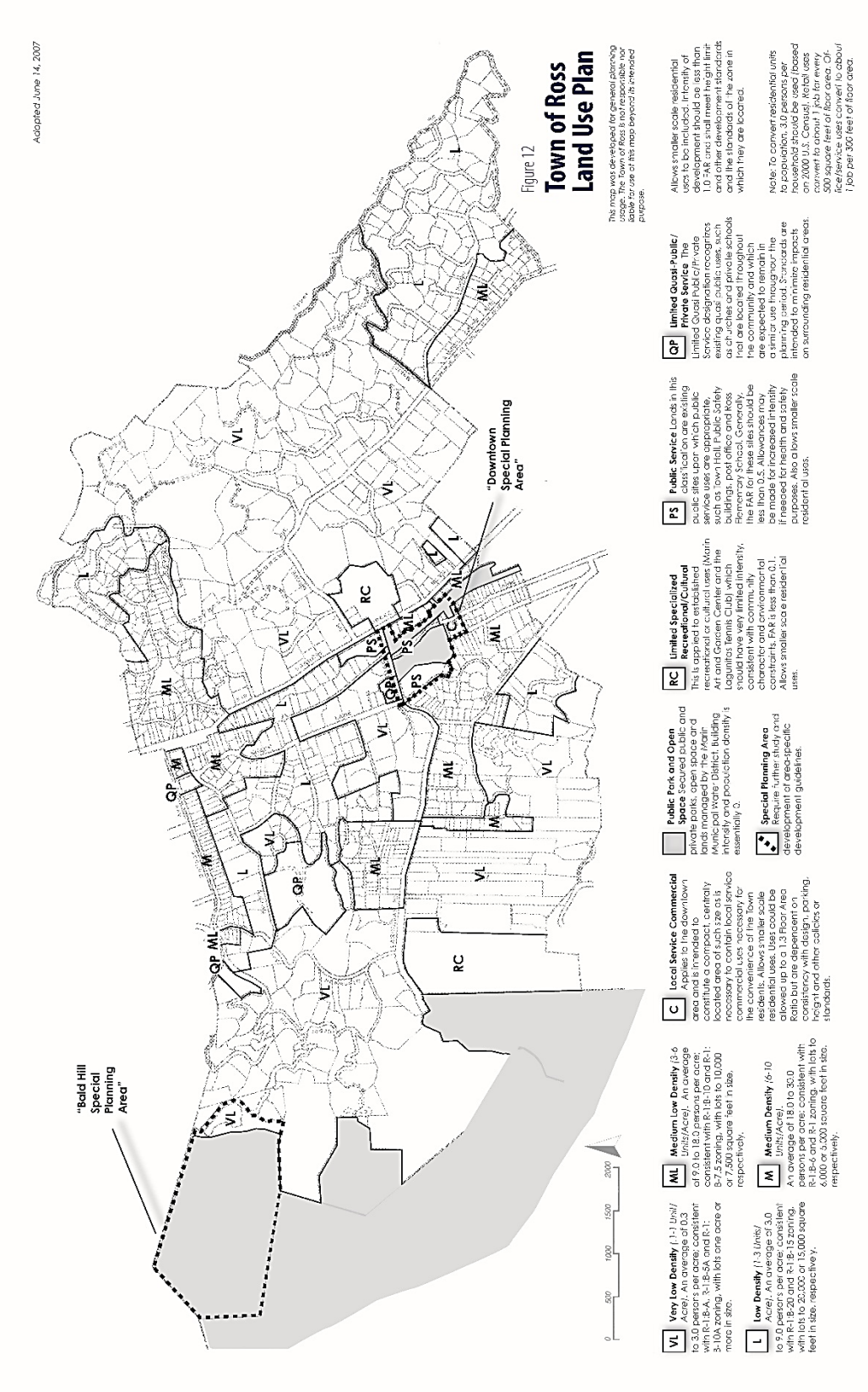


Figure 470: Town of Ross Land Use Map
Source: Town of Ross General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County MJHMP Hazards

NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 230: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

Table 9 illustrates the NRI Hazard Type Risk Index for Ross Census Tract 1181.00.

Table 9: NRI Hazard Type Risk Index for Ross Census Tract 1181.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,147,502	Very Low	Very High	0.73	$838,311	89.9
Riverine Flooding	$423,455	Very Low	Very High	0.73	$309,356	94.3
Coastal Flooding	$0	Very Low	Very High	0.73	$0	0
Heat Wave	$3,653	Very Low	Very High	0.73	$2,669	31.1
Landslide	$2,353	Very Low	Very High	0.73	$1,719	73.5
Wildfire	$15,170	Very Low	Very High	0.73	$11,082	84.3
Tsunami	$0	Very Low	Very High	0.73	$0	0
Strong Wind	$141	Very Low	Very High	0.73	$103	4.7
Drought	$0	Very Low	Very High	0.73	$0	0

Table 231: NRI Hazard Type Risk Index for Ross Census Tract 1181.00
Source: FEMA National Risk Index 2023

Social groups in Census tract 06041118100 have a Very Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

Figure 10 illustrates the Social Vulnerability Map for Ross Census Tract 1181.00.

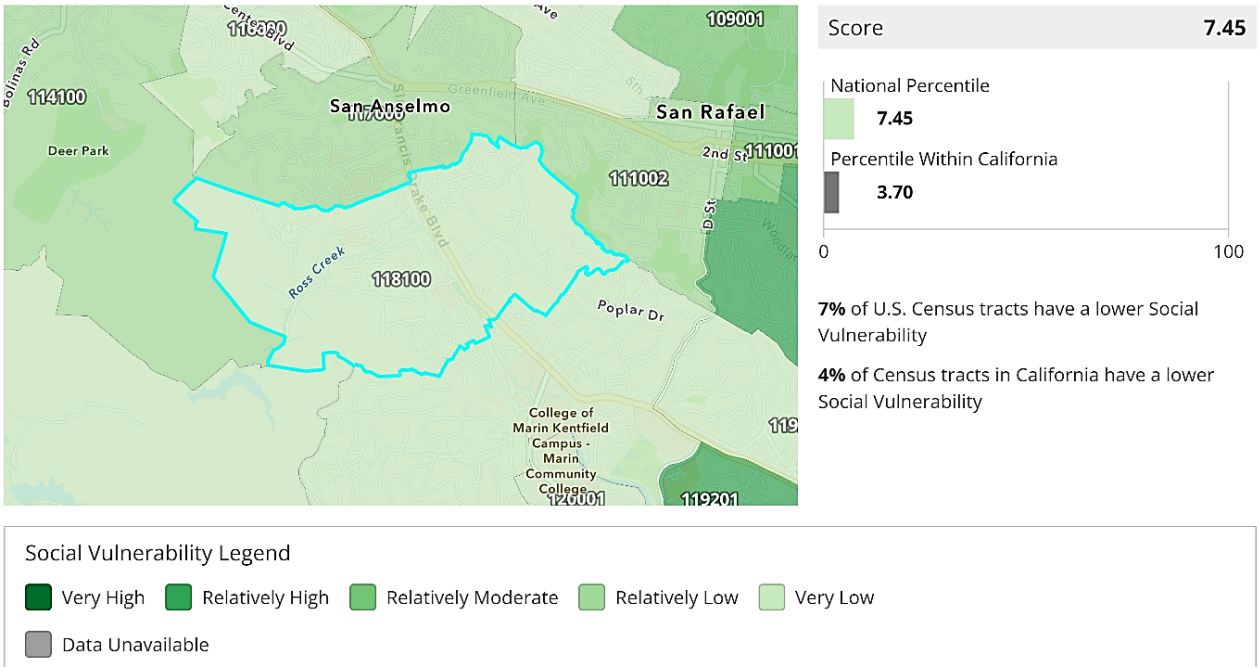


Figure 471: Town of Ross Social Vulnerability Map Census Tract 1181.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in Marin County reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

The Town of Ross has a “Very Low” Social Vulnerability rating. The median income for a household in the Town is $250,000 and the per capita income for the Town is $128,126. Approximately 0 percent of families and 3.5 percent of the population is below the poverty line (2020 data, U.S. Census Bureau/ 2021 American Community Survey).

1.8 ECONOMY AND TAX BASE

The Town of Ross is Marin County's primary retail, service, and commercial center. Table 10 shows income by household in The Town of Ross as of 2019.

Table 10: Household Income for The Town of Ross as of 2019		
Household Income	Number	Percent
Total Households	852	-
Less than $10,000	0	0.0
$10,000 to $14,999	36	4.2
$15,000 to $24,999	4	0.5
$25,000 to $34,999	0	0.0
$35,000 to $49,999	37	4.3
$50,000 to $74,999	46	5.4
$75,000 to $99,999	46	5.4
$100,000 to $149,999	101	11.9
$150,000 to $199,999	46	5.4
$200,000 or more	536	62.9
Median household income (dollars)	$250,000	
Mean household income (dollars)	$363,130	

Table 232: Household Income for The Town of Ross as of 2019
Source: US Census Bureau American Community Survey 2019 Estimates

Table 11 shows the percentage of people in The Town of Ross over the age of 16 employed by industry.

Table 11: Town of Ross Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	1503	-
Agriculture, forestry, fishing and hunting, and mining	9	0.60 %
Construction	124	8.25%
Manufacturing	128	8.52%
Wholesale trade	0	0%
Retail trade	249	16.57%
Transportation and warehousing, and utilities	33	2.20%
Information	0	0
Finance and insurance, and real estate and rental and leasing	45	2.99%
Professional, scientific, and management, and administrative and waste management services	130	8.65%
Educational services, and health care and social assistance	388	25.81%

Arts, entertainment, and recreation, and accommodation and food services	221	14.70%
Other services, except public administration	45	2.99%
Public administration	131	8.72%

Table 233: Town of Ross Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Town of Ross to fulfill the requirements of its mission during an emergency:

Table 12: Town of Ross Critical Facilities					
	Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities					
47.	Fire	Ross Valley Fire District Station 18	33 Sir Francis Drake Boulevard, Ross, CA 94957	Moderate	AE/X
48.	Law	Ross Police Department	33 Sir Francis Drake Boulevard, Ross, CA 94957	Moderate	X
49.	Local Government	Ross Town Hall	31 Sir Francis Drake Blvd. Ross, CA 94957	Moderate	X
50.	Health / Medical EMS	Ross Valley Paramedic Authority	33 Sir Francis Drake Blvd. Ross, CA 94957	Moderate	AE/X
51.	Health / Medical	Cedars Of Marin Ross Campus	115 Upper Rd, Ross, CA 94957	High	X
52.	School	Ross School K-8	9 Lagunitas Rd. Ross, CA 94957	High	AE
53.	School	Branson High School	39 Fernhill Avenue, Ross, CA 94957	High	X

Table 234: Town of Ross Critical Facilities
Source: Town of Ross

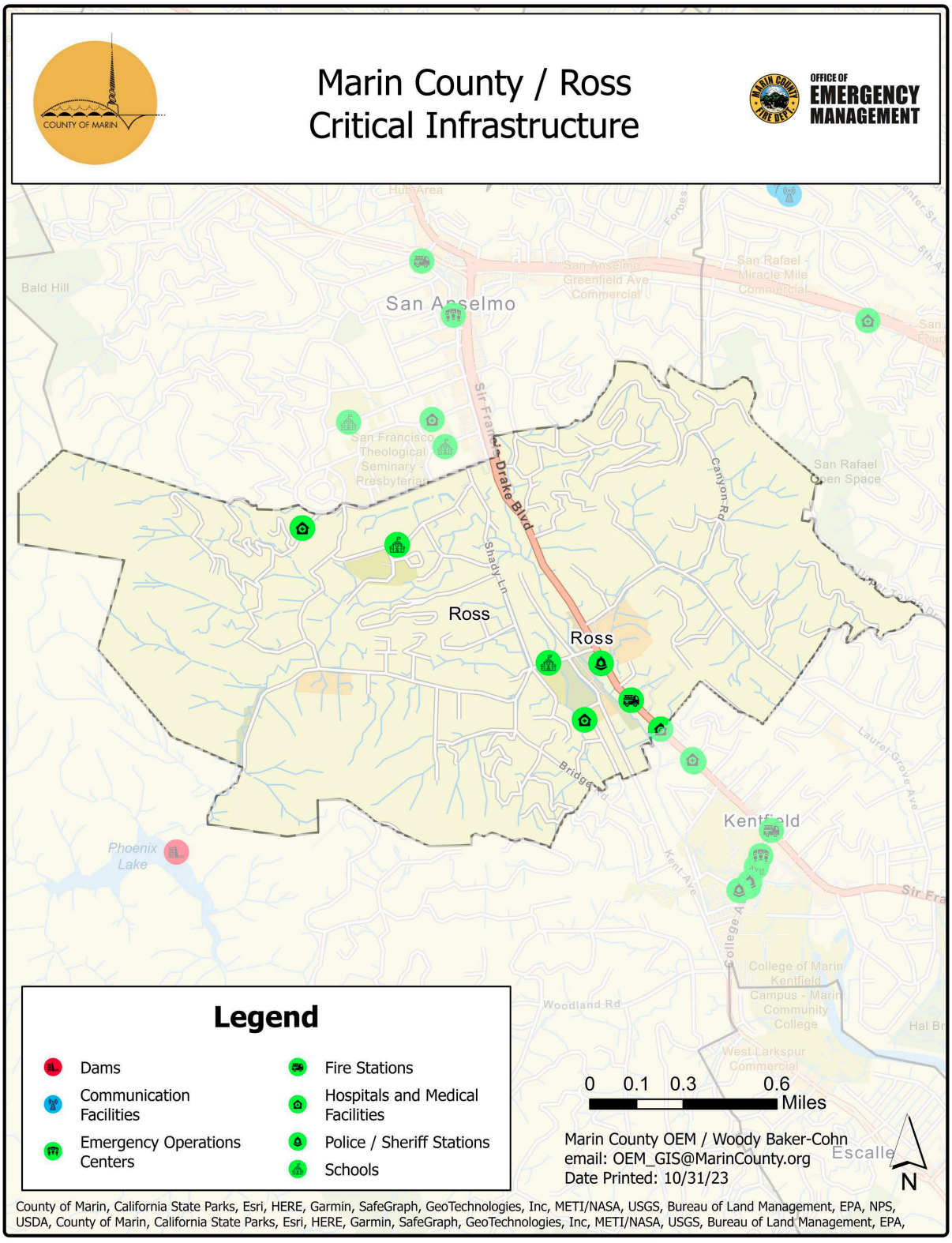


Figure 472: Town of Ross Critical Facilities
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The Town of Ross has one registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- Town of Ross website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

Table 13: Historic Sites in Marin County

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Marin Art and Garden Center	X			6/6/2022	Ross

Table 235: Historic Sites in The Town of Ross

Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Town of Ross identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 12 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

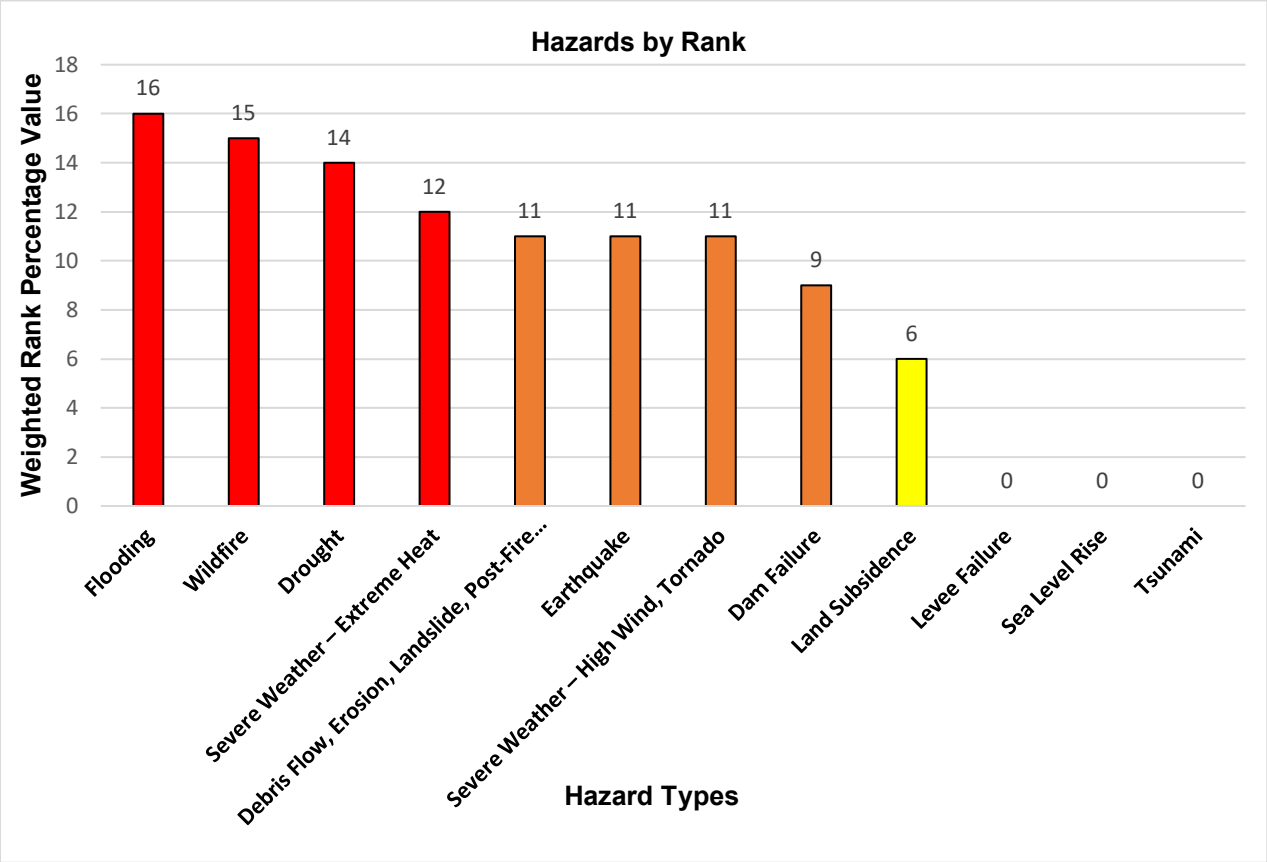


Figure 473: Town of Ross Risk Assessment – Planning Team Top Hazards

Figure 13: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 474: Hazard Risk Categorization

Each Marin County MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 236: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

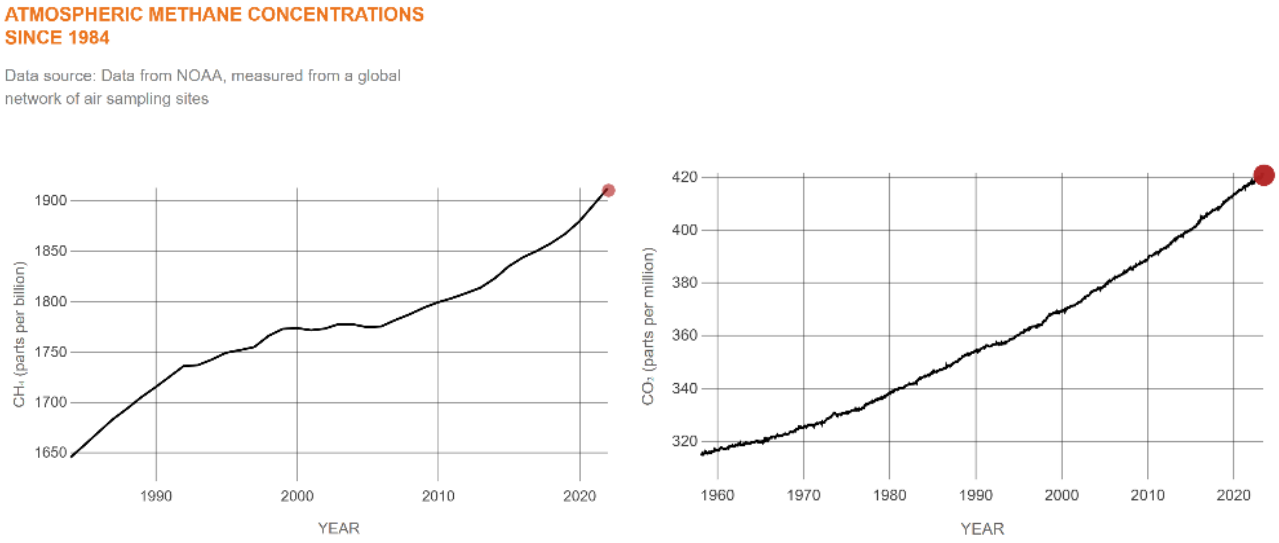


Figure 475: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

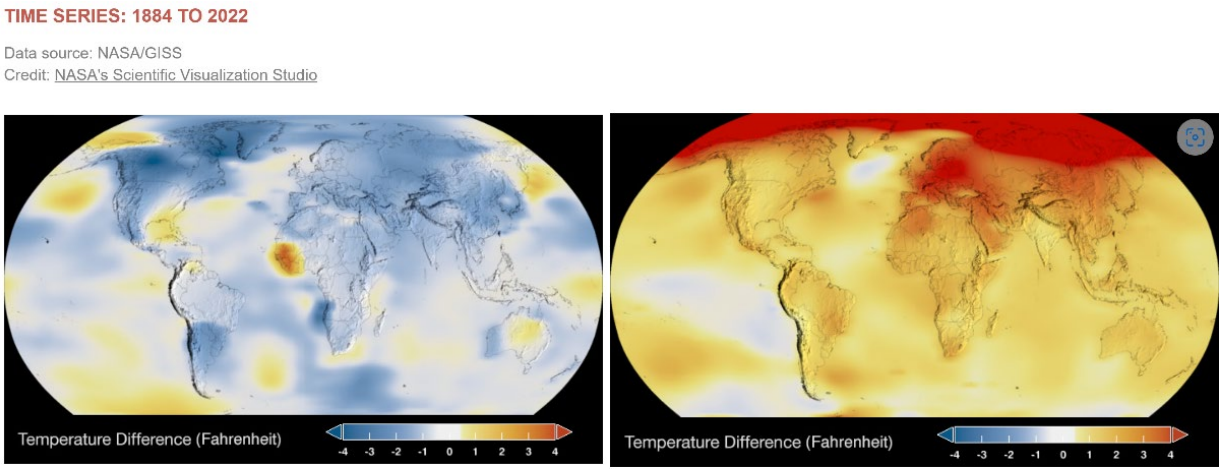


Figure 476: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.

- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

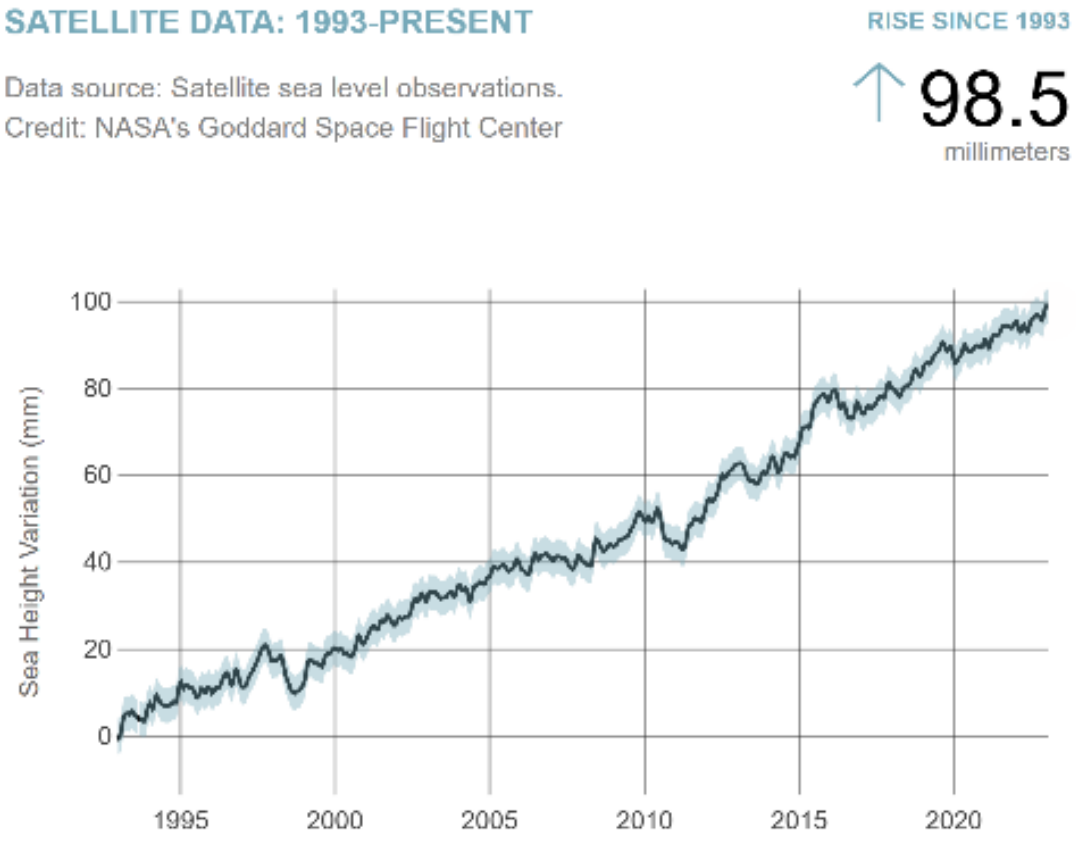


Figure 477: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals,

workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.

- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

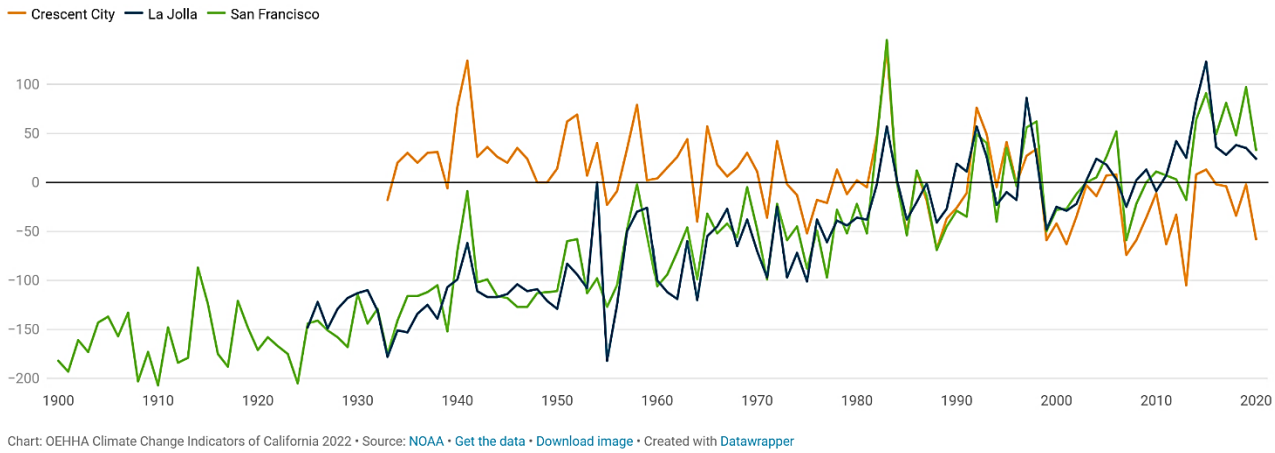


Figure 478: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water. Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the Town of Ross as per the planning team.

Table 15: Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Limited	Severe	Low	Medium	**9.00**
Debris Flow	Occasional	Significant	Moderate	Medium	Medium	**11.00**
Drought	Likely	Extensive	Moderate	Medium	High	**14.00**
Earthquake	Likely	Significant	Severe	None	Medium	**11.00**
Flooding	Highly Likely	Significant	Severe	High	High	**16.00**
Land Subsidence (Sinkhole)	Unlikely	Limited	Weak	Low	Low	**6.00**
Severe Weather – Extreme Heat	Likely	Significant	Moderate	Medium	Medium	**12.00**
Severe Weather – Wind, Tornado	Occasional	Significant	Moderate	Medium	Medium	**11.00**
Wildfire	Likely	Extensive	Severe	Medium	High	**15.00**

Table 237: Hazard Risk Assessment
Source: Town of Ross

Omitted Hazards

Levee Failure: Ross does not have any levees and would not experience a levee failure.

Sea Level Rise and Tsunami: Ross is not located along a coastline and is not in a tsunami inundation zone. The Town would not experience impacts associated with sea level rise or a tsunami.

Table 16: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 238: Hazard Risk Assessment
Source: Marin County

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design

- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.
- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, which caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

While there are no dams located within Ross, the Town could be impacted by a failure of the Phoenix Lake Dam in unincorporated Marin County. The Phoenix Lake Dam and Phoenix Lake are located directly adjacent to the western border of Ross (see Figure 18). The dam has storage of 612-acre feet of water that could be released down Ross Creek in the event of a full sunny-day dam failure. Water could extend out 500 feet on both sides of Ross Creek for about five miles at a depth up to thirty feet in some areas before it dumps into Corte Madera Creek. Dozens of homes lie in this area and could be susceptible to flooding. Flooding could continue north along San Anselmo Creek and south along Corte Madera Creek, extending the entire length of Sir Francis Drake Boulevard within the Town and through the downtown area. Flooding could extend out 1,000 feet along the west side and 500 feet along the east side of Anselmo and Corte Madera Creeks, flooding hundreds of homes, the Ross Fire Station, the Ross Police Station, the Ross Town Hall, the Ross Grammar School, all of the designated shelters in Ross, and most of the main commercial area of Ross in two to ten feet of water approximately 10-20 minutes after the dam fails.

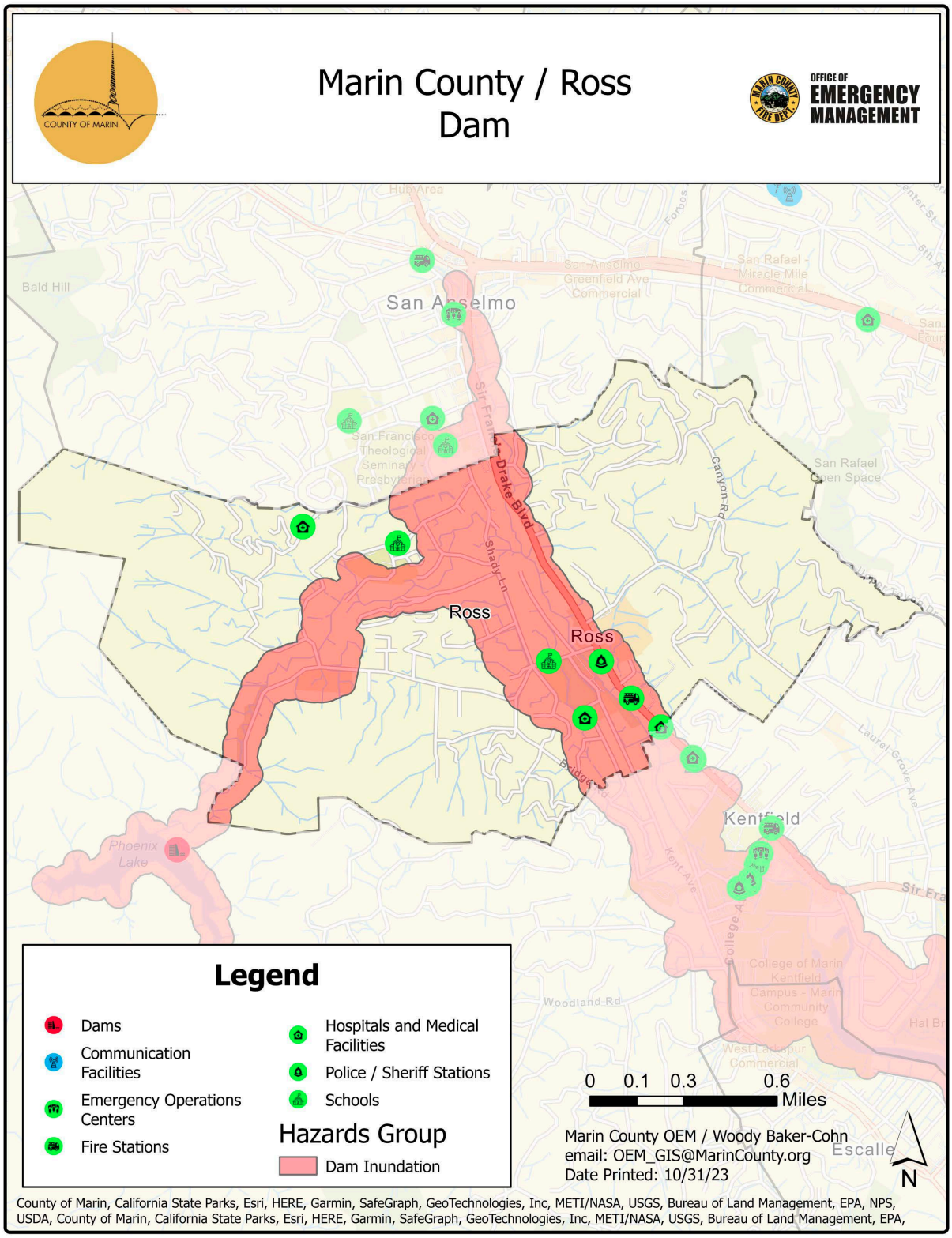


Figure 479: Town of Ross Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

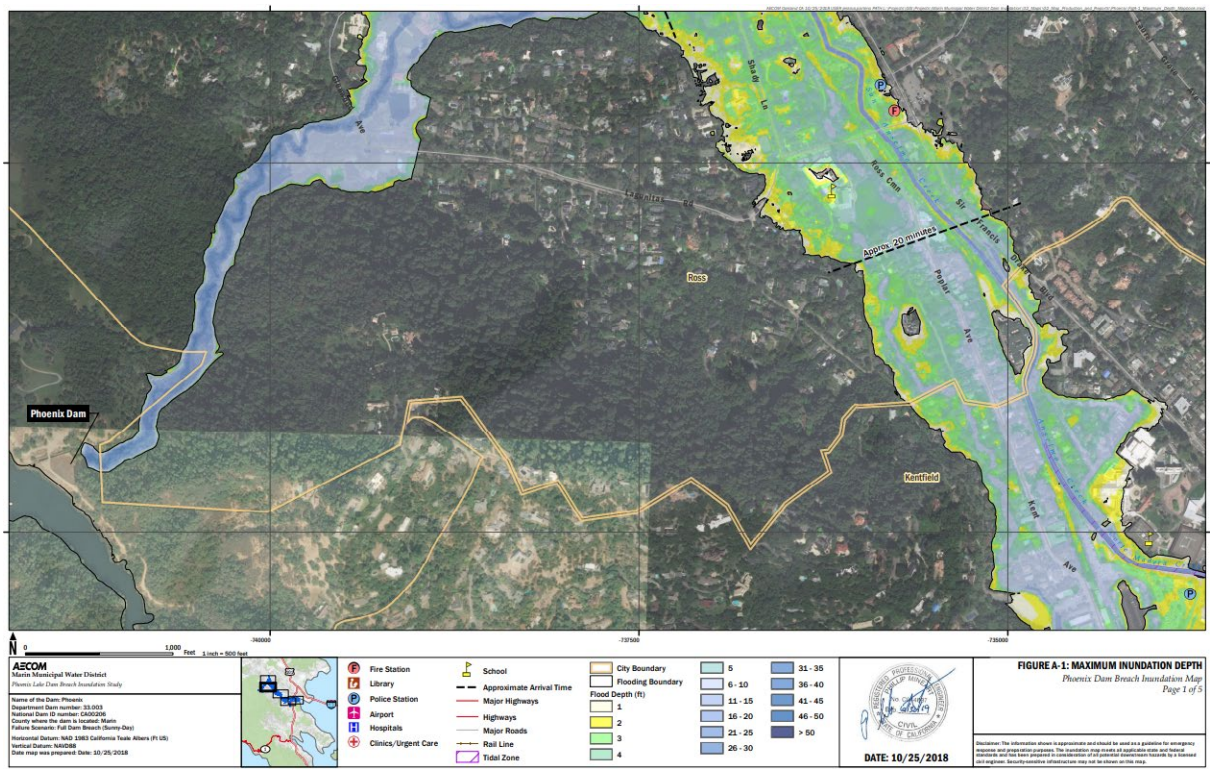


Figure 480: Phoenix Lake Dam Inundation Area – Ross South
Source: California Department of Water Resources

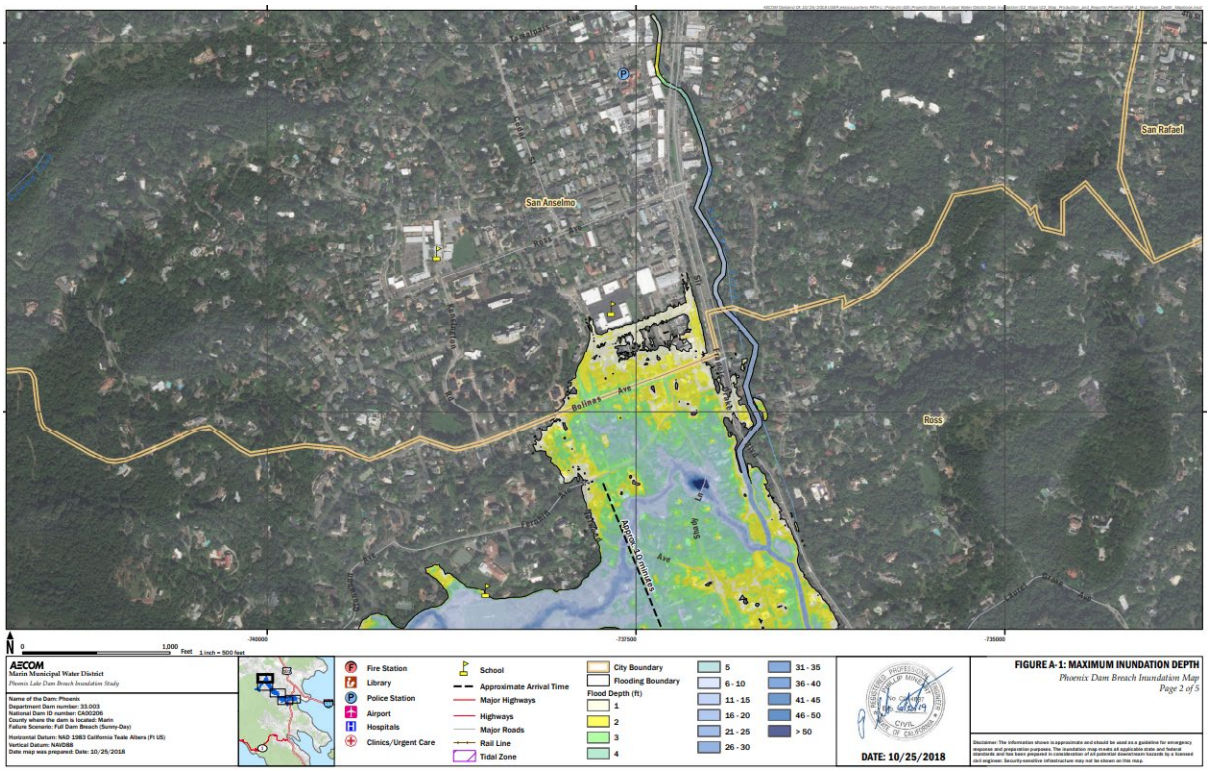


Figure 481: Phoenix Lake Dam Inundation Area – Ross North
Source: California Department of Water Resources

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Phoenix Lake Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of Ross. Future development along Corte Madera Creek and Ross Creek could expose additional people and structures to risk of a dam failure.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without

a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 21 shows landslide susceptibility classes.

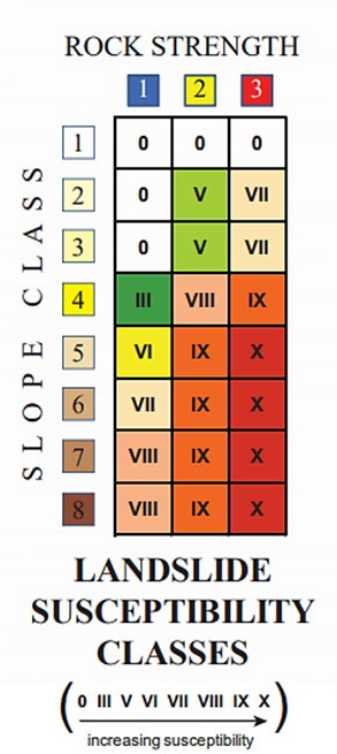


Figure 482: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 22 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

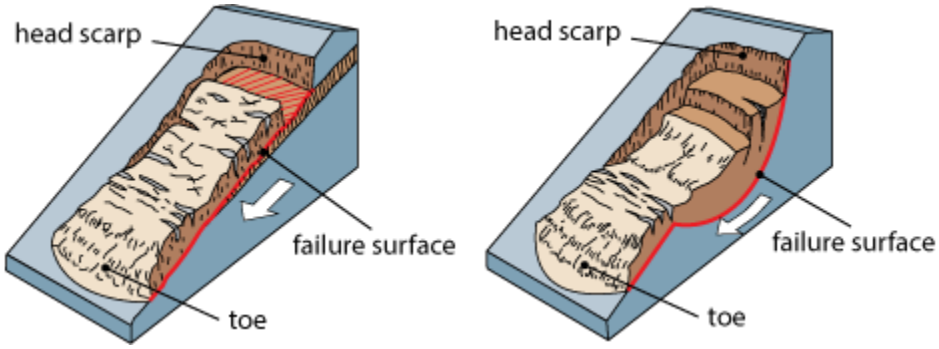


Figure 483: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
  Areas where surface runoff is directed

A landslide in Ross would most likely occur on the western and eastern sides of the Town where the terrain is steeper and is more susceptible to movement of hill slope materials. This area of Ross is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. A school and medical facility also lie in this area.

Most of the downtown area of Ross, including the entirety of its main thoroughfare San Francis Drake Boulevard lie outside a landslide susceptibility area.

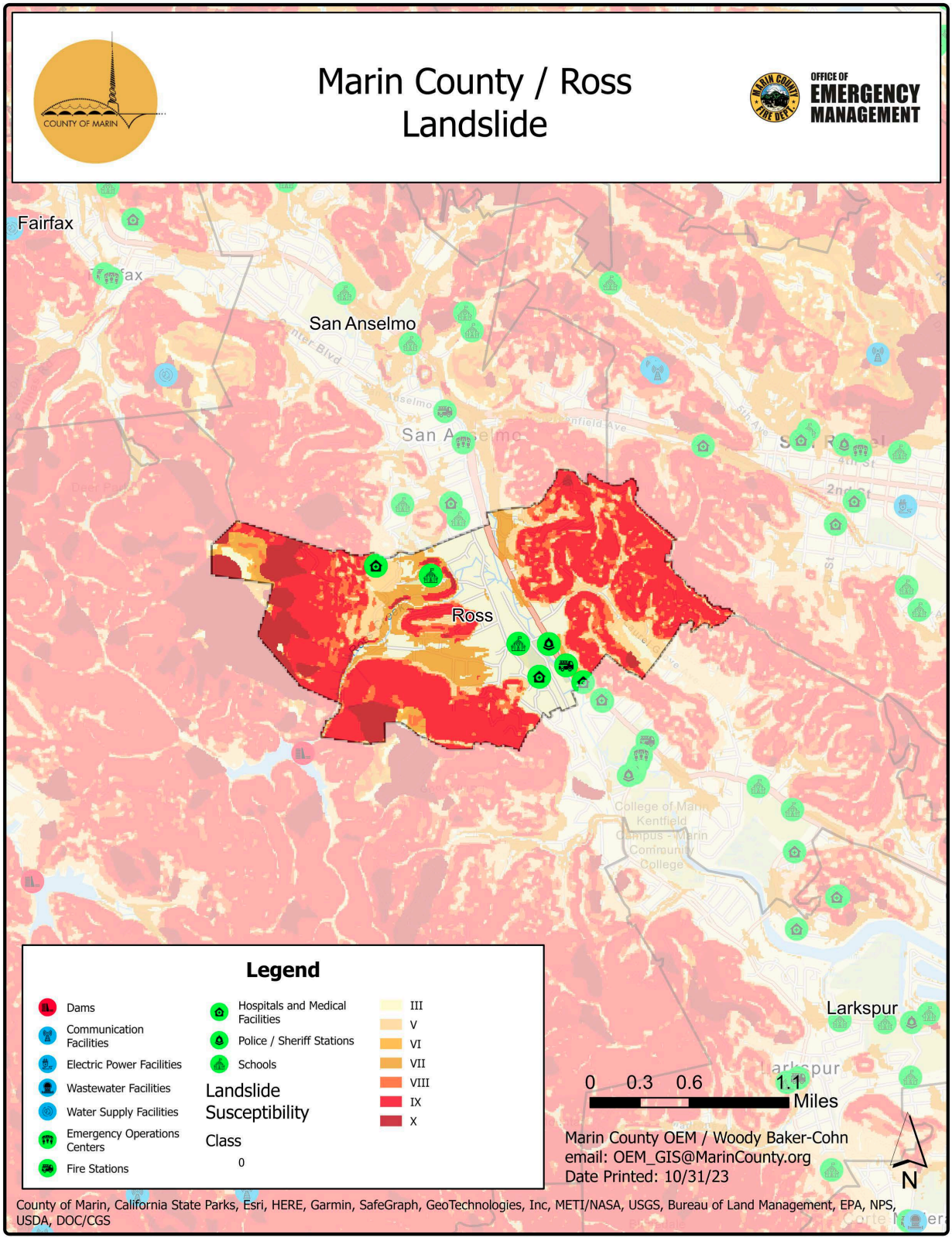


Figure 484: Town of Ross Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in this area could affect the ability of residents to reach their homes. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open space to the east and west of Ross, including Bald Hill Open Space Preserve, Ross Open Space Preserve and the West End San Rafael Open Space Preserve, could potentially contribute to significant debris flows in Ross. Ross Creek flows from Phoenix Lake directly into Ross and could potentially contribute to a debris flow that could impact bridges, residences and other structures in the Town, affecting ingress and egress to residential areas.

On 1/3-5/1982, a severe storm caused numerous landslides in Ross, destroying several homes. It is not uncommon for the Town of Ross to experience some type of minor mud or debris flow within the steep terrain areas during major storm or "atmospheric river" events. These flows usually have some type of impact on emergency access to residents by closing down the public and private roadways.

There have been no recorded debris flows in Ross since the last plan update.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[30], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Ross that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Ross could be susceptible to post-fire debris flows. This includes areas around Ross Creek and Corte Madera Creek, including its numerous tributaries. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex

[30] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on their effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Ross, though it's effects would be most felt in the mountainous areas to the east and west where the risk of wildfire would increase. Dry trees in public spaces like Ross's Bald Hill Open Space Preserve, the Ross Open Space Preserve and the West End San Rafael Open Space Preserve can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Ross may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Ross, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Ross. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Ross where wildfires are more likely to occur. Future development in this area and in the mountainous areas of Ross could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil

erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Ross can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 24).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 485: Modified Mercalli Intensity Scale
Source: USGS

Figure 25 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 486: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 26). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 487: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

Earthquake Shake Intensity

The colors on Figures 27 and 28 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

An earthquake could occur anywhere in and around Ross due to the number of active faults within and near Marin County.

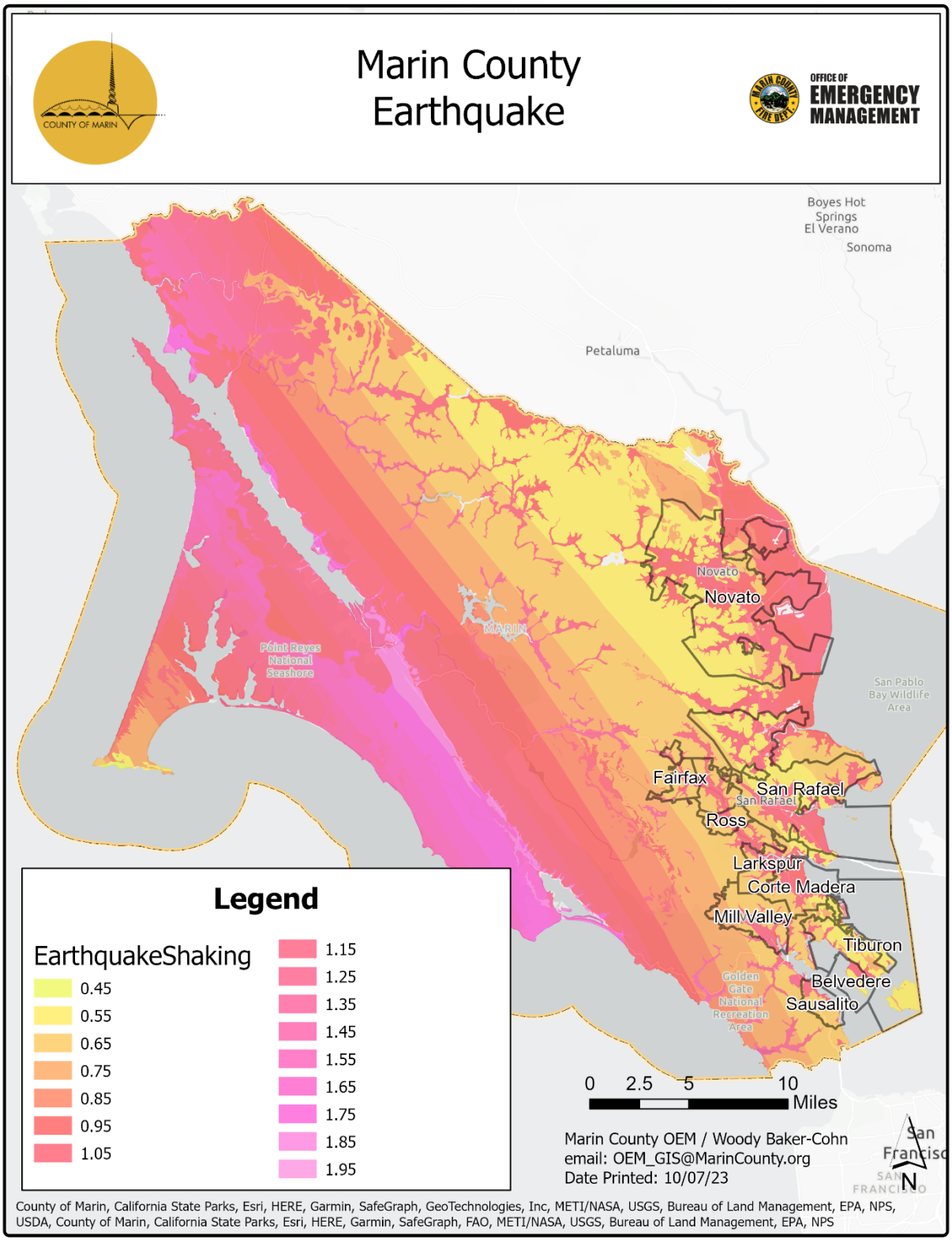


Figure 488: Marin County Earthquake Impact and Fault Lines
Source: Marin County OEM

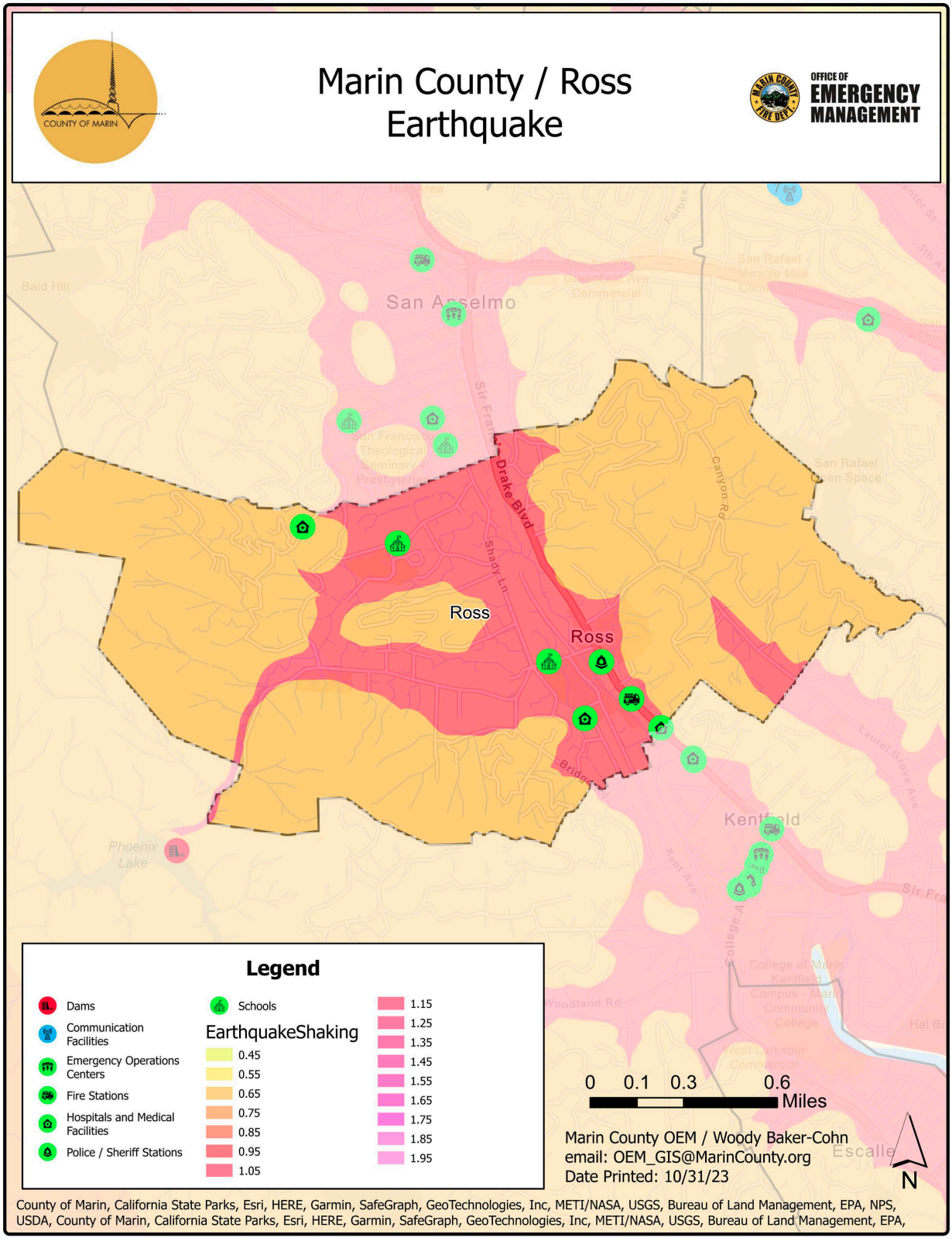


Figure 489: Town of Ross Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Ross is near several active faults that have the potential to cause earthquakes that would be a hazard for the Town. The San Andreas Fault runs north and south in the western side of Marin County, approximately 8 miles southwest from Ross. The San Andreas Fault is considered capable of generating a magnitude 8.0 earthquake. The northern section of the Hayward fault is less than 10 miles northeast of Ross. The entire Hayward fault may generate magnitude 7.2 and 7.4 earthquakes. The Rodgers Creek fault is less than fifteen miles northeast of Ross and may generate a magnitude 7.0 earthquake. The San Gregorio fault is less than 10 miles south of Ross and may generate a magnitude 7.3 earthquake. Areas in Town, primarily the low-lying areas adjacent to the Town creeks, have a “moderate” liquefaction susceptibility and could be more susceptible to an earthquake. The Ross Fire Station, Ross Police Station and Ross Town Hall lie along Corte Madera Creek and could be vulnerable to an earthquake.

Additional vulnerable structures in town include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the Town could be impacted by an earthquake. Approximately half of the residences in Ross, all of the commercial buildings, two churches, the public grade school, and public facilities (including the town hall, post office, police and fire stations) are within the strong shaking and moderate liquefaction hazard areas. There are approximately 20 residential units in the least stable hillside areas, with approximately two dozed residences down slope of the least stable areas. It is estimated that half of the structures in Ross were built prior to 1940. Some of these structures have been retrofitted with modern foundations. Typical damage to pre-1940 single-family homes include the wood frame coming off its foundation, racking of the cripple walls, the foundation itself cracking, or the chimney breaking at the roof line. A typical problem with houses built during this era is the connection between the wood frame and the foundation. These houses often lack steel bolts or any other type of "tie-down" between the foundation and the wood frame. Since these houses were built before the widespread use of plywood, they also typically lack appropriate shear reinforcing of the cripple walls (the walls between the top of the foundation and the floor diaphragm). Finally, steel reinforcing is often not found in the foundation of these houses or their chimneys. Some of these older houses may have brick foundations with weakly cemented joints. The post-1940 house accounts for the remainder of the Ross housing stock. Typical building damage to post-1940 houses does not present widespread problems with foundation anchorage and foundation reinforcing. However, there often is a lack of proper reinforcement of the masonry chimneys. A significant number of post-1940 dwellings may suffer some type of chimney damage. The second major source of damage is damage (or even collapse) of garages with living area above in two-story or split-level homes due to long spans over the garages.

Strong shaking conditions could damage masonry that is not reinforced or not designed to resist lateral forces, cause chimneys to fall, and move frame houses on their foundations if not bolted down. A major earthquake event could result in deaths, injuries, property and environmental damage, and disruption of normal government and community services. Hospitals outside of the Town may be impacted by an earthquake. Telephone systems could be affected by system failure, overloads and loss of electrical power. Natural gas leaks pose a fire threat and breaks in the system could affect service to the Town. Water sources could be compromised due to damage to treatment plants, pump stations and/or the pipelines that distribute potable water. Liquefaction-related damage to water supply pipelines could impair fire suppression, leaving the Town vulnerable to a large fire. Sewage collection systems throughout Marin County may sustain widespread damage if ground movement damages mains or pipelines. Electricity may be interrupted. Landslides may occur. Bridges and roads may be closed because of damage. An earthquake may also result in dam failure. Liquefaction of creeks during the winter storm

season could exacerbate flood hazards. The Town may experience road closures from liquefaction, earthquake-triggered landslides, shaking damage to bridges as well as indirect causes of closures such as building damage, hazmat releases, and utility pipeline breaks and fallen trees. The Town of Ross will be affected by the regional impacts of regional transportation disruption, particularly closure of the Golden Gate Bridge. Earthquakes could also cause landslides in the western areas of Ross with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Ross hasn't yet experienced a significant earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Ross.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Ross, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[31], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Ross. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Ross downtown and along its creek beds, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change. The Town will consider additional GIS mapping to identify vulnerable areas of the town.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas

[31] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally resulting from prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the “Atmospheric River” contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the “Pineapple Express” because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 29.

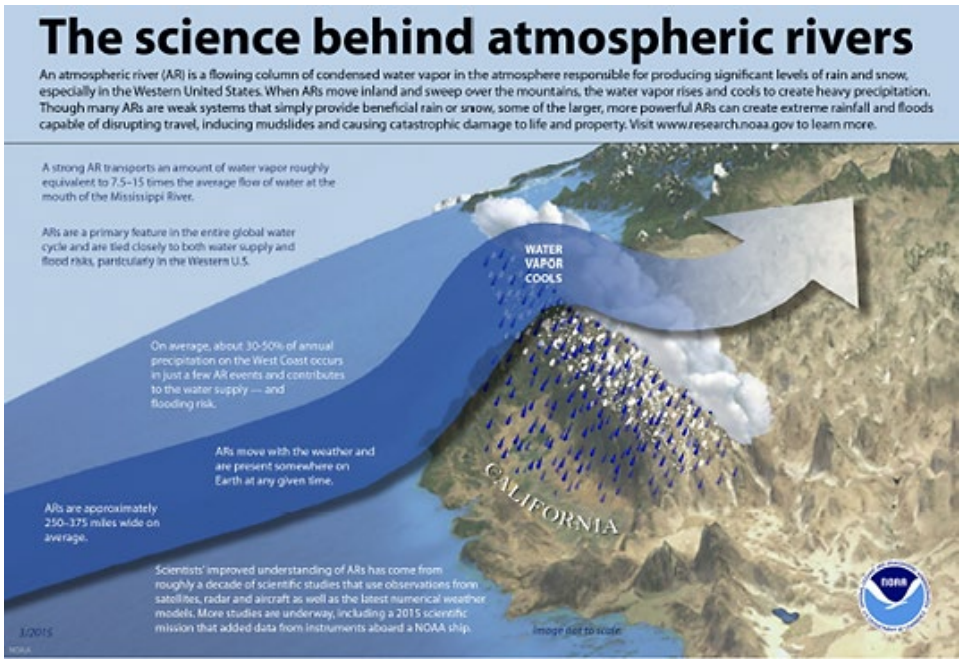


Figure 490: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn’t drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Ross Valley (where the Town of Ross is located) is naturally prone to flooding by its location, geologic and geomorphic setting: rainfall can be intense, soils are shallow with limited absorption capacity, slopes are steep, stream channels are entrenched and in many places narrow with relatively little storage capacity. The watershed has been altered from its natural

condition and many sections of creeks and streams have been placed in culverts and the natural pattern of runoff has been changed. During prolonged and heavy storms the watershed can become saturated. If rainfall is sufficiently intense, heavy runoff can result in high flows exceeding the capacity of the creek in places where conveyance is constrained. Floodwaters escape the creek capacity and breech the creek bank in downtown San Anselmo, north of the Town, and above the Lagunitas Bridge in the Town of Ross.

Flooding in Ross generally results from creek flooding along Anselmo and Corte Madera Creeks. Ross is not located along the Coast and would not experience coastal flooding. Local flooding in Ross is exacerbated where the storm water drainage network has inadequate capacity for peak flows, primarily when combined with high flows at the outfalls to Corte Madera Creek.

The 100-year floodplain extends primarily west of Anselmo and Corte Madera Creeks up to 1,000 feet in some areas and extending across the main throughfare Sir Francis Drake Boulevard in the northern area of town along the border with San Anselmo. The 500-year floodplain occurs primarily along the 100-year floodplain fringe and in the southeastern area of the Town east of Corte Madera Creek and along Sir Francis Drake Boulevard. There are dozens of homes, the Ross Grammar School, and most of the downtown commercial area of Ross that lie in the 100-year floodplain. The Ross Fire Station, the Ross Police Station and the Ross Town Hall along with numerous homes and businesses and sections of Sir Francis Drake Boulevard are all located adjacent to Corte Madera Creek and just lie in the 500-year floodplain just outside the Special Flood Hazard Area AE designation, (per the 2016 FIRM Map updates). The Town built the structures in the 1920s, prior to the FIRM and Town floodplain development regulations. The buildings have experienced water damage from flooding and are inaccessible during major flood events. Town electrical equipment is on poles and elevated from floodwaters, although the electrical service may be interrupted by trees falling on power lines and other problems associated with storms. Pipelines, as underground lines, should not be impacted by flooding. The main Town thoroughfares are inaccessible during flood events. Medical facilities are located outside of the Ross Town limits but may be inaccessible for some residents due to impassible roads.

Floods in the Town of Ross develop rapidly, generally within 24 to 36 hours after the beginning of the flood-producing storm but are short in duration. Flood conditions usually subside within 24 hours. In 1982, flood depths of 4 to 5 feet were reported. Floods in Ross usually occur during large storm events. High winds and mudslides compound the flood problems from the flood hazard. A U.S. Army Corps of Engineers report noted that the total storm damage was far greater than flood damage during the flood of 1982. 11 Local counties were declared Major Disaster Areas. Typical winter peak discharges have been measured below 3,500 cubic feet per second (cfs). The two most severe foods occurred in the winters of 1982 and 2005, with peak discharges of approximately 7,200 cfs and 6,800 cfs, respectively.

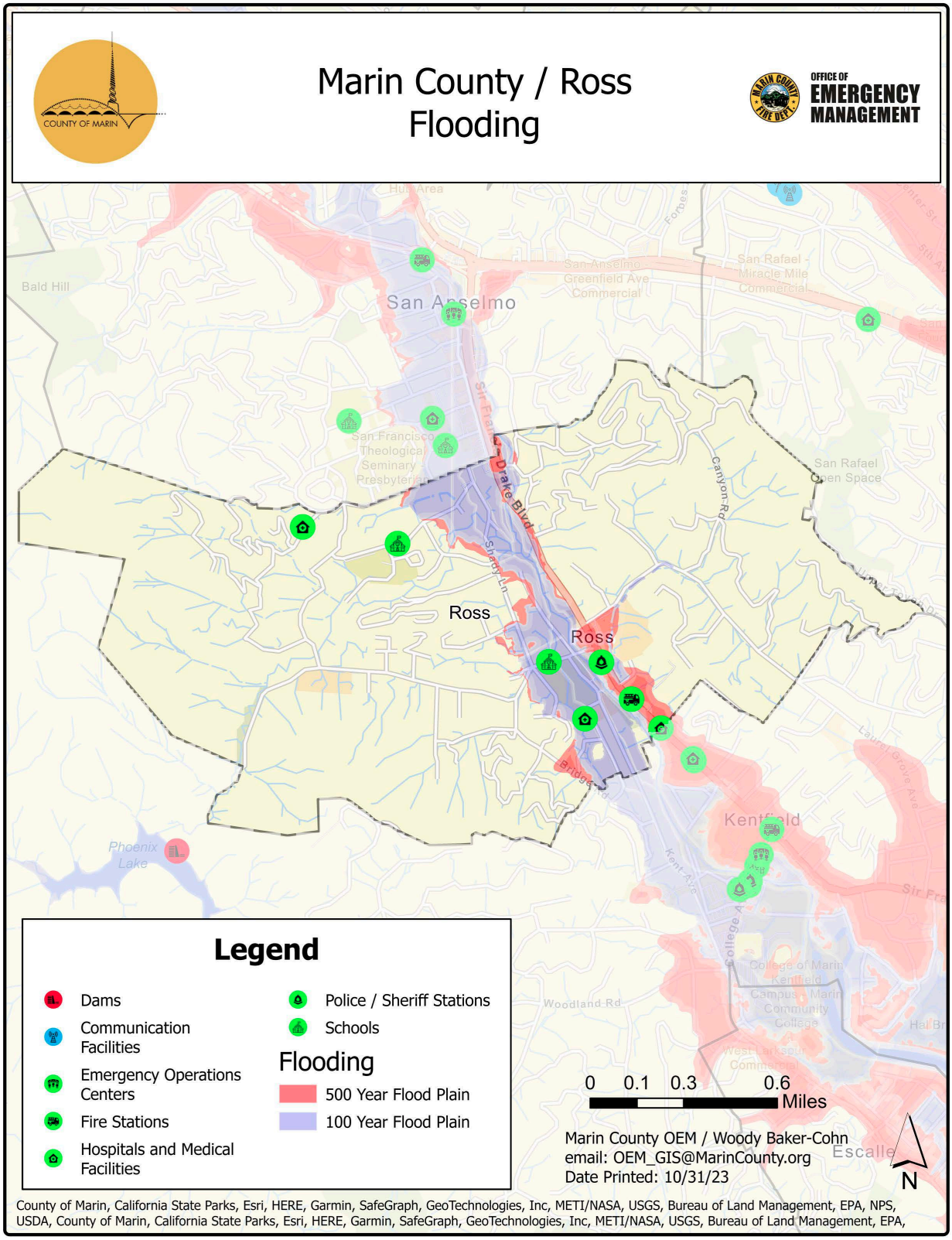


Figure 491: Town of Ross Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Numerous businesses, residential neighborhoods, schools, churches, community centers, roads, and other critical facilities lie in this area and are susceptible to flooding. Table 17 shows the number of Town of Ross critical facilities by flood zone.

Table 17: Town of Ross Critical Facilities by Flood Zone				
	Category	Name	Address	Flood Zone
Critical Facilities				
1.	Fire	Ross Valley Fire District Station 18	33 Sir Francis Drake Boulevard, Ross, CA 94957	X/AE
2.	Law	Ross Police Department	33 Sir Francis Drake Boulevard, Ross, CA 94957	X/AE
3.	Local Government	Ross Town Hall	31 Sir Francis Drake Blvd. Ross, CA 94957	X/AE
4.	Health / Medical EMS	Ross Valley Paramedic Authority	33 Sir Francis Drake Blvd. Ross, CA 94957	X/AE
5.	Health / Medical	Cedars Of Marin Ross Campus	115 Upper Rd, Ross, CA 94957	X
6.	School	Ross School K-8	9 Lagunitas Rd. Ross, CXA 94957	AE
7.	School	Branson High School	39 Fernhill Avenue, Ross, CA 94957	X

Table 239: Town of Ross Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. A failure of the Phoenix Lake Dam or a breach and/or overtopping of the levees along Ross Creek could contribute to flooding in the lowland areas of Ross.

Ross has experienced three 100-year storms in the past decades (1982, 1986 and 2006). Prior to establishment of the USGS stream flow gauging station in Ross on Corte Madera Creek in February 1951, flooding was reported in calendar years 1914, 1925, 1937, and 1942. Since the Ross gage has been in operation, flood flows have been recorded in 1951, 1955, 1958, 1967, 1969, 1970, 1982, 1983, 1986, 1994 (flooding was reported, but the stream flow gage was not in operation), and 2005. The flood in December 2005 - January 2006, was a federally declared disaster DR-1628.

On 10/24/2021, a bomb cyclone caused Corte Madera Creek to crest. Flood sirens were activated in Ross but no major flooding occurred.

On 1/10/2017, a moderate storm flooded Sir Francis Drake Boulevard, closing it between College Avenue and Lagunitas Road in Kentfield and Ross. Flooding threatened several buildings. A flash flood warning was issued, and the flood alarm was sounded in Ross. The

downtown area was prepared for evacuation, but the flooding threat at Corte Madera Creek eased.

On New Year's Eve 2005/2006, a significant storm caused flooding in Ross. Water 3 feet deep ran down Sir Francis Drake Boulevard and blew down a huge wooden gate across the entrance to a home. Swimming pools filled with mud, and standing water filled the lawn in front of the Ross Town Hall. The flood crested at 22.5 feet in Corte Madera Creek, 3.5 feet above flood stage.

In January 1982, several homes in Ross were destroyed in a flood during a major winter storm. Neighboring San Anselmo was under almost six feet of water.

On 2/10-2/11/1925 a severe storm caused flooding damage in the commercial area of Ross. Numerous residences along Sylvan Lane, Poplar Avenue and Redwood Drive suffered water damage.

Figure 492: Ross Flooding - 1925
Source: Marin History Museum

There have been no major flooding events in Ross since the last plan update.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[32] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Ross. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Ross will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development along Corte Madera Creek

[32] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regions. https://www.nature.com/articles/s41598-017-11285-y

including the downtown area would expose more people, structures and infrastructure including major roads to creek flooding as a result of climate change.

2.2.6 LAND SUBSIDENCE/SINKHOLES

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 32 for a picture and description of how dissolution sinkholes form.

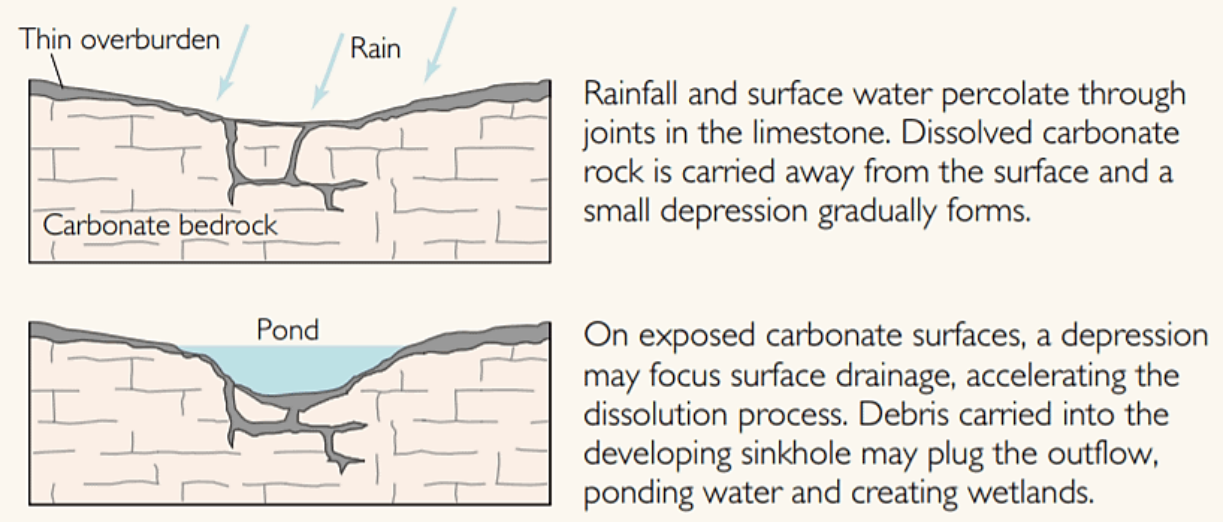


Figure 493: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 33 for a picture and description of how cover-subsidence sinkholes form.

Subsidence can also occur in bay mud areas which are prevalent around San Francisco Bay. Bay Mud, which has very little strength, can move and shift over long periods of time and is also affected by other natural events such as earthquakes, storm activities, water pressure and composition. Older construction of buildings placed on fill material on Bay Mud are susceptible to differential settlement which affects the service life of the structures as well as utilities,

roadways and other infrastructure that supports these areas. The Marinship area and other low elevation areas built on bay mud have experienced significant differential settlement over time.

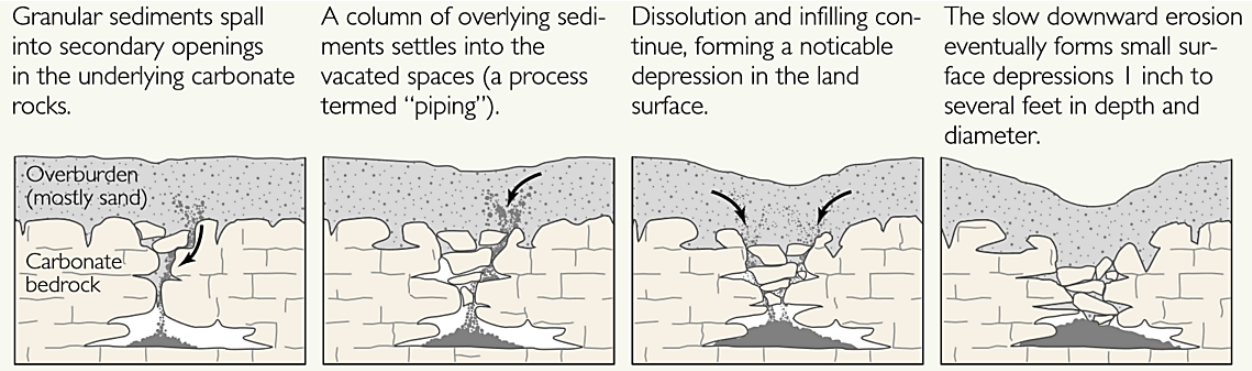


Figure 494: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 34 for a picture and description of how cover-collapse sinkholes form.

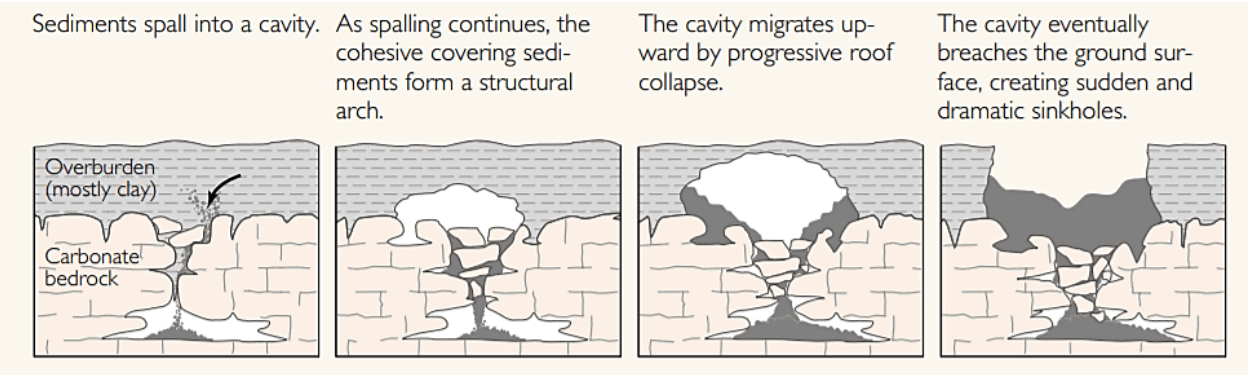


Figure 495: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed, and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central lowland areas of Ross along Corte Madera Creek where the ground is more porous. This includes the primary commercial area of town along Sir Francis Drake Boulevard where there are numerous residences and critical facilities. Land subsidence could have numerous impacts for Ross, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the Town.

On 1/4/2023, a five by eight-foot sinkhole opened outside a residence on Shady Lane during a period of heavy rain. There was concern that the sinkhole would compromise the structure of Shady Lane and Norwood Avenue but no further damage occurred.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Ross as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Ross could increase with future development in the lowland populated areas of the city, particularly the downtown area, where land subsidence is more likely to occur.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 35):

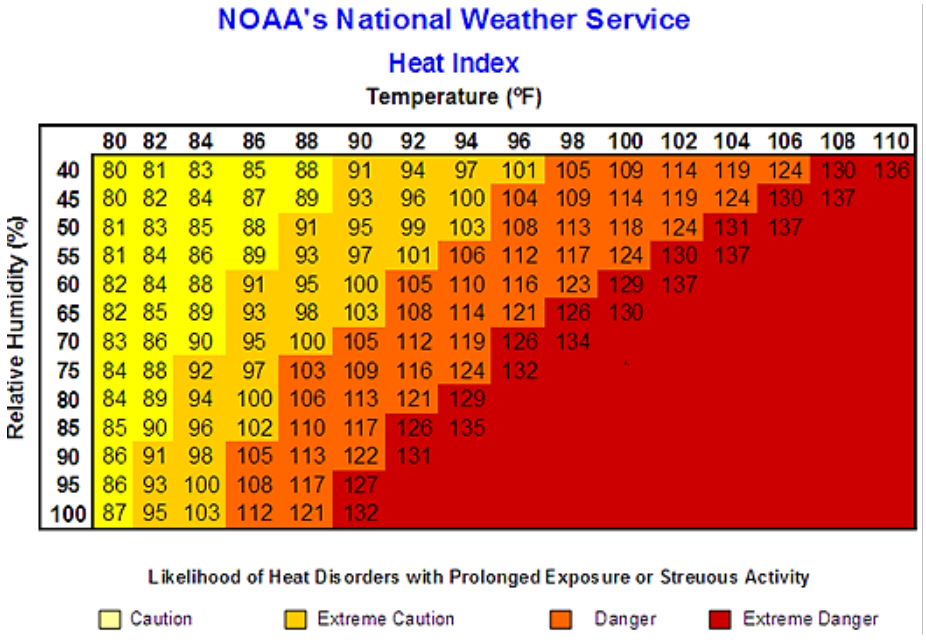


Figure 496: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause

of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Mill Valley and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city between Miller Avenue and E. Blithedale Avenue. There are dozens of residences in this area. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 Marin County and the Town of Ross experienced an Extreme Heat Event with temperatures exceeding 95 degrees. Because of the high percentage of elderly residents in Ross, extreme heat emergency awareness is and response planning is an integral part of the town's local emergency response plan.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

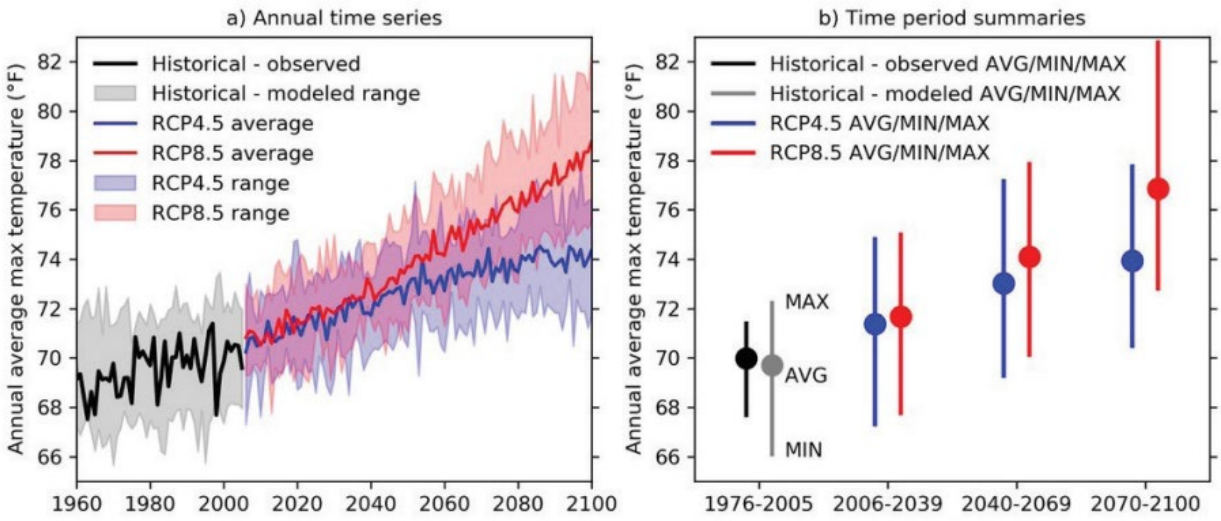


Figure 497: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Ross. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Ross where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Ross could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in

the occurrence and severity of wildfires across the Marin County OA including Ross as conditions become hotter and drier. These effects will primarily be felt in the mountainous areas of Ross where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Ross could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 37).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 498: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 38) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 499: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

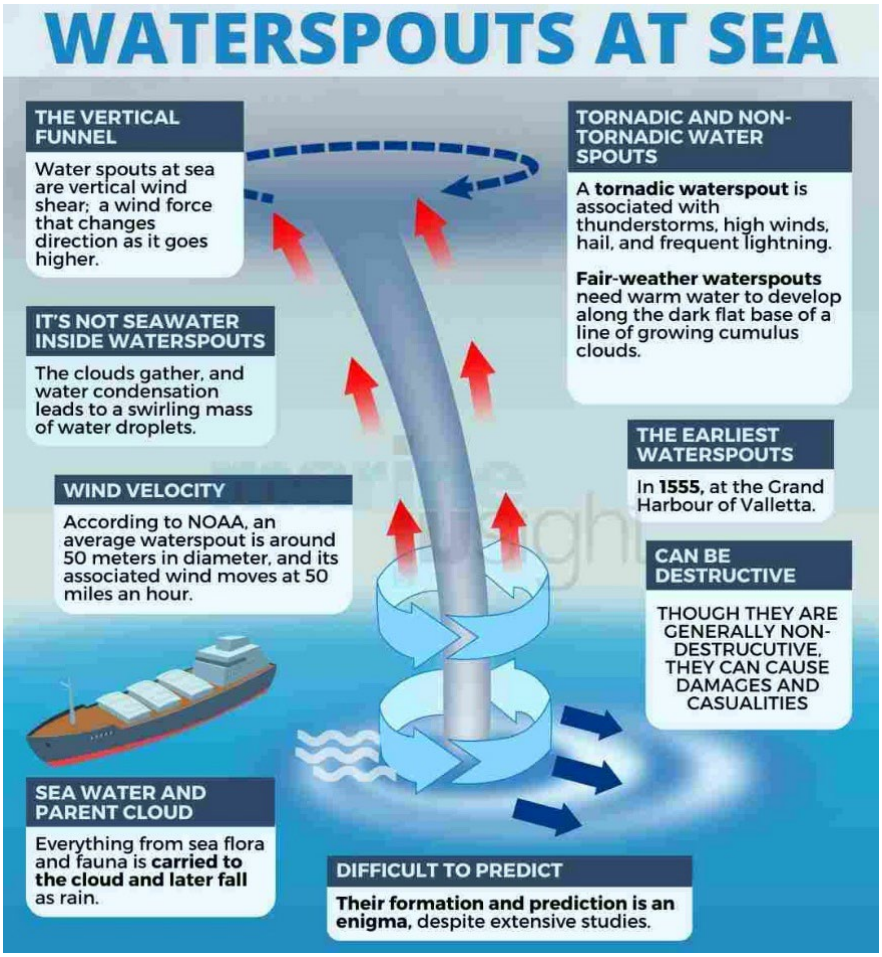


Figure 500: Waterspout Formation
Source: MarineInsights

All of Ross is susceptible to storms and damage from wind and tornadoes, as most of the Town has tree cover. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

While Ross has experienced winter storms, there have been no wind events that have caused major damage. Ross has never experienced a tornado.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Ross. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Ross as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Ross with high tree cover including in the eastern and western mountainous residential areas will increase the effects of severe wind events.

2.2.10 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation

resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 40 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

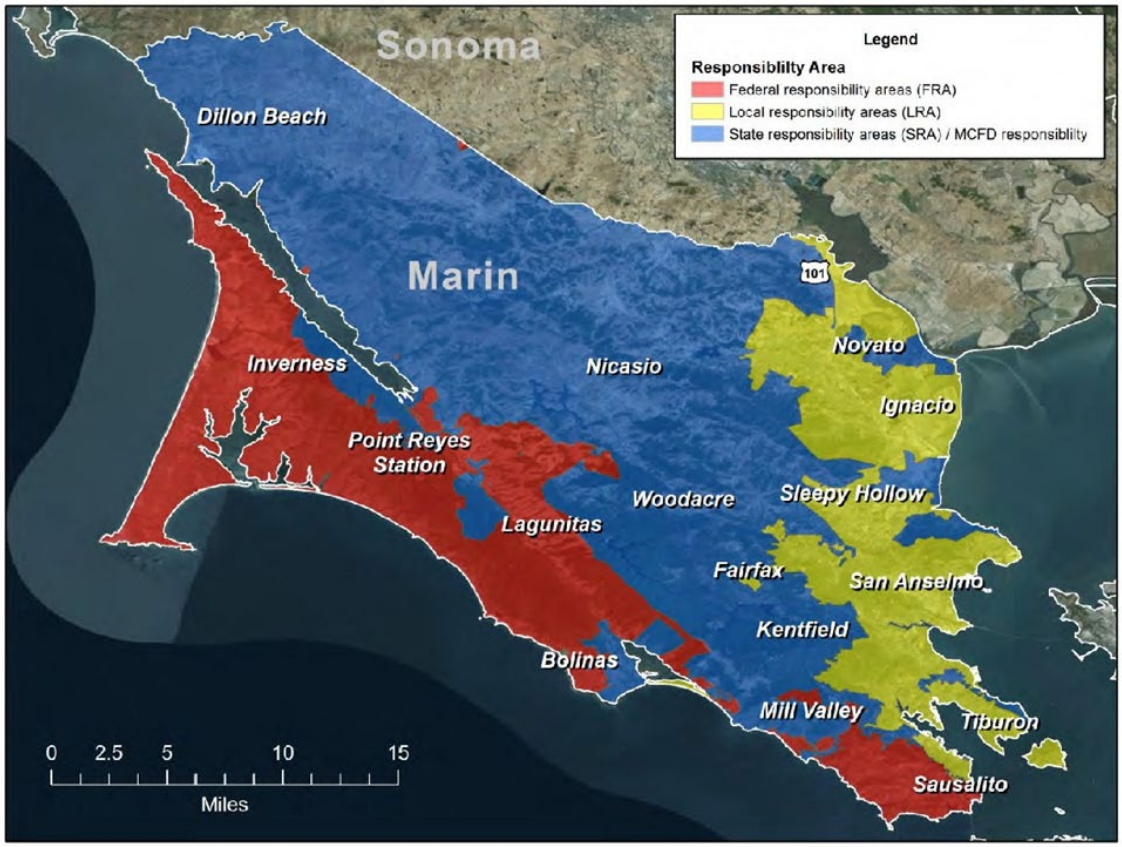


Figure 501: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It

is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County

OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

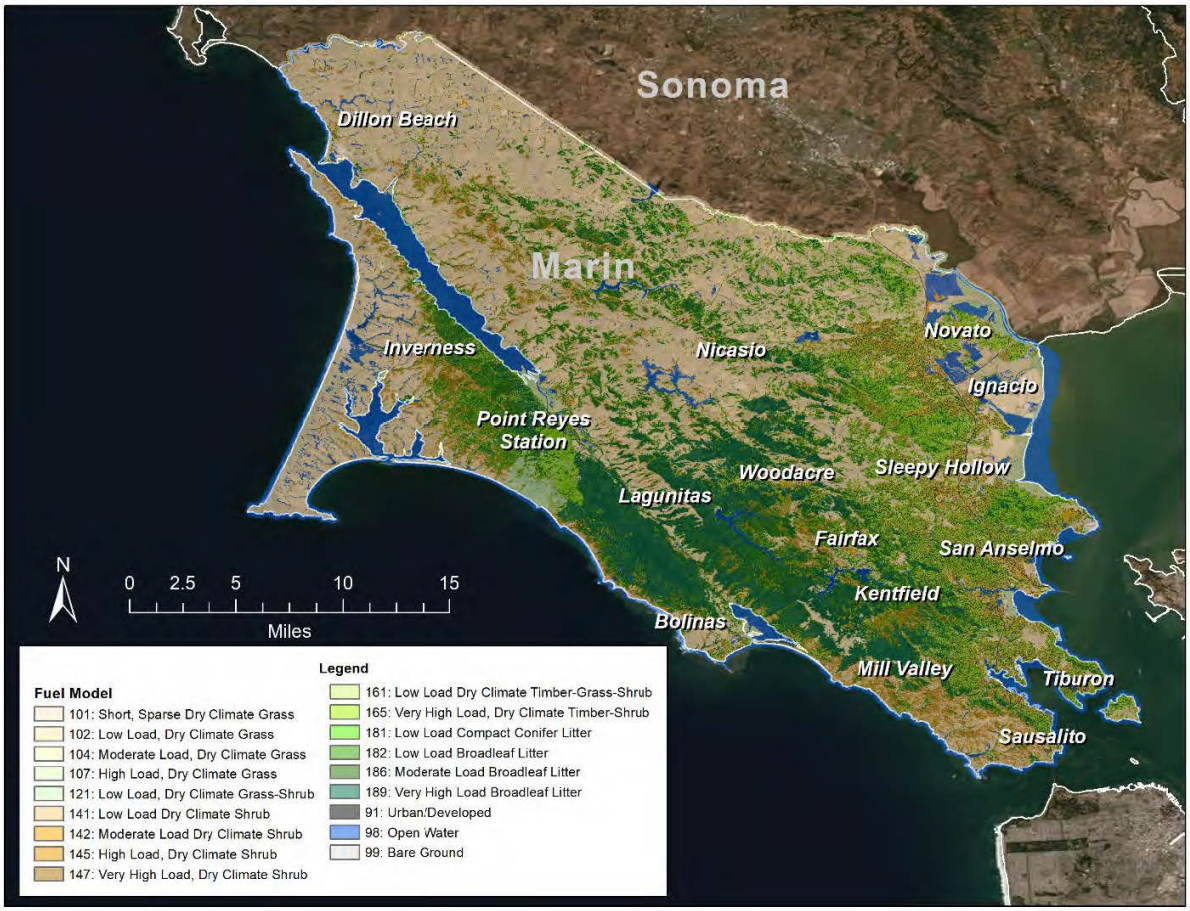


Figure 502: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a

particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 Marin County and the Town of Ross experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in

targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in Ross would most likely occur on the western and eastern side of town where there are numerous open spaces and forested terrain. The hillsides and canyons carry the potential of high fire danger. A major wildlife could also descend on Ross from the foothills of Mount Tamalpais to the west, which lie in a Very High FHSZ. The potential of wild land fire is an extreme risk to all areas within the Town, not just hillside areas. Most of Ross lies in a FHSZ and could be susceptible to a wildfire. The middle of Ross, including hundreds of residences, the commercial town center and the Ross Grammar School lie in a high FHSZ. The east and west sides of town lie in a moderate FHSZ and includes dozens of residences, the Ross Fire Station, the Ross Police Station, the Ross City Hall and several medical facilities. Many residences in the high wildfire threat areas were built prior to code changes and have wood shingle siding and some have wood shake roofs. Residences may be surrounded by flammable vegetation. Certain areas of the Town have water pressure and water flow that do not meet current standards. Access to adjacent open space areas and the hillside and canyon areas is limited by few access routes and narrow roads. There is limited water availability, water pressure, and water flow in certain areas within the Town. The wildland fire hazard is caused by a combination of factors including hillside terrain, highly flammable vegetation and forest, long summers, and human activity. There are heavy fuel loads. Many homes have been built on steep slopes with vegetation in close proximity.

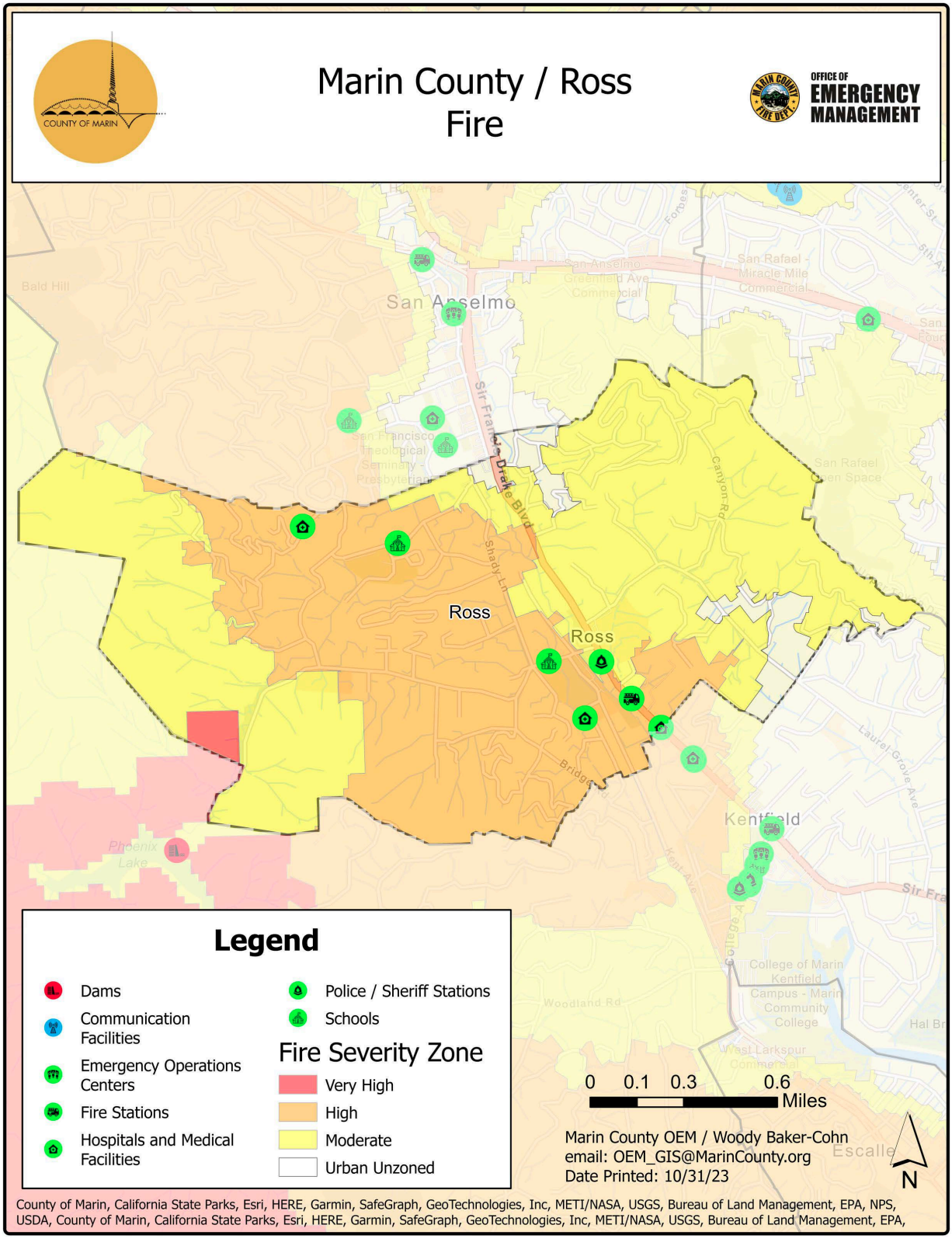


Figure 503: Town of Ross Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Wildfires can cause short-term and long-term disruption to the Ross. Fires may result in deaths and injuries and can destroy buildings and infrastructure. Additional costs associated with the loss of homes to wildland fire include disruption of utilities, transportation, and other public services. Although the physical damages and casualties arising from wildfires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In large wildfire events, the economic impact of this loss of services may be comparable to the economic impact of physical damages to the Town. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Wildfires can also cause major damage to power lines needed to distribute electricity to operate facilities. High intensity wildfires can also have substantial effects on watersheds through loss of vegetation and soil erosion, which may impact the Town by changing runoff patterns, reducing water storage capacity of Phoenix Lake, and degrading water quality through sedimentation and contamination.

All of Ross could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As wildland areas around Ross become drier due to climate change, the risk of a wildfire occurring and impacting the Town will continue to increase. Brush fires in the Town may increase over time as parks and other open spaces experience drier conditions.

Ross has never experienced a major wildfire.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

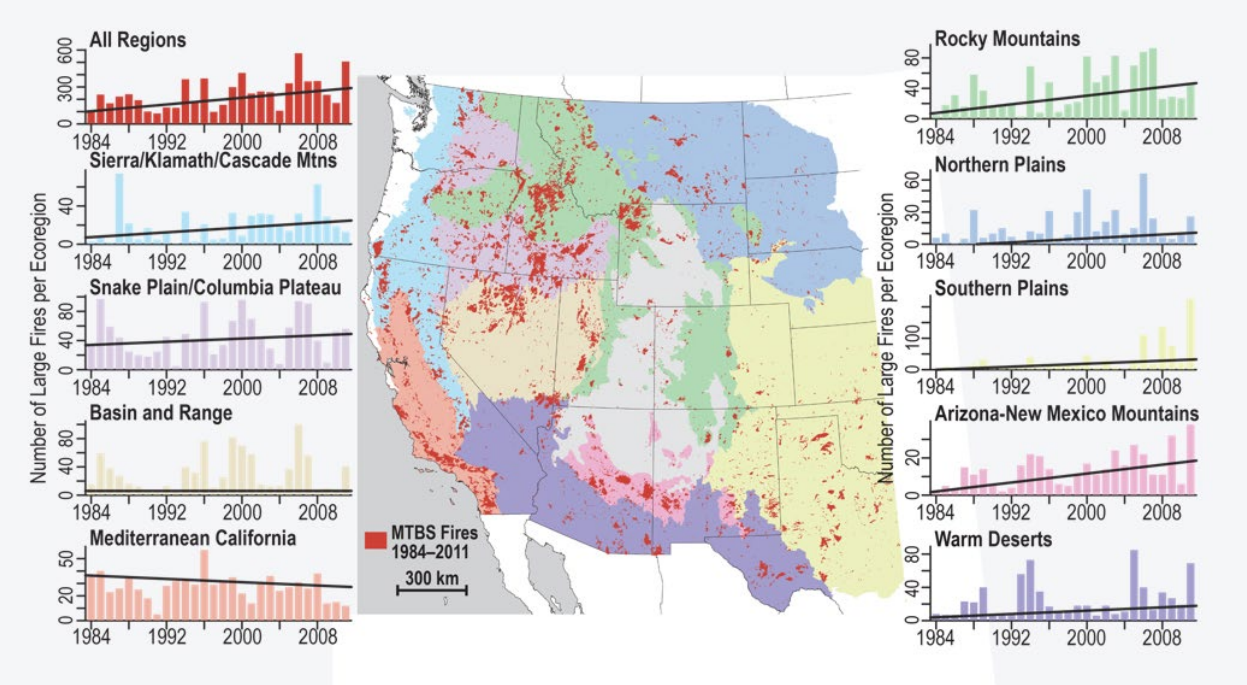


Figure 504: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Ross is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Ross. Future development in the WUI throughout Ross will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Ross WUI can increase risk to life, property and public health as a result of a wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

Marin County is a county located in the northwestern San Francisco Bay Area. As of the 2020 census, the population was 262,231. Its county seat and largest city is San Rafael. Marin County is across the Golden Gate Bridge from San Francisco, and is included in the San Francisco–Oakland–Berkeley, CA Metropolitan Statistical Area.

Located in the scenic Ross Valley amid wooded hillsides and meandering creeks, the Town of Ross is a quiet residential community that takes pride in its historic character, small-town charm, tree-lined streets, and excellent school system. Existing residential development in Ross numbers approximately 880 homes. These are predominantly single-family residences, with some guest houses and accessory dwelling units on single-family properties, and some apartment units located above retail in the downtown commercial area. The beauty of the natural landscape helps define the character of the community, but it also presents risk of natural hazards that limit the potential for new housing, including steep topography and areas of landslide hazard in the hills and risk of flooding and liquefaction on much of the valley floor. The existing housing stock in Ross is predominantly single-family homes. In 2020, 94.6 percent of homes were single family (833 single family detached units, 17 percent single family attached units) and 5.4 percent were multifamily [23 small multifamily units (2-4 units) and 26 medium or large multifamily units (5 or more units). There has been no multi-family development since 2015; however, the Town has seen marked interest in accessory dwelling units in recent years.

According to the U.S. Census, Ross' population increased by 9.5 percent between 2000 and 2020, rising from 2,341 in 2000 to 2,550 in 2020, which is a rate higher than Marin County (5.4 percent). The Department of Finance estimates that in 2022, the Town of Ross had a population of 2,301 residents. This decline in population is consistent with DOF projections for Marin County.

Ross's Regional Housing Needs Assessment (RHNA) allocation for the 2023-31 planning period has been determined by ABAG to be 111 housing units, including 34 units for very low-income households, 20 units for low-income households, 16 units for moderate-income households, and 41 units for above moderate-income households.

Table 18: Town of Ross Future Growth Areas

	Development	# of Units	# of Parcels	Project Date[1]	Acres	Fire Severity Zone	Flood Zone
1	**Berg/Bingo** Between 7 and 25 Upper Rd	6	1	unknown	40	Moderate	N
2	**Branson School** 39 Fernhill Ave	10	4	unknown	15	High	N
3	**11WH** At the end of unnamed road west of Chestnut Ave and Hillside Ave intersection, south of 24 Chestnut Ave	2		unknown	8	High	N
4	**Pomeroy** North of 14 Bellagio Rd and South of 78 Baywood Ave	1		unknown	2.5	Moderate	N
5	**Civic Center** 33 Sir Francis Drake Blvd	9		unknown	2.4	High	X

6	**Badalamenti** 27 Ross Common	4		unknown	.22	High	X
7	**Bellagio** 0 Bellagio Road (at the intersection of Bellagio Rd and Canyon Rd)	2		unknown	2.63	Moderate	N
8	**Siebel** Between 36 Glenwood Ave and 81 Fernhill Ave	1		unknown	1	High	N
	Other	25	25	unknown	20	High	X
	Various ADU's	80	80	continuous	N/A	High	X
	Total	**140**	**110**		**91.5**		

Table 240: Town of Ross Future Growth Areas
Source: Town of Ross

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Ross has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

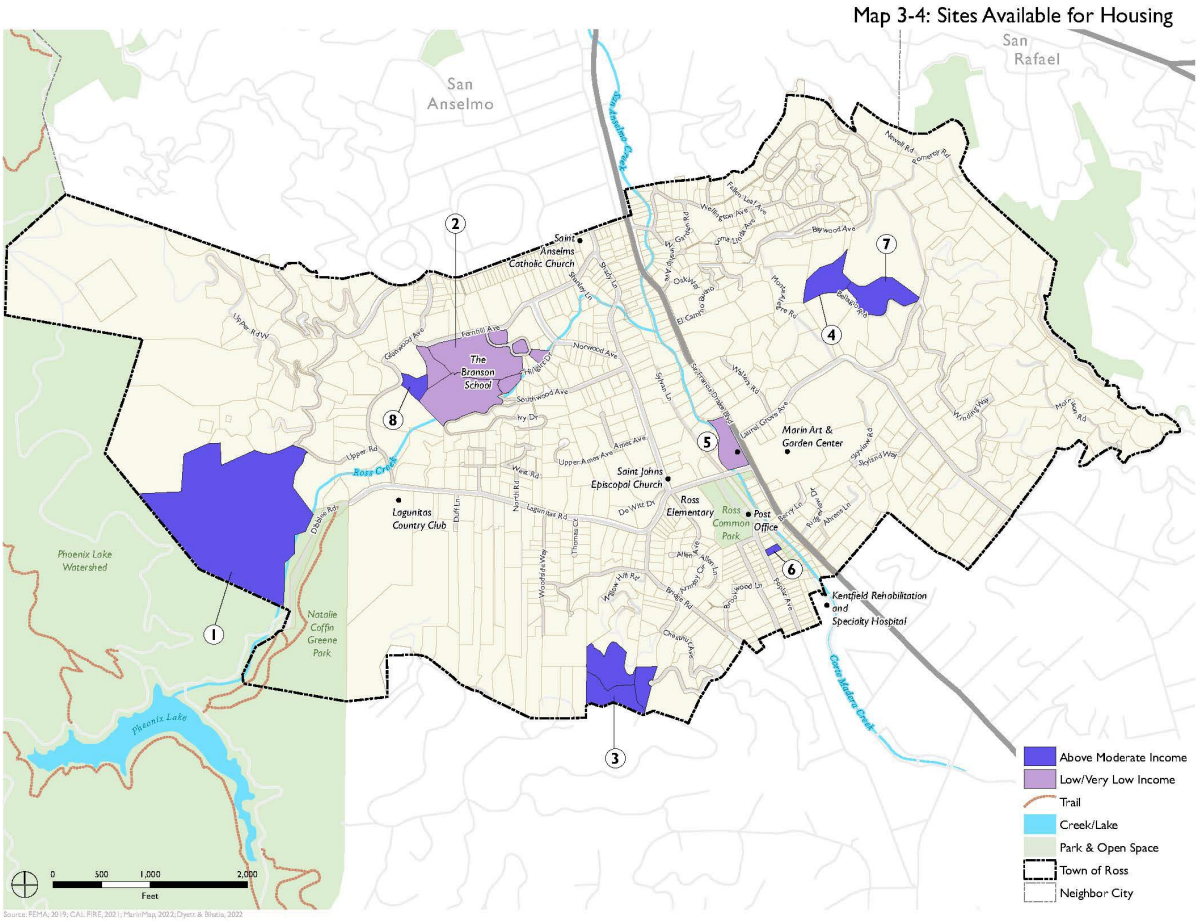


Figure 505: Town of Ross Future Growth Areas
Source: Town of Ross 2023- 2331 Housing Element

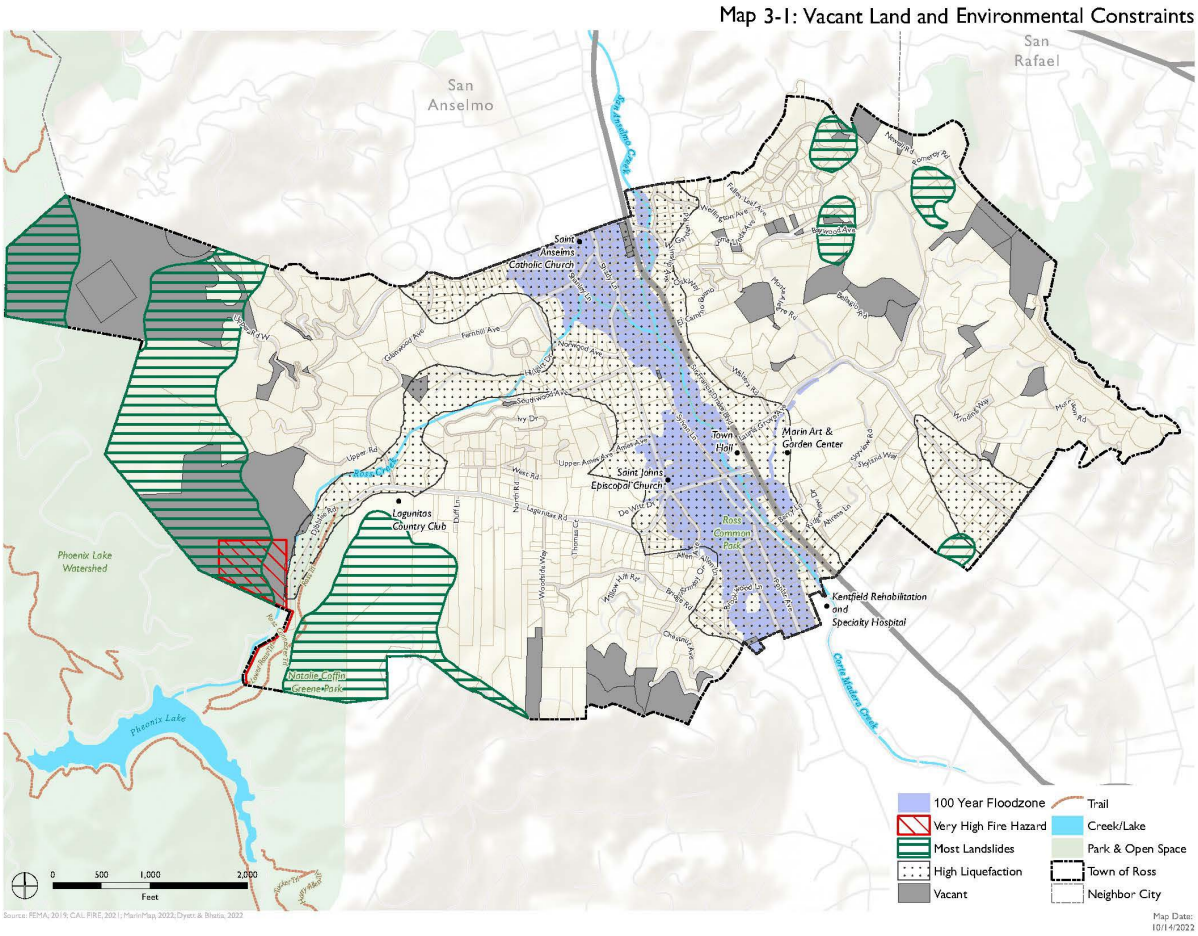


Figure 506: Town of Ross Hazard Zones
Source: Town of Ross 2023 – 2031 Housing Element

3.2 CAPABILITY ASSESSMENT

The overall priorities in the Town of Ross have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall town priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed, and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the Town of Ross General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the Town's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the Town of Ross an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Continuity of Operations Plan**: The Town would benefit from the development of a Continuity of Operations Plan to enhance resiliency and develop response and contingency plans for the risk and vulnerability of the Town to the hazards identified in the Hazard Mitigation Plan.
- **Community Wildfire Protection Plan:** The Town plans to take an active role in mitigation actions to enhance wildfire protection.
- **Emergency Manager:** The Town will consider identifying staff to provide emergency management or disaster preparedness duties as a collateral role.
- **StormReady certification and Firewise Communities certification:** The town will consider participation in these programs.

Table 19: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan	Y 2010	The General Plan outlines long-term direction for development and policy. The Protecting Community Health and Safety, and Preparing for Emergencies Element includes a discussion of fire and hazardous materials; and importantly includes a section on Emergency Preparedness. The Protecting Creek Habitat and Reducing Flooding Hazards Element addresses flooding and watershed hazards. The plan can be used to implement mitigation actions.
Strategic Plan	N	
Capital Improvements Plan	Y 2022	The Capital Improvement Plan provides an annual 5-year forecast of capital infrastructure expenditures for roadways, drainage, and Town facilities. Recent projects include seismic upgrades to the Town Hall and flood protection projects along Bolinas Avenue. The plan can be

		used to provide funding for mitigation measures.
Economic Development Plan	N	
Local Emergency Operations Plan	Y 2021	The E0P addresses the Town's planned response to extraordinary emergency situations associated with natural, technological, and human caused emergencies or disasters within or affecting the Town of Ross. The plan can be used to implement mitigation actions.
Continuity of Operations Plan	N	
Flood Mitigation Plan (FMP)	N	
Engineering Studies for Streams	Y 2019	In conjunction with the Town's Winship Bridge replacement project and local projects implemented by Marin County Flood Control, the Town of Ross receives continuous updates to the latest hydraulic methodology for the Corte Madera Creek floodplain from the Marin County Flood Control District.
Open Space Management Plan	N	
Regional Transportation Plan (RTP)	Y 2018	The Town participated in the Marin County Traffic Safety Plan systemic safety analysis.
Stormwater Management Plan/Program	Y 2022	The Town partners with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to manage stormwater runoff caused by construction activities.
Community Wildfire Protection Plan	Y 2020	Ross is a member agency of the Marin Community Wildfire Protection Plan
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y 2023	Code violations are digitally tracked with the permitting software TRAKiT and adequately enforced.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	N	
Site plan review requirements	Y 2021	Site plan review checklist for projects in a flood zone are reviewed biannually for compliance with FEMA CRS program
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Muni Code includes several sections that address hazard mitigation. The Town adopts the current California Building Code which applies to all construction activity

		within the Town boundaries. The California Building Code is comprised of 11 parts that incorporate public health, safety, energy, green building and access standards used in the design and construction of all buildings. The new code provisions will allow the Town to utilize the latest technologies, advances in construction standards and seismic design for the use in new residential and commercial construction and in remodels.
Zoning ordinance	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision ordinance	Y	New subdivisions & structures require compliance with NFIP and CRS programs
Floodplain ordinance	Y 2021	Recently updated for flood protection standards above FEMA/NFIP minimum requirements.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Hillside/Hazard lot ordinance in place, updated in 2018. Entire Town is subject to WUI hardening.
Flood insurance rate maps	Y	Current and historic FIRM maps and riverine studies kept on file.
Elevation Certificates	Y	FEMA requires annual review of Town-issued Elevation certificates to maintain CRS rating. EC's are required prior to foundation pour and on project completion.
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Y	Coordinated through MCSTOPPP and Towns small MS4 General storm water permit.

Table 241: Town of Ross Legal and Regulatory Capabilities
Source: Town of Ross

Town of Ross General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The Town of Ross General Plan, adopted in 2007, was prepared over a one year period that included an extensive public review process. The General Plan is the most important policy and planning document in the Town and is used by virtually every department. The General Plan is the Town's statement of its vision for the future. The General Plan contains policies covering every aspect of the Town: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

Town of Ross specific goals and policies related to mitigation of natural hazards are as follows:

Table 20: Town of Ross General Plan	
Goal/Policy/ Program	**Explanation**
Land Use Element	
Goal 8	**A Beautiful, Safe and Close-Knit Community**
Policy 8.1	Establish land use categories, densities, and intensities of land use, as depicted on the Land Use Plan, that support the vision and goals of the Ross General Plan.
Policy 8.7	Ensure the safety, proper construction and maintenance of buildings, property and neighborhoods through enforcement of codes, public education and cooperation with other public agencies.
Conservation and Open Space Element	
Goal 1	**An Abundance of Green and Healthy Natural Systems**
Policy 1.5	Execute the Open Space Plan for land in public and private ownership, including existing and future parcels.
Policy 1.4	Maximize the amount of land retained in its natural state. Wherever possible, residential development should be designed to preserve, protect and restore native site vegetation and habitat. In addition, where possible and appropriate, invasive vegetation should be removed.
Public Safety - Assuring the Health and Safety of the Community	
Goal 5	**Protecting Community Health and Safety, and Preparing for Emergencies**
Policy 5.1	Location of Future Development. Development will only be permitted in areas where risks to residents can be adequately mitigated.
Policy 5.2	Geologic Review Procedures. At the time a development is proposed, Ross geologic and slope stability maps should be reviewed to assess potential geologic hazards. In addition, suitability for development must be based on site-specific geotechnical investigations.
Policy 5.3	Fire Resistant Design. Buildings should be designed to be fire defensive. Designs should minimize risk of fire by a combination of factors including, but not limited to, the use of fire-resistant building materials, fire sprinklers, noncombustible roofing and defensible landscaping space.
Policy 5.4	Maintenance and Landscaping for Fire Safety. Ensure that appropriate fire safety and landscaping practices are used to minimize fire danger, especially in steeper areas. Due to the high fire hazard in the steeper areas of Town, special planting and maintenance programs will be required to reduce fire hazards in the hills and wildland areas, including removal of invasive non-native vegetation such as broom, acacia and eucalyptus.
Policy 5.5	Fire Safety in New Development. New construction will adhere to all safety standards contained in the Building and Fire Code. Hazards to life and property shall be minimized by such measures as fire preventive site design, fire resistant landscaping and building materials, and the use of fire suppression techniques and resources.
Policy 5.11	Hazardous Materials Storage and Disposal. Require the proper use, storage, and disposal of hazardous materials to prevent leakage, contamination, potential explosions, fires or the escape of harmful gases, and to prevent individually innocuous materials from combining to form hazardous substances, especially at the time of disposal.
Policy 5.12	Access for Emergency Vehicles. New construction shall be denied unless designed to provide adequate access for emergency vehicles, particularly fire fighting equipment.
Policy 5.13	Town Responsibilities for Emergency Preparation and Response. Undertake emergency preparedness planning in cooperation with other public agencies and

Table 20: Town of Ross General Plan	
Goal/Policy/ Program	**Explanation**
	local organizations. Publicize emergency plans, provide information on disaster preparedness to residents and businesses, and continue essential Town emergency public services during natural disasters.
Goal 6	**Protecting Creek Habitat and Reducing Flooding Hazards**
Policy 6.1	Flood Protection in New Development. All new construction and substantial remodels within the 100-year floodplain must comply with the Town's floodplain regulations.
Policy 6.2	Flood Control Improvements. The Town supports the construction of flood control improvements consistent with the natural environment, the design character of the Town of Ross and the safety and protection of persons and property.
Policy 6.3	Ross Valley Flood and Watershed Protection. The Town will work with other jurisdictions within the Ross Valley watershed to develop a comprehensive approach to flood protection and resource preservation strategies.
Policy 6.4	Runoff and Drainage. Stormwater runoff should be maintained in its natural path. Water should not be concentrated and flow onto adjacent property. Instead, runoff should be directed toward storm drains or, preferably to other areas where it can be retained, detained, and/or absorbed into the ground.
Policy 6.5	Permeable Surfaces. To the greatest extent possible, development should use permeable surfaces and other techniques to minimize runoff into underground drain systems and to allow water to percolate into the ground. Landscaped areas should be designed to provide potential runoff absorption and infiltration.
Policy 6.6	Creek and Drainageway Setbacks, Maintenance and Restoration. Keep development away from creeks and drainageways. Setbacks from creeks shall be maximized to protect riparian areas and to protect residents from flooding and other hazards. Encourage restoration of runoff areas, to include but not be limited to such actions as sloping banks, providing native vegetation, protecting habitat, etc., and work with property owners to identify means of keeping debris from blocking drainageways.
Policy 6.7	Riparian Vegetation. Protect existing creek and riparian vegetation and encourage the use of native species during creek restoration. Assure that modification of natural channels is done in a manner that retains and protects creekside vegetation, integrates fish passage and includes habitat restoration in its natural state.
Public Facilities Element	
Goal 9	Excellence of Community Stewardship
Policy 9.2	Maintain facilities and staffing to support general government, public works, fire protection and police services that are responsive to local needs. Use the design and development review process to minimize increases in service needs resulting from new development.

Table 242: Town of Ross General Plan
Source: **Town of Ross** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the Town personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 21: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Planning Commission	Y	Yes, Town Council acts as Planning Commission, reviewing planning applications for conformance with Town policies, culture, and ordinances.
Administrative Services	Y	Yes. Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Hazard Mitigation Planning Committee	Y	Yes. The Town participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee that meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Yes. Tree alteration and removal Ordinance updated in 2022 to facilitate removal and limit replanting of fire-prone species
Mutual aid agreements	N	
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	Y	Regional and local GIS database of flood hazards, landslide hazard, fire risk, dam inundation.
Grant writing	N	
Hazus analysis	N	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/PT	Adequate to enforce regulations
Floodplain Administrator	Y/FT	CFM - Adequate, trained, and effective
Emergency Manager	N	
Community Planner	Y/FT	Adequate, trained, and effective

Civil Engineer	Y/FT	Adequate, trained, and effective
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Y/FT	Adequate to enforce regulations
GIS Coordinator	Y/FT	Adequate to enforce regulations
Community Development Staff	Y/FT	Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan. Adequate, trained, and effective.
Town Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building related activities including issuing permits, conducting environmental review, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. Public Works Department is responsible for Town-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department. Adequate, trained, and effective
Police Department Staff	Y/FT	The Town Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department. Adequate, trained, and effective
Fire Protection District Staff	Y/PT	The Ross Valley Fire District protects the town from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire. Adequate, trained, and effective

Table 243: Town of Ross Administrative and Technical Capabilities
Source: **Town of Ross**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 22: Fiscal Capabilities		
Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.

Table 244: Town of Ross Fiscal Capabilities
Source: **Town of Ross**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Town of Ross and the Town of Ross partnerships utilized to promote those programs.

Table 23: Town of Ross Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Much of what happens in Town happens at each month's regular Town Council meeting. Since most Town residents don't regularly attend Council meetings, "The Morning After", monthly e-newsletter, was created to fill that void by delivering news highlights delivered by email the day following the Council meeting. The Morning After is the flagship publication of the Town's email list designed to keep residents, business owners, Ross organizations and interested parties up-to-date on Town news and information.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	The Town website offers detailed Emergency Services information for Wildland fires, Community preparedness, and flooding.
Natural disaster or safety related school programs	N	
StormReady certification		
Firewise Communities certification	Y	Communities in Ross have received Firewise certification.
Community Rating System	Y	Town has a CRS rating of 8 and is in good standing.
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 245: Town of Ross Community Outreach
Source: **Town of Ross**

3.2.5 PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

The Town of Ross has participated in the Regular Phase of the NFIP since May 1, 2015. Since then, The Town of Ross has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. The Town of Ross has been in the CRS program since May 1, 2015. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, The Town of Ross is currently ranked Class 8 community, which gives a 10% premium discount to individuals in The Town of Ross Special Flood Hazard Area (SFHA), and a 5% discount to policyholders outside the SFHA.

Presently, The Town of Ross manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the Town's participation in the NFIP. Also, the Town's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the Town.

The Town of Ross will continue to manage their floodplains in continued compliance with the NFIP. An overview of the Town's NFIP status and floodplain management program are discussed in Table 24. Additional information on the Town's CRS program follows.

The activities credited by the CRS program provide direct benefits to Marin County and its residents,

including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that Town of Ross implements and receives CRS credits include:

Ross's CRS program as of September , 2021.

Activity 310 – Elevation Certificates: Credit is provided for having written construction certificate management procedures for all new and substantially improved/substantially damaged buildings. (5 points)

Activity 330 – Outreach Projects: Credit is provided for general outreach projects and targeted outreach projects. These projects are disseminated annually. (69 points)

Activity 340 – Hazard Disclosure: Credit is provided for state regulations requiring disclosure of flood hazards. (48 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Ross Library. Credit is also provided for floodplain information displayed on the community's website.

(15 points)

Activity 360 – Flood Protection Assistance: Credit is provided for offering one-on- one advice regarding property protection and making site visits before providing advice. The service is publicized annually and records are maintained. (55 points)

Activity 370 – Flood Insurance Promotion: Credit is provided for promoting Flood Insurance Promotion at the Town public library and/or Town website with references to flood insurance and flood protection. The information is publicized annually, and records are maintained. (15 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 55 percent of the Special Flood Hazard Area (SFHA) as open space, and preserving open space land in a natural state. (121 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new construction and substantial improvement, foundation protection, cumulative substantial improvement, and local drainage protection. Credit is also provided for the enforcement of building codes and Building Code Effectiveness Grading Schedule (BCEGS®) Classification. (209 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using additional map data in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study reports. (151 points)

Activity 450 – Stormwater Management: The community enforces regulations for soil and erosion control, and water quality. (31 points)

Section 502 – Repetitive Loss Category: Based on the updates made to the NFIP Report of Repetitive Losses as of October 3, 2022, the Town of Ross, CA has 15 repetitive loss properties and is a Category B community for CRS purposes. All requirements for a Category B community have been met. (No credit points are applicable to this section)

Activity 510 – Floodplain Management Planning: Credit is provided for the Marin County Multi-Jurisdictional Local Hazard Mitigation Plan, adopted on September 17, 2019. A progress report must be submitted on an annual basis. (171 points)

Activity 540 – Drainage System Management: Credit is provided for a drainage system management program and conducting annual inspections of all channels and detention basins and the removal of debris as needed. (191 points)

Activity 630 – Dams: Credit is provided for a State Dam Safety Program. (37 points)

Activity 710 – County Growth Adjustment: All credit in the 400 series is multiplied by the growth rate of the county to account for growth pressures. The growth rate for Marin County, CA is 1.04.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 15
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 4
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 1
- Repetitive Loss Residential Structures: 15
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 4
- Severe Repetitive Loss Non-Residential Structures: 0

Table 24: Town of Ross NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	182 Premium = $291,576 Coverage = $53,019,600
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	206 Total Paid Losses=$9,483,218 Substantial Damage Claims=Unknown
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	219 buildings in sfha
Describe any areas of flood risk with limited NFIP policy coverage	Flood risk caused by failure of municipal storm drains outside of zone ae
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	Yes
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Permit review for compliance with floodplain ordinance. Elevation certificate review. Site visits and inspections.
What are the barriers to running an effective NFIP program in the community, if any?	Lack of trained staff
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	None, as of 2023
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	5-year recertification in 2021
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	May 1, 2015
Are the FIRMs digital or paper?	Both

Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Exceed (bfe +1' for residential buildings, hvac, electrical))
Provide an explanation of the permitting process.	Fpm reviews planning and building permit applications for compliance with floodplain ordinance.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	8
What categories and activities provide CRS points and how can the class be improved?	See table above. Increase public outreach, acquire and demolish flood prone structures.
Does the plan include CRS planning requirements	Yes Lhmp + crs activities

Table 246: Town of Ross NFIP Status
Source: FEMA, Town of Ross

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 25 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 25: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Consider establishing a hazard mitigation fee for building permits to create a hazard mitigation funding source for initiatives or grant cost-share requirements			X	X	X
Consider improvement of currently unused pedestrian rights-of-way/paths as walkways to serve as additional evacuation routes.			X	X	X
Conduct periodic tests of the alerting and warning system.		X		X	X
Develop and enforce a repair and reconstruction ordinance to ensure that damaged buildings are repaired in an appropriate and timely manner and retrofitted concurrently.			X	X	X
Develop post-disaster development and recovery ordinance to facilitate recovery.			X	X	X
Encourage the formation of a community- and neighborhood-based approach to wildfire education and action through local Fire Safe Councils and the Fire Wise Program to take advantage of grant funds currently available to offset costs of specific		X		X	X
Obtain at least three laptop computers for use outside of Police Department should the public safety building be uninhabitable due to hazards.	X				
Obtain propane heaters, stoves and lanterns for emergency use for employees.	X				
Consider expanding residential building reports to include hazard disclosure for known natural hazards in Ross: 1) Special Flood Hazards Areas (designated by FEMA), 2) Areas of Potential Flooding from dam failure inundation, 3) Very High Fire Hazards Severity Zones, 4) Wildland Fire Zones, and 5) Liquefaction and Landslide			X	X	X

Table 25: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Hazards Zones (designated under the Seismic Hazards Mapping Act).					
Improve coordination among the Marin Municipal Water District and the Town so that the Town can better plan for evacuation of areas that could be inundated if the Phoenix Lake Dam fails.		X		X	
Install grates to catch debris.	X				
Work with other Ross Valley jurisdictions to explore and adopt land use regulations to minimize additional runoff, or reduce runoff, within the Ross Valley watershed. (General Plan Program 6.C)	X				
Prepare GIS storm water map of the watershed to determine the water flow and design a culvert system appropriate to the volume and flow of peak runoff. Complete the identification of existing culverts and the need for new ones.	X				
Construct a new 1,400 ft. long, 42-48" diameter reinforced concrete pipe culvert network running under the south gutter line on lower Bolinas Avenue. The culvert would originate with inlets at the Richmond Avenue intersection and outfall to Corte Madera Creek at the Sir Francis Drake Boulevard Bridge, as identified as Measure 4 in the "Final Draft Report: Planning-Level Hydrology and Hydraulics Study for Reducing Street Inundation and Overflow by Stormwater; Bolinas Avenue in Ross and San Anselmo, California," January 25, 2011.	X				
Create bioretention areas at the St. Anselm Church overflow parking lot and the Town's adjacent right of way as identified as Measure 4b in the "Final Draft Report: Planning-Level Hydrology and Hydraulics Study for Reducing Street Inundation and Overflow by Stormwater; Bolinas Avenue in Ross and San Anselmo, California,"			X		
Secure a one-way flap gate at the existing Corte Madera Creek outfall at the Winship Avenue Bridge section as identified as Measure 2j in the "Final Draft Report: Planning- Level Hydrology and Hydraulics Study for Reducing Street Inundation and Overflow by Stormwater; Bolinas Avenue in Ross and San Anselmo, California," January 25, 2011.	X				
When properties that may provide opportunities for drainage improvements are for sale, acquire easements to install drainage improvements, such as between Bolinas Avenue and Fernhill.			X		
Create a building and elevation inventory of structures in the floodplain		X		X	X
Amend Town floodplain management regulations to adopt freeboard regulation to require finished floor to be 18" above the base flood elevation, rather than at the base flood elevation, to protect joists and vents from flood damage. Develop base flood elevation map using historical flood data.			X		**No Longer Relevant**

Table 25: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
Purchase three pair hip-wader pants, for use by on-duty personnel to reach flooded areas.	X				
Purchase one SUV for use in flooding situations where patrol cars may not be able to operate due to high water.	X				
Continue to provide link to web enabled and publicly accessible County automated system of flood gauges.		X		X	X
Establish and enforce provisions under the creek protection, grading, storm water management, and discharge control ordinances designed to control erosion and Town.		X		X	X
Require geotechnical and soil-hazard investigations be conducted and filed to prevent grading from creating unstable slopes, and that any necessary corrective actions be taken prior to development approval.		X		X	X
Prepare an accurate database of water tanks owned by Marin Municipal Water District and privately owned tanks and swimming pools that are available for fire fighting.			X	X	X
Create a mechanism to enforce provisions of the California Building and Fire Codes and other local codes that require the installation of smoke detectors and fire-extinguishing systems on existing residential buildings by making installation a condition of finalizing a permit for any work valued at over a fixed amount and/or as a condition for the transfer of property.	X				
Require fire sprinklers in all new or substantially remodeled structures.		X			
Prepare Water System (Pressure) Master Plan. Coordinate with the Marin Municipal Water District (MMWD) to evaluate water pressure and water lines to ensure adequate fire protection. Identify locations where improvements are needed and adopt requirements and funding mechanisms in coordination with MMWD to implement these improvements. (General Plan Program 5.A)			X		**No Longer Relevant**
Increase local patrolling during periods of high fire weather.		X		X	X
Monitor weather during times of high fire risk using, for example, weather stations tied into police and fire dispatch centers.		X		X	X
Participate in multi-agency efforts to mitigate fire threat, such as the Hills Emergency Forum (in the East Bay), various FireSafe Council programs, and town/city-utility task forces. Such participation increases a jurisdiction's competitiveness in obtaining grants.		X		X	X

Table 247: Status of Previous Hazard Mitigation Actions
Source: Town of Ross

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Town of Ross based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no

funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.

- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 26 lists the Current Hazard Mitigation Actions for the Town of Ross.

Table 26: Town of Ross Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
R-1	Prepare and submit an annual Hazard Mitigation plan implementation progress report to the local elected body.	All Hazards 1, 2, 3, 4, 5	Town of Ross	New	Staff time only	December 2023 High	Recommended by CRS activity and this would provide additional incentive to prepare and publish the report on an annual basis
R-2	Enhance and promote community and individual emergency preparedness. MU-15 Develop and Conduct a Household Disaster Preparedness Program. ET-2 Increase awareness of extreme temperatures risk and safety.	All Hazards/ 3, 4, 5	Town of Ross, Marin County, Fire Districts	New	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	Focus on signing residents up for Alert Marin and establish a personal evacuation kit and plan.
R-3	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential Dam related emergencies or risk.	Dam Failure 1, 2, 3, 4, 5, 6	Marin County, MMWD, & Town of Ross	New	Cost: General Funds	1-5 years/ High	Continue to encourage residents to participate in Alert Marin with an emphasis on properties at risk from dam failure.
R-4	Coordinate with MMWD to develop a Dam-Safety hazard mitigation plan for Ross, including a new section dedicated to climate change, and a discussion of atmospheric rivers and their accelerating potential threats to dam and reservoir safety.	Dam Failure 1, 2, 3, 4, 5, 6	MMWD & Town of Ross	New	Staff time only	December 2024 Medium	Identified in the Grand Jury Report on Dam Safety, June 2023
R-5	Develop and implement an erosion management plan including strict enforcement of 25' creek setback along CMC and Ross Creek for new and substantial remodel permit approval.	Debris Flow 1, 2, 4, 5	Town of Ross	New	Staff Time only	December 2023 Medium	
R-6	Develop a drought communication plan and early warning system to facilitate timely communication of relevant information to officials, decision makers, emergency managers, and the general public.	Drought 1, 2, 3, 4, 5	Town of Ross	New	Staff time only	December 2024 Low	

Table 26: Town of Ross Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
R-7	Using GIS to map hazard areas, at-risk structures, and associated hazards (e.g., liquefaction and landslides) to assess high-risk areas.	Earthquake 1, 2, 4, 5	Town of Ross	New	Cost: $15,000 + staff time. General Fund.	December 2024 Low	Need to hire a consultant to supplement staff GIS development.
R-8	Requiring that all critical facilities including emergency operations centers (EOC), police stations, and fire department facilities be located outside of flood-prone areas.	Flooding 1, 2, 4, 5	Town of Ross	New	Cost: $1M from facilities fund for new Civic Center project	2027 High	
R-9	Requiring all critical facilities to meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation.	Flooding 1, 2, 4, 5	Town of Ross	New	Cost: $0.5M from facilities fund for new Civic Center project	2027 High	Town will be reconstructing the Civic Center, Admin, and Emergency Services facilities beginning in 2027 (est.)
R-10	Install datalogger in Ross Common well to monitor areas at risk to subsidence by remaining aware of changes in groundwater levels.	Land Subsidence 1, 2, 4, 5	Town of Ross	New	Cost: $35,000. General Fund.	December 2024 Low	Will require installing wireless telemetry in at least 1 well.
R-11	Educate citizens regarding the dangers of extreme heat and the steps they can take to protect themselves when extreme temperatures occur.	Severe Weather – Extreme Heat 1, 2, 4, 5	Town of Ross	New	Staff time only	December 2024 Medium	Town of Ross
R-12	Identifying specific at-risk populations that may be exceptionally vulnerable in the event of long-term power outages.	Severe Weather – Wind 1, 2, 4, 5	Town of Ross	New	Staff time only	Annually Medium	
R-13	Inform the public about proper evacuation procedures.	Wildfire 1, 2, 4, 5	Town of Ross	New	Staff time only	Annually Medium	Work with an OES consultant to develop an SOP for evacuation decision making.
R-14	Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas.	Wildfire, Debris Flow 1, 2, 4, 5,	Town of Ross, Marin County, Fire Districts	New	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	This reduces the chance of a wildland fire igniting the structure(s) and reciprocally,

Table 26: Town of Ross Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
R-14	WF-9 Implement a Fuels Management Program						wildland ignition from a structure fire.
R-15	Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species and replacing them with native, safer vegetation. WF-9 Implement a Fuels Management Program, ET-1 Reduce Urban Heat.	Wildfire, Drought Severe Weather-Wind, Heat 1, 2, 4, 5,	Town of Ross, Marin County, Fire Districts	New	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	Reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire. Supports environmental restoration and the use of drought, heat, and wind tolerant plants.
R-16	Soft Story Program to identify and require retrofitting per adopted ordinance.	Earthquake 1, 2, 4, 5	Town of Ross	New	Cost TBD General Fund	1-5 years Medium	

Table 248: Town of Ross Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Town of Ross. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 25 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Town of Ross identified and prioritized the mitigation actions as detailed in Table 26, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this MJHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Project Implementation

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the Town of Ross will maintain this plan and will serve as a lead staff for grant project applications on Town projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Town of Ross will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Town of Ross already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

Town General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the Town. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

Town Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the Town.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

4) As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
5) Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
6) Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

Located in the scenic Ross Valley amid wooded hillsides and meandering creeks, the Town of Ross is a quiet residential community that takes pride in its historic character, small-town charm, tree-lined streets, and excellent school system. Existing residential development in Ross numbers approximately 880 homes. These are predominantly single-family residences, with some guest houses and accessory dwelling units on single-family properties, and some apartment units located above retail in the downtown commercial area. The beauty of the natural landscape helps define the character of the community, but it also presents risk of natural hazards that limit the potential for new housing, including steep topography and areas of landslide hazard in the hills and risk of flooding and liquefaction on much of the valley floor.

Approximately 18 miles north of San Francisco and centrally located in Marin County, Ross is bounded by the Town of San Anselmo to the north, the City of San Rafael to the east, and the unincorporated community of Kentfield to the south, with undeveloped open space administered by the Marin Municipal Water District in the hills to the west. Sir Francis Drake Boulevard bisects Ross in a north south direction, providing the principal access route to and from the region. Marin Transit operates bus service along Sir Francis Drake, connecting Ross with San Rafael, Larkspur, Fairfax and the wider Bay Area. The Corte Madeira Creek runs roughly parallel to Sir

Francis Drake Boulevard and Ross Creek drains from Phoenix Lake in the western hills to the Ross Valley floor.

Home to 2,453 residents, the Town of Ross is the second smallest jurisdiction in Marin County, encompassing just 1.6 square miles. The town is largely developed with single-family homes with no vacant parcels on the valley floor. At the heart of the community is the Ross Common, located just west of Sir Francis Drake Boulevard and flanked by the Ross Post Office, the Ross School, and the downtown commercial area. The Ross Civic Center, comprised of the Town Hall and Public Safety Building, is located just north of the Post Office on the west side of Sir Francis Drake, while on the opposite side street is the Marin Art and Garden Center, an 11-acre site that features gardens and historic buildings, added to the National Register of Historic Places in 2022. Other notable land uses in Ross include the Branson School, the Lagunitas Country Club, and Saint Anselms Church. Much of the rest of the community is made up of single-family neighborhoods with a dense tree canopy. The lots on the flat land of the valley floor tend to be smaller, with large lots in the hilly terrain further away from the center of the community. Overall, residential uses account for 657.3 acres, commercial uses occupy 20.3 acres, and institutional uses occupy 1.6 acres. Vacant land accounts for 145.6 acres; however, this is predominantly located in areas of steep terrain.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Ross has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Town of Ross.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Town of Ross Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Town of Ross plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Town of Ross is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Town of Ross Public Works Director will monitor and update the Town of Ross Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan

requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the Town of Ross, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Town of Ross, to evaluate the plan after each update meeting.

4.4 Plan Update

The Town of Ross Public Works Director will monitor and update the Town of Ross Annex to the Marin County OA MJHMP. During the five-year update cycle, the Town of Ross and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of

Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website and Town of Ross Link 10-19
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 10-20
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 10-21
Figure 4: Hazard Mitigation Plan Survey 10-23
Figure 5: Map of the Town of Ross within Marin County 10-25
Figure 6: Map of the Town of Ross 10-26
Figure 7: The Town of Ross Precipitation and Monthly Temperatures 10-27
Figure 8: Races in Ross 10-29
Figure 9: Town of Ross Land Use Map 10-30
Figure 10: Town of Ross Social Vulnerability Map Census Tract 1181.00 10-33
Figure 11: Town of Ross Critical Facilities 10-36
Figure 12: Town of Ross Risk Assessment – Planning Team Top Hazards 10-38
Figure 13: Hazard Risk Categorization 10-38
Figure 14: NASA Global Temperature Change CO2 Gas 10-42
Figure 15: NASA Global Temperature Change 1884 to 2022 10-42
Figure 16: NASA Global Temperature Change Sea Level 10-43
Figure 17: Annual Mean Sea Level Trends 10-45
Figure 18: Town of Ross Dam Inundation Critical Facilities and Infrastructure 10-51
Figure 19: Phoenix Lake Dam Inundation Area – Ross South 10-52
Figure 20: Phoenix Lake Dam Inundation Area – Ross North 10-52
Figure 21: Landslide Susceptibility Classes 10-55
Figure 22: Mud Flow Areas 10-56
Figure 23: Town of Ross Debris Flow Critical Facilities and Infrastructure 10-57
Figure 24: Modified Mercalli Intensity Scale 10-60
Figure 25: Mercalli Scale vs. Magnitude 10-61
Figure 26: Soil Types 10-61
Figure 27: Marin County Earthquake Impact and Fault Lines 10-63
Figure 28: Town of Ross Earthquake Critical Facilities and Infrastructure 10-64
Figure 29: Diagram of an Atmospheric River Event 10-68
Figure 30: Town of Ross Flooding Critical Facilities and Infrastructure 10-70
Figure 31: Ross Flooding - 1925 10-72
Figure 32: Dissolution Sinkhole Formation 10-73
Figure 33: Cover-Subsidence Sinkhole Formation 10-74
Figure 34: Cover-Collapse Sinkhole Formation 10-74
Figure 35: Heat Index 10-75
Figure 36: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 10-76
Figure 37: Beaufort Wind Scale 10-78
Figure 38: Enhanced Fujita Scale 10-78
Figure 39: Waterspout Formation 10-79
Figure 40: Federal, State and Local Responsibility Areas in the Marin County OA 10-81
Figure 41: Fuel Model Map for the Marin County OA 10-85
Figure 42: Town of Ross Wildfire Critical Facilities and Infrastructure 10-89
Figure 43: Trends in the Annual Number of Large Wildfires in the United States 10-90

Figure 44: Town of Ross Future Growth Areas 10-93
Figure 45: Town of Ross Hazard Zones 10-94

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 10-8
Table 2: 2023 MJHMP Planning Team Members 10-12
Table 3: Town of Ross & Marin County MJHMP Planning Meetings 10-16
Table 4: Town of Ross Estimated Jurisdictional Population 10-28
Table 5: Population Change of The Town of Ross 10-28
Table 6: Languages Spoken in Ross 10-28
Table 7: Marin County Jurisdictional Housing Stock 10-29
Table 8: NRI Hazards and Marin County MJHMP Hazards 10-31
Table 9: NRI Hazard Type Risk Index for Ross Census Tract 1181.00 10-32
Table 10: Household Income for The Town of Ross as of 2019 10-34
Table 11: Town of Ross Civilian Employed Population 16 years+ by Industry 10-35
Table 12: Town of Ross Critical Facilities 10-35
Table 13: Historic Sites in The Town of Ross 10-37
Table 14: Select Hazards Magnitude/ Severity Scale or Index 10-39
Table 15: Hazard Risk Assessment 10-47
Table 16: Hazard Risk Assessment 10-48
Table 17: Town of Ross Critical Facilities in the Flood Zones 10-71
Table 18: Town of Ross Future Growth Areas 10-93
Table 19: Town of Ross Legal and Regulatory Capabilities 10-97
Table 20: Town of Ross General Plan 10-99
Table 21: Town of Ross Administrative and Technical Capabilities 10-101
Table 22: Town of Ross Fiscal Capabilities 10-102
Table 23: Town of Ross Community Outreach 10-103
Table 24: Town of Ross NFIP Status 10-107
Table 25: Status of Previous Hazard Mitigation Actions 10-112
Table 26: Town of Ross Current Hazard Mitigation Actions 10-117

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

11. Town of San Anselmo Community Profile

EST. 1907

TOWN OF
SAN ANSELMO

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Town of San Anselmo and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required and without their commitment; this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the Town of San Anselmo more disaster resistant and sustainable.

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TABLE OF CONTENTS

11. Town of San Anselmo Community Profile 11-1
Acknowledgements 11-3
Table of Contents 11-5
Section 1.0: Introduction 11-7
1.1 Introduction 11-7
1.2 Planning Process 11-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 11-8
1.2.2 Steering Committee Planning Process 11-9
1.2.3 Coordination with stakeholders and agencies 11-9
1.2.4 Public Engagement 11-16
1.3 Overview and History 11-23
1.4 Government 11-26
1.5 Weather and Climate 11-26
1.6 Demographics 11-27
1.7 Social Vulnerability and Risk 11-31
1.8 Economy and Tax Base 11-35
1.9 Critical Facilities 11-36
1.10 Historical Properties 11-38
Section 2.0: Hazard Identification and Risk Assessment 11-39
2.1 Climate Change 11-41
2.2 Hazards 11-48
2.2.1 Dam Failure 11-49
2.2.2 Debris Flows 11-53
2.2.3 Drought 11-59
2.2.4 Earthquake 11-61
2.2.5 Flooding 11-67
2.2.6 Land Subsidence 11-76
2.2.8 Severe Weather – Extreme Heat 11-78
2.2.9 Severe Weather – High Wind & & Tornado 11-80
2.2.10 Wildfire 11-83
Section 3.0: Mitigation Strategy 11-96
3.1 Changes in Development 11-96
3.2 Capability Assessment 11-97

3.2.1 Regulatory Capabilities 11-98
3.2.2 Administrative and Technical Capabilities 11-106
3.2.3 Fiscal Capabilities 11-108
3.2.4 Community Outreach 11-109
3.2.5 Participation in the National Flood Insurance Program 11-110
3.3 Mitigation Goals 11-114
3.4 Status of Previous Mitigation Actions 11-116
3.5 Hazard Mitigation Actions 11-119
3.6 Progress in Local Mitigation Efforts 11-124
3.7 Project Implementation 11-124
3.8 Future Development Trends 11-125
Section 4.0: Plan Review, Evaluation, and Implementation 11-127
4.1 Plan Adoption 11-127
4.2 Plan Monitoring 11-127
4.3 Plan Evaluation 11-128
4.4 Plan Update 11-128
Figures and Tables 11-130
Acronyms/Abbreviations 11-132

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Town of San Anselmo Community Profile has been prepared in conjunction with the Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Town of San Anselmo.

1.2 PLANNING PROCESS

The majority of the Marin County Operational Area (OA) is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population, both incorporated and unincorporated, is concentrated in the Eastern portion of the county. There are a total of 11 incorporated jurisdictions within Marin County. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA MJHMP Steering Committee, the Town of San Anselmo involved additional internal planning team to support the broader planning process. The Town of San Anselmo jurisdictional representatives for the

coordinated Marin County OA MJHMPs Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Sean Condry, Director of Public Works
Telephone: (415) 258-4676
E-mail address:
scondry@townofsananselmo.org

Alternate Point of Contact
Erica Freeman, Building Official
Telephone: (415) 523-4984
E-mail address:
efreeman@townofsananselmo.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
San Anselmo	Sean Condry	Public Works & Building Director	415-258-4676	scondry@townofsananselmo.org
San Anselmo	Erica Freeman	Building Official	415-523-4984	efreeman@townofsananselmo.org
San Anselmo	Scott Schneider	Asst. PW Director	415-258-4653	sschneider@townofsananselmo.org
Central Marin Fire District	Matt Cobb	Battalion Chief/Fire	415-927-5077	ecolman@centralmarinfire.org
Central Marin Fire District	Ezra Colman	Battalion Chief/Fire	415-927-5077	rmartin@centralmarinfire.org

Table 249: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the Town of San Anselmo. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.

- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Town of San Anselmo Steering

Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Town of San Anselmo communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Town of San Anselmo Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Town of San Anselmo and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	Public Works Director
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chief
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES, Sr. Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II/ Environmental & Occupational Emergency Preparedness Team
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 250: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Mill Valley's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard

vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Town of San Anselmo & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee,	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview

Table 3: Town of San Anselmo & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
		Planning Team		• Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process

Table 3: Town of San Anselmo & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects

Table 3: Town of San Anselmo & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 251: Town of San Anselmo & Marin County OA MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The

Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to

ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 507: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County OA MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in to 28 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a

Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provided the URL link to the Survey Monkey website to complete the survey.

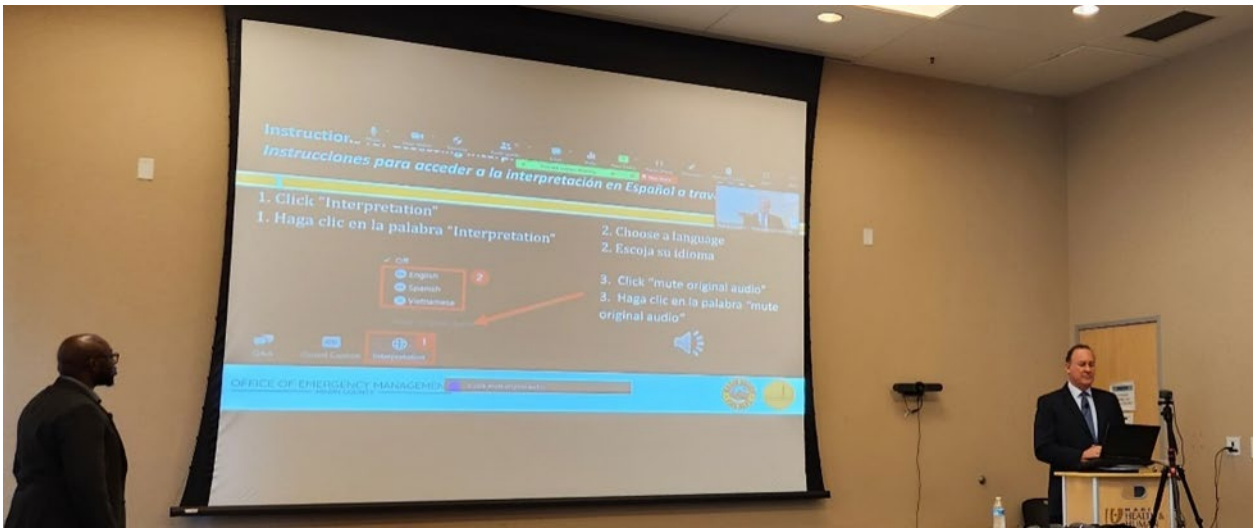


Figure 508: Marin County OA MJHMP Public Town Hall Meeting

SOCIAL MEDIA

The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

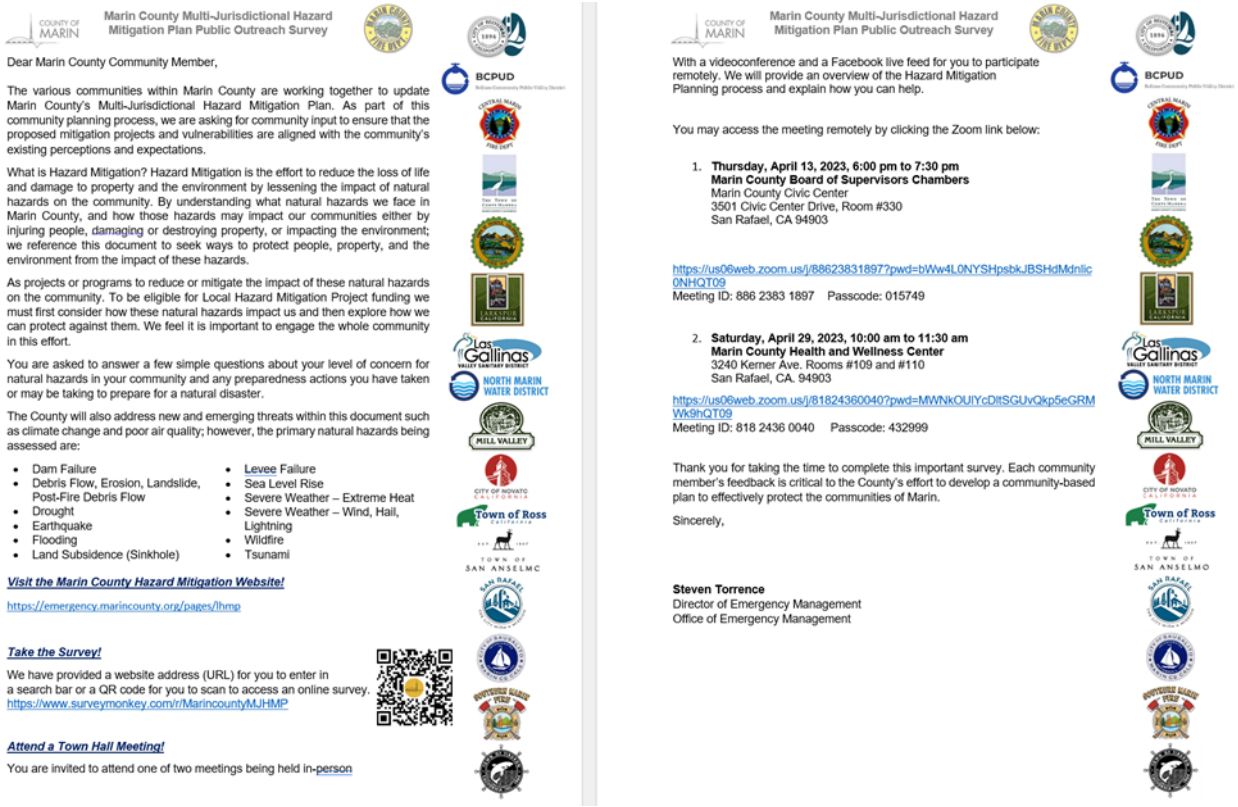
The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.

- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey.
https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 509: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input were advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

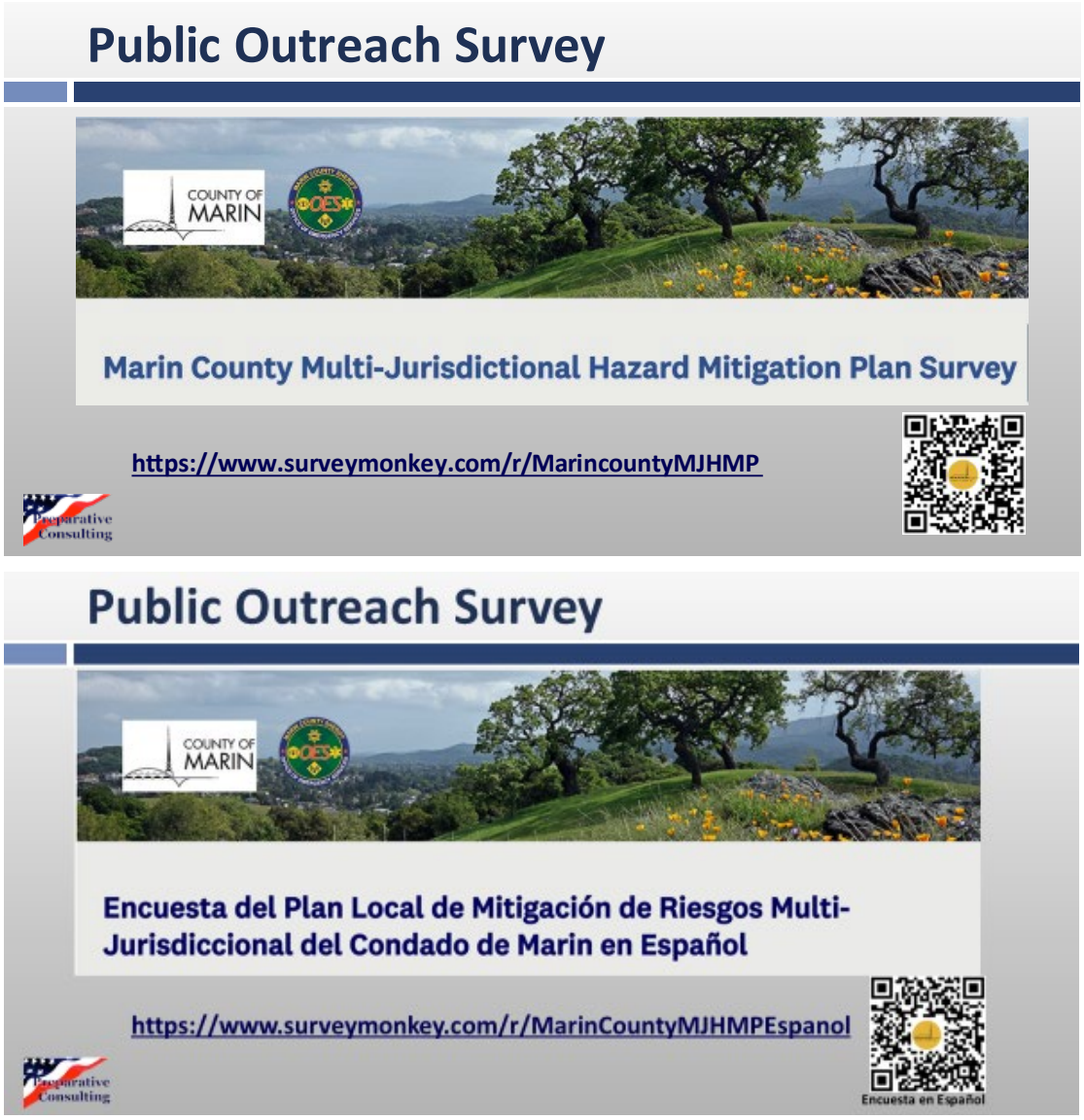


Figure 510: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The Town of San Anselmo had an additional 14-day comment period for the Town of San Anselmo Community Profile where their profile was posted on the Town website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of San

Anselmo distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

For thousands of years prior to 1800, the Coast Miwok Indians lived and were sustained by the land that is now called Ross Valley. The Coast Miwok revered the land, plants and animals of the Ross Valley through tribal cultural beliefs and practices. European diseases eventually decimated the Indian population. The settlement in 1817 of Mission San Rafael, with its vast land holding, also resulted in further incursions into areas occupied by the Coast Miwok Indians.

After the Mexican Revolution of 1821, the “land grant” system of parceling out land gave rise to what we now know as the County of Marin. San Anselmo was originally part of an 8,877-acre Mexican land grant to Juan B.R. Cooper in 1840 known as Ranch Punta de Quentin Canada de San Anselmo. The Town of San Anselmo itself was named in honor of James San Anselmo, who purchased the land in 1857 for $50,000. San Anselmo built his home on Redwood Drive and moved there with his wife and three children. When James San Anselmo died in 1862 his wife, Annie San Anselmo, was forced to sell a portion of James San Anselmo’ larger land holdings to pay each of their daughters $10,000. The 297 acres she had remaining make up part of the Town of San Anselmo today.

The Town of San Anselmo was incorporated as a town in 1907. The Town of San Anselmo had an estimated population of 12,830 in 2020, with 5,518 housing units in the Town. The Town has a total area of 2.677 square miles. The median income for a household in the Town is $153,381 and the per capita income for the Town is $87,951. Approximately 0 percent of families and 3.9 percent of the population is below the poverty line (2020 data, U.S. Census Bureau).

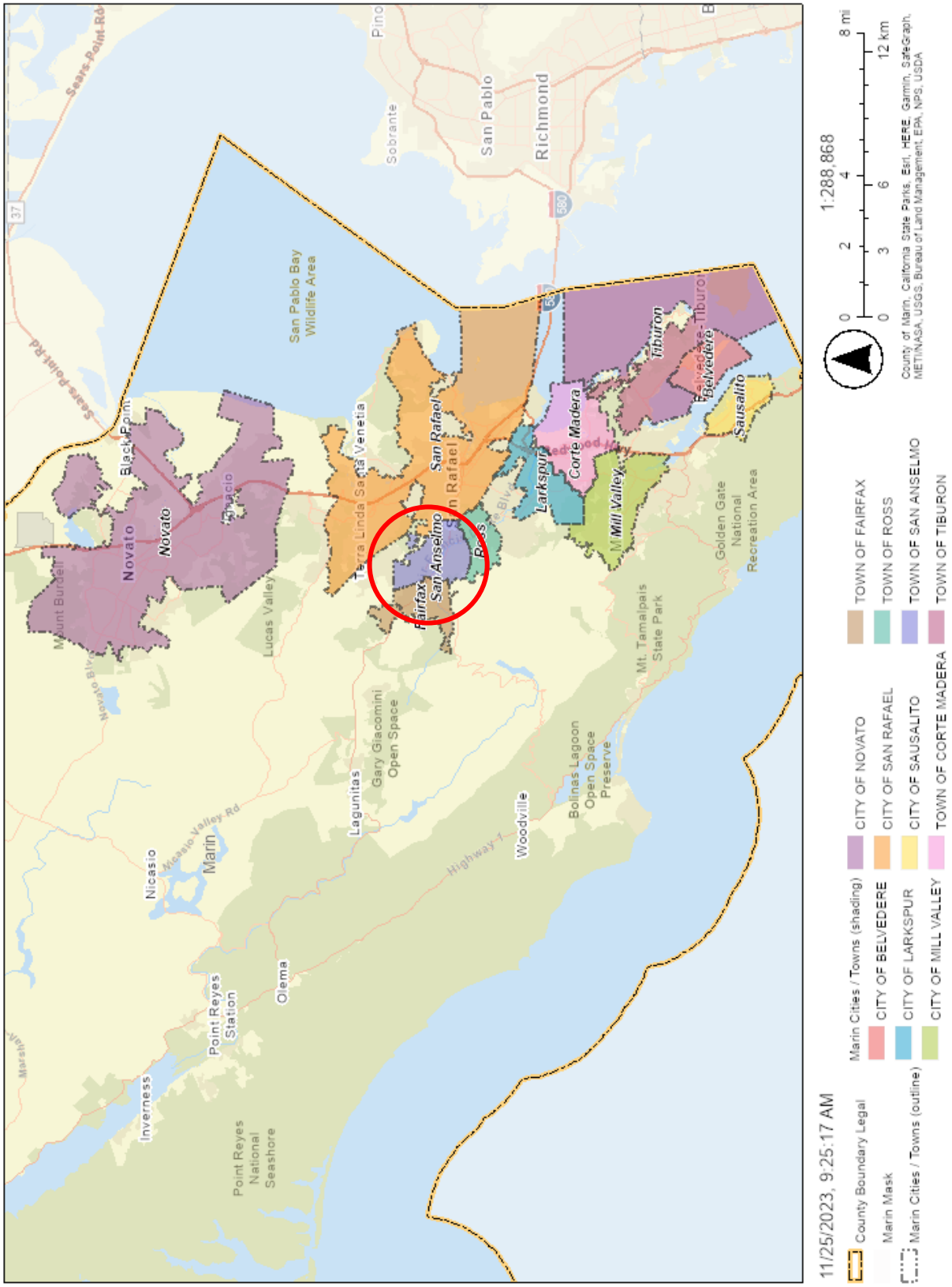


Figure 511: Map of the Town of San Anselmo in Marin County
Source: Marin County OEM

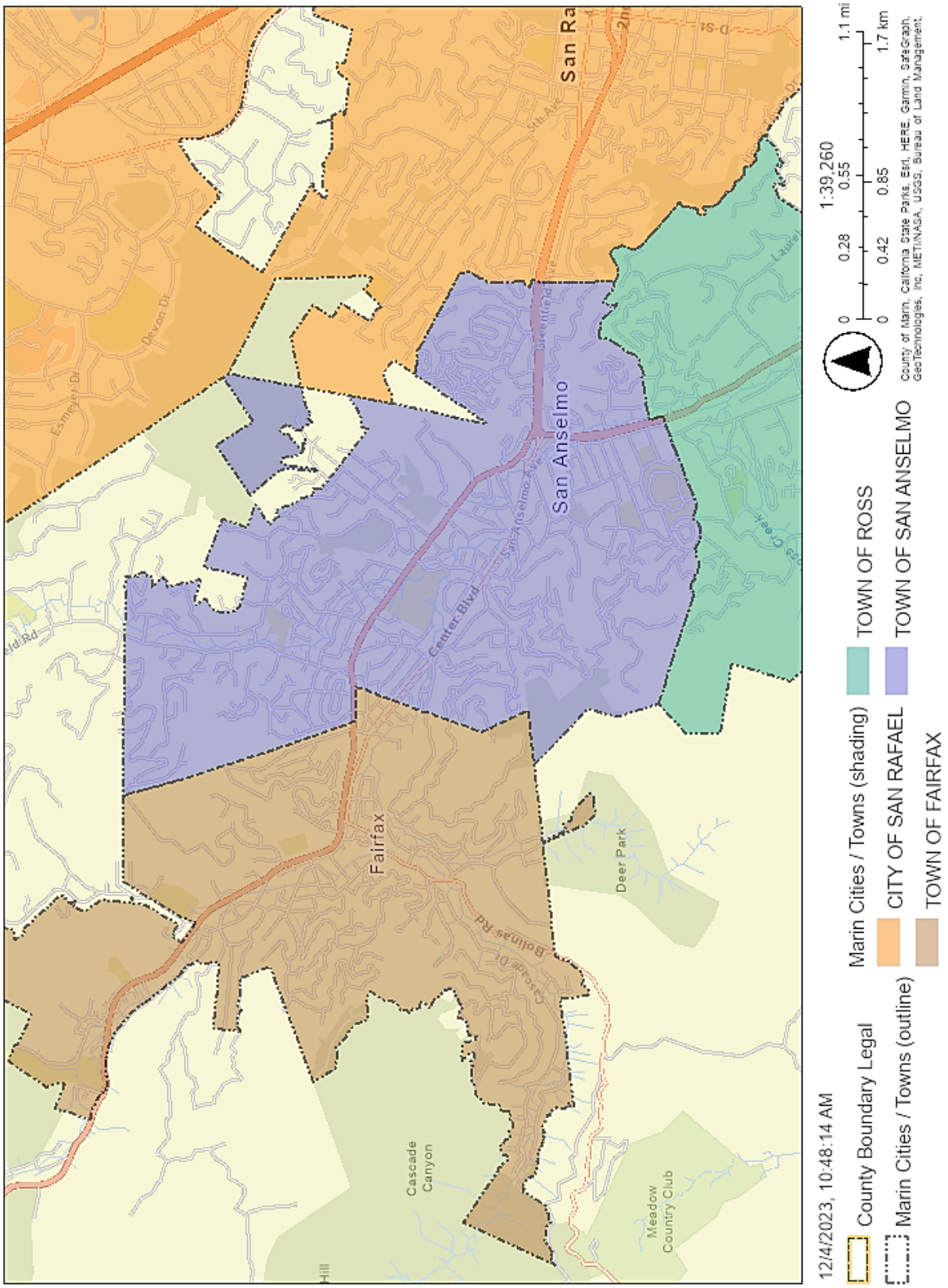


Figure 512: Map of the Town of San Anselmo
Source: Marin County OEM

1.4 GOVERNMENT

The Town of San Anselmo was incorporated as a town in 1907 and is governed by a five-person Town Council. Each year the Town Council elects one of its members to serve as Mayor, the executive head of the Town; and appoints a Town Manager, the administrative head of the Town. The Town consists of 9 departments: the Administration and Finance, Building, Fire Department, Human Resources, Library, Planning, Police, Public Works, and Recreation.

The Town Council assumes responsibility for the adoption of this plan; and the Town Manager will oversee its implementation.

The Ross Valley Fire Department provides Fire services to the City of San Anselmo. In 2012, the Town of San Anselmo voted to consolidate with Ross Valley Fire Department, joining Ross, Fairfax, and Sleepy Hollow to provide fire protection to Town of San Anselmo. In 2012, Ross Valley Fire Department's Board of Directors voted to consolidate fire services with the Town of Ross, incorporating the Town of Ross Fire Station 18, and the 9 firefighters employed there, into the Ross Valley Fire Department.

The Central Marin Police Authority is a full-service Police agency for the communities of Corte Madera, Larkspur, San Anselmo and portions of Greenbrae comprising of approximately 35,000 residents. The communities consolidated police services on January 1, 2013, into the Central Marin Police Authority formed under a Joint Powers Agreement (JPA).

1.5 WEATHER AND CLIMATE

The Town of San Anselmo lies 46 feet above sea level. In San Anselmo, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43°F to 71°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 18 inches. The month with the highest relative humidity is February (80%). The month with the lowest relative humidity is June (70%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.3 °C (48.7) °F	9.8 °C (49.7) °F	10.9 °C (51.6) °F	11.8 °C (53.2) °F	13.6 °C (56.5) °F	15.6 °C (60.2) °F	16 °C (60.8) °F	16.4 °C (61.4) °F	16.4 °C (61.5) °F	15 °C (58.9) °F	11.9 °C (53.5) °F	9.5 °C (49) °F
Min. Temperature °C (°F)	6.3 °C (43.4) °F	6.9 °C (44.4) °F	7.8 °C (46.1) °F	8.5 °C (47.4) °F	10.1 °C (50.2) °F	11.7 °C (53) °F	12.3 °C (54.2) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.5 °C (52.7) °F	8.9 °C (48) °F	6.8 °C (44.2) °F
Max. Temperature °C (°F)	13.3 °C (56) °F	13.9 °C (57) °F	15.1 °C (59.2) °F	16.2 °C (61.2) °F	18.3 °C (64.9) °F	20.9 °C (69.6) °F	21.2 °C (70.2) °F	21.5 °C (70.8) °F	21.9 °C (71.4) °F	20 °C (68.1) °F	16.2 °C (61.2) °F	13.1 °C (55.7) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	78%	72%	71%	70%	75%	76%	73%	72%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 513: The Town of San Anselmo Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the Town of San Anselmo since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The Town of San Anselmo had an estimated population of 12,853 in the 2018 plan. 2020 U.S. Census Survey estimated the Town's population at 12,830. However, revised estimates for 2022 estimate the population to decrease to 12,645 population.

Table 4: Town of San Anselmo Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
Town of San Anselmo	12,645	12,830	12,853	-1.62%

Table 252: Town of San Anselmo Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The Town of San Anselmo is 12,830 as of 2020. Between 2018-2022, the City's growth rate increased at an average annual rate of -1.62%, lower than the historic twenty-year average growth rate of 3.2%. Table 5 shows the population growth comparison of the State of California, The Marin County OA, and the Town of San Anselmo between 2010 - 2020.

Table 5: Population Change of The Town of San Anselmo				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
San Anselmo, town	12,853	12,830	23	-1.62%

Table 253: Population Change of The Town of San Anselmo
Source: Town of San Anselmo Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the Town of San Anselmo.

Table 6: Languages Spoken in San Anselmo	
Primary Language Spoken	% of Population
English only	94.2%
Spanish	1.0%
Other Indo-European languages	2.5%
Asian and Pacific Islander languages	2.0%
Other languages	0.3%

Table 254: Languages Spoken in San Anselmo
Source: US Census Bureau (2020)

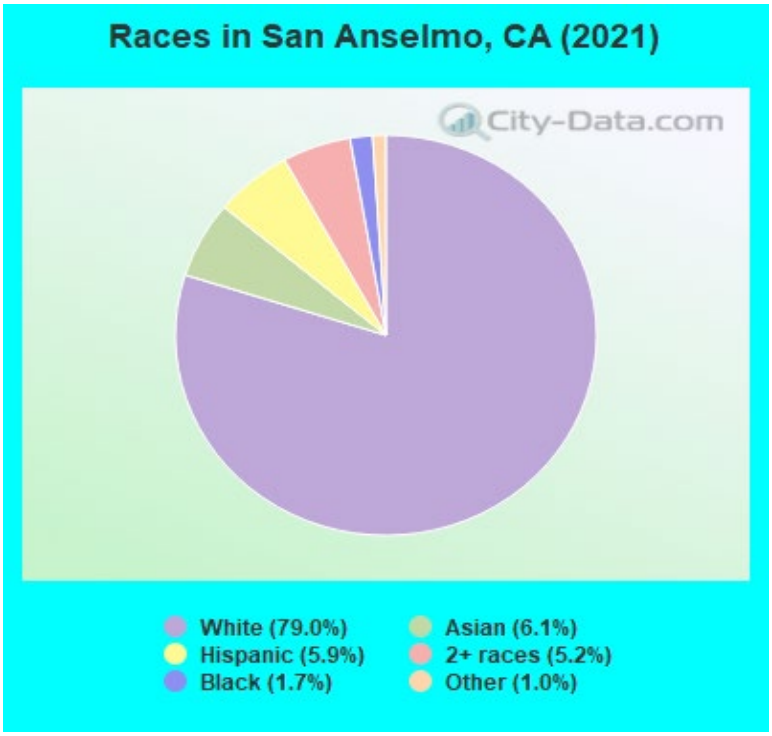
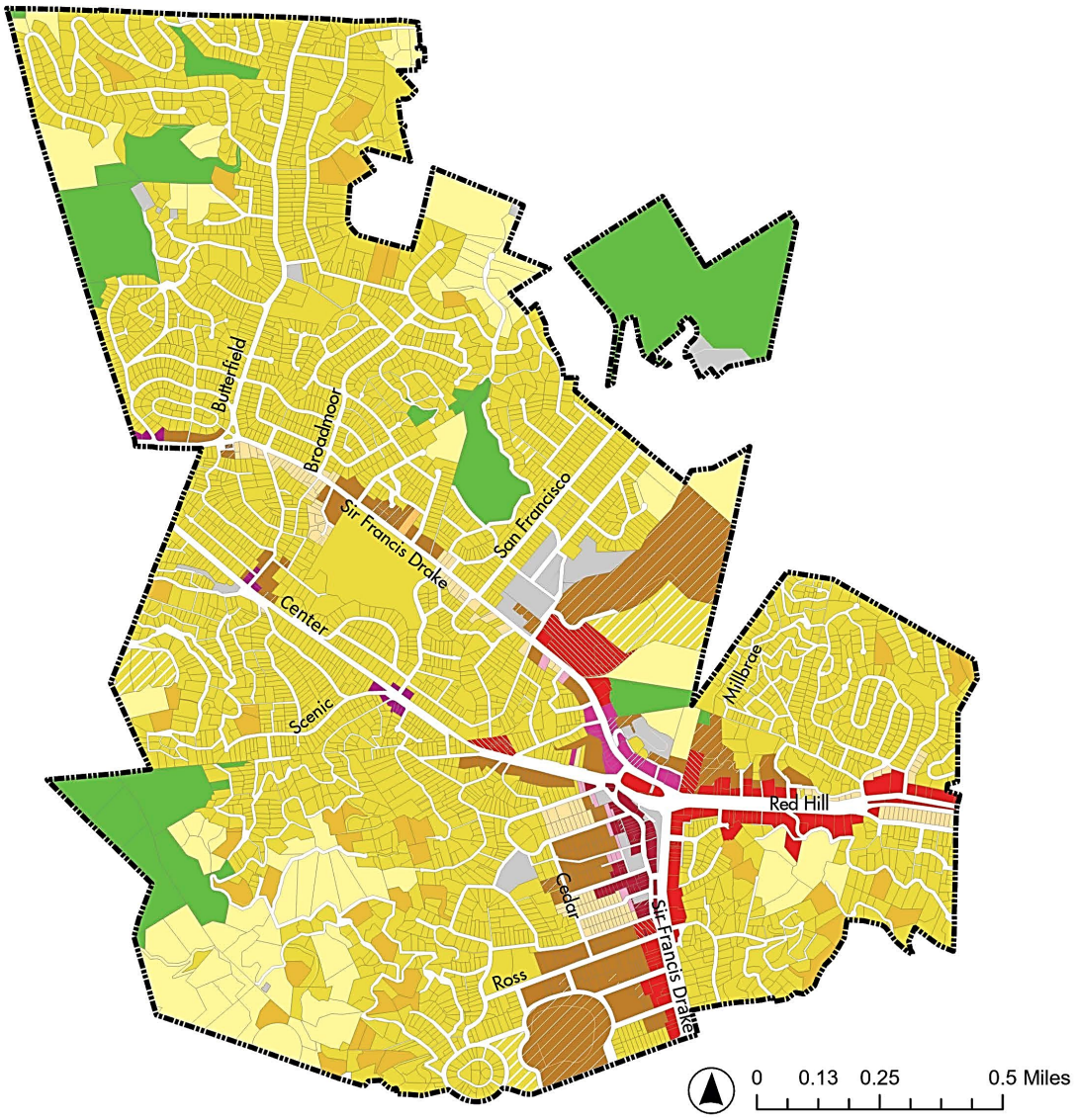


Figure 514: Races in San Anselmo
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
Town of San Anselmo							
2022	Number	5,539	4,177	266	376	683	37
	Percent	100.00%	75.41%	6.37%	141.35%	181.65%	5.42%
2018	Number	5,563	4,211	269	356	690	37
	Percent	100.00%	75.70%	6.39%	132.34%	193.82%	5.36%

Table 255: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

Proposed Zoning
Town of San Anselmo



Zoning Districts

- R-1 - Single Family Residential
- R-1/SPD - Single Family Residential Specific Planned Development
- R-1-C - Single Family Residential - Conservation
- R-1-H - Very Low Density Residential
- R-2 - Medium Density Residential
- R-3 - High Desnity Residential
- R-3/SPD - High Density Residential Specific Planned Development
- PPD/R-1 - Preliminary Planned Development
- PPD/R-3 - Preliminary Planned Development
- C-1 - Neighborhood Commercial
- C-2 - Downtown Commercial
- C-2/SPD - Downtown Commercial Specific Planned Development
- C-3 - Commercial District
- C-3/SPD - Commercial District Specific Planned Development
- C-L - Limited Commercial
- C-L/SPD - Limited Commercial Specific Planned Development
- OS - Open Space
- P - Professional
- PF - Public Facilities

ATTACHMENT 11
PAGE 1

Figure 515: Town of San Anselmo Zoning Map
Source: Town of San Anselmo Housing Element

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards

NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 256: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

Social groups in Census tract 06041111700 have a Very Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

Figure 10 illustrates the Social Vulnerability Map for San Anselmo Census Tract 1117.00. Social groups in Census tract 06041117000 have a Relatively Low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.

Table 9 illustrates the NRI Hazard Type Risk Index for San Anselmo Census Tract 1117.00.

Table 9: NRI Hazard Type Risk Index for San Anselmo Census Tract 1117.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,968,575	Relatively Low	Very High	0.96	$1,883,575	95.8
Riverine Flooding	$852,461	Relatively Low	Very High	0.96	$815,653	98
Landslide	$36,673	Relatively Low	Very High	0.96	$35,089	99
Wildfire	$21,409	Relatively Low	Very High	0.96	$20,484	87.2
Heat Wave	$7,364	Relatively Low	Very High	0.96	$7,046	45.4
Tornado	$4,457	Relatively Low	Very High	0.96	$4,265	10
Strong Wind	$259	Relatively Low	Very High	0.96	$248	8.7
Drought	$0	Relatively Low	Very High	0.96	$0	0

Table 257: NRI Hazard Type Risk Index for San Anselmo Census Tract 1117.00
Source: FEMA National Risk Index 2023

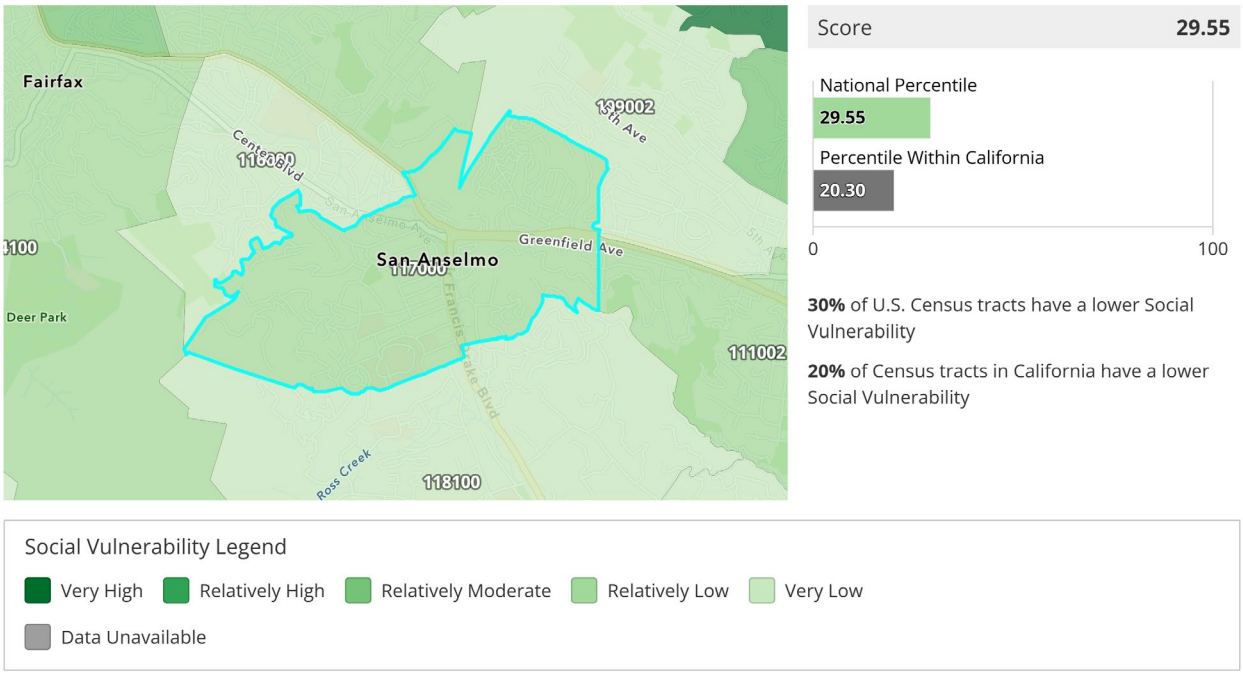


Figure 516: Town of San Anselmo Social Vulnerability Map Census Tract 1181.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. Across three local elementary schools in West Marin (2022-2023 school year), students eligible for free and reduced lunch program represent between 41 percent and 62 percent of the student population, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers who may not have taken part in a census survey, which informs the Social Vulnerability Index. In the last three months of 2022, bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since the-COVID pandemic (increase 0.1%; Marin Transit, 2022), which indicates that West Marin residents may be more reliant on public transportation than other Marin residents. However, this data continues to adjust based upon the increase in alternate methods of mass transportation. Therefore, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

The Town of San Anselmo has a “Relatively Low” Social Vulnerability rating. The median income for a household in the Town is $153,381 and the per capita income for the Town is $87,951. Approximately 0 percent of families and 3.9 percent of the total population is below the poverty line (2021 data, U.S. Census Bureau).

While the Town of San Anselmo has a “Relatively Low” Social Vulnerability rating and the median household income is high, approximately 17 percent of San Anselmo’s population, 2,145 people, are 65 years in age or older. Approximately 26 percent of the Town’s households

have a senior head-of-household, and the vast majority (74 percent) of these householders own their homes. Approximately 43 percent of San Anselmo's senior households qualify as lower income households (less than 80 percent of the Area Median Income), and 299 seniors have incomes which fall below the level of poverty (less than 30 percent of Area Median Income). Needs for seniors with disabilities include smaller and more efficient housing, barrier free and accessible housing, and housing with health care and/or personal care for daily living. Such specific housing needs can drive up the cost of suitable housing, resulting in a higher housing cost burden for seniors.

Seniors often express concern for their ability to pay for necessities. The 2012-2016 Marin County Aging Area Plan found that 17 percent of senior homeowners in the Marin County OA had trouble paying for home repairs over the past year. Affording home repairs is the most reported housing issue for seniors who had been in their homes for more than 30 years. While most seniors prefer to stay in their homes, some may find that property maintenance costs make it difficult to age in place. In San Anselmo, approximately 545 lower-income senior households own their own home and 234 lower-income senior households rent. In 2017, approximately 28 percent of senior households were housing cost burdened.

Disabilities and limited mobility can create additional special housing needs for seniors. Approximately 17 percent of senior residents in San Anselmo have some type of disability, which may limit their access to housing. An estimated 94 seniors have independent living difficulty, 55 have a self-care difficulty, and 165 have ambulatory difficulty. Housing with enhanced accessibility features can support independent living for seniors as they continue to age.

1.8 ECONOMY AND TAX BASE

The Town of San Anselmo is one of the Marin County OA's primary retail, service, and commercial center. Table 10 shows income by household in The Town of San Anselmo as of 2019.

Table 10: Household Income for the Town of San Anselmo as of 2019		
Household Income	Number	Percent
Total Households	4,995	-
Less than $10,000	125	2.5
$10,000 to $14,999	75	1.5
$15,000 to $24,999	185	3.7
$25,000 to $34,999	120	2.4
$35,000 to $49,999	235	4.7
$50,000 to $74,999	350	7.0
$75,000 to $99,999	509	10.2
$100,000 to $149,999	774	15.5
$150,000 to $199,999	789	15.8
$200,000 or more	1,838	36.8
Median household income (dollars)	$153,381	
Mean household income (dollars)	$217,811	

Table 258: Household Income for The Town of San Anselmo as of 2021
Source: US Census Bureau American Community Survey 2021 Estimates

Table 11 shows the percentage of people in The Town of San Anselmo over the age of 16 employed by industry.

Table 11: Town of San Anselmo Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	6,922	-
Agriculture, forestry, fishing and hunting, and mining	29	0.42%
Construction	309	4.46%
Manufacturing	342	4.94%
Wholesale trade	180	2.60%
Retail trade	575	8.31%
Transportation and warehousing, and utilities	222	3.21%
Information	287	4.15%
Finance and insurance, and real estate and rental and leasing	666	9.62%
Professional, scientific, and management, and administrative and waste management services	1623	23.45%
Educational services, and health care and social assistance	1604	23.17%

Arts, entertainment, and recreation, and accommodation and food services	568	8.21%
Other services, except public administration	290	4.19%
Public administration	227	3.28%

Table 259: Town of San Anselmo Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Town of San Anselmo to fulfill the requirements of its mission during an emergency:

Table 12: Town of San Anselmo Critical Facilities

	Category	Name	Address	Fire Severity Zone	Flood Zone
54.	Fire	Fire: Ross Valley Fire Department (RVY) / Station 19	777 San Anselmo Avenue San Anselmo, CA 94960	N	AE
55.	Fire	Fire: Ross Valley Fire Department (RVY) / Station 20	150 Butterfield Road San Anselmo, CA 94960	High	AE
56.	Law	Central Marin Police	525 San Anselmo Avenue San Anselmo, CA 94960	N	AE
57.	Local Government	San Anselmo Town Hall	525 San Anselmo Avenue San Anselmo, CA 94960	N	AE
58.	Community Center	Isabel Cook Community Center (ICC)	1000 Sir Francis Drake Blvd. San Anselmo, CA 94960	N	X
59.	Library	San Anselmo Public Library	110 Tunstead Ave. San Anselmo, CA 94960	N	AE
60.	School	Brookside Elementary School	116 Butterfield Road San Anselmo, CA 94960	High	AE/X
61.	School	Wade Thomas Elementary School	150 Ross Avenue San Anselmo, CA 94960	N	X
62.	School	St. Anselm School	40 Belle Avenue San Anselmo, CA 94960	N	AE
63.	School	Archie Williams High School	1327 Sir Francis Drake San Anselmo, CA 94960	N	AE/X
64.	School	Parkside Preschool and Daycare	1000 Sir Francis Drake Blvd. San Anselmo, CA 94960	N	X
65.	School	University of Redlands	105 Seminary Road San Anselmo, CA 94960	N	AE/X

Table 260: Town of San Anselmo Critical Facilities
Source: Town of San Anselmo

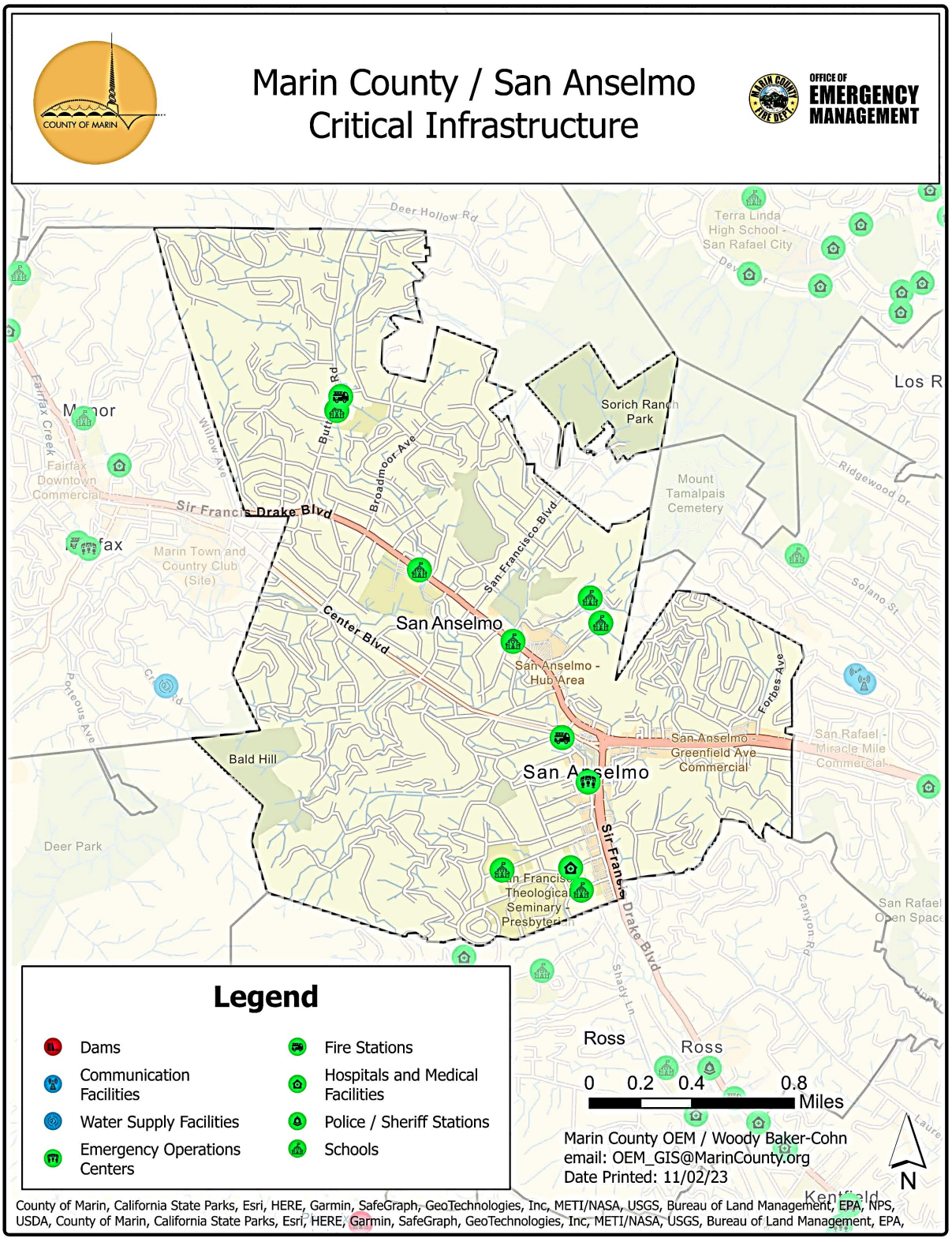


Figure 517: Town of San Anselmo Critical Facilities and Infrastructure
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The Town of San Anselmo has no registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- Town of San Anselmo Chamber of Commerce.
- Town of San Anselmo website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA).

Table 13: Historic Sites in San Anselmo

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
None					

Table 261: Historic Sites in The Town of San Anselmo
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Town of San Anselmo identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 12 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

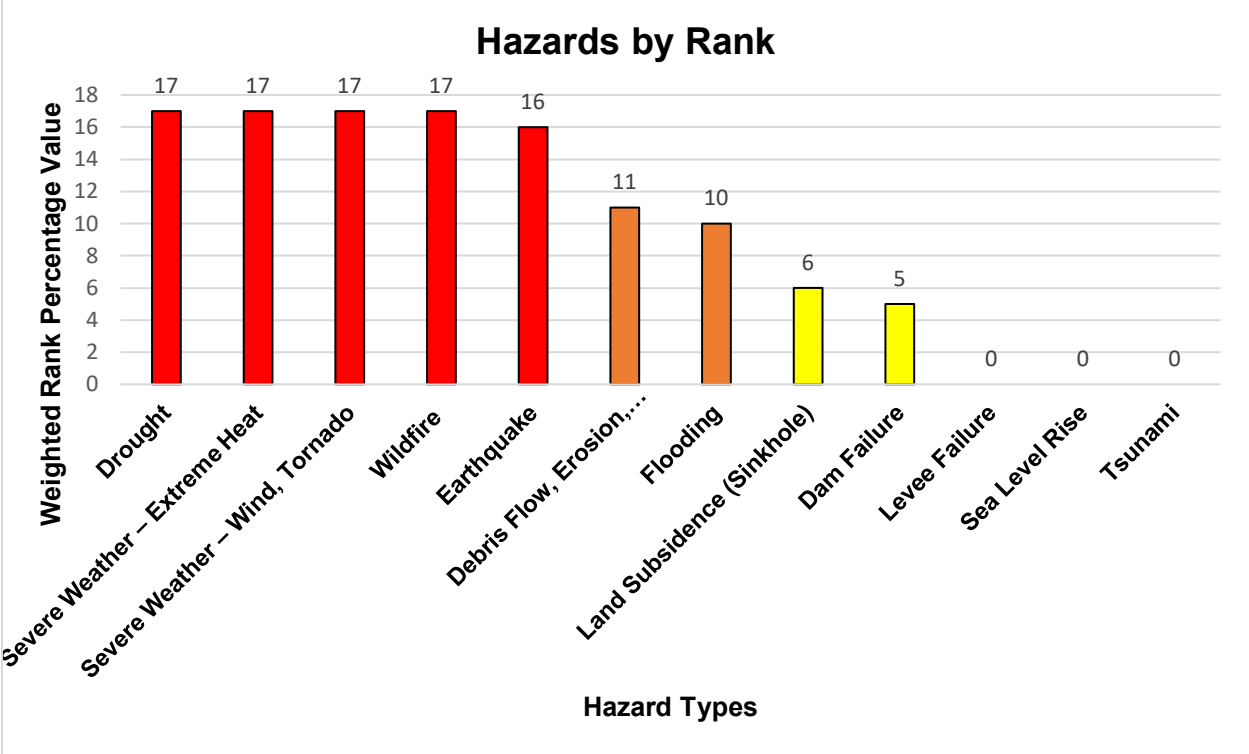


Figure 518: Town of San Anselmo Risk Assessment – Planning Team Top Hazards

Figure 13: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 519: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 262: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 Climate Change

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

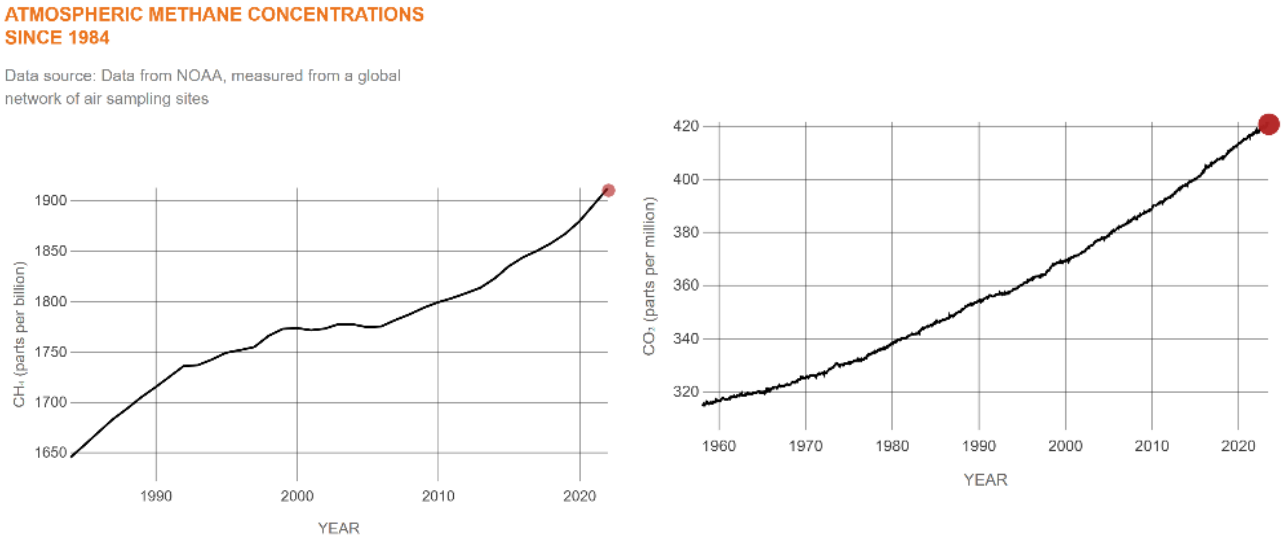


Figure 520: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

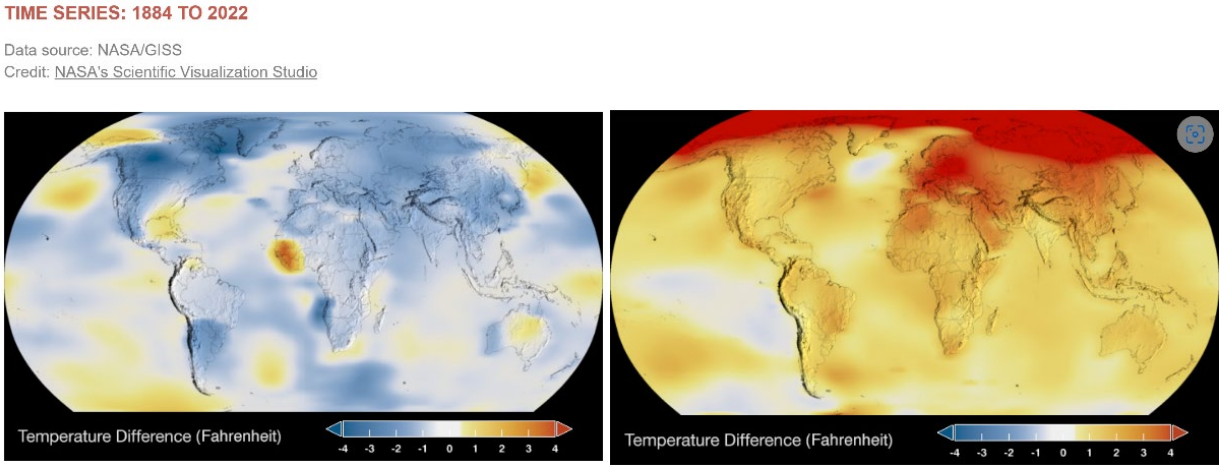


Figure 521: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

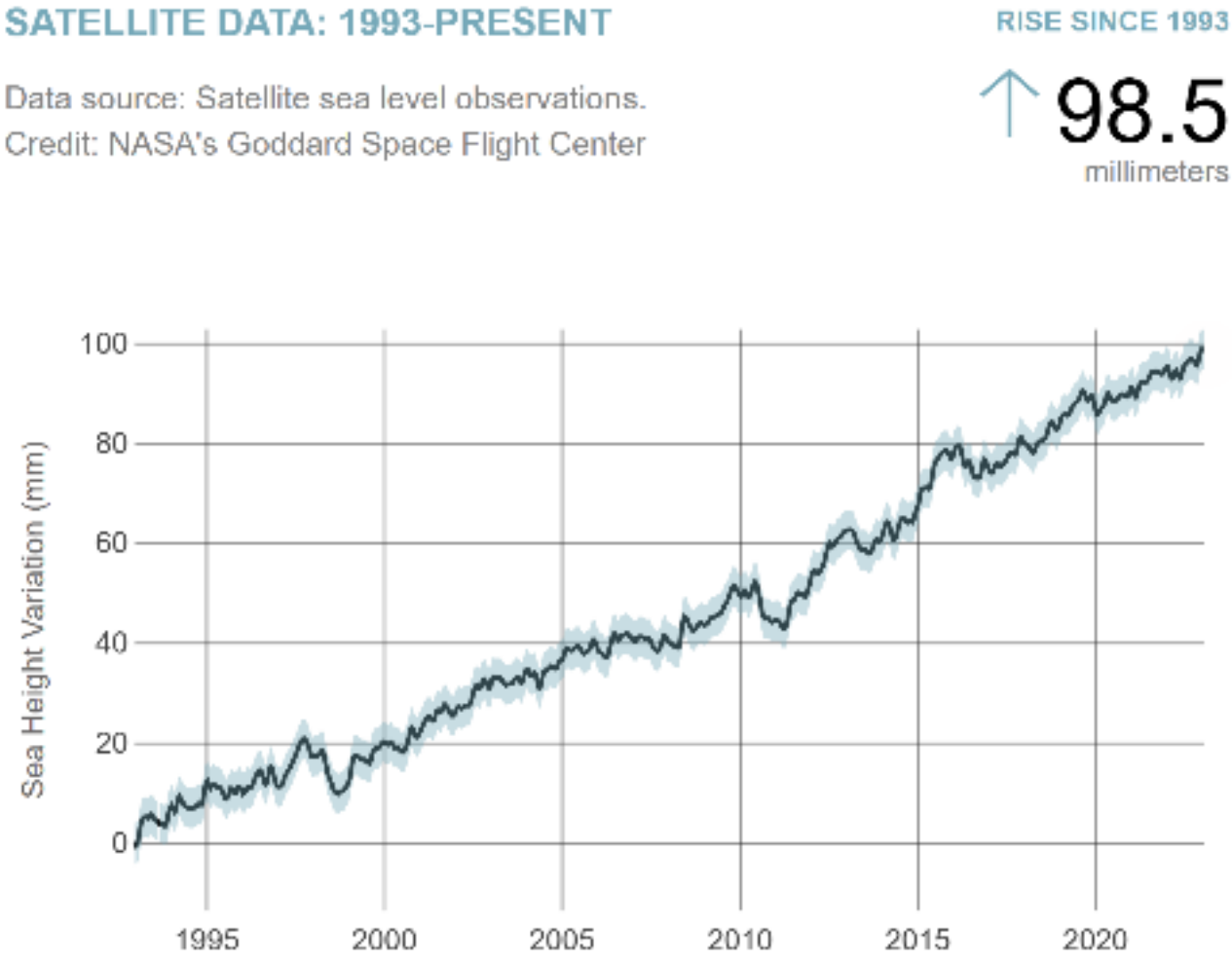


Figure 522: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.
-

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, increased intensity of rain fall may occur and may become more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals,

workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.

- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

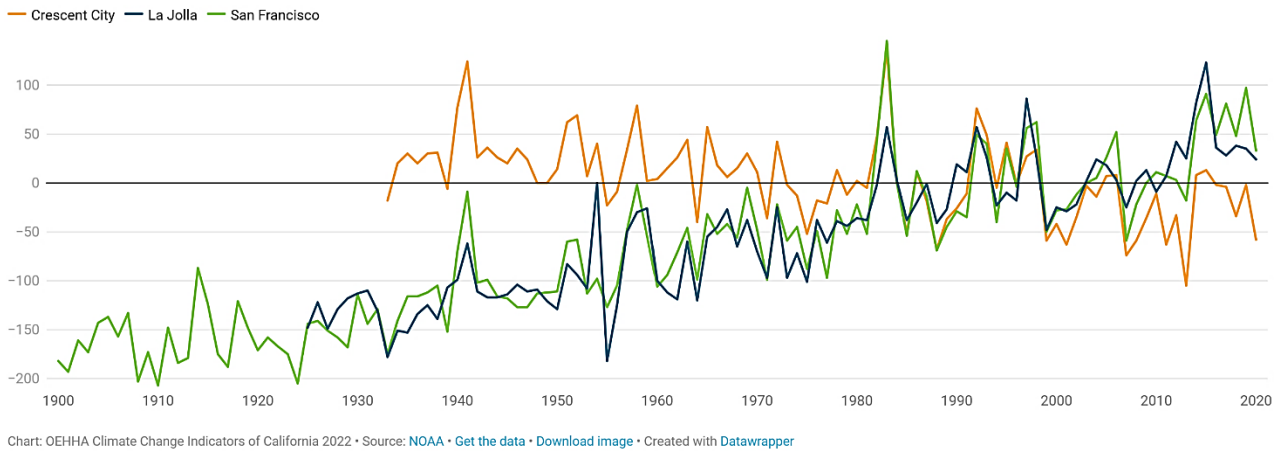


Figure 523: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the Town of San Anselmo as per the planning team.

Table 15: Town of San Anselmo Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Weak	Low	Low	**5.00**
Debris Flow	Likely	Limited	Moderate	Medium	Medium	**11.00**
Drought	Likely	Extensive	Extreme	High	High	**17.00**
Earthquake	Occasional	Extensive	Extreme	High	High	**16.00**
Flooding	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Land Subsidence	Unlikely	Negligible	Moderate	Low	Low	**6.00**
Severe Weather – Extreme Heat	Likely	Extensive	Extreme	High	High	**17.00**
Severe Weather – High Wind/Tornado	Likely	Extensive	Extreme	High	High	**17.00**
Wildfire	Likely	Extensive	Extreme	High	High	**17.00**

Table 263: Town of San Anselmo Hazard Risk Assessment
Source: Town of San Anselmo

Omitted Hazards

The Town of San Anselmo does not have risk exposure to Levee Failure, Sea Level Rise, or Tsunamis.

Table 16: Marin County OA Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow, Erosion, Landslide, Post-Fire Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence (Sinkhole)	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 264: Marin County OA Hazard Risk Assessment
Source: County of Marin

2.2.1 DAM FAILURE

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failure is the uncontrolled release of impounded water from behind a dam. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, and terrorism can all cause a dam to fail. Dam failure causes downstream flooding that can affect life and property. Dam failures can result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows

- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously, where the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach, where a flood wave will build gradually to a peak and then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. The Cal DWR DSOD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in three categories that identify the potential hazard to life and property:

- **High hazard** indicates that a failure would most probably result in the loss of life
- **Significant hazard** indicates that a failure could result in appreciable property damage
- **Low hazard** indicates that failure would result in only minimal property damage and loss of life is unlikely

Since 1929, the state has supervised all non-federal dams in California to prevent failure for the purpose of safeguarding life and protecting property. Supervision is carried out through the state's Dam Safety Program under the jurisdiction of DWR. The legislation requiring state supervision was passed in response to the St. Francis Dam failure and concerns about the potential risks to the general populace from a number of water storage dams. The law requires:

- Examination and approval or repair of dams completed prior to August 14, 1929, the effective date of the statute.

- Approval of plans and specifications for and supervision of construction of new dams and the enlargement, alteration, repair, or removal of existing dams.
- Supervision of maintenance and operation of all dams under the state's jurisdiction.

The 1963 failure of the Baldwin Hills Dam in Southern California led the Legislature to amend the California Water Code to include within state jurisdiction both new and existing off-stream storage facilities.

Dams and reservoirs subject to state supervision are defined in California Water Code §6002 through §6004, with exemptions defined in §6004 and §6025. In administering the Dam Safety Program, DWR must comply with the provisions of the California Environmental Quality Act (CEQA). As such, all formal dam approval and revocation actions must be preceded by appropriate environmental documentation.

In 1972, Congress moved to reduce the hazards from the 28,000 non-federal dams in the country by passing Public Law 92-367, the National Dam Inspection Act. With the passage of this law, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The action was spurred by two disastrous earthen dam failures during the year, in West Virginia and South Dakota, that caused a total of 300 deaths.

The Water Resources Development Act of 1986 (P.L 99-662) authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). The Water Resources Development Act of 1996 (P.L. 104-303), Section 215, re-authorized periodic updates of the NID by USACE.

While there are no dams located within San Anselmo, the Town could be impacted by a failure of the Phoenix Lake Dam in the unincorporated County of Marin. The dam has storage of 612-acre feet of water that could be released down Ross Creek in the event of a full sunny-day dam failure. Water could extend out 500 feet on both sides of Ross Creek for about five miles at a depth up to thirty feet in some areas before it dumps into Corte Madera Creek and San Anselmo Creek. Flooding could continue north along San Anselmo Creek into San Anselmo, extending along Sir Francis Drake Boulevard to the intersection of Red Hill Avenue. Flooding could extend out 1,000 feet along the west side of the creek in the southern part of the Town and 200 feet along both sides of the creek further north, flooding dozens of homes, most of the main commercial area, and part of the San Anselmo School, the San Anselmo Town Hall and the San Anselmo Emergency Operations Center in two to ten feet of water approximately 10-20 minutes after the dam fails.

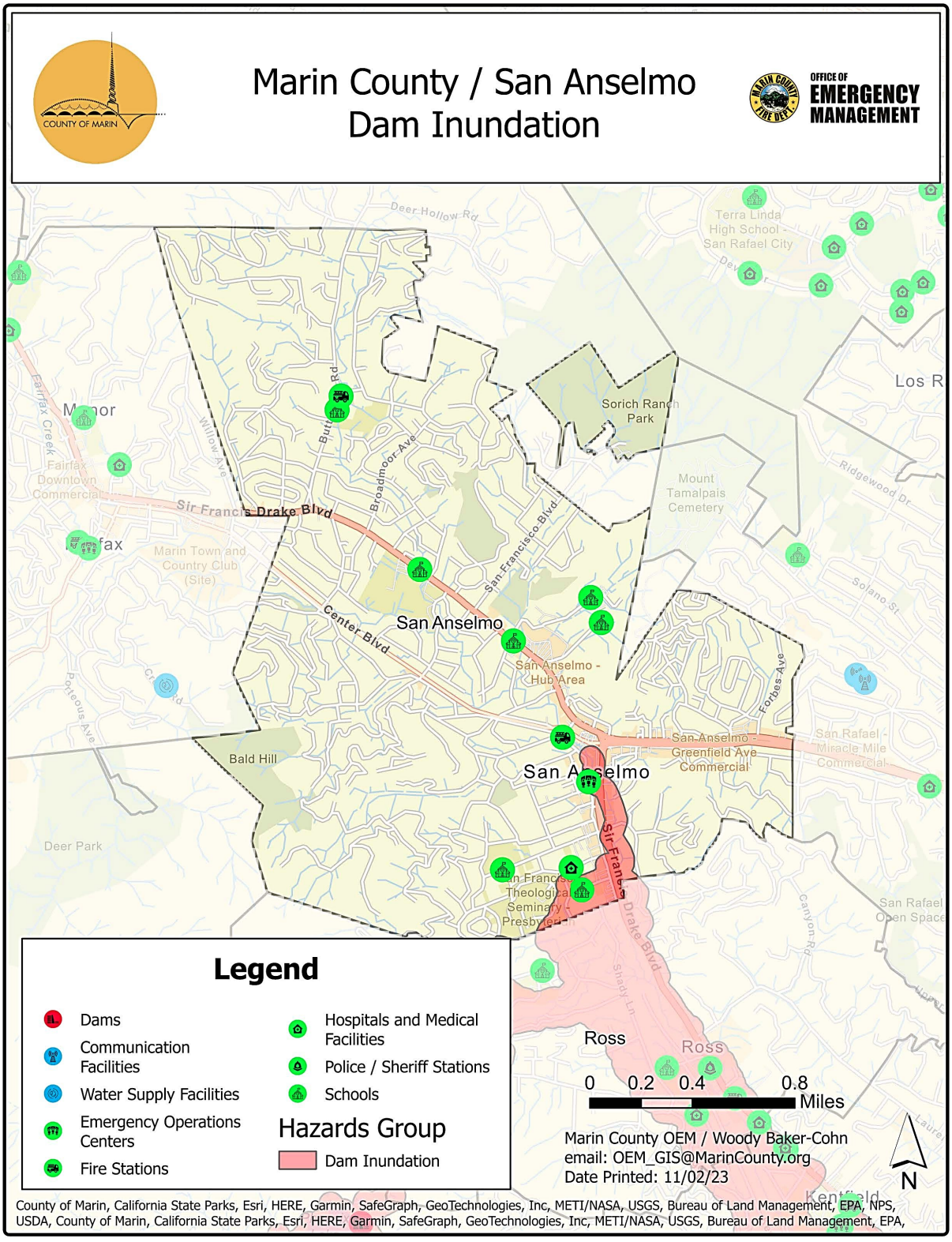


Figure 524: Town of San Anselmo Dam Inundation Critical Facilities and Infrastructure
Source: Marin County OEM

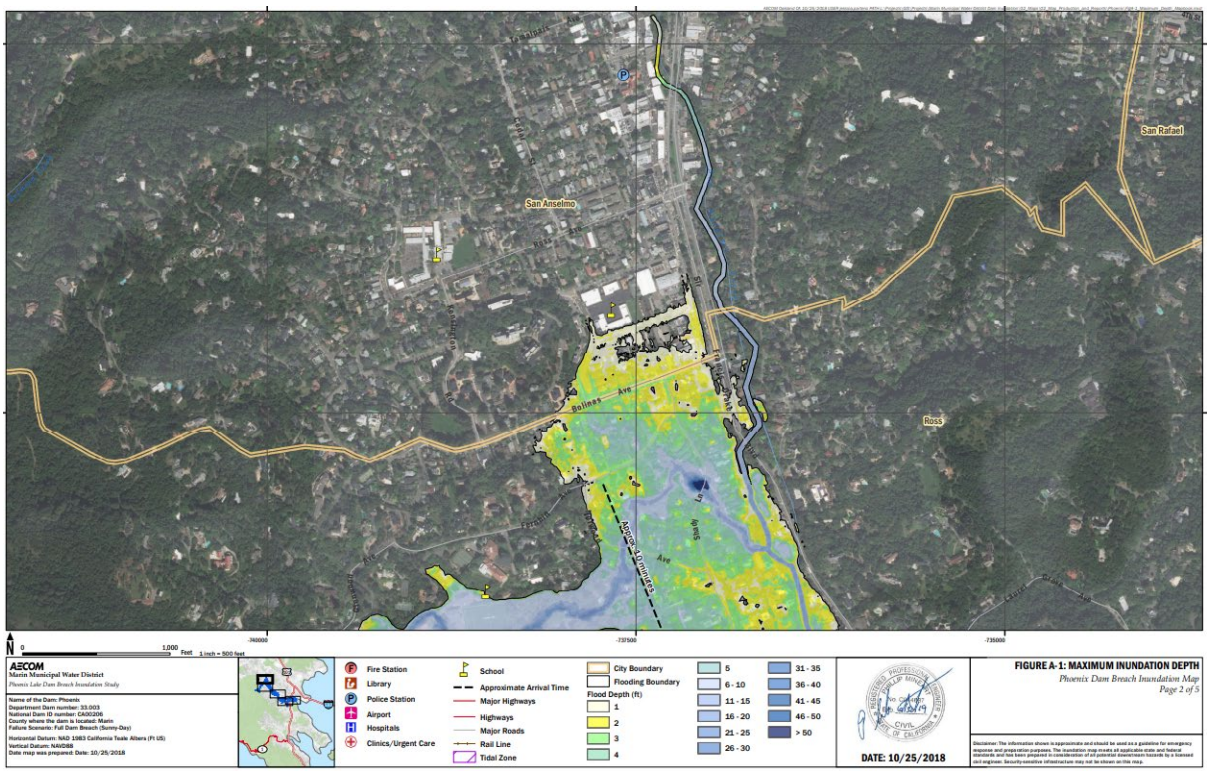


Figure 525: Phoenix Lake Dam Inundation Area – San Anselmo
Source: California Department of Water Resources

There is no record of a failure of any regulated dam located in the Marin County OA. On December 29, 2022, Phoenix Lake hit capacity after recent rains and the dam saw some spillover with no impacts.

Climate Change and Future Development Considerations

Most dams in the United States are aging and are at significant risk from increased storm events as a result of climate change. The average dam age in the United States is 60 years, and more than 8,000 dams in the United States including the Phoenix Lake Dam are over 90 years old. More than 200 U.S. dams have failed in bad weather since 2000. As the climate warms, rain events are predicted to become more intense. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in reservoirs across the Marin County OA, placing increased stress on its dams and increasing the potential for a dam failure. As development increases in the populated areas of the Marin County OA downstream of its dams, particularly in the inundation area of the Phoenix Lake Dam, the potential for significant impacts to residents and infrastructure will only increase. This area includes part of San Anselmo. Future development along San Anselmo Creek in and near downtown could expose additional people and structures to risk of a dam failure.

2.2.2 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour

depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most

common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 20 shows landslide susceptibility classes.

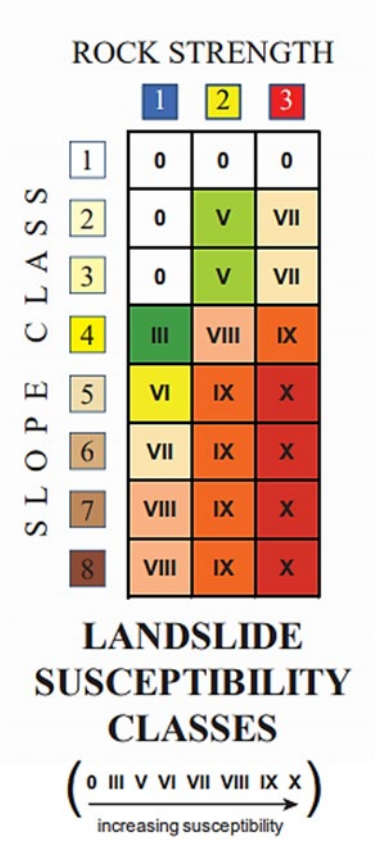


Figure 526: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 21 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

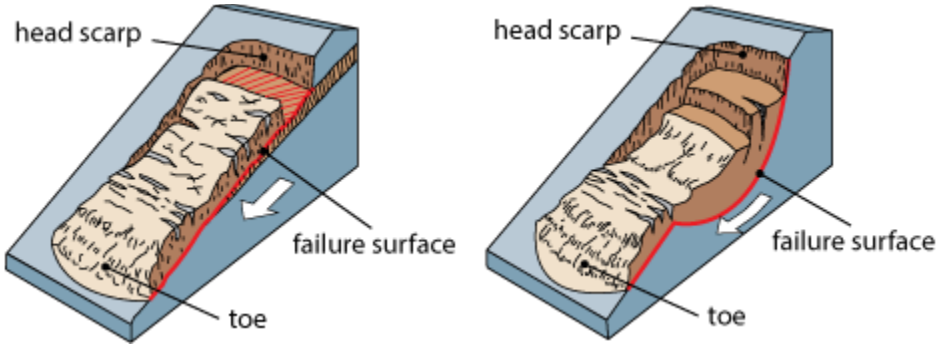


Figure 527: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in San Anselmo would most likely occur on the northern and southern sides of the Town where the terrain is steeper and is more susceptible to movement of hill slope materials. This area of San Anselmo is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. The Ross Valley Fire Staton #20, Brookside Elementary School, the Irene M. Hunt School and the San Anselmo Montessori School lie in a landslide susceptibility area. Most of the main commercial area of San Anselmo lies outside a landslide susceptibility area though several businesses along both Sir Francis Drake Boulevard and Red Hill Avenue near Red Hill have some susceptibility to a landslide.

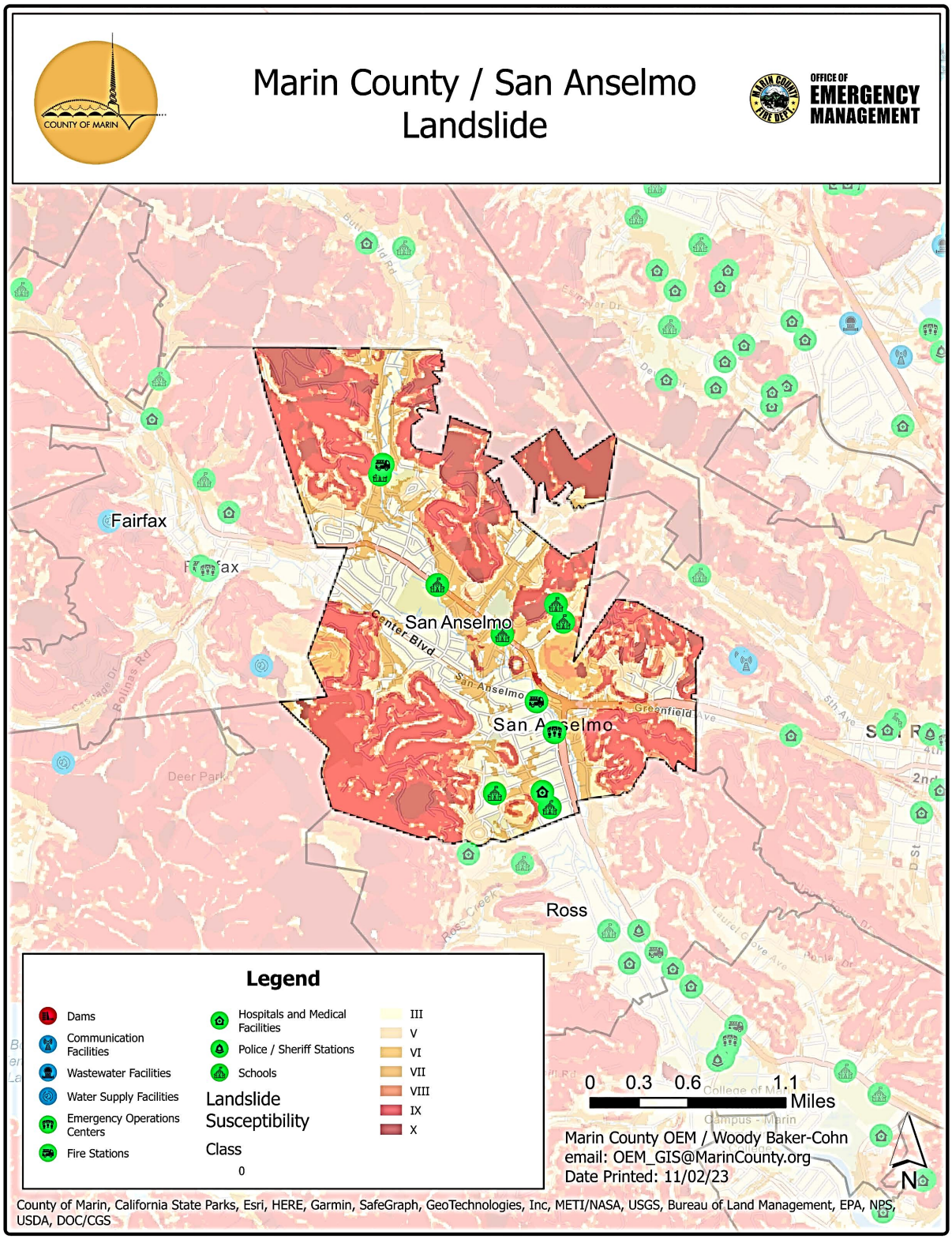


Figure 528: Town of San Anselmo Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in this area could affect the ability of residents to reach their homes. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open space to the east and west of San Anselmo, including Bald Hill Open Space Preserve, Hawthorne Canyon Open Space Preserve, Faude Open Space Park, Sorich Park and Red Hill could potentially contribute to debris flows in San Anselmo. San Anselmo Creek flows from the Mount Tamalpais watershed into San Anselmo and could potentially contribute to a debris flow that could impact bridges, residences and other structures in the Town, affecting ingress and egress to residential areas.

San Anselmo declared a state of emergency in 1958 from damage caused by heavy rains when homes were in danger of sliding into the creek on Forest Avenue.

On 1/3–1/5/1982, a severe storm caused numerous landslides across the Town, isolating several areas and blocking access roads. Six houses were destroyed by mudslides and phone and electricity was out.

On March 27, 2011, approximately five inches of rain fell within a 50-minute period in San Anselmo and there were five landslides.

On 2/12-2/14/2019, a series of storms caused two landslides. One of the landslides occurred between Summit Road and Francis Avenue, damaging a retaining wall which resulted in $250,000 in damages. A slide on Francis Drake Boulevard at a cactus nursery carried part of the nursery fence along with some power lines down toward San Anselmo Creek.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[33], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of San Anselmo that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents around San Anselmo could be susceptible to post-fire debris flows. This includes areas around San Anselmo Creek and Sleepy Hollow Creek. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

[33] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

2.2.3 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of San Anselmo, though it's effects would be most felt in the mountainous areas to the north and south where the risk of wildfire would increase. Dry trees in public spaces like the Bald Hill Open Space Preserve, Hawthorne Canyon Open Space Preserve, Faude Open Space Park, Sorich Park and Red Hill can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

The Town of San Anselmo has experienced four droughts since rainfall records began: 1920s, 1970s, 1980s and 2012-2017. Historically, the Marin Municipal Water District (MMWD) which serves San Anselmo has been able to meet demands during periods of extreme drought with a combination of rationing, conservation, and increased purchases of imported water supply from the Sonoma County Water Agency (SCWA). There is a probability of future drought events. In the future as the climate changes, less frequent, more intense storms are expected; these storms have an increased potential to cause flooding. Additionally, with less frequent and more intense storms, there will likely also be extended dry periods.

Since there is no agriculture in San Anselmo and zoning precludes agricultural uses, prolonged periods of drought do not cause crop losses in the town. Lack of water affects the Town creeks, groundwater supply, threatened species (Steelhead), and the Town's ability to suppress

wildfires. A drought may result in dry vegetation in San Anselmo that is susceptible to ignition and wildfires.

Drought is anticipated to cause loss of landscaping. The Town does not have means to measure the cost of this loss to the community or its economic base. The San Anselmo Town Hall, Memorial Park, and a popular private park in the downtown area have natural grass lawns and fields that could be impacted by severe water rationing that includes public facilities. Renovating the Memorial Park turf and irrigation is currently estimated at approximately $700,000. Town median landscaping may also be damaged by severe water.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including San Anselmo may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the San Anselmo, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around San Anselmo. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including San Anselmo where wildfires are more likely to occur. Future development in this area and in the mountainous areas of San Anselmo could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including San Anselmo can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.4 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 23).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 529: Modified Mercalli Intensity Scale
Source: USGS

Figure 24 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 530: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 25). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 531: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around San Anselmo due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity

The colors on Figures 26 and 27 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

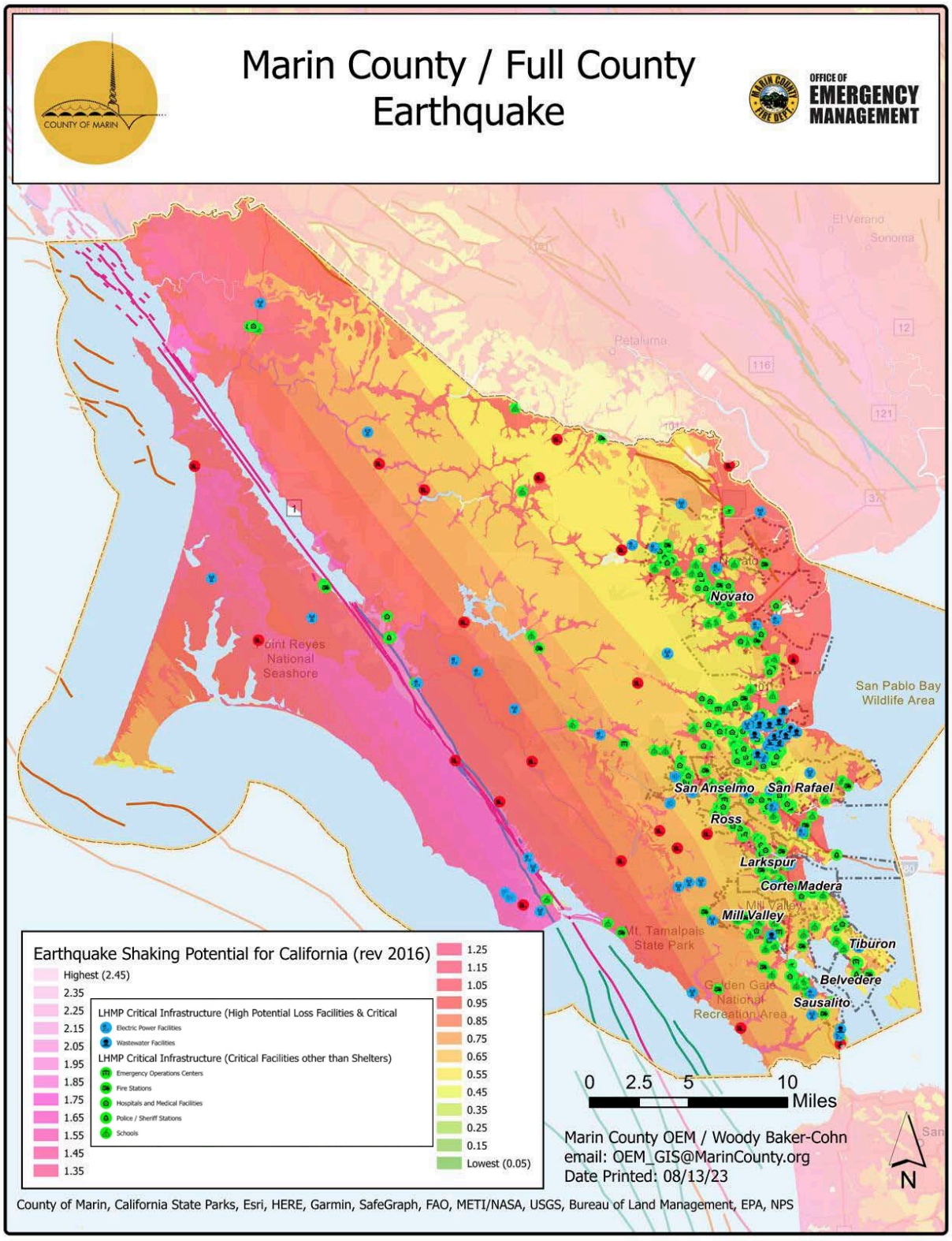


Figure 532: County of Marin Earthquake Impact and Fault Lines
Source: Marin County OEM

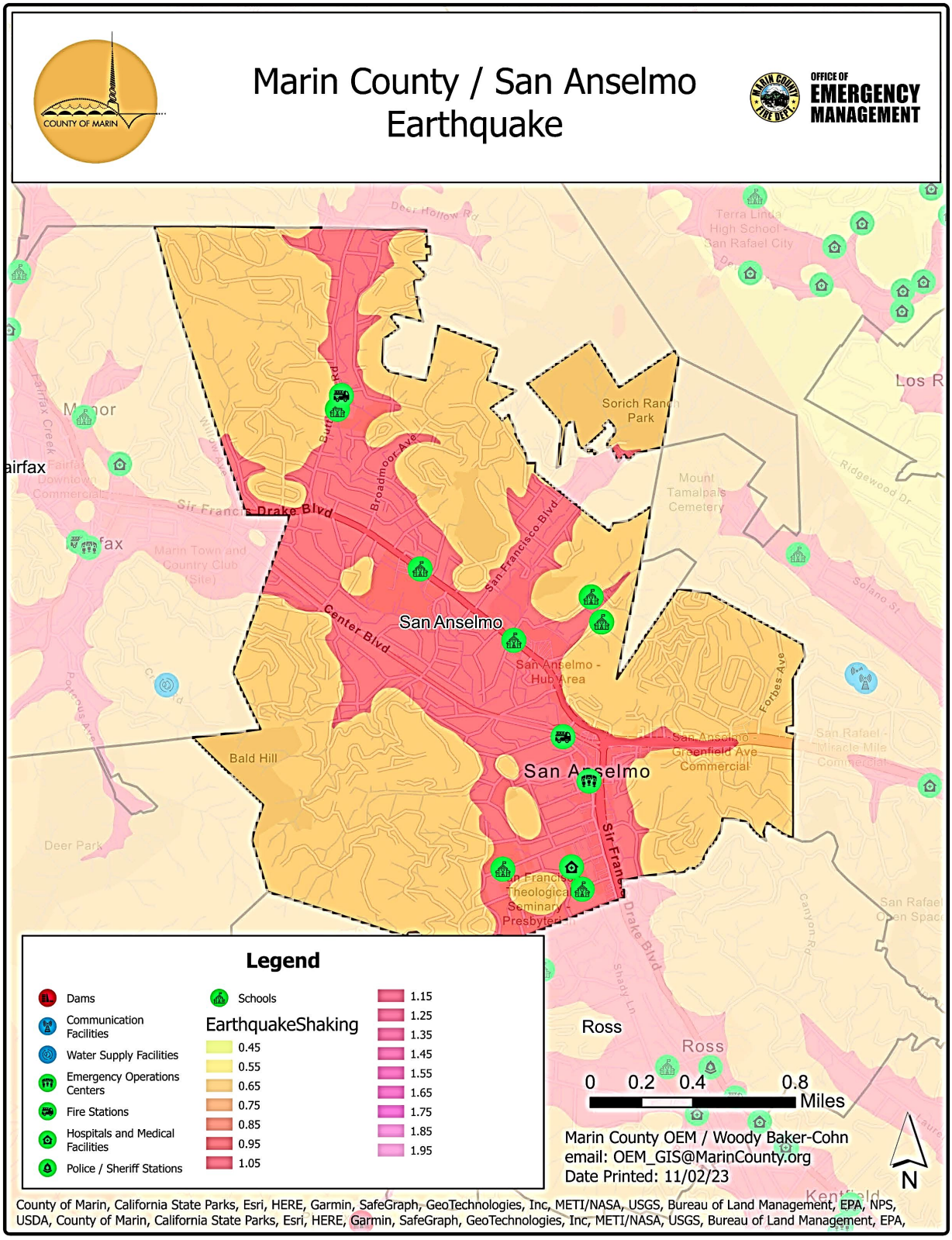


Figure 533: Town of San Anselmo Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

San Anselmo is near several active faults that have the potential to cause earthquakes that would be a hazard for the Town. The San Andreas Fault runs north and south in the western side of the Marin County OA, approximately 8 miles southwest from San Anselmo. The San Andreas Fault is considered capable of generating a magnitude 8.0 earthquake. The northern section of the Hayward fault is less than 10 miles northeast of San Anselmo. The entire Hayward fault may generate magnitude 7.2 and 7.4 earthquakes. The Rodgers Creek fault is less than fifteen miles northeast of San Anselmo and may generate a magnitude 7.0 earthquake. The San Gregorio fault is less than 10 miles south of San Anselmo and may generate a magnitude 7.3 earthquake. Areas in Town, primarily the low-lying areas adjacent to the San Anselmo Creek and along the Town's main thoroughfares, have a "moderate" liquefaction susceptibility and could be more susceptible to an earthquake. All of the Town's critical facilities including its schools, nursing facilities, fire stations, Emergency Operations Center, Town Hall lie in an area of moderate vulnerability to shaking from an earthquake. Hundreds of homes and dozens of businesses, including the main commercial area of town, lie in this area. Hundreds more homes lie in an area of lower earthquake shaking susceptibility.

Additional vulnerable structures in town include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the Town could be impacted by an earthquake. Many multifamily apartment buildings were constructed in San Anselmo in the 1950's and 1960's that may be considered "soft story" structures. San Anselmo has not yet completed a soft story inventory or implemented a retrofit program. Typical damage to pre-1940 single-family homes include the wood frame coming off its foundation, racking of the cripple walls, the foundation itself cracking, or the chimney breaking at the roof line. A typical problem with houses built during this era is the connection between the wood frame and the foundation. These houses often lack steel bolts or any other type of "tie-down" between the foundation and the wood frame. Since these houses were built before the widespread use of plywood, they also typically lack appropriate shear reinforcing of the cripple walls (the walls between the top of the foundation and the floor diaphragm). Finally, steel reinforcing is often not found in the foundation of these houses or their chimneys. Some of these older houses may have brick foundations with weakly cemented joints. Typical building damage to post-1940 houses does not present widespread problems with foundation anchorage and foundation reinforcing. However, there often is a lack of proper reinforcement of the masonry chimneys. A significant number of post-1940 dwellings may suffer some type of chimney damage. The second major source of damage is damage (or even collapse) of garages with living area above in two-story or split-level homes due to long spans over the garages.

The San Anselmo Building Department completed an inventory of masonry buildings and stone buildings in 2006. All 18 masonry and 3 stone buildings have been reinforced. According to a former building department employee, the San Anselmo Town Hall was constructed in 1911 and renovated in 1976 and 2006. It is a wood building in good condition. Fire station #19 was constructed in 1976 and renovated in 2009-2011; it is also in good condition and not in need of retrofits or upgrades. Fire station #20 was constructed in 1961 and is in satisfactory condition. The Town Corporation yard buildings are metal framed, constructed in 2002, and in good condition.

A major earthquake event could result in deaths, injuries, property and environmental damage, and disruption of normal government and community services. Hospitals outside of the Town may be impacted by an earthquake. Telephone systems could be affected by system failure, overloads and loss of electrical power. Natural gas leaks pose a fire threat and breaks in the system could affect service to the Town. Water sources could be compromised due to damage to treatment plants, pump stations and/or the pipelines that distribute potable water.

Liquefaction-related damage to water supply pipelines could impair fire suppression, leaving the Town vulnerable to a large fire. Sewage collection systems throughout the Marin County OA may sustain widespread damage if ground movement damages mains or pipelines. Electricity may be interrupted. Landslides may occur. Bridges and roads may be closed because of damage. An earthquake may also result in dam failure. Liquefaction of creeks during the winter storm season could exacerbate flood hazards. The Town may experience road closures from liquefaction, earthquake-triggered landslides, shaking damage to bridges as well as indirect causes of closures such as building damage, hazmat releases, and utility pipeline breaks and fallen trees. The Town of San Anselmo will be affected by the regional impacts of regional transportation disruption, particularly closure of the Golden Gate Bridge. Earthquakes could also cause landslides in the areas around San Anselmo with steeper terrain, causing damage to homes and roads as a result of shifting soils.

San Anselmo hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across San Anselmo the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in San Anselmo.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including San Anselmo, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[34], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including San Anselmo. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of San Anselmo downtown and along its creek beds, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.5 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or

[34] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally resulting from prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown.

A diagram of an atmospheric river event is shown in Figure 28.

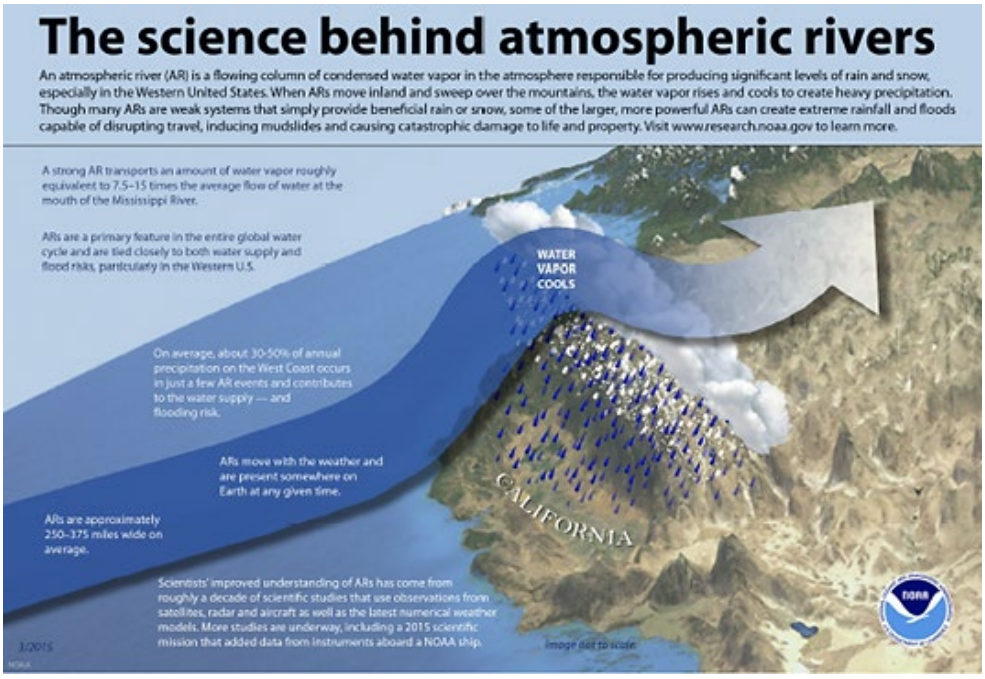


Figure 534: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the stormdrains are obstructed or broken or when the water bodies to which they lead to are already full, water

backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in San Anselmo generally results from creek flooding, and downtown San Anselmo will often flood in high rain events. San Anselmo is not located along the Coast and would not experience coastal flooding. San Anselmo is subject to periodic flooding from San Anselmo and Sleepy Hollow Creeks. The low-lying areas of San Anselmo and its neighboring communities have experienced widespread flooding throughout history as creeks overflow their banks. Ross Valley, where San Anselmo is located, is naturally prone to flooding by its location, geologic and geomorphic setting: rainfall can be intense, soils are shallow with limited absorption capacity, slopes are steep, stream channels are entrenched and in many places narrow with relatively little storage capacity. The watershed has been altered from its natural condition and many sections of creeks and streams have been placed in culverts and the natural pattern of runoff has been changed. During prolonged and heavy storms the watershed can become saturated. If rainfall is sufficiently intense, heavy runoff can result in high flows exceeding the capacity of the creek in places where conveyance is constrained. Floodwaters escape the creek capacity and breach the creek bank in downtown San Anselmo. 'Localized' flooding also occurs in many places in San Anselmo and is exacerbated where the storm water drainage network has inadequate capacity for peak flows or is blocked from sediment, debris, or vegetation. Localized flooding is characterized by excessive ponding in the street, and overflow onto lower-lying residential properties even during 5-year storm events. Localized flooding can occur within or outside of the FEMA designated floodplain. One example of localized flooding within the floodplain is Bolinas Avenue, on the border with the Town of Ross. Because the historic flow path has been severed, ponding occurs in the street during most large storms. When regional flooding occurs water flows down San Anselmo Avenue and connects to Bolinas and Shady Lane. Severe winter storms can also be accompanied by hazards and destruction resulting from high winds. High winds knock down limbs or entire trees which subsequently damage power and utility lines, buildings, block streets, and even pose a direct risk to human safety.

Local flooding in San Anselmo is exacerbated where the storm water drainage network has inadequate capacity for peak flows. The 100-year floodplain extends primarily west of San Anselmo Creek up to 1,000 feet in some areas up to Center Boulevard and extending up to 500 feet along both sides of the Creek past Center Boulevard to the boundary of Fairfax. An area of the 100-year floodplain extends north of Sir Francis Drake Boulevard near Butterfield Road for several hundred feet. The 500-year floodplain occurs primarily along the 100-year floodplain fringe, extending up to 1,000 feet south of Center boulevard in the middle of town and several hundred feet north of Sir Francis Drake Boulevard through San Anselmo Memorial Park. There are hundreds of homes, all of the downtown commercial area of San Anselmo, the St. Anselmo School, the San Anselmo Town Hall, the San Anselmo Emergency Operations Center, both of the San Anselmo Fire Department stations, the Archie Williams High School and part of the Brookside Elementary School that lie in the 100-year floodplain. Part of Sir Francis Drake Boulevard and Center Boulevard also lie in the 100-year floodplain. The Chronos Academy and parts of Sir Francis Drake Boulevard and Center Boulevard lie in the 500-year floodplain.

The most flood-prone areas San Anselmo are west of Sir Francis Drake near downtown, and along Sleepy Hollow Creek from the confluence upstream to the Fire Station #20. Main breakout points are where man-made obstructions, such as retaining walls, bridges, and buildings obstruct the flow of water. The deepest and most widespread flooding occurs in the area around downtown San Anselmo. At its upstream extent, floodwater jumps the bank at Nokomis and Madrone Avenues and heads through properties and towards Sycamore Ave. As San Anselmo Creek enters downtown San Anselmo it is constricted by the series of Building Bridges

downstream of Bridge Avenue. The creek's capacity here is approximately 2,800cfs, which is approximately the discharge of the 20 percent annual chance flood When discharge exceeds this capacity, floodwaters overtop and escape the banks of the creek, flooding the downtown business and residential district. During large floods, these floodwaters eventually reach the floodplain in Ross where they continue to flow through the downtown business and residential district there before continuing farther downstream through the unincorporated community of Kentfield. Floodwaters return to the channel near the College of Marin in lower Kentfield.

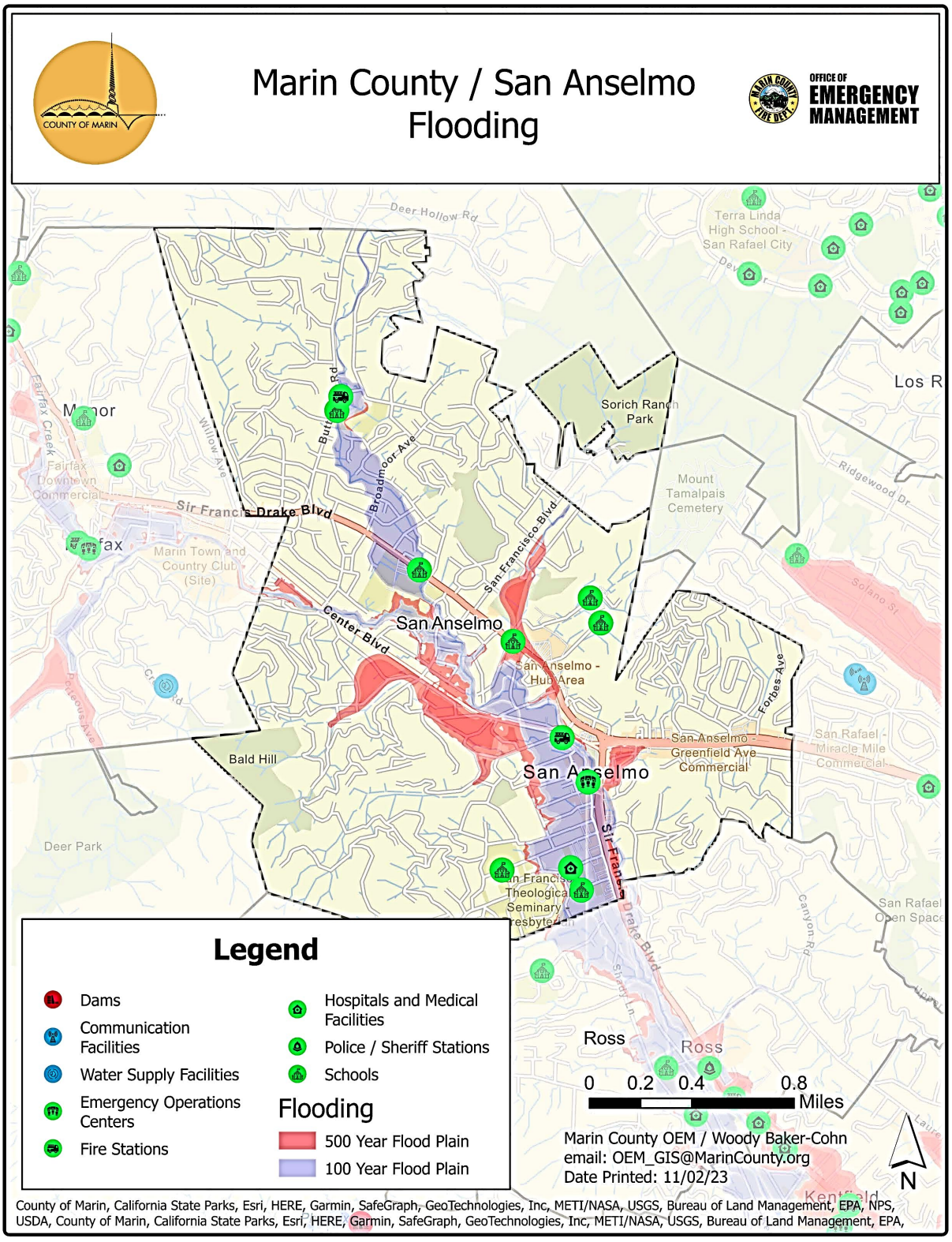


Figure 535: Town of San Anselmo Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Numerous businesses, residential neighborhoods, schools, churches, community centers, roads, and other critical facilities lie in this area and are susceptible to flooding. San Anselmo has approximately 60 structures within the Floodway and approximately 562 within Special Flood Hazard Areas. Table 17 shows the number of San Anselmo critical facilities by flood zone.

Table 17: Town of San Anselmo Critical Facilities by Flood Zone

	Category	Name	Address	Flood Zone
1.	Fire	Fire: Ross Valley Fire Department (RVY) / Station 19	777 San Anselmo Avenue San Anselmo, CA 94960	AE
2.	Fire	Fire: Ross Valley Fire Department (RVY) / Station 20	150 Butterfield Road San Anselmo, CA 94960	AE
3.	Law	Central Marin Police	525 San Anselmo Avenue San Anselmo, CA 94960	AE
4.	Local Government	San Anselmo Town Hall	525 San Anselmo Avenue San Anselmo, CA 94960	AE
5.	Community Center	Isabel Cook Community Center (ICC)	1000 Sir Francis Drake Blvd. San Anselmo, CA 94960	X
6.	Library	San Anselmo Public Library	110 Tunstead Ave. San Anselmo, CA 94960	AE
7.	School	Brookside Elementary School	116 Butterfield Road San Anselmo, CA 94960	AE/X
8.	School	Wade Thomas Elementary School	150 Ross Avenue San Anselmo, CA 94960	X
9.	School	St. Anselmo School	40 Belle Avenue San Anselmo, CA 94960	AE
10.	School	Archie Williams High School	1327 Sir Francis Drake San Anselmo, CA 94960	AE/X
11.	School	Parkside Preschool and Daycare	1000 Sir Francis Drake Blvd. San Anselmo, CA 94960	X
12.	School	University of Redlands	105 Seminary Road San Anselmo, CA 94960	AE/X

Table 265: Town of San Anselmo Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. A failure of the Phoenix Lake Dam or a breach and/or overtopping of the levees along San Anselmo Creek could contribute to flooding in the lowland areas of San Anselmo.

Floods in the San Anselmo develop rapidly, generally within 24 to 36 hours after the beginning of the flood-producing storm but are short in duration. Flood conditions usually subside within 24 hours. Floods in San Anselmo usually occur during large storm events. Typical winter peak discharges have been measured below 3,500 cfs. The two most severe floods occurred in the winters of 1982 and 2005, with peak discharges of approximately 7,200 cfs and 6,800 cfs,

respectively. The 1982 flood was a 150-year event and the 2005 flood was approximately a 100-year event.

There is a long history of flooding in San Anselmo. The two most severe foods occurred in the winters of 1982 and 2005 (see below). Prior to establishment of the USGS stream flow gauging station in Ross on Corte Madera Creek in February 1951, flooding was reported in calendar years 1914, 1925, 1937, and 1942. Since the Ross gage has been in operation, flood flows have been recorded in 1951, 1955, 1958, 1967, 1969, 1970, 1982, 1983, 1986, 1994 (flooding was reported, but the stream flow gage was not in operation), and 2005. Town resolutions indicate a State flood relief was requested in 1957 and 1973. San Anselmo declared a local emergency for a flood of 3:00 a.m. on January 12, 1973. The flood in December 2005 - January 2006, was a federally declared disaster DR-1628. Seven inches of rain fell on the Ross Valley Watershed in the two weeks prior to the 2005 flood. Because of this near saturated condition, the earth had little or no capacity to absorb storm water on December 31, 2005. At 2:00 am on December 31, 2005, Corte Madera Creek was already at flood stage of 19 feet. The strongest part of the storm occurred from 3:00 am to 6:00 am. Flood waters topped the banks at Ross and San Anselmo creeks at the same time. The flood crested at 22.5 feet, 3.5 feet above flood stage at Ross.

In 2017, several rain events caused flooding in San Anselmo. On 2/7/2017, a powerful atmospheric river event caused flooding to several neighborhoods (see Figure 30.)

Figure 536: February 2017 Flood in San Anselmo
Source: Marin Independent Journal

December 2005 was the wettest December in San Anselmo in over 50 years. On 12/31/2005-1/1/2006, an atmospheric river event caused San Anselmo Creek to overflow its banks. More than four feet of water rushed down San Anselmo Avenue downtown. Town facilities include the police department, library, council chambers and fire department were damaged as well as 140 businesses and 290 homes. Damage was estimated at $30 million. The San Anselmo library lost around 1,000 books.

Figure 537: 2005 Flood in San Anselmo
Source: San Anselmo History Museum

On 1/3–1/5/1982, a severe storm caused serious flooding damage in San Anselmo. Floodwaters were three-four feet deep on San Anselmo Boulevard, essentially turning it into a river (see Figure 32.) All the commercial buildings in the downtown area suffered water damage, with damages estimated at $4 million. One house was destroyed, and thirty or more homes and thirty-forty businesses damaged. Utilities were out for several days and a curfew was enforced.

Figure 538: 1982 Flood in San Anselmo
Source: San Anselmo History Museum

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[35] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including San Anselmo. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including San Anselmo will likely experience more

[35] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development along San Anselmo Creek and Sleepy Hollow Creek would expose more people, structures and infrastructure including major roads to creek flooding as a result of climate change. Flooding in downtown San Anselmo would continue to worsen with climate change.

2.2.6 LAND SUBSIDENCE

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 33 for a picture and description of how dissolution sinkholes form.

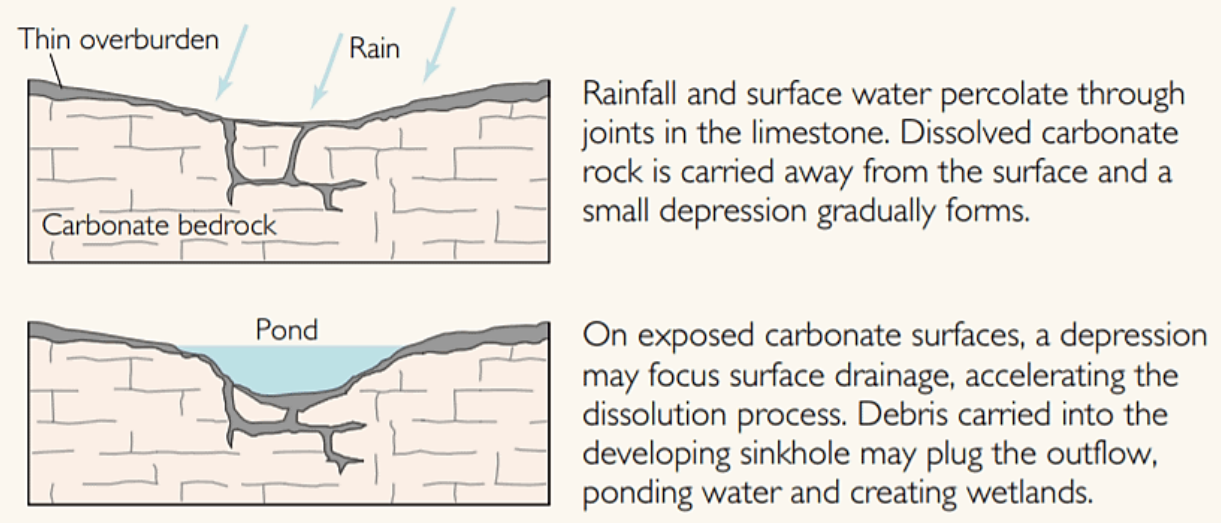


Figure 539: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 34 for a picture and description of how cover-subsidence sinkholes form.

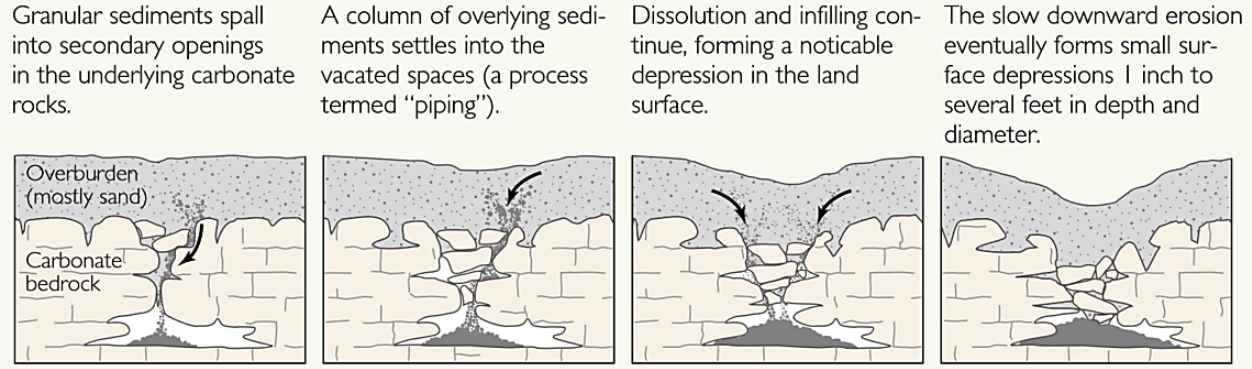


Figure 540: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 35 for a picture and description of how cover-collapse sinkholes form.

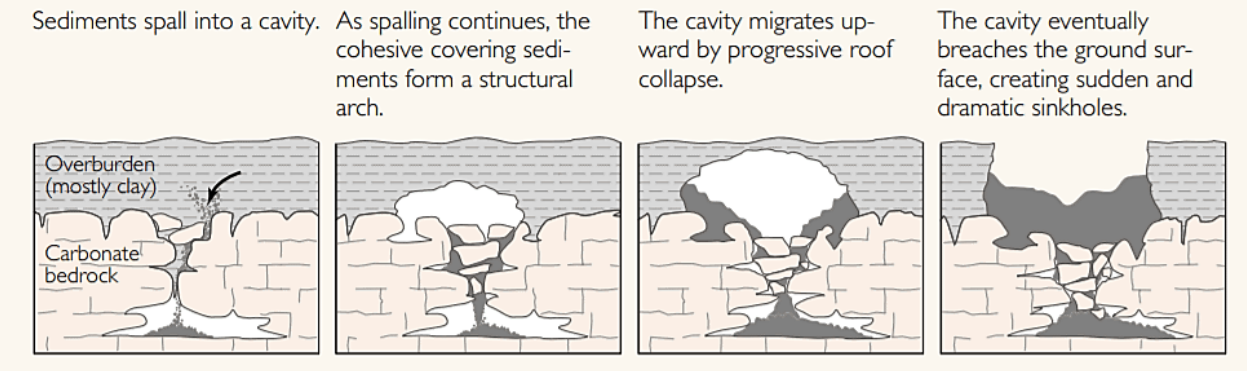


Figure 541: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the central lowland areas of San Anselmo along San Anselmo Creek where the ground is more porous. This includes the primary commercial area of town there are numerous residences and critical facilities. Land

subsidence could have numerous impacts for San Anselmo, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the Town.

On 4/12/2022, a sinkhole developed on Center Boulevard at San Anselmo Avenue and Sycamore Boulevard. The hole was about 3 to 4 feet near the surface and was possibly caused by a failed corrugated metal pipe under the street.

Figure 542: 2022 San Anselmo Sinkhole
Source: Marin Independent Journal

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. The rate of land subsidence could increase across the Marin County OA including the lowland areas of San Anselmo as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in San Anselmo could increase with future development in the lowland populated areas of the city, particularly downtown, where land subsidence is more likely to occur.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 37):

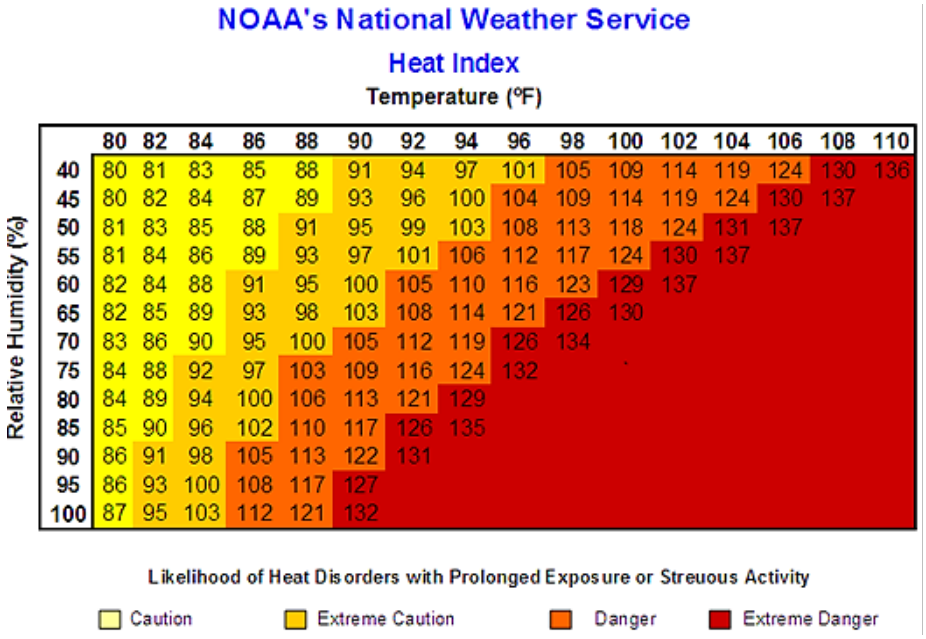


Figure 543: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of San Anselmo and would be felt more at lower elevations in the central areas of the Town. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the Town of San Anselmo experienced an Extreme Heat Event with temperatures exceeding 113 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

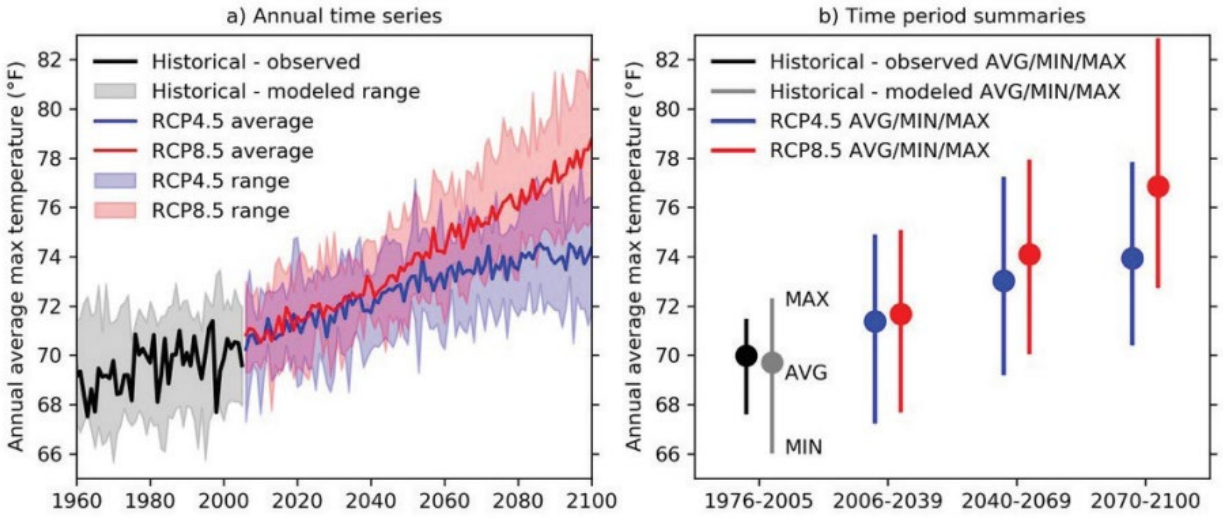


Figure 544: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in San Anselmo. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of San Anselmo where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including San Anselmo could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including San Anselmo as conditions become hotter and drier. These effects will primarily be felt in the mountainous areas of San Anselmo where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around San Anselmo could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 39).

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 545: Beaufort Wind Scale
Source: NOAA

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 40) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 546: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 547: Waterspout Formation
Source: MarineInsights

All of San Anselmo is susceptible to storms and damage from wind and tornadoes, as most of the Town has tree cover. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

San Anselmo has experienced winter storms that have caused damage.

On 3/21/2023, powerful winds and rain caused numerous large trees to fall across San Anselmo, some falling on and damaging houses.

On 2/14/2019, a large tree was blown onto power lines near a Butterfield Road home in San Anselmo during a storm. The tree tilted toward the house and forced traffic restrictions.

San Anselmo has never experienced a tornado.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and San Anselmo. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in San Anselmo as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of San Anselmo with high tree cover including in the mountainous residential areas will increase the effects of severe wind events.

2.2.10 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have

critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 42 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

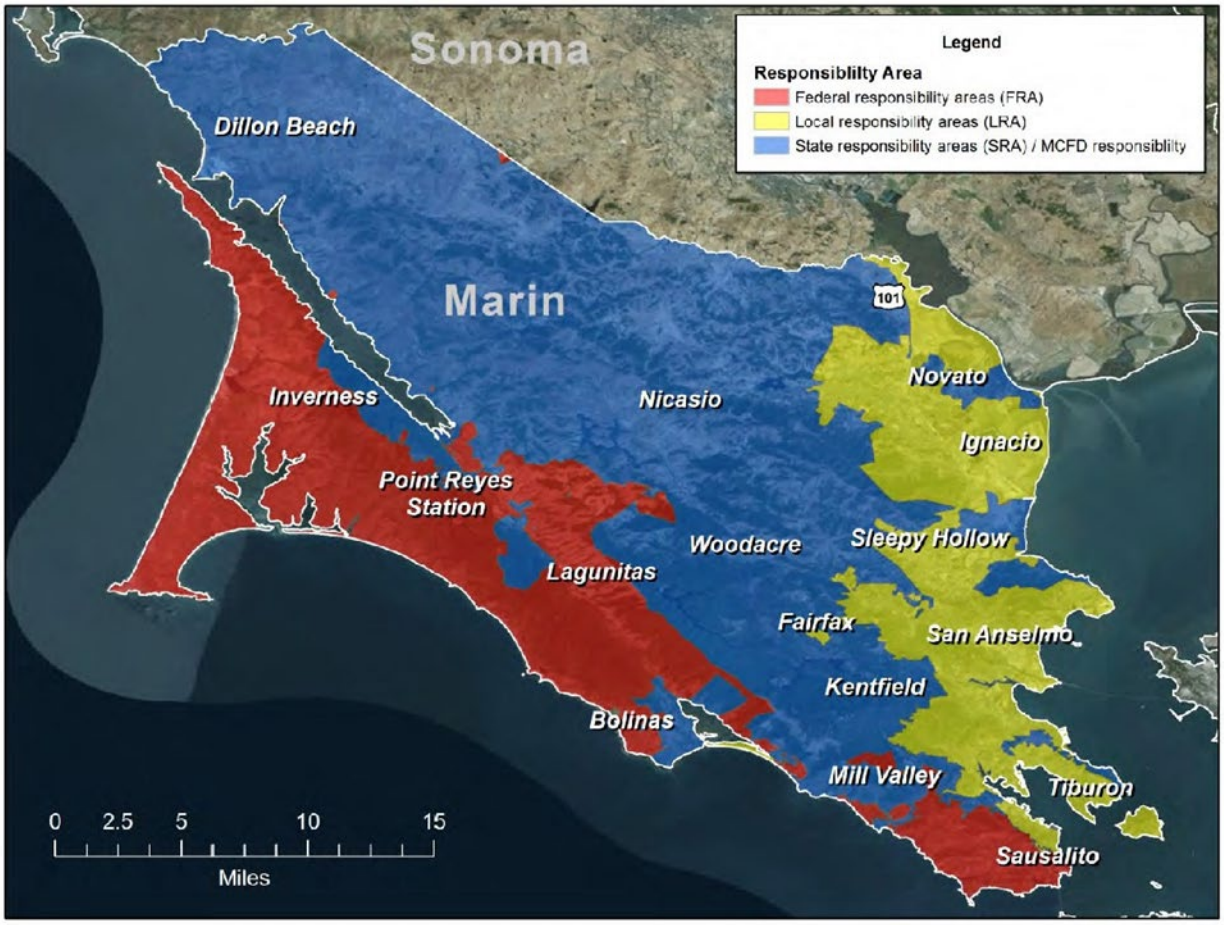


Figure 548: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late

December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to

have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

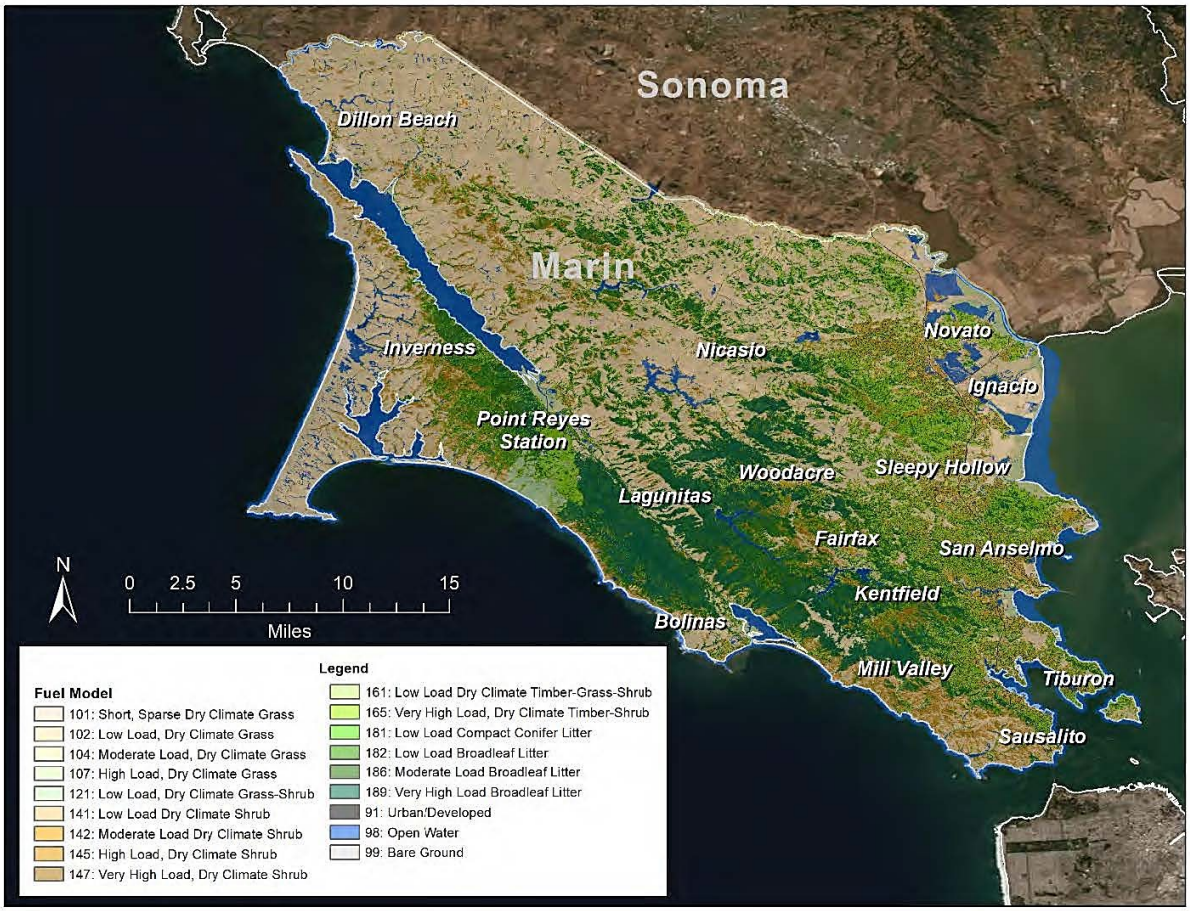


Figure 549: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is a concern since this specific disease can impact vegetation through Marin including the WUI; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular, appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease

largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin County OA) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 the Marin County OA including the Town of San Anselmo experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening

the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

The fire season generally lasts from five to six months, when there is little rain. Access to the adjacent open space areas and the hillside and canyon areas is limited by few access routes and narrow roads. San Anselmo is within the Wildland-Urban Interface (WUI) and most of the town is in a moderate to high FHSZ. San Anselmo currently has approximately 2,243 homes, six Marin Municipal Water District (MMWD) water tanks and pump stations, the Ross Valley School District and three schools located in the WUI. The Town borders directly on the open space lands of the MMWD. The hillsides and canyons carry the potential of high fire danger. The potential of wild land fire is an extreme risk to all areas within the Town, not just hillside areas. Many residences in the high wildfire threat areas were built prior to current fire codes and have siding and roofing that is not fire resistant. Residences may be surrounded by flammable vegetation. Certain areas of the Town have water pressure and water flow that do not meet current standards. There is limited water availability, water pressure, and water flow in certain areas within San Anselmo. The wildland fire hazard is caused by a combination of factors including hillside terrain, highly flammable vegetation and forest, long summers, and human activity. There are heavy fuel loads. Many homes have been built on steep slopes with vegetation in close proximity. The onset of Sudden Oak Death (SOD) has significantly increased the number of dead or weakened trees in the areas, which contributes to the fuel loads. Wind is a predominant factor in the spread of fire.

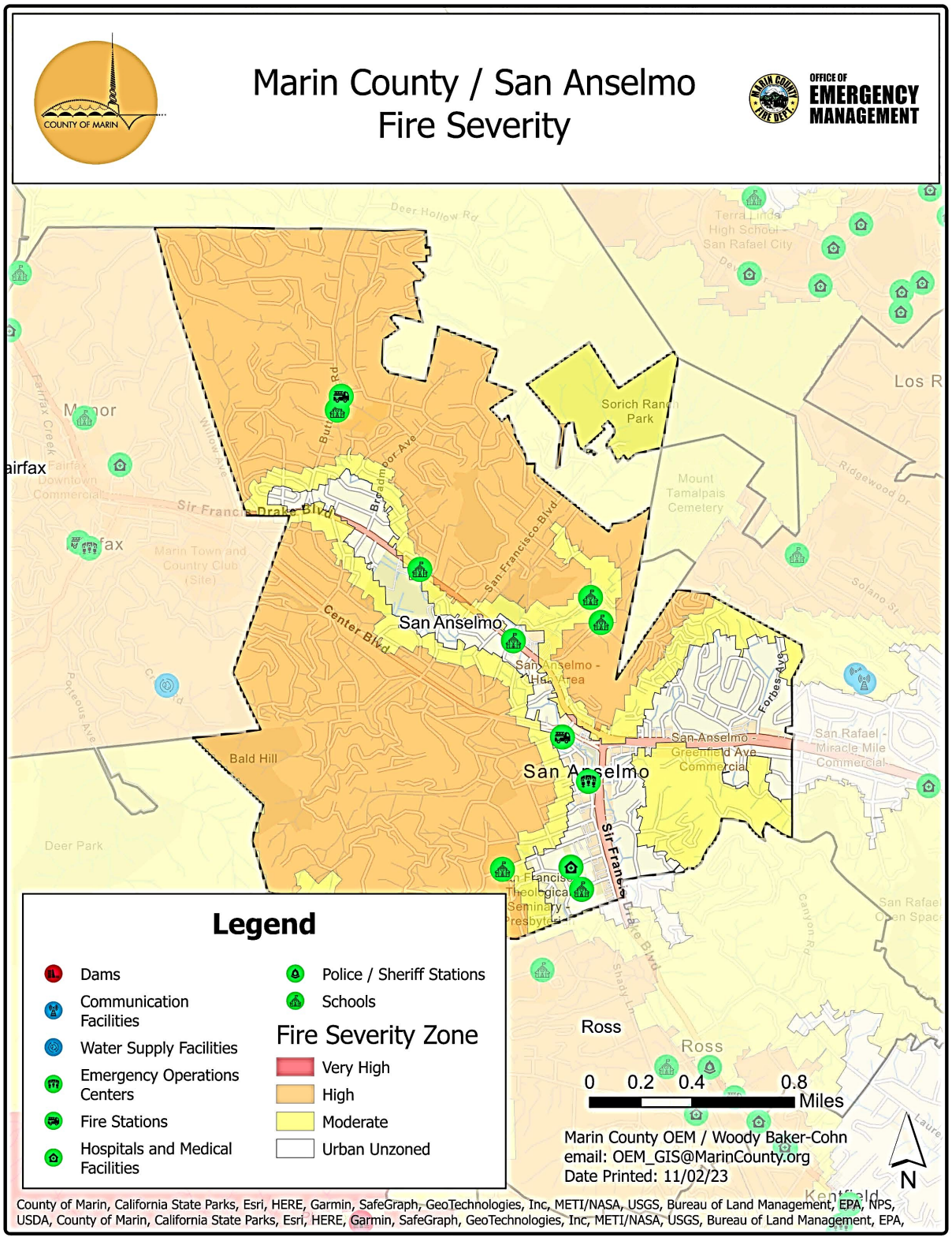


Figure 550: Town of San Anselmo Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Wildfires can cause short-term and long-term disruption to San Anselmo. Fires may result in deaths and injuries and can destroy buildings and infrastructure. Additional costs associated with the loss of homes to wildland fire include disruption of utilities, transportation, and other public services. Although the physical damages and casualties arising from wildfires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In large wildfire events, the economic impact of this loss of services may be comparable to the economic impact of physical damages to the Town. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Wildfires can also cause major damage to power lines needed to distribute electricity to operate facilities. High intensity wildfires can also have substantial effects on watersheds through loss of vegetation and soil erosion, which may impact the Town by changing runoff patterns, reducing water storage capacity of Phoenix Lake, and degrading water quality through sedimentation and contamination.

All of San Anselmo could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around San Anselmo become drier due to climate change, the risk of a wildfire occurring and impacting the Town will continue to increase. Brush fires in the Town may increase over time as parks and other open spaces experience drier conditions.

San Anselmo has never experienced a major wildfire. The Town experiences small fires annually but none since the last plan update.

In 1976, the Town experienced an approximately 100-acre fire at the end of San Francisco Boulevard, currently Sorich Park, which burned up towards Indian Rock. Two homes were lost.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

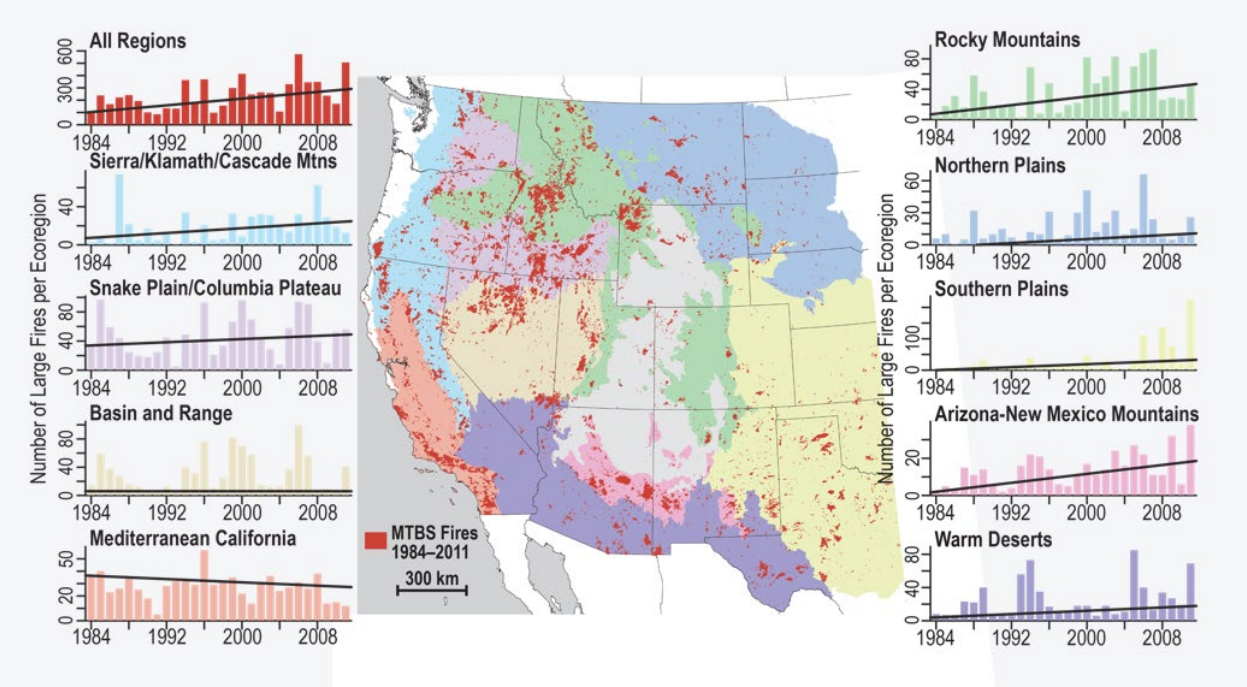


Figure 551: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including San Anselmo is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around San Anselmo. Future development in the WUI throughout San Anselmo will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the San Anselmo WUI can increase risk to life, property and public health as a result of a wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The County of Marin is a county located in the northwestern San Francisco Bay Area. As of the 2020 census, the population was 262,231. Its county seat and largest city is San Rafael. The Marin County OA is across the Golden Gate Bridge from San Francisco, and is included in the San Francisco–Oakland–Berkeley, CA Metropolitan Statistical Area.

The Town is approximately 2.68 square miles in size with a population of 12,623. The community is situated in the Ross Valley, bordered by steep hillside areas including the Mount Tamalpais Watershed, and located 20 miles north of San Francisco in Marin County. San Anselmo is a small, established residential community with visitor- and neighborhood-serving businesses centered on the major transportation thoroughfares, including Sir Francis Drake Boulevard, San Anselmo Avenue, and Red Hill Avenue. Winding streets emanate out from the major roadways into quiet, residential neighborhoods and steep hillsides. Historic Downtown San Anselmo, one of the major commercial centers in San Anselmo, sits at the heart of the town and follows San Anselmo Creek. Existing residential development in San Anselmo numbers approximately 5,567. These are predominantly single-family residences, with some accessory dwelling units on single-family properties, and some apartment units located near commercial corridors. In 2020, approximately 80 percent of homes were single family (4,174 single family detached units, and 266 single family attached units) and approximately 19 percent were multi-family units (358 units within duplexes, triplexes, or quadplexes and 683 units in developments of five or more units). There have been few multi-family developments since 2015; however, the Town has seen marked interest in accessory dwelling units in recent years.

The town is largely developed with most remaining land constrained by environmental hazards or conserved as open space. The beauty of the natural landscape helps define the character of the community, but it also presents risk of natural hazards that limit the potential for new housing, including steep topography and areas Furthermore, the community values the town's close access to open space with its natural beauty and recreation opportunities. Therefore, new construction is predominantly limited to infill development.

San Anselmo's Regional Housing Needs Assessment (RHNA) allocation for the 2023-2031 planning period has been determined by ABAG to be 833 housing units, including 253 units for very low-income households, 145 units for low-income households, 121 units for moderate-income households, and 314 units for above moderate-income households.

Table 18: Town of San Anselmo Future Growth Areas

	Development	# of Units	# of Parcels	Project Date	Acres	Fire Severity Zone	Flood Zone
1	729 Sir Francis Drake Blvd	1	1	TBD1	0.09	No	AE/X
2	1214 San Anselmo Ave	1	1	TBD1	0.02	No	X
3	Vacant Lot - Sturdivant Ave	1	1	TBD1	0.31	No	No
4	61 Hillside Ave	1	1	TBD1	0.22	Yes	X
5	63 Hillside Ave	1	1	TBD1	0.21	Yes	X
6	1 Saunders Ave	1	1	TBD1	0.11	No	X
7	21 Santa Barbara Ave, Unit A	1	1	Underway	0.16	No	X

8	40 Sir Francis Drake Blvd, Unit A	1	1	TBD2	0.26	No	AE/AE FLOODWAY/X
9	1 The Alameda Knolls, Unit A	1	1	TBD2	0.65	Yes	X
10	344 Oak Ave, Unit A	1	1	TBD2	0.46	Yes	X
11	55 Avenue Del Norte, Unit A	1	1	TBD2	1.00	Yes	X
12	101 Cedar St, Unit A	1	1	Underway	0.17	Yes	X
13	112 Crescent Rd, Unit A	1	1	Underway	0.19	Yes	X
14	22 Belle Ave	1	1	Underway	0.18	No	AE
15	3 Ray Ct, Unit A	1	1	Underway	0.26	Yes	X
16	9 Tomahawk Dr, Unit A	1	1	Underway	0.56	Yes	X
17	15 Oak Springs Dr, Unit A	1	1	Underway	0.17	Yes	X
18	20 Karl Ave, Unit A	1	1	Underway	0.13	No	X
19	11 Hooper Ln, Unit A	1	1	Underway	0.16	No	AE/AE FLOODWAY/X
20	100 Berkeley Ave	1	1	Underway	0.14	Yes	X
21	49 Cedar St	1	1	TBD2	0.26	Yes	X
22	600 Red Hill Ave	18	1	TBD2	1.61	Yes	X
23	65 Lincoln Park	1	1	TBD2	0.07	Yes	X
24	43 Indian Rock Ct	1	1	TBD2	0.72	Yes	X
25	72 Oak Knoll Ave	1	1	Underway	0.21	No	X
26	55 Avenue Del Norte	1	1	Underway	1.00	Yes	X
27	78 Longwood Dr	1	1	Underway	0.46	Yes	X
28	16 Broadmoor Ave	1	1	Underway	0.13	No	AE
29	268 Brookside Dr	1	1	Underway	0.12	Yes	X
30	24 Ross Valley Dr	1	1	TBD2	0.21	No	X
31	151 Los Angeles Blvd	1	1	TBD2	0.16	No	AE/X
32	10 Humboldt Ave	1	1	TBD2	0.45	Yes	X
33	53 Canyon Rd	1	1	TBD2	0.18	Yes	X
34	88 Crooked Ave	1	1	TBD2	0.46	Yes	X
35	16 Berkeley Ave	1	1	Underway	0.13	No	X
36	316 Greenfield Ave	1	1	TBD2	0.22	No	X
37	6 Spruce Ave	1	1	TBD2	0.22	Yes	X
38	Total	54	37	n/a	12.06	n/a	n/a
39	729 Sir Francis Drake Blvd	1	1	TBD1	0.09	No	AE/X
40	1214 San Anselmo Ave	1	1	TBD1	0.02	No	X
	Total	**54**	**37**	**n/a**	**12.06**	**n/a**	**n/a**

Table 266: Town of San Anselmo Future Growth Areas
Source: Town of San Anselmo

3.2 CAPABILITY ASSESSMENT

The overall priorities in the Town of San Anselmo have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall town priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the

local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the Town of San Anselmo General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the Town's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 19: Town of San Anselmo Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y	The Town's General Plan outlines long-term direction for development and policy. It describes hazard areas and regulates current and future development based on known hazard areas. The General Plan has been amended every few years since 1975 and as this plan gets updated there is potential to improve it with updated risk information and strategies.
Strategic Plan	Y	The Town's strategic plan addresses flood control, a resilient hub, and multi-model transportation, which includes mitigation strategies and actions.
Capital Improvements Plan	Y 2019	This study describes plans and technical rationale for a suite of projects along the watershed that work together as a system to reduce flooding and seeks to restore the ecological health and function of Corte Madera Creek and its tributaries.
Economic Development Plan	Y 2018	The goal of the Economic Development Plan is to provide specific Town actions to maintain and enhance the economic viability of the Town's Commercial area through actions that attract, retain and nurture local businesses consistent with General Plan goals to preserve the small town community character, scale, and pace of life and the Town's close connection with the natural beauty of its setting.

Local Emergency Operations Plan	Y	The plan identifies hazards and mitigation strategies for earthquakes, storms, fire, floods, landslides, airplane crashes, vehicle accidents and terrorism.
Continuity of Operations Plan	N	
Flood Mitigation Plan (FMP)	Y 2008	San Anselmo's 2008 Flood Mitigation Plan provides a glimpse of the Town's response to the 2005/06 flood and the mitigation options that were considered before the 2019 Capital Improvement Plan Study for Flood Damage Reduction and Creek Management
Engineering Studies for Streams	Y	The Town's 100-year flood mitigation plan with the County of Marin includes mitigation strategies and actions.
Open Space Management Plan	Y	The Town has an Open Space Committee and a Sorich Park Master Plan. Sorich Park is approximately 64 acres of open space in San Anselmo. Management of the park strive to reduce fire and safety hazards, accommodate existing reasonable uses, and reconcile the needs of the neighborhood and the community.
Regional Transportation Plan (RTP)	N	Regional transportation plan completed by Transportation Authority of Marin
Stormwater Management Plan/Program	Y	The Town participates in Marin Countywide Stormwater Pollution Prevention Program, MCSTOPPP.
Engineering Studies for Streams	Y	The Town's 100-year flood mitigation plan with the County of Marin includes mitigation strategies and actions.
Community Wildfire Protection Plan	Y	The Town is part of the Marin County Wildfire Protection Plan, which includes mitigation strategies and actions.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	San Anselmo's Climate Action Plan 2030 is a tool to develop strategies and guide the implementation of local measurable actions needed to (1) mitigate climate change by dramatically reducing our greenhouse gas emissions while also sequestering GHG from the atmosphere, and (2) prepare for and adapt to increasing extremes and impacts.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	Yes, state and local building codes are adequately enforced.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Fire department has an ISO rating of 2. It is adequately enforced.
Site plan review requirements	Y	Site plans shall include: an outline of the lot showing the length and direction of all property lines; relevant property setbacks; all buildings, fences, retaining walls, walkways, and driveways. Clearly indicate the distances from any structure to the property lines. Show all structures presently on the site and those proposed; indicate paving material for the driveway and if the paving is new or existing; a north

		arrow; the edge of street pavement and name of any abutting street; if a curb and/or sidewalk exists; site drainage; contour lines for properties steeper than a one-foot drop over a seven-foot horizontal distance (15% grade).
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Municipal Code includes several sections that address hazard mitigation. The Town adopts the current California Building Code which applies to all construction activity within the Town boundaries and supports earthquake and fire mitigation. Watercourse Protection and Floodplain Development are sections that protect against worsening flood situations. The Municipal code is updated periodically to improve mitigation efforts.
Zoning ordinance	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision ordinance	Y	Title 10, Chapter 2 (Subdivisions). In addition, Title 10, Chapter 4 (Housing Developments Under Government Code Section 65852.21) establishes a ministerial review process and provide objective zoning standards for Two-Unit Developments and Urban Lot Splits.
Floodplain ordinance	Y	Title 7, Chapter 11 Protection of Flood Hazard Areas is an effective measure for reducing the impact to structures located in the AE floodplain and AE floodway. The ordinance is enforced by Building and Public Works Departments.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Title 9, Chapter 1, 9-1.214 Exterior Fire Resistive Construction reduces the impacts of fire through the hardening of structures in the identified Wildland Urban Interface (WUI) or otherwise known as High Fire Severity Zones. Ordinance 9-1.215 Outside opening protection Section R303.6 reduces the impacts of fire on structures in all of San Anselmo. Title 5, Chapter 8, 5-8.11 Limitation of Impervious Surfaces, Flatwork Permits and Post-Construction Requirements effectively reduces impervious surfaces and requires bioretention or permanent stormwater controls to remove sediment and other pollutants from entering the stormwater runoff. These ordinances are enforced by Building and Public Works Departments.
Flood insurance rate maps	Y	Title 7, Chapter 11 Protection of Flood Hazard Areas establishes the areas of special flood hazards identified by the Federal Emergency Management Agency

		(FEMA), with accompanying Flood Insurance Rate Maps (FIRMs) adopted by reference and declared to be a part of the Municipal Code. These maps are used by the Planning, Building, and Public Works Departments to identify flood hazards
Elevation Certificates	Y	Title 10, Chapter 4, 10-4.301 Administration, all projects located in a special flood hazard area are required to provide an elevation certificate for the structure. The ordinance is enforced by the Building Department. The ordinance effectively identifies structures in the special flood hazard area as well as identifies how the structures either comply with the Town's flood ordinance or how the structures need to be altered to comply with the Flood ordinance.
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Y	Title 5, Chapter 8, Urban Runoff Prevention is to ensure the future health, safety, and general welfare of Town of San Anselmo citizens and to protect and enhance watercourses, fish, and wildlife habitat by: a. minimizing discharges other than storm runoff into drains and watercourses. b. Responding to the discharge of spills, preventing and controlling the discharge of spills to storm drains or watercourses, and prohibiting dumping or disposal of materials other than stormwater; c. Reducing pollutants in stormwater discharges to the maximum extent practicable; d. Requiring operators of construction sites, new or redeveloped land, and industrial and commercial facilities to install, implement, and maintain appropriate best management practices (BMPs); and e. Requiring development projects to maintain or reduce the volume, velocity, peak flow rate, and duration of runoff as compared to the pre-development stormwater runoff rates; and preventing stormwater pollution whenever possible, through stormwater management controls and ensuring that these management controls are properly maintained. Title 9, Chapter 18, Excavation, Grading and Erosion Control, establishes controls on excavation, grading, and fill within the town. The controls are enforced by the Planning, Building, and Public Works Departments. The ordinance requires work proposing movement of 25 or more cubic yards of soil to obtain a permit to protect safety, erosion control, sound soil engineering practice, aesthetics, environmental protection, and water quality

		protection. In addition, the ordinance restricts work during the rainy season (from October 15th to April 15th).

Table 267: Town of San Anselmo Legal and Regulatory Capabilities
Source: Town of San Anselmo

Town of San Anselmo General Plan or Master Plan

California Government Code 65300 requires that every Town and County in the state have a General Plan. The Town of San Anselmo General Plan, adopted in 1975 and most recently amended in 2019, included an extensive public review process. The General Plan is the most important policy and planning document in the Town and is used by virtually every department. The General Plan is the Town's statement of its vision for the future. The General Plan contains policies covering every aspect of the Town: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

Town of San Anselmo specific goals and policies related to mitigation of natural hazards are as follows:

Table 20: Town of San Anselmo General Plan

Goal/Policy/ Program	Explanation
Land Use Element	
Goals	LU 3. New developments shall be integrated harmoniously into San Anselmo's existing neighborhoods and commercial areas. LU 4. New developments in the Town's open hillside and ridge areas will be regulated to protect the natural beauty of these areas.
Objective	LU 1: To manage future growth to ensure the orderly development of the community, the logical extension of urban services, preservation of the area's natural and cultural resources, and protection of the area's environmental setting.
Policy	LU 1.2: Future growth will be managed based on the ability to provide needed public services, the constraints associated with development of the site, the costs and revenues associated with new development, and the effects of growth on local traffic conditions.
Objective	LU 2: To preserve and enhance the unique natural and urban characteristics of the community while accommodating suitable new growth.
Policy	LU 2.1: All land use decisions within the Town and the planning area will take into consideration the protection and preservation of the area's surrounding hillsides, ridges, water courses, and any unique natural habitats. LU 2.2: New development will be required to preserve some of the natural and cultural characteristics of their respective development sites.
Objective	LU 3: To establish residential densities which are compatible with the environmental constraints of the area, and sensitive to adjacent land uses
Policy	LU 3.1: Very low density (hillside and ridge) and single-family conservation residential development should be located in areas of (1) relatively high visibility, (2) environmental hazards, (3) sensitive environmental resources, or (4) areas which are established as high priority open space lands. LU 3.2: Single-family residential development is most appropriate within and adjacent to existing single-family areas, and in areas easily served with water and sewer lines. Such areas should also serve as transition zones between mixed density and very low density areas.

Table 20: Town of San Anselmo General Plan	
Goal/Policy/ Program	**Explanation**
	LU 3.3: Mixed residential and housing opportunity development is most appropriate where sites have few environmental constraints, and have adequate facilities, such as water, sewer, transit, and access to commercial services.
Objective	LU 7: To protect and preserve those areas of unique natural and visual resources within the planning area
Policy	LU 7.1: To limit or prohibit development in hazardous areas or areas of high resource value. LU 7.6: 7.6 Continue to preserve open space and provide for the conservation of resources through innovative implementation including zoning, development controls (including grading, public and private acquisition, and incentives for private improvements which enhance the environment).
Objective	LU 9: To regulate future development on hillside and ridge parcels so as to protect, maintain, and enhance the natural characteristics of the land which contribute to the open space qualities of the parcel.
Policy	LU 9.5: New roads or extensions of existing roads which provide access to hillside and ridge parcels shall be limited in paved width to the minimum necessary to provide for adequate public safety LU 9.7: Development on hillside and ridge parcels shall be so designed as to minimize grading and disruption of natural contours.
Objective	LU 13: To ensure that existing and future development in hillside and ridge areas has a continuous supply of domestic water, adequate water to protect structures from domestic and wild fires
Policy	LU 13.1: To encourage the Fire District to require sprinkler systems in new residential buildings which the Water District cannot supply with the ISO recommended fireflow. LU 13.2: New homes shall hook into MMWD's system where feasible. If a water moratorium exists or public water cannot be provided, owners may construct potable water wells for new homes in accordance with the San Anselmo Municipal Code but shall connect to MMWD for their sole potable water supply as soon as water supplied by MMWD is available
Objective	LU 14: To require homes and other improvements constructed in hillside and ridge or other high fire hazard areas to be designed to reduce the potential for a disastrous fire.
Policy	LU 14.1: To prohibit on street parking on public and private roadways which, due to their width or circuitous routing, create problems for fire equipment access. LU 14.2: To prohibit the use of combustible roofing materials in residential areas that have a high wildfire potential (e.g., hillside and ridge areas). LU 14.3: To require brush clearance around structures which encroach on wild vegetative groundcover.
Objective	LU 15: To ensure that onsite sewage treatment systems do not create a potential health problem or contribute to a potential unstable slope condition.
Policy	LU 15.2: Where it is not feasible to hook into the Sanitation District collection system, the builder must supply a copy of a sanitation engineer's report to the Town stating that disposal is feasible on the site from a health standpoint. Further, a professional geotechnical report by a professional engineer shall be supplied to the Town stating that the proposed wastewater disposal field will not result in contribute to any landslide or other adverse geologic condition.
Objective	LU 16: To protect the community from danger to life and property caused by flooding.
Policy	LU 16.1: All new developments in the Town should be designed to minimize vegetation

Table 20: Town of San Anselmo General Plan	
Goal/Policy/ Program	**Explanation**
	removal, soils compaction, and site coverage. LU 16.2: To only allow development within the 100-year floodplain which is consistent with the Town's adopted Protection of Flood Hazard Areas and Water Course Ordinance. LU 16.3: To inform the citizens of the community of existing and potential flooding problems on an ongoing basis. LU 16.4: To repair and improve the Town's storm drainage system to handle existing and projected runoff. LU 16.5: To prepare evacuation plans for flood-prone areas and distribute information to affected residents, businesses, and property owners
Objective	LU 17: To ensure that facilities needed to function in a natural disaster are not located in the floodplain or, if there is no other choice, that they are designed to function adequately under emergency conditions.
Policy	LU 17.1: Facilities designated as "critical" in the emergency preparedness plan should not be located in the 100-year floodplain, or if no other choice shall be designed to function adequately under emergency conditions.
Circulation Element	
Goals	C 2. To design a roadway network which will maintain and enhance the quality of life on local residential streets in the community. C 5. To support transportation improvements and emerging vehicle technology that help reduce greenhouse gas emissions.
Objective	C 10: To allow limited improvements to the existing narrow and circuitous roadways which provide access to ridge and hillside properties while maintaining their existing rural character.
Policy	C 10.1 The only improvements the Town will allow on existing roads which serve ridge and hillside properties are those necessary to improve safety and drainage. The types of improvements which will be allowed include: resurfacing of existing paved areas, cross slope correction, small automobile turnouts, isolated widening, straightening of roads to correct safety hazards, placement of mirrors at blind curves, improved roadway drainage, and repair of existing slides along the roadway, or improvements similar in nature to those described herein.
Objective	C 17: To work toward more widespread use of electric vehicles to lower greenhouse gas emissions from transportation.
Policy	C 17.1: Zero Emission Vehicle readiness. Provide a foundation for electric vehicle implementation efforts, including investments in electric vehicle infrastructure and guidance for ongoing Town initiatives, by preparing an Electric Vehicle Strategy. The strategy should establish a framework for near-term actions that support longer-term mobility goals and initiatives, including, but not limited to, Town policy on costs and fees for Town charging stations, regulations for residential And workplace electric vehicle readiness, and policies for conversion of the Town vehicle fleet.
Open Space Element	
Goal	OS 2. Protect ridgelines, including the ridge zone, and preservation of the natural features of hillside lands
Objective	OS 2: To prohibit development on the ridgeline and within the ridge zone of the major ridges identified on the Open Space and Conservation Map, as well as the secondary ridges

Table 20: Town of San Anselmo General Plan	
Goal/Policy/ Program	**Explanation**
Policy	OS 2.8: Construction within the ridge zone shall be permitted only when the applicant has demonstrated to the satisfaction of the Town Engineer and Planning Commission that construction outside of the ridge zone would be detrimental with respect to soil and geologic conditions, vegetation removal, drainage, and such other factors as are determined to be pertinent.
Conservation Element	
Goals	CO 1. Minimize environmental harm and the disruption of natural features, particularly in hillside and unstable soil areas. CO 2. Protect creeks from pollution and against any unnecessary disturbance of the natural contours and vegetation of the banks. CO 3. Establish policies and practical guidelines for the prevention of erosion, the stabilization of soils, and the protection of the watershed necessary to minimize excessive water runoff. CO 5. Preserve ridgetops* and other locally important natural or man-made historic areas or features.
Policy	CO 3: Activities causing damage to hydrological and biological processes shall be discouraged.
Policy	CO 4: Streams shall be maintained in or restored to their natural state. A flood channel maintaining the natural settings on San Anselmo Creek and Sleepy Hollow Creek shall be of adequate width and properly maintained to allow passage of flood waters and preservation of riparian vegetation and habitat. Removal of vegetation on the hillsides should be closely controlled in order to minimize erosion, siltation of watercourses, and runoff.
Policy	CO 7: Construction shall be located and designed to avoid or minimize the hazards from earthquake, erosion, landslides, floods, fire, and accidents.
Policy	CO 9: Structures, parks, and other areas modified by man, where people spend most of their time, shall be healthful, safe, quiet, and of good design, both functionally and aesthetically.
Policy	CO 10: Projects shall not overburden the water supply, fire protection, waste disposal, schools, traffic and circulation, or other services and facilities, or adversely affect the financial or social environment of the community.
Policy	CO 11: Water supply, flood control, wastewater and solid waste disposal, soil conservation, and open space preservation shall be coordinated to create the greatest public benefit and the least degree of environmental damage.
Policy	CO 13: The Town and County shall take measures to reduce existing and future inefficient or unnecessary energy or natural resources consumption. Recyclable and biodegradable materials shall be utilized and used materials shall be recycled or reused whenever possible.
Town Parks, Recreation, and Public Facilities Element	
Goal	PS C3: The natural appearance and runoff capacity of stream channels should be protected, preserved, and enhanced by the development of small improvements (e.g., small earth-fill dams for storm water retention) and landscaping rather than a major flood-control project such as the concrete channel in lower Corte Madera Creek. The channel lines on both sides of San Anselmo Creek should be protected from encroachment by development.

Table 268: Town of San Anselmo General Plan
Source: Town of San Anselmo General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the Town personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 21: Town of San Anselmo Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Planning Commission	Y	The Planning Commission meetings on the first and third Monday of each month. The Commission holds public hearings and takes action on subdivisions, design reviews, conditional use permits, and items that may be forwarded to or called up by the commission.
Hazard Mitigation Planning Committee	N	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	The Town's Public Works Department has sidewalk, tree, and stormwater maintenance programs that reduce risk of injuries due to falls, fire, and floods.
Mutual aid agreements	N	
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the County emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	Y	Data has been used for the determination of floodplain areas. Different building code requirements are enforced based on the location of a structure in the floodplain to mitigate risk.
Grant writing	Y	Grant writing is performed by Town staff and consultants. Grants have been obtained for flood control, to improve sidewalk safety, replace failing bridges etc.
Hazus analysis	N	
Staff/Personnel Resources	Yes/No Full Time/ Part Time	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	The Building Official is a registered architect, professional civil engineer, certified building official, and has a CAL OES certification. She is well trained on

		hazards and mitigation. She coordinates between the Town, agencies, and staff.
Flood Control and Water Conservation District Staff	Y	The Marin County Flood Control and Water Conservation District supports flood mitigation efforts by partnering with Cities and Towns to design, construct and maintain flood control infrastructure and channel improvements.
Emergency Manager	Y/FT	The Public Works Director serves as the emergency manager. He is adequate and well-trained to enforce regulations. He coordinates between the Town, agencies, and staff.
Community Planner	Y/FT	The Planning Director serves as the community planner. She is adequate and well-trained to enforce regulations. She coordinates between the Town, agencies, and staff.
Civil Engineer	Y/FT	The Town has multiple civil engineers under the Public Works Department. All staff are involved with the enforcement of regulations and are trained on hazard mitigation.
GIS Coordinator	N	
Community Development Staff	Y/FT	Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan.
Town Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building related activities including issuing permits, conducting environmental review, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. Public Works Department is responsible for Town-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department.
Police Department Staff	Y/FT	The Ross Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Department Staff	Y/FT	The Ross Valley Fire Department protects the town from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire.
Volunteer Boards and	Y	The Town has several volunteer groups that can help

Commissions		hazard mitigation efforts including the Town Council, Planning Commission, Flood Committee and the Quality of Life Committee. These groups are both personnel resources and can make recommendations to the Town Council, the governing body, which can update municipal and zoning codes.

Table 269: Town of San Anselmo Administrative and Technical Capabilities
Source: **Town of San Anselmo**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 22: Town of San Anselmo Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has been included in the 5 Year CIP for flood control projects, stormwater mitigation, fire hazard reduction, etc both presently and in the past. The resource can and will be used in the future to fund mitigation projects.
Authority to levy taxes for specific purposes	Y	San Anselmo along with the County of Marin gets funding from Measure C for Wildfire Mitigation. In addition, Measure D (now J) a local sales tax has been used in the past for flood control mitigation. Both Measure C and J will be used in the future for wild fire mitigation and flood control, respectively. Measure J is also planned to be used for stormwater cleanup and mitigation and climate adaptation and resiliency. The measures could be used to fund future mitigation actions.
Fees for water, sewer, gas, or electric services	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities. However, these utilities are not in the direct control of San Anselmo and may be limited by Public Utility Commission regulations.
Impact fees for new development	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Storm water utility fee		
Incur debt through general obligation bonds and/or special tax bonds	Y	The Town has used general obligation bonds to fund stormwater projects. Future funding could possibly be obtained through these means.

Incur debt through private activities	N	The Town is a public entity and doesn't incur private debt.
Community Development Block Grant	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Other federal funding programs	Y	Federal funding has been used in the past to mitigate landslides and flooding. Federal funding could be used in the future to fund various projects including stormwater runoff, flood control, and climate adaption.
State funding programs	Y	State funding has been obtained for replacement of bridges which cause flooding along with funding for other flood control projects. Future state funding could be obtained through the use of state funding for various mitigation activities.

Table 270: Town of San Anselmo Fiscal Capabilities
Source: **Town of San Anselmo**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Town of San Anselmo and the Town of San Anselmo partnerships utilized to promote those programs.

Table 23: Town of San Anselmo Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The Town has several volunteer groups that can help hazard mitigation efforts including the Town Council, Planning Commission, Flood Committee and the Quality of Life Committee. These groups are both personnel resources and can make recommendations to the Town Council, the governing body, which can update municipal and zoning codes.
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The Town Manager's newsletter was initiated after the 2005-06 floods and became a regular method of communication between the Town and its residents.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	The Town partners with state and federal fire agencies. Partnerships with these groups could assist in future mitigation programs/actions.
Natural disaster or safety related school programs	Y	The Town conducts Public Outreach Programs at local schools on Fire Safety.

StormReady certification	N	In the future the Town could look at participating in this.
Firewise Communities certification	Y	Various neighborhoods in San Anselmo have Firewise Certification.
Community Rating System	Y	A Countywide collaboration of CRS community staff has been started in recent years and has led to shared resources including outreach materials and floodplain management training. This collaboration has the potential to expand and lead to a wide variety of flood mitigation activities.
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in the County of Marin, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 271: Town of San Anselmo Community Outreach
Source: Town of San Anselmo

3.2.5 Participation in the National Flood Insurance Program

Town of San Anselmo has participated in the Regular Phase of the NFIP since December 1st, 2077. Since then, the Town of San Anselmo has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. The Town of San Anselmo has been in the CRS program since May 1st, 2016. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, the Town of San Anselmo is currently ranked Class 8 community, which gives a 10% premium discount to individuals in the Town of San Anselmo Special Flood Hazard Area (SFHA), and a 5%discount to policyholders outside the SFHA.

Presently, the Town of San Anselmo manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the Town's participation in the NFIP. As well, the Town's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the Town.

The Town of San Anselmo will continue to manage their floodplains in continued compliance with the NFIP. An overview of the Town's NFIP status and floodplain management program are discussed in Table 24. Additional information on the Town's CRS program follows.

The activities credited by the CRS program provide direct benefits to the Marin County OA and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that the Town of San Anselmo implements and receives CRS credits include:

San Anselmo's CRS program as of May 1, 2016.

Activity 310 – Elevation Certificates: Credit is provided for having written construction certificate management procedures for all new and substantially improved/substantially damaged buildings. (46 points)

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community offering additional FIRM information, historical flood information, and natural floodplain functions. The service is publicized annually and records are maintained. (90 points)

Activity 330 – Outreach Projects: Credit is provided for general outreach projects and targeted outreach projects. These projects are disseminated annually. (82 points)

Activity 340 – Hazard Disclosure: Credit is provided for state regulations requiring disclosure of flood hazards. (15 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the San Anselmo Library. Credit is also provided for floodplain information displayed on the community's website. (73 points)

Activity 360 – Flood Protection Assistance: Credit is provided for offering one-on- one advice regarding property protection and making site visits before providing advice. The service is publicized annually and records are maintained. (55 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 55 percent of the Special Flood Hazard Area (SFHA) as open space, and preserving open space land in a natural state. (46 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new construction and substantial improvement, foundation protection, cumulative substantial improvement, and local drainage protection. Credit is also provided for the enforcement of building codes and Building Code Effectiveness Grading Schedule (BCEGS®) Classification. (111 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using additional map data in the day to day management of the floodplain. Credit is also provided for

establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study reports. (161 points)

Activity 450 – Stormwater Management: The community enforces regulations for soil and erosion control, and water quality. (52 points)

Activity 510 – Floodplain Management Planning: Credit is provided for the Marin County Operational Area Multi-Jurisdictional Local Hazard Mitigation Plan, adopted on September 17, 2019. A progress report must be submitted on an annual basis. (171 points)

Activity 520 - Acquisition and Relocation : Credit is provided for a acquiring and/or relocating flood prone buildings so that they are out of the floodplain. (190 points)

Activity 630 – Dams: Credit is provided for a State Dam Safety Program. (37 points)

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 4
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: All 4 RL properties were identified as "no" for mitigated.
- There were 0 repetitive loss properties that were categorized as mitigated.
- Repetitive Loss (RL) Residential Structures: 4
- Repetitive Loss (RL) Non-Residential Structures: 0
- Severe Repetitive Loss (SRL) Residential Structures: 0
- Severe Repetitive Loss (SRL) Non-Residential Structures: 0

Table 24: Town of San Anselmo NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	415 Policies $495,946 Premiums $125,204,000 coverage
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	285 Paid losses $11,765,301 Paid losses 35 Substantial damage claims
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	561 – GIS, Maps, Hand count
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	Community FPA

Is floodplain management an auxiliary function?	Community FPA
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	June 28, 2019
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	December 1st, 1977
Are the FIRMs digital or paper?	Digital, some paper
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Community FPA
Provide an explanation of the permitting process.	Community FPA, State, FEMA NFIP
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	Class 8
What categories and activities provide CRS points and how can the class be improved?	310 Elevation Certificates 320 Map Information Service – 90 Points 330 Outreach Projects – 82 Points 340 Hazard Disclosure – 15 Points 350 Flood Protection Information - 73 Points 360 Flood Protection Advice – 55 Points 420 Open Space Preservation - 46 Points 430 Higher Regulatory Standards – 111 Points 440 Flood Data Maintenance – 161 Points 450 Stormwater Management – 52 Points 510 Floodplain Management Plan – 171 Points 520 Acquisition and Relocation – 190 Points 630 Dams – 37 Points
Does the plan include CRS planning requirements	Yes

Table 272: Town of San Anselmo NFIP Status
Source: FEMA, Town of San Anselmo

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA, including each of its jurisdictions, as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 25 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 25: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Develop list of locally historic resources and create incentives for private owners of historic or architecturally significant buildings to undertake mitigation to levels that will minimize the likelihood that these buildings will need to be demolished after a disaster and/or establish preservation-sensitive measures for the repair and re-occupancy of historically significant privately-owned structures.			X		Yes
Develop unused or new pedestrian rights-of-way as walkways to serve as additional evacuation routes.		X			Yes
Encourage Marin Municipal Water District to review and update mapped inundation area for Phoenix Dam and coordinate with the Town on procedures for the emergency evacuation of areas that would be inundated by a failure of Phoenix Dam.				X	Yes
Conduct an inventory of privately-owned existing or suspected soft-story structures as a first step in establishing voluntary or mandatory programs for retrofitting these buildings.			X		Yes
Use the soft-story inventory to require private owners to inform all existing andprospective tenants that they live or work in this type of building and may need to be prepared to live or work elsewhere following an earthquake if the building has not been retrofitted.			X		Yes
Require private owners to inform all existing tenants (and prospective tenants prior to signing a lease agreement) that they live in an unreinforced masonry building and the standard to which it may have been retrofitted. Require private owners to inform all existing tenants that they may need to be prepared to work elsewhere following an earthquake even if the building has been retrofitted, because it has probably been retrofitted to a life-safety standard, not to			X		Yes

Table 25: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
a standard that will allow occupancy following major earthquakes.					
Continue Mapping of the creeks to further evaluate, design, and implement additional flood control projects.		X			Yes
Pursue funding for the design and construction of storm drainage projects to protect vulnerable properties, including property acquisitions, upstream storage such as detention and retention basins (excluding Memorial Park), and channel widening with the associated right-of-way acquisitions, relocations, and environmental mitigations.		X			Yes
Develop an approach and locations for various watercourse bank protection strategies, including for example, (1) an assessment of banks to inventory areas that appear prone to failure, (2) bank stabilization, including installation of rip rap, or whatever regulatory agencies allow (3) stream bed depth management using dredging, and (4) removal of out-of-date coffer dams in rivers and tributary streams		X			Yes
Working with stakeholders and the community, consider feasibility (including cost, funding, environmental and downstream impacts) and options for removal of Morningside Avenue Bridge and potential construction of upstream and downstream extended wing walls.		X			Yes
Recognize that a multi-agency approach is needed to mitigate flooding by having flood control districts, cities, counties, and utilities meet at least annually to jointly discuss their capital improvement programs for most effectively reducing the threat of flooding. Work toward making this process more formal to insure that flooding is considered at existing joint-agency meetings.		X			Yes
Improve upon existing hydrologic analysis of runoff and drainage systems to predict areas of insufficient capacity in the storm drain and natural creek system.		X			Yes
Continue to develop guidelines that limit the coverage of impervious surfaces, that require the use of permeable surfaces, that implement other regulations to effectively channel and minimize site runoff, and that allow water to percolate into the ground.		X			Yes
Encourage home and apartment owners to get elevation certificates.		X			Yes
Continue to encourage new development near floodways to incorporate a setback from watercourses to allow for changes in stormwater flows in the watershed over time.		X			Yes
Continue to have Town staff inspect creek areas after each storm.		X			Yes
Work with other Ross Valley jurisdictions to explore and adopt land use regulations to minimize additional runoff, or reduce runoff, within the Ross Valley watershed.			X		Yes
Working with stakeholders and the community, consider feasibility (including cost, funding, environmental and downstream impacts) and options for flow bypass accommodation for downtown constrictions			X		Yes
As new flood-control projects are completed, request that		X			Yes

Table 25: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
FEMA revise its flood- insurance rate maps and digital Geographic Information System (GIS) data to reflect flood risks as accurately as possible.					
Consider adopting cumulative substantial improvement requirement of 3 to 5 years under Municipal Code Protection of Flood Hazard Areas.	X				No
Update hydraulic model at least once every ten years, or more frequently if there is a major development in the watershed or a major change in the Land Use Element of the General Plan of the cities or counties within the watershed.		X			Yes
Require an annual inspection of approved flood-proofed privately-owned buildings to ensure that (a) all flood-proofing components will operate properly under flood conditions and (b) all responsible personnel are aware of their duties and responsibilities as described in their building's Flood Emergency Operation Plan and Inspection & Maintenance Plan.		X			Yes
Ensure that Town and Ross Valley Fire Department-initiated fire-preventive vegetation-management techniques and practices for creek sides and high-slope areas do not contribute to the landslide and erosion hazard. For example, vegetation in these sensitive areas could be thinned, rather than removed, or replanted with less flammable materials. When thinning, the non-native species should be removed first. Other options would be to use structural mitigation, rather than vegetation management in the most sensitive areas.			X	X	Yes
Tie public education on defensible space and a comprehensive Fire Wise and defensible space ordinance to a field program of enforcement.		X			Yes
Encourage the formation of a community- and neighborhood-based approach to wildfire education and action through local Fire Safe Councils and the Fire Wise Program .		X			Yes
Encourage Ross Valley Fire Department to increase local patrolling during periods of high fire weather.		X			Yes
Encourage Ross Valley Fire Department to monitor weather during times of high fire.		X			Yes
Seek funding to prepare a Biodiversity, Fire, and Fuels Integrated Plan (BFFIP) that describes action that the Town will take to minimize fire hazards and maximize ecological health in its open space areas.		X			Yes
Improve engineering design and vegetation management for mitigation, appropriate code enforcement, and public education on defensible space mitigation strategies.		X			Yes
Ensure adequate fire department access to developed and open space areas and keep fire roads and public rights-of-way passable at all times.		X			Yes

Table 273: Status of Previous Hazard Mitigation Actions
Source: Town of San Anselmo

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Town of San Anselmo based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no

funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.

- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 26 lists the Current Hazard Mitigation Actions for the Town of San Anselmo.

Table 26: Town of San Anselmo Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SA-1	Marin Emergency Radio Authority (MERA) Upgrades. MU-13 Protect Infrastructure and Critical Facilities	All Hazards/ 1, 2, 3, 4, 5	County of Marin and the Town of San Anselmo	Existing (2018)	Cost TBD; HMGP, BRIC, CDAA, FMA, grants, existing budgets	Ongoing/ 1-3 years. High	Town as a participant, is also studying replacement for the system as it reaches the end of its service life.
SA-2	Implement the Goals, Policies, and Actions listed in Table 20 of the General Plan Safety Element.	All Hazards/ 1, 2, 4, 5	Town of San Anselmo	New (2023)	Cost: General Funds	Ongoing/ 1-3 years High	A new General Plan Safety Element was adopted which includes significant public safety components.
SA-3	Review and adopt current California Building and Fire codes. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of San Anselmo	Existing (2018)	Cost: General Funds	1 – 3 years/ High	The Town continues to review and adopt current California Building and Fire codes.
SA-4	Review and adopt current California Building codes for seismic, flood, fire, and other disaster. MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	Town of San Anselmo	Existing (2018)	Cost: General Funds	3 - 5 years/ Medium	The Town continues to review and adopt current California Building codes.
SA-5	As new development occurs; roadways and driveways are required to be of minimal 12 to 20 foot width and with approved turnarounds and/or turnouts.	All Hazards/ 1, 2, 4, 5	Town of San Anselmo	Existing (2018)	Cost: General Funds	1 – 3 years/ High	Ongoing
SA-6	Enhance Community facilities to support the socially vulnerable population during extreme heat weather events. Design and Build a Resilience Hub ET-3 Assist Vulnerable Population	Severe Weather-Heat/ 1, 2, 4, 5	Town of San Anselmo	New (2022)	Cost TBD: HMGP, BRIC, CDAA, PG&E Grants	1 - 2 years/ High	The Resilience Hub Concept design has been completed, the project will go out for RFPs and will be funded by local funds if no grant funds are available. Identified in the Town 2030 Climate Action Plan
SA-7	Fire code amendments to reduce the damage to structures from earthquakes, landslides, and fires. Including automatic natural gas shut-off valves and fire sprinklers for new	Earthquake, Debris Flow, Wildfire, Land Subsidence/ 1, 2, 4, 5	Town of San Anselmo	Existing (2018)	Cost: General Funds	1 – 3 years/ High	Ongoing every 3 years.

Table 26: Town of San Anselmo Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
	and substantially remodeled structures.						
SA-8	Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas. WF-9 Implement a Fuels Management Program	Wildfire/ 1, 2, 4, 5,	Town of San Anselmo, Ross Valley Fire	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	This reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire.
SA-9	Vegetation Management Plan to include the removal of exotic, invasive, and hazardous species and replacing them with native, safer vegetation. WF-9 Implement a Fuels Management Program, ET-1 Reduce Urban Heat.	Wildfire, Severe Weather - Heat & Wind 1, 2, 4, 5,	Town of San Anselmo, Ross Valley Fire	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	Reduces the chance of a wind/ wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire. Supports environmental restoration.
SA-10	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Severe Weather - Wind/ 1, 2, 4, 5,	Town of San Anselmo, County of Marin, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	Under grounding power lines will reduce vulnerability to fires caused by wind driven power line breaks.
SA-11	Local, Open Space, and Defensible Space fire fuel reduction and removal of non native plants and trees.	Wildfire 1, 2, 4, 5,	Town of San Anselmo, County of Marin, Fire Districts, and Marin Wildfire Protection Authority	New (2020/21)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants, Measure C funding	1 - 10 years/ High	Measure C 10 Year Parcel Tax fire fuel reduction, community education, etc.
SA-12	Flood risk reduction projects including bridge replacements, building removal and other flood projects. F-2, F-19	Flooding, 1, 2, 4, 5	Town of San Anselmo, County of Marin, Flood Control Zone 9	Existing (2007)	Cost TBD: HMGP, FMA, CDAA, Flood Fee, and other grants	2 -20 Years/ High	San Anselmo is part of the Ross Valley Flood Control Zone 9 with Marin County Flood Control
SA-13	Community Rating System provide information to residential and commercial properties to reduce flood risk. Code to require and inspect flood	Flooding 1, 2, 4, 5	Town of San Anselmo, County of Marin	Existing (2016)	Cost General Fund	2 -5 Years/ High	Ongoing program which helps reduce insurance rates by providing public information, enforcement, etc.

Table 26: Town of San Anselmo Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
	gates in commercial areas on an annual basis.						
SA-14	Groundwater use and monitoring program to reduce use of the domestic water supply. Install new irrigation systems, plan install piping for future greywater systems -D-1,2,3,4,5	Drought 1, 2, 3, 4, 5	Town of San Anselmo	Existing 2021	Cost TBD: General Fund, Measure A and J, grants	Ongoing/ High	During the recent drought wells were brought online, improved as well as improved efficient irrigation, and ground water monitoring
SA-15	Soft Story Program to identify and require retrofitting per adopted ordinance	Earthquake 1, 2, 4, 5	Town of San Anselmo	New 2023	Cost TBD General Fund	1-5 years Medium	
SA-16	Objective Design and Development Standards The ODDS provide clear and objective zoning standards and streamlined review and approval processes for multifamily and mixed-use residential development to ensure that local housing production goals are met in accordance with State law.	All Hazards 1, 2, 4, 5	Town of San Anselmo	New 2023	Cost TBD General Fund	Ongoing Medium	Adopted
SA-17	Housing Element The Housing Element is a part of the General Plan for the Town that assesses and lays out policies to meet the existing and projected housing needs of all economic segments of the community.	All Hazards 1, 2, 4, 5	Town of San Anselmo	New 2023	Cost TBD General Fund	1-8 years High	Adopted
SA-18	Stormwater State General Plan Remove trash from stormwater system, prevent erosion, and improve overall stormwater system	Flooding 1, 2, 5	Town of San Anselmo and County of Marin	Existing 2020	Cost TBD in the millions of dollars General Fund	1-10 years Medium	
SA-19	Firewise Community NFPA's Firewise USA® program teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action now to prevent wildfires.	All Hazards MU-16 1, 2, 3, 4, 5	Ross Valley Fire, Fire Safe Marin, County of Marin, and Town of San Anselmo	Existing 2019	Volunteer program	Ongoing Medium	

Table 274: Town of San Anselmo Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Town of San Anselmo. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 25 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Town of San Anselmo identified and prioritized the mitigation actions as detailed in Table 26, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this MJHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Project Implementation

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the Town of San Anselmo will maintain this plan and will serve as a lead staff for grant project applications on Town projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Town of San Anselmo will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Town of San Anselmo already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

Town General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the Town. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

Town Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the Town.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

7) As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
8) Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
9) Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

In the Marin County OA, new housing construction continues to exacerbate the high proportion of detached, single-family housing. In 2020, 96 percent of construction permits issued countywide were for single-family units. In 2020, 61 percent of existing residential buildings are single-family detached units in the Marin County OA. In 2015 and 2017, 100 percent of construction permits issued were for single-family homes, making the 2020 figure of 96 percent the third highest in proportion of single-family unit construction permits issued in the last seven years, but the greatest number of permits in a year is consistently issued for the construction of this type of housing.

Although the demographic trends in San Anselmo indicate that future housing supply is needed to support smaller household sizes and an older population, the predominant housing type continues to be the single-family detached homes, which comprise 76 percent of the housing stock (Department of Finance, 2020). Single-family attached units and small, multifamily complexes (2 to 4 units) comprise 11 percent of San Anselmo's housing, and larger multifamily complexes (5+ units) comprise 12 percent. Countywide single-family detached units comprise 61 percent of the housing stock and multifamily units (2+ units) comprise 27 percent.

To meet the needs of current and future residents, Chapter 8 of the Housing Element contains several programs, policies, and actions aimed at facilitating the development of multifamily housing in the Town's commercial corridors, missing middle housing in predominantly single-

family detached neighborhoods, and accessory dwelling units (ADUs) throughout the community.

From 2010 to 2011, the median sales price for a single-family home in San Anselmo dropped to a low of $700,000, and then began to increase steadily through 2021 where the median sales price was $1,600,000. Condominium sales prices dropped to a low of $295,000 in 2011. Sales prices have ebbed and flowed since 2011 and peaked in 2020, where the median condominium sales price of $1,400,000. Condominium sales prices have since decreased in 2021 where the median sales price was $805,000.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Town of San Anselmo.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Town of San Anselmo Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Town of San Anselmo plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Town of San Anselmo is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Town of San Anselmo Public Works Director will monitor and update the Town of San Anselmo Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the Town of San Anselmo, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Town of San Anselmo, to evaluate the plan after each update meeting.

4.4 Plan Update

The Town of San Anselmo Public Works Director will monitor and update the Town of San Anselmo Annex to the Marin County OA MJHMP. During the five-year update cycle, the Town of San Anselmo and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local

stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website....11-18
Figure 2: Marin County OA MJHMP Public Town Hall Meeting....11-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release....11-20
Figure 4: Hazard Mitigation Plan Survey....11-21
Figure 5: Map of the Town of San Anselmo in Marin County....11-24
Figure 6: Map of the Town of San Anselmo....11-25
Figure 7: The Town of San Anselmo Precipitation and Monthly Temperatures....11-27
Figure 8: Races in San Anselmo....11-28
Figure 9: Town of San Anselmo Zoning Map....11-30
Figure 10: Town of San Anselmo Social Vulnerability Map Census Tract 1181.00....11-33
Figure 11: Town of San Anselmo Critical Facilities and Infrastructure....11-37
Figure 12: Town of San Anselmo Risk Assessment – Planning Team Top Hazards....11-39
Figure 13: Hazard Risk Categorization....11-39
Figure 14: NASA Global Temperature Change CO2 Gas....11-43
Figure 15: NASA Global Temperature Change 1884 to 2022....11-43
Figure 16: NASA Global Temperature Change Sea Level....11-44
Figure 17: Annual Mean Sea Level Trends....11-46
Figure 18: Town of San Anselmo Dam Inundation Critical Facilities and Infrastructure....11-52
Figure 19: Phoenix Lake Dam Inundation Area – San Anselmo....11-53
Figure 20: Landslide Susceptibility Classes....11-55
Figure 21: Mud Flow Areas....11-56
Figure 22: Town of San Anselmo Debris Flow Critical Facilities and Infrastructure....11-57
Figure 23: Modified Mercalli Intensity Scale....11-61
Figure 24: Mercalli Scale vs. Magnitude....11-62
Figure 25: Soil Types....11-62
Figure 26: County of Marin Earthquake Impact and Fault Lines....11-64
Figure 27: Town of San Anselmo Earthquake Critical Facilities and Infrastructure....11-65
Figure 28: Diagram of an Atmospheric River Event....11-69
Figure 29: Town of San Anselmo Flooding Critical Facilities and Infrastructure....11-72
Figure 30: February 2017 Flood in San Anselmo....11-74
Figure 31: 2005 Flood in San Anselmo....11-75
Figure 32: 1982 Flood in San Anselmo....11-75
Figure 33: Dissolution Sinkhole Formation....11-76
Figure 34: Cover-Subsidence Sinkhole Formation....11-77
Figure 35: Cover-Collapse Sinkhole Formation....11-77
Figure 36: 2022 San Anselmo Sinkhole....11-78
Figure 37: Heat Index....11-79
Figure 38: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100....11-80
Figure 39: Beaufort Wind Scale....11-81
Figure 40: Enhanced Fujita Scale....11-82
Figure 41: Waterspout Formation....11-82
Figure 42: Federal, State and Local Responsibility Areas in the Marin County OA....11-85
Figure 43: Fuel Model Map for the Marin County OA....11-89

Figure 44: Town of San Anselmo Wildfire Critical Facilities and Infrastructure 11-93
Figure 45: Trends in the Annual Number of Large Wildfires in the United States 11-95

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 11-8
Table 2: 2023 MJHMP Planning Team Members 11-12
Table 3: Town of San Anselmo & Marin County OA MJHMP Planning Meetings 11-16
Table 4: Town of San Anselmo Estimated Jurisdictional Population 11-27
Table 5: Population Change of The Town of San Anselmo 11-28
Table 6: Languages Spoken in San Anselmo 11-28
Table 7: Marin County OA Jurisdictional Housing Stock 11-29
Table 8: NRI Hazards and Marin County OA MJHMP Hazards 11-31
Table 9: NRI Hazard Type Risk Index for San Anselmo Census Tract 1117.00 11-32
Table 10: Household Income for The Town of San Anselmo as of 2021 11-35
Table 11: Town of San Anselmo Civilian Employed Population 16 years+ by Industry 11-36
Table 12: Town of San Anselmo Critical Facilities 11-36
Table 13: Historic Sites in The Town of San Anselmo 11-38
Table 14: Select Hazards Magnitude/ Severity Scale or Index 11-40
Table 15: Town of San Anselmo Hazard Risk Assessment 11-48
Table 16: Marin County OA Hazard Risk Assessment 11-49
Table 17: Town of San Anselmo Critical Facilities in the Flood Zones 11-73
Table 18: Town of San Anselmo Future Growth Areas 11-97
Table 19: Town of San Anselmo Legal and Regulatory Capabilities 11-102
Table 20: Town of San Anselmo General Plan 11-105
Table 21: Town of San Anselmo Administrative and Technical Capabilities 11-108
Table 22: Town of San Anselmo Fiscal Capabilities 11-109
Table 23: Town of San Anselmo Community Outreach 11-110
Table 24: Town of San Anselmo NFIP Status 11-113
Table 25: Status of Previous Hazard Mitigation Actions 11-118
Table 26: Town of San Anselmo Current Hazard Mitigation Actions 11-123

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AMI	Area Median Income
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency

CNRA	California Natural Resource Agency
CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance

FMP	Flood Mitigation Plan
FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department

MCOSD	Marin County Open Space District
MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management

OHP	Office of Historic Preservation
OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System

UCERF2	Uniform California Earthquake Rupture Forecast, Version 2
UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

12. City Of San Rafael
Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The City of San Rafael and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required and without their commitment; this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of San Rafael more disaster resistant and sustainable.

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TABLE OF CONTENTS

CITY OF SAN RAFAEL COMMUNITY PROFILE 12-1
Acknowledgements 12-3
Table of Contents 12-5
Section 1.0: Introduction 12-7
1.1 Introduction 12-7
1.2 Planning Process 12-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 12-8
1.2.2 Steering Committee Planning Process 12-9
1.2.3 Coordination with stakeholders and agencies 12-9
1.2.4 Public Engagement 12-16
1.3 Overview and History 12-24
1.4 Government 12-28
1.5 Weather and Climate 12-28
1.6 Demographics 12-29
1.7 Social Vulnerability and Risk 12-33
1.8 Economy and Tax Base 12-50
1.9 Critical Facilities 12-51
1.10 Historical Properties 12-57
2.0: Hazard Identification and Risk Assessment 12-60
2.1 Climate Change 12-62
2.2 Hazards 12-70
2.2.1 Debris Flows 12-71
2.2.2 Drought 12-77
2.2.3 Earthquake 12-79
2.2.4 Flooding 12-85
2.2.5 Land Subsidence/Sinkholes 12-96
2.2.6 Levee Failure 12-99
2.2.7 Sea Level Rise 12-102
2.2.8 Severe Weather – Extreme Heat 12-108
2.2.9 Severe Weather – High Wind and Tornado 12-110
2.2.10 Tsunami 12-113
2.2.11 Wildfire 12-115
Section 3.0: Mitigation Strategy 12-128

3.1 Changes in Development 12-128
3.2 Capability Assessment 12-129
3.2.1 Regulatory Capabilities 12-130
3.2.2 Administrative and Technical Capabilities 12-136
3.2.3 Fiscal Capabilities 12-138
3.2.4 Community Outreach 12-139
3.2.5 Participation in the National Flood Insurance Program 12-140
3.3 Mitigation Goals 12-143
3.4 Status of Previous Mitigation Actions 12-145
3.5 Hazard Mitigation Actions 12-147
3.6 Progress in Local Mitigation Efforts 12-155
3.7 Plan Integration 12-155
3.8 Future Development Trends 12-156
Section 4.0: Plan Review, Evaluation, and Implementation 12-159
4.1 Plan Adoption 12-159
4.2 Plan Monitoring 12-159
4.3 Plan Evaluation 12-160
4.4 Plan Update 12-160
Figures and Tables 12-162
Acronyms/Abbreviations 12-165

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of San Rafael, Community Profile has been prepared in conjunction with the Marin County OA Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of San Rafael.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County OEM, would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the City of San Rafael involved additional internal planning team to support the broader planning process. The City of San Rafael jurisdictional representatives for the coordinated Marin County OA Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Quinn Gardner, Deputy Director of Emergency Management
Telephone: 415-726-1960
Email: Quinn.Gardner@cityofsanrafael.org

Alternate Point of Contact
Manny Albano, San Rafael Fire Community Disaster Preparedness Coordinator
Telephone: 415-256-5508
Email: manny.albano@cityofsanrafael.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: City of San Rafael Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
San Rafael	Quinn Gardner	Deputy Director of Emergency Management	415-726-1960	Quinn.Gardner@cityofsanrafael.org
San Rafael	Cory Bytof	Sustainability Program Manager	415-485-3407	Cory.bytof@cityofsanrafael.org
San Rafael	Joanna Kwok	Senior Civil Engineer	415-485-3408	Joanna.Kwok@cityofsanrafael.org
San Rafael	April Miller	Public Works Director	415-485-3355	April.Miller@cityofsanrafael.org
San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner	415-256-5534	Kate.Hagemann@cityofsanrafael.org
San Rafael	Manny Albano	San Rafael Fire Community Disaster Preparedness Coordinator	415-256-5508	manny.albano@cityofsanrafael.org

Table 275: City of San Rafael Local Hazard Mitigation Planning Team Members

This 2023 Marin County OA MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of the unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the City of San Rafael. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.

- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of San Rafael Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of San Rafael communities

and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of San Rafael Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of San Rafael and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	DPW
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Director of Emergency Management
47	San Rafael	Cory Bytof	Sustainability Program Manager
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 276: 2023 MJHMP Local Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of San Rafael's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained

on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of San Rafael & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview

Table 3: City of San Rafael & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website.

Table 3: City of San Rafael & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps

Table 3: City of San Rafael & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 277: City of San Rafael & Marin County OA MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The

public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site for the public review period. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

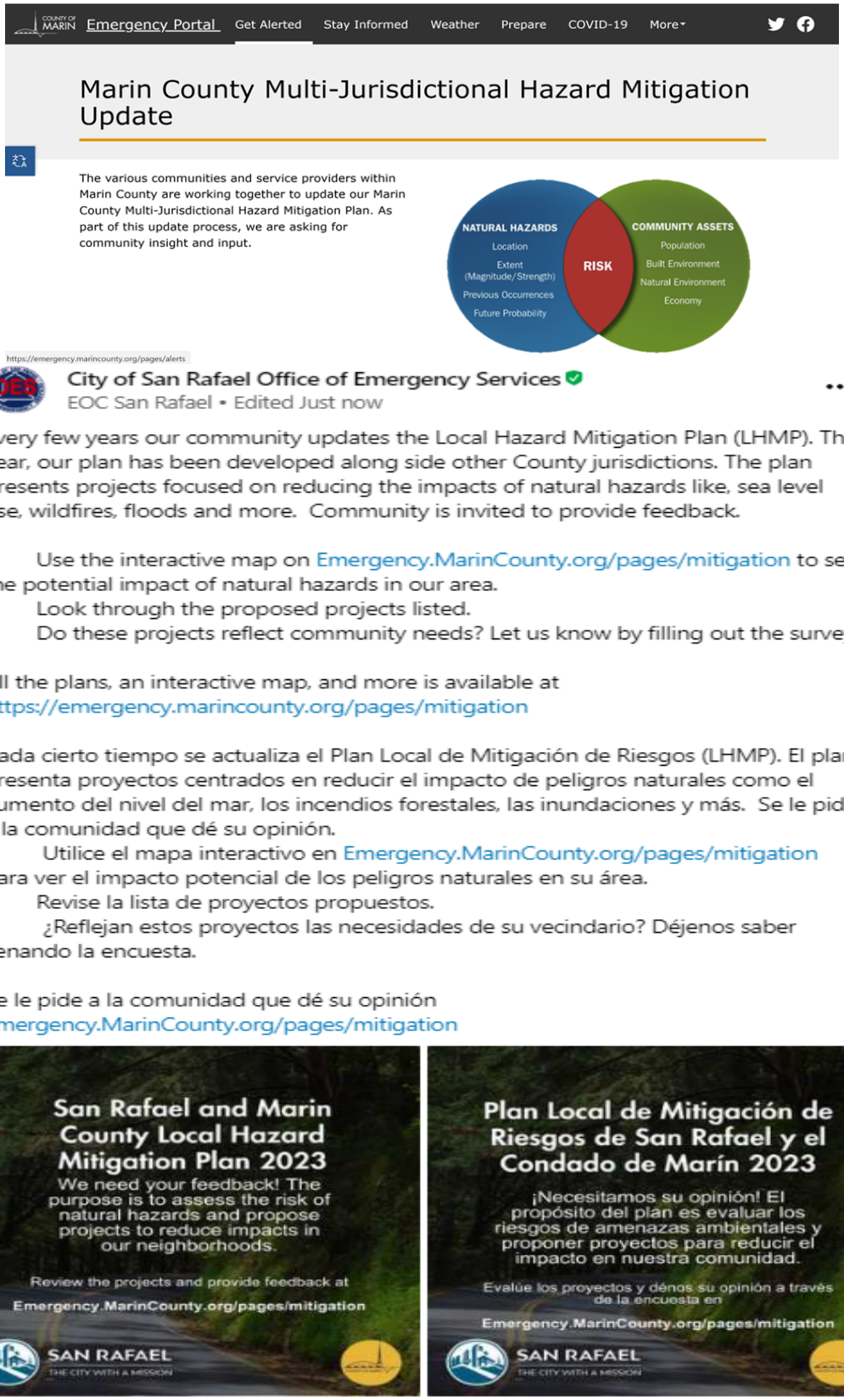


Figure 552: Marin County OEM MJHMP Website and San Rafael Public Outreach

PUBLIC MEETINGS

Two separate Marin County OA MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in to 28 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

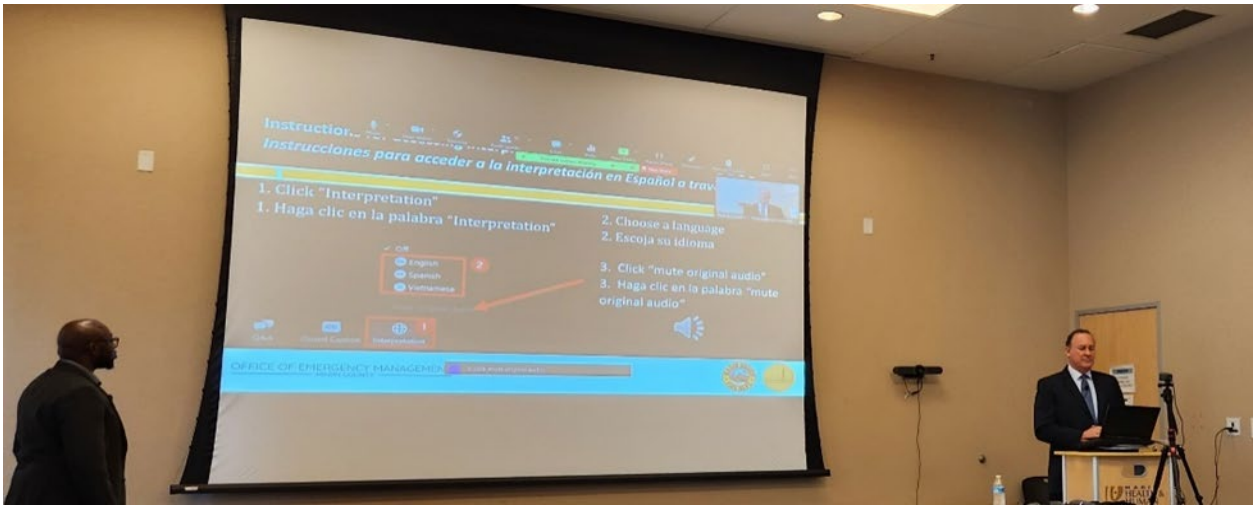


Figure 553: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

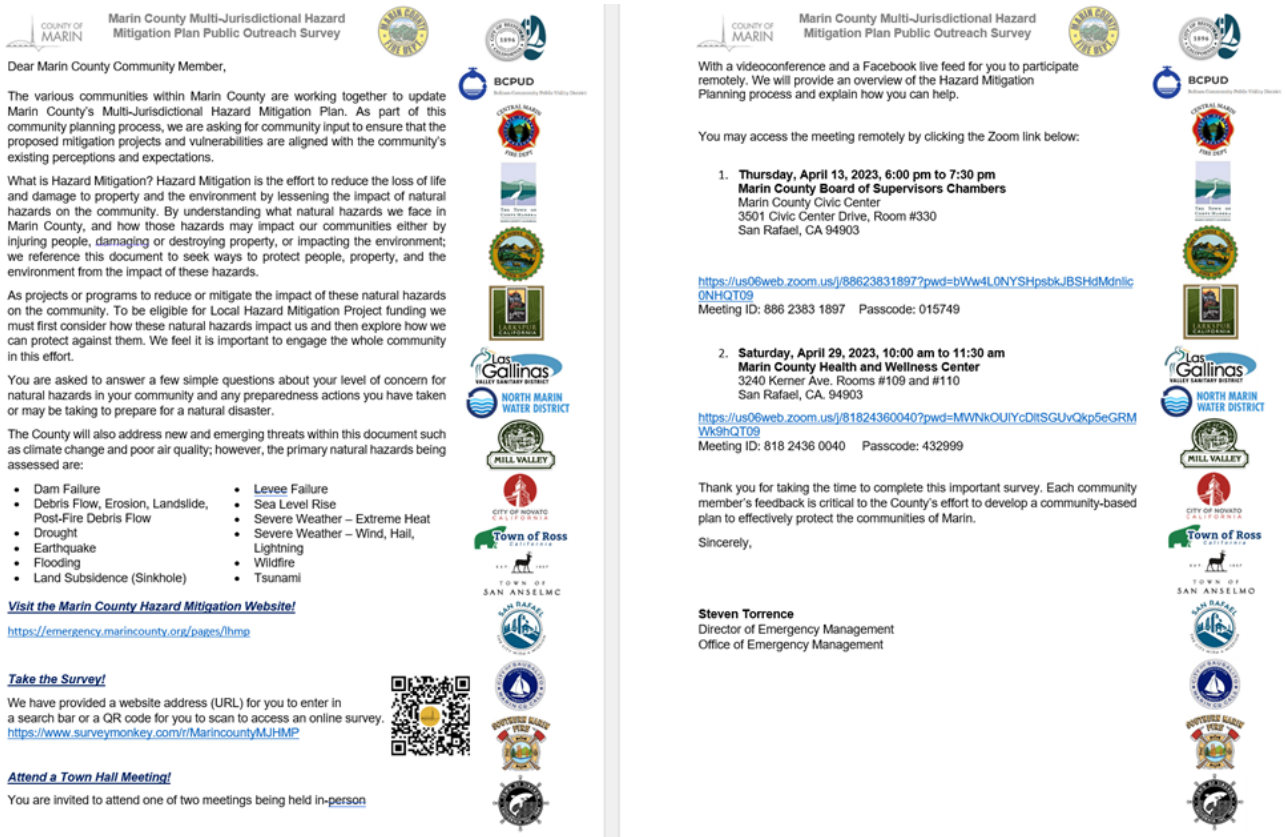
The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 554: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 555: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of San Rafael had an additional 14-day comment period for the City of San Rafael Community Profile where their profile was posted on the City website for final public comment from January 29 – February 12, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team
The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The City of San Rafael distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions

1.3 Overview and History

The area that is now the City of San Rafael was once the site of several Coast Miwok villages, including the village of Nanaguani along San Rafael Creek, inhabited by the Aguasto tribe. In 1817, Mission San Rafael Arcangel was founded as the 20th of 21 Spanish missions in the Spanish colonial province of Alta California. Originally planned as an asistencia (hospital) for Native Americans who became ill at Mission Dolores in present day San Francisco, Mission San Rafael Arcangel gained full mission status in 1822. Following the secularization of Spanish missions in 1833, the mission was placed under the control of administrators. In 1837, Timothy Murphy was appointed as administrator, and by 1844, was granted three contiguous parcels that shaped the future boundaries of San Rafael as Murphy's land was eventually devised and portioned into smaller tracts.

San Rafael incorporated as a city in 1874. San Rafael grew gradually after California statehood in 1850 and was named county seat in 1851. Following the completion of the Transcontinental Railroad in 1869, the construction of the County Courthouse in 1872, and incorporation in 1874, San Rafael entered a period of accelerated growth. Over the ensuing decades leading into the turn of the twentieth century, the nascent town built out as freight, passenger, and streetcar extensions were completed4.

The opening of the Golden Gate Bridge in 1937, and the increasing popularity of the automobile, increased connectivity between Marin County and San Francisco, effectively ending the rail transit era as the Great Depression neared its end and World War II dawned. Following the war, housing starts increased, and the Terra Linda and Marinwood neighborhoods were developed on former ranch lands in 1953 and 1955, respectively. In the years immediately after the war, Fourth Street emerged as the main shopping area for Marin County. San Rafael's downtown continued to prosper, as department stores, restaurants, the County Courthouse, and City Hall combined with churches, nearby residences, and emerging postwar industries to define the modern city.

Over the mid-twentieth century, San Rafael's downtown continues to be centered on its Fourth Street commercial corridors, which displays a great variety of period architecture, embodied in its stores, shops, and restaurants. In 2017, Downtown San Rafael was designated as a California Cultural District.

The City of San Rafael is the county seat of Marin County located on the traditional lands of the Coast Miwok people. The City has a total area of 22.422 square miles.

City of San Rafael Land Acknowledgment

A Land Acknowledgment is a formal statement that recognizes the history and legacy of colonialism that impacted Indigenous Peoples, their traditional territories, and practices. It is a simple, powerful way of showing respect and a step toward correcting past practices and honoring truth.

This land acknowledgement is provided by the Federated Indians of the Graton Rancheria. Outside of the acknowledgement, the partnership and work continues with the tribe to take actions that are most important to them.

We acknowledge that the present day City of San Rafael is traditionally home to the Coast Miwok people many of whom today are tribal citizens of the Federated Indians of Graton Rancheria. We thank the original care takers of this land and honor their continuing involvement in stewardship practices that benefit us all.

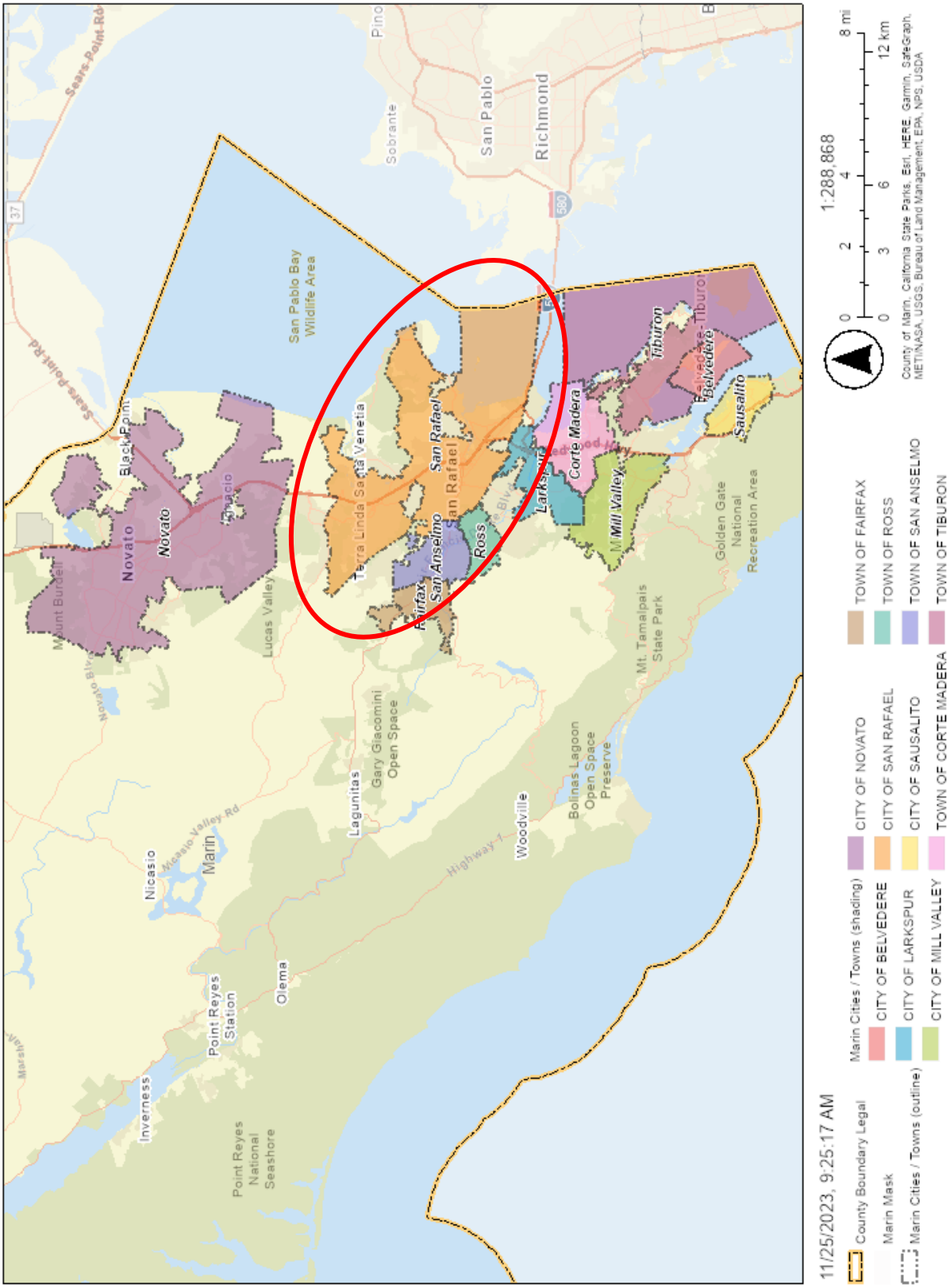


Figure 556: Map of City of San Rafael in Marin County
Source: Marin County OEM

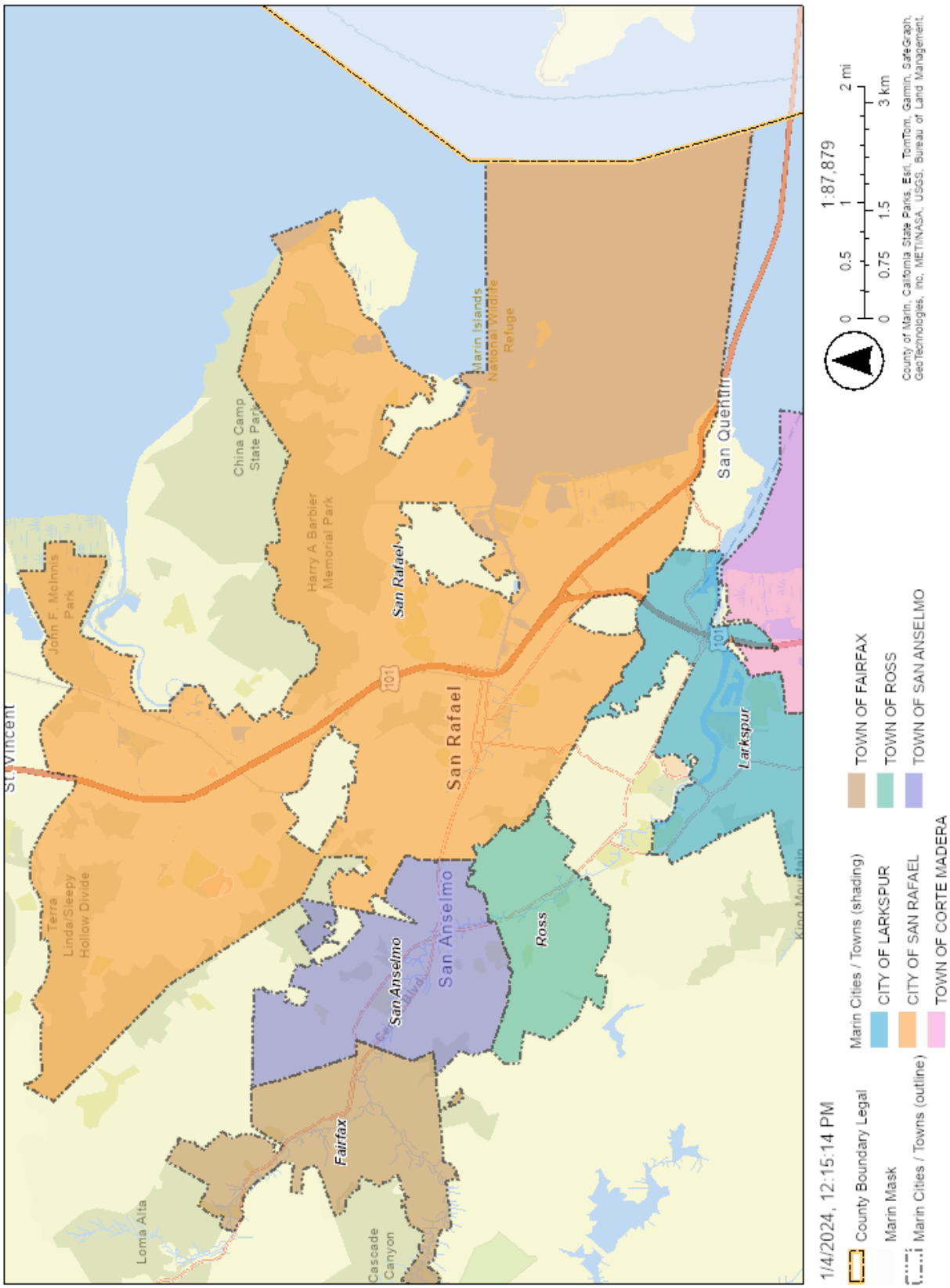


Figure 557: Map of the City of San Rafael
Source: Marin County OEM

1.4 GOVERNMENT

The City of San Rafael is governed by a five-person City Council, four councilmembers are elected by their districts and the mayor is elected at large. The city council elects a vice mayor each year from its membership. The Mayor is the executive head of the City; and appoints a City Manager, the administrative head of the City. The city consists of 20 departments: the City Attorney, City Clerk, City Council, City Manager's Office, Community Development (including homelessness and housing), Digital Service & Open Government, Economic Development, Finance, Fire Department, Human Resources, Library & Recreation, Parking Services, Police Department (including the Specialized Assistance for Everyone (SAFE)) , Public Works,),, the Sanitation District, and Sustainability and Volunteer Program.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

The San Rafael Fire Department delivers exceptional public service from six neighborhood fire stations and provides Chief services to the Marinwood Fire Department. On December 5, 1874, the San Rafael Fire Department was organized as a volunteer company for the purpose of providing fire protection for the newly incorporated City of San Rafael. Today, the San Rafael Fire Department is an organization with over 90 professionals trained in specialties including emergency medical care, firefighting, hazardous materials and emergency preparedness.

The San Rafael Police Department is a full time police department. In 1935 San Rafael Police Officers started wearing its own badges that said San Rafael Police. Prior to that year, they wore sheriff's badges. There are approximately 63 sworn police officers that work for the department.

1.5 WEATHER AND CLIMATE

The City of San Rafael lies 12 feet above sea level. In San Rafael, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43.1°F to 73.7°F and is rarely below 49°F or above 63°F. The difference in precipitation between the driest month and the wettest month is 5 inches. The annual rainfall is 8 inches. The month of highest relative humidity is February (79%). The month with the lowest relative humidity is June (66%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.3 °C (48.7) °F	10 °C (50) °F	11.2 °C (52.2) °F	12.2 °C (54) °F	14.2 °C (57.5) °F	16.3 °C (61.3) °F	16.6 °C (61.8) °F	16.9 °C (62.4) °F	17 °C (62.6) °F	15.4 °C (59.7) °F	12.1 °C (53.8) °F	9.5 °C (49.1) °F
Min. Temperature °C (°F)	6.1 °C (43.1) °F	6.8 °C (44.3) °F	7.8 °C (46.1) °F	8.6 °C (47.6) °F	10.3 °C (50.5) °F	11.8 °C (53.3) °F	12.4 °C (54.4) °F	13 °C (55.3) °F	12.8 °C (55) °F	11.6 °C (52.8) °F	8.8 °C (47.9) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.6 °C (56.5) °F	14.4 °C (57.9) °F	15.8 °C (60.5) °F	17.2 °C (62.9) °F	19.4 °C (67) °F	22.2 °C (72) °F	22.5 °C (72.6) °F	22.8 °C (73) °F	23.2 °C (73.7) °F	21 °C (69.8) °F	16.7 °C (62.1) °F	13.5 °C (56.2) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	79%	77%	70%	69%	66%	72%	73%	70%	69%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 558: The City of San Rafael Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the City of San Rafael since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The City of San Rafael had an estimated population of 59,851 in the 2018 plan. 2020 U.S. Census Survey estimated the City's population at 61,271. However, revised estimates for 2022 estimate the population to decrease to 60,560 population.

Table 4: City of San Rafael Estimated Jurisdictional Population				
Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
City of San Rafael	60,560	61,271	59,851	1.17%

Table 278: City of San Rafael Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of The City of San Rafael is 61,271 as of 2020. Table 5 shows the population growth comparison of the State of California, County of Marin and the City of San Rafael between 2010 – 2020.

Table 5: Population Change of The City of San Rafael				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
City of San Rafael	59,851	61,271	1,420	1.17%

Table 279: Population Change of The City of San Rafael
Source: City of San Rafael Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the City of San Rafael.

Table 6: Languages Spoken in San Rafael	
Primary Language Spoken	% of Population
English only	64.7%
Spanish	25.0%
Other Indo-European languages	5.2%
Asian and Pacific Islander languages	3.7%
Other languages	1.3%

Table 280: Languages Spoken in San Rafael
Source: US Census Bureau (2020)

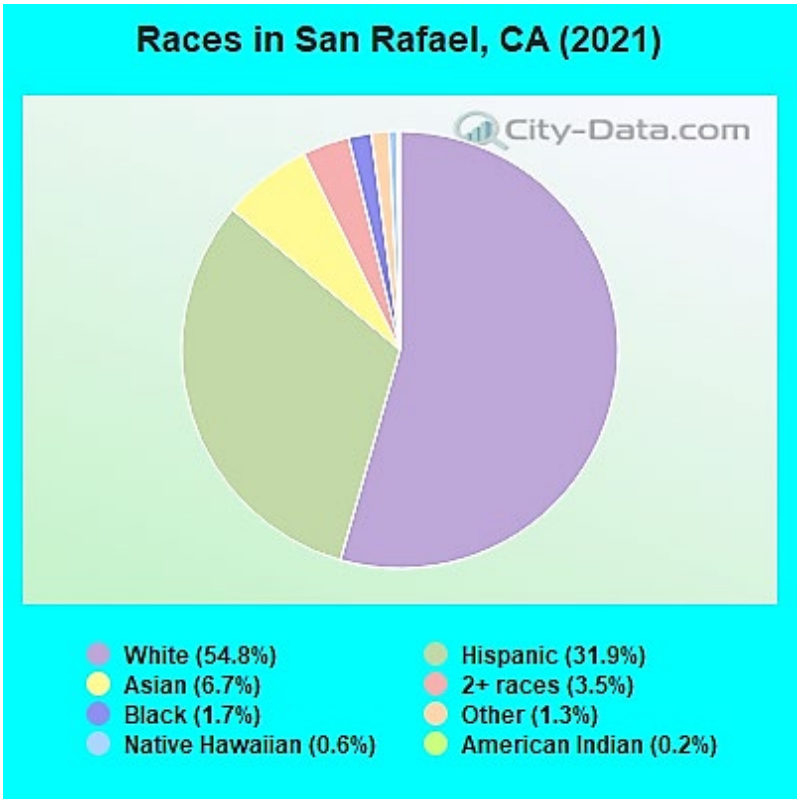


Figure 559: Races in San Rafael
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of San Rafael							
2022	Number	21,337	12,465	3,395	1,362	3,572	543
	Percent	100.00%	58.42%	27.24%	40.12%	262.26%	15.20%
2018	Number	21,448	12,581	3,427	1,335	3,557	548
	Percent	100.00%	58.66%	27.24%	38.96%	266.44%	15.41%

Table 281: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

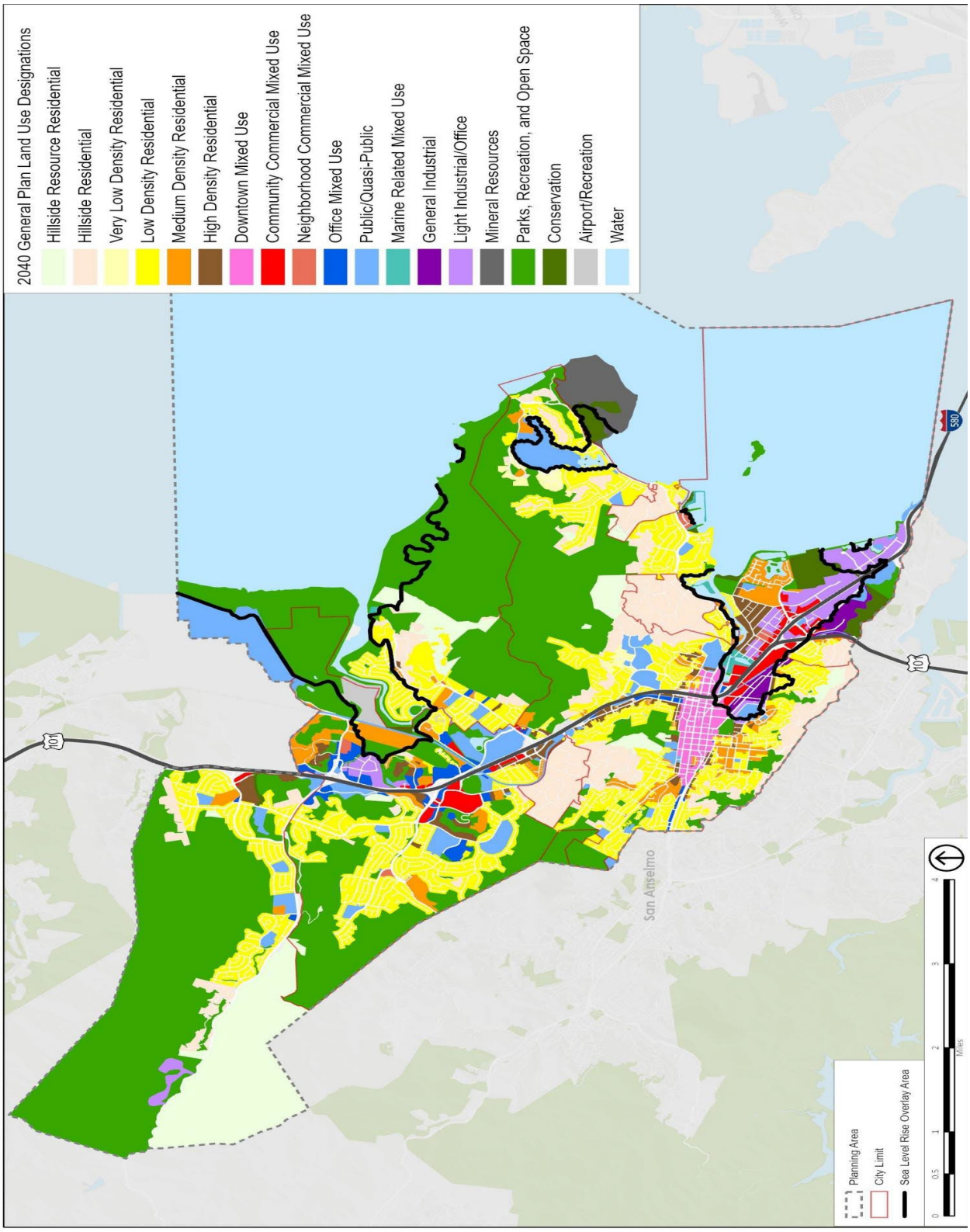


Figure 560: City of San Rafael Land Use Map
Source: City of San Rafael General Plan 2040 (Aug. 2021)

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards	
NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Hail, Lightning

Table 282: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to

better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

The following Tables 9 - 22 illustrate the NRI Hazard Type Risk Index for the San Rafael Census Tracts.

Table 9: NRI Hazard Type Risk Index for San Rafael Census Tract 1060.01						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,896,142	Very High	Very High	1.4	$4,040,816	98.9
Riverine Flooding	$558,070	Very High	Very High	1.4	$778,642	97.8
Coastal Flooding	$208,258	Very High	Very High	1.4	$290,569	98.2
Drought	$146,022	Very High	Very High	1.4	$203,736	98.7
Wildfire	$23,077	Very High	Very High	1.4	$32,198	89.3
Heat Wave	$7,811	Very High	Very High	1.4	$10,898	53.1
Tornado	$4,247	Very High	Very High	1.4	$5,925	14.3
Landslide	$4,006	Very High	Very High	1.4	$5,589	91.1
Strong Wind	$268	Very High	Very High	1.4	$373	11.9
Tsunami	$23	Very High	Very High	1.4	$33	91

Table 283: NRI Hazard Type Risk Index for San Rafael Census Tract 1060.01
Source: FEMA National Risk Index 2023

The following Figures 10 - 23 illustrate the Social Vulnerability Map for the San Rafael Census Tracts.

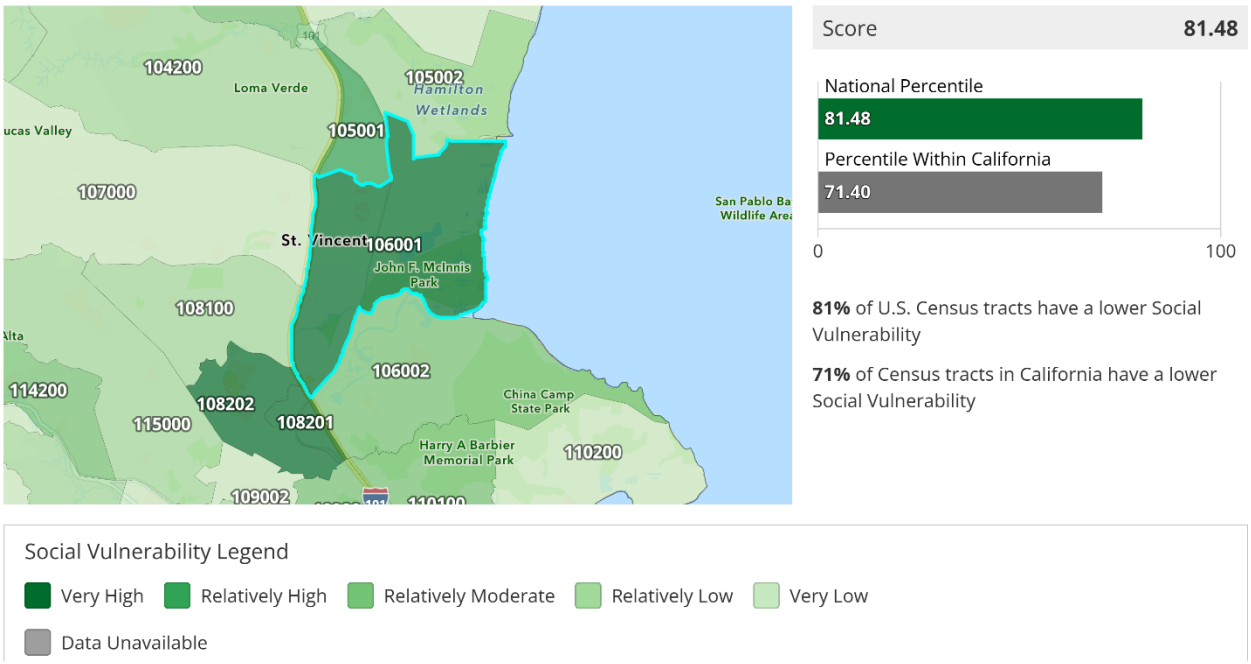


Figure 561: City of San Rafael Social Vulnerability Map Census Tract 1060.01
Source: FEMA National Risk Index 2023

Table 10: NRI Hazard Type Risk Index for San Rafael Census Tract 1081.00						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,252,334	Relatively Low	Very High	1.03	$1,287,401	93.1
Wildfire	$31,464	Relatively Low	Very High	1.03	$32,345	89.3
Heat Wave	$10,456	Relatively Low	Very High	1.03	$10,749	52.8
Tornado	$4,772	Relatively Low	Very High	1.03	$4,906	11.6
Landslide	$3,550	Relatively Low	Very High	1.03	$3,650	85.7
Strong Wind	$336	Relatively Low	Very High	1.03	$345	11.2
Riverine Flooding	$308	Relatively Low	Very High	1.03	$317	29.3
Coastal Flooding	$0	Relatively Low	Very High	1.03	$0	0
Drought	$0	Relatively Low	Very High	1.03	$0	0
Tsunami	$0	Relatively Low	Very High	1.03	$0	0

Table 284: NRI Hazard Type Risk Index for San Rafael Census Tract 1081.00
Source: FEMA National Risk Index 2023

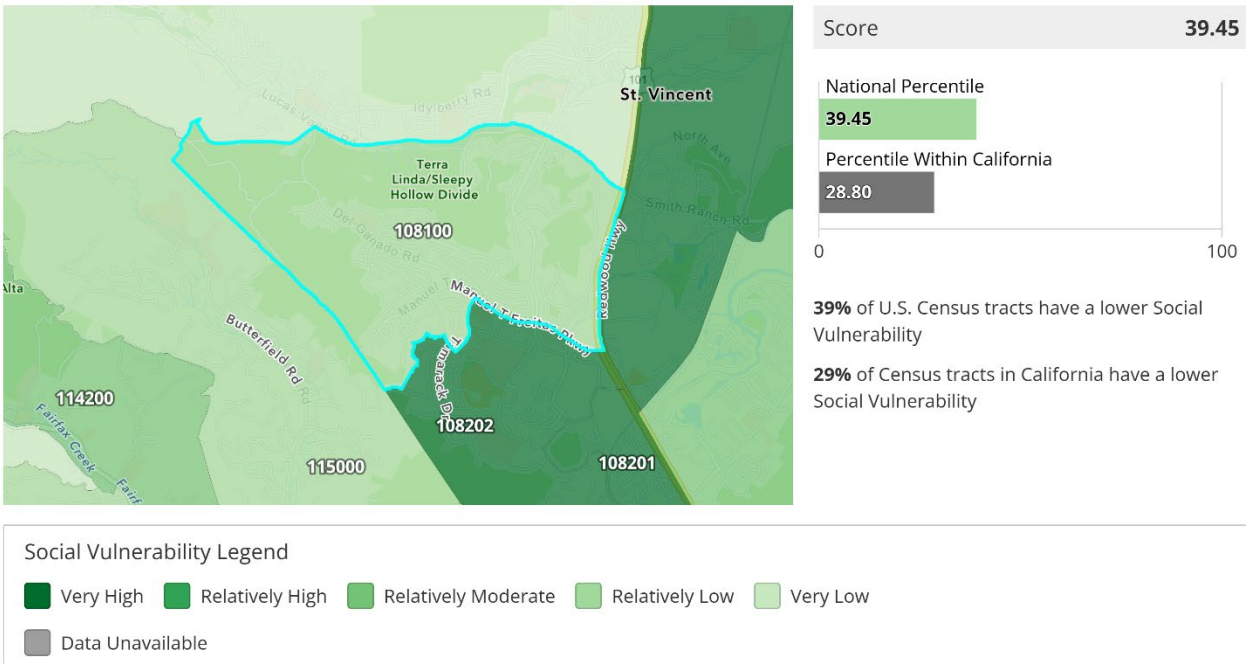


Figure 562: City of San Rafael Social Vulnerability Map Census Tract 1081.00
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.01						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$546,877	Very High	Very High	1.57	$859,791	90.1
Heat Wave	$3,994	Very High	Very High	1.57	$6,279	43.5
Tornado	$1,577	Very High	Very High	1.57	$2,480	5.7
Landslide	$599	Very High	Very High	1.57	$941	63.7
Wildfire	$158	Very High	Very High	1.57	$248	45.8
Strong Wind	$123	Very High	Very High	1.57	$194	7.2
Coastal Flooding	$0	Very High	Very High	1.57	$0	0
Drought	$0	Very High	Very High	1.57	$0	0
Riverine Flooding	$0	Very High	Very High	1.57	$0	0
Tsunami	$0	Very High	Very High	1.57	$0	0

Table 285: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.01
Source: FEMA National Risk Index 2023

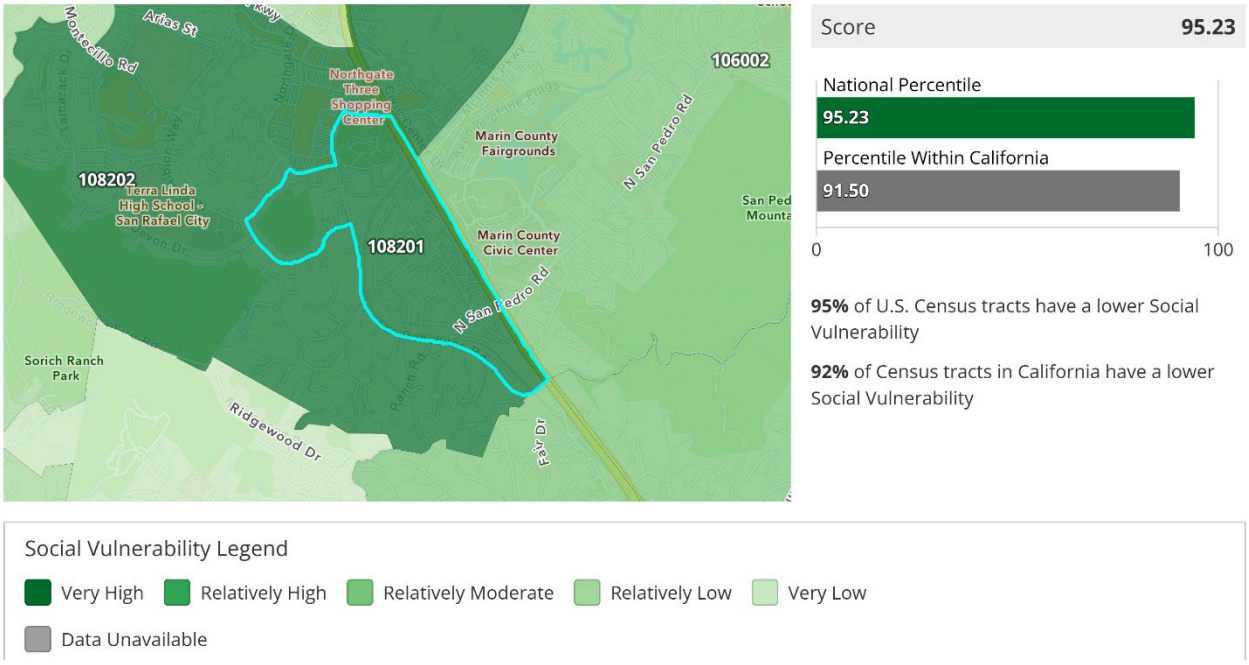


Figure 563: City of San Rafael Social Vulnerability Map Census Tract 1082.01
Source: FEMA National Risk Index 2023

Table 12: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.02						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,683,172	Very High	Very High	1.4	$2,358,985	97
Heat Wave	$6,786	Very High	Very High	1.4	$9,510	50.6
Tornado	$4,156	Very High	Very High	1.4	$5,825	14.1
Landslide	$3,401	Very High	Very High	1.4	$4,767	89.3
Strong Wind	$240	Very High	Very High	1.4	$336	11
Wildfire	$116	Very High	Very High	1.4	$162	40.9
Coastal Flooding	$0	Very High	Very High	1.4	$0	0
Drought	$0	Very High	Very High	1.4	$0	0
Riverine Flooding	$0	Very High	Very High	1.4	$0	0
Tsunami	$0	Very High	Very High	1.4	$0	0

Table 286: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.02
Source: FEMA National Risk Index 2023

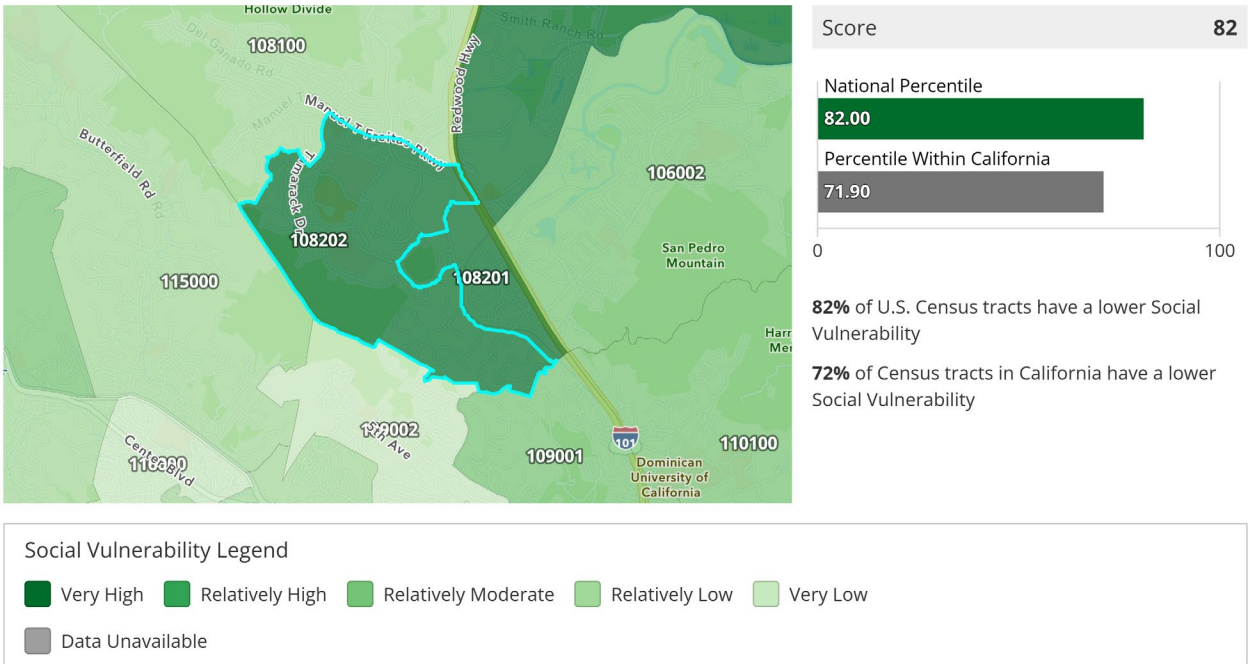


Figure 564: City of San Rafael Social Vulnerability Map Census Tract 1082.02
Source: FEMA National Risk Index 2023

Table 13: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$858,614	Relatively Moderate	Very High	1.08	$926,933	90.7
Heat Wave	$6,980	Relatively Moderate	Very High	1.08	$7,535	46.6
Tornado	$3,117	Relatively Moderate	Very High	1.08	$3,365	7.7
Landslide	$2,980	Relatively Moderate	Very High	1.08	$3,217	83.9
Wildfire	$1,757	Relatively Moderate	Very High	1.08	$1,897	73.6
Strong Wind	$223	Relatively Moderate	Very High	1.08	$240	8.5
Coastal Flooding	$0	Relatively Moderate	Very High	1.08	$0	0
Drought	$0	Relatively Moderate	Very High	1.08	$0	0
Riverine Flooding	$0	Relatively Moderate	Very High	1.08	$0	0
Tsunami	$0	Relatively Moderate	Very High	1.08	$0	0

Table 287: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.01
Source: FEMA National Risk Index 2023

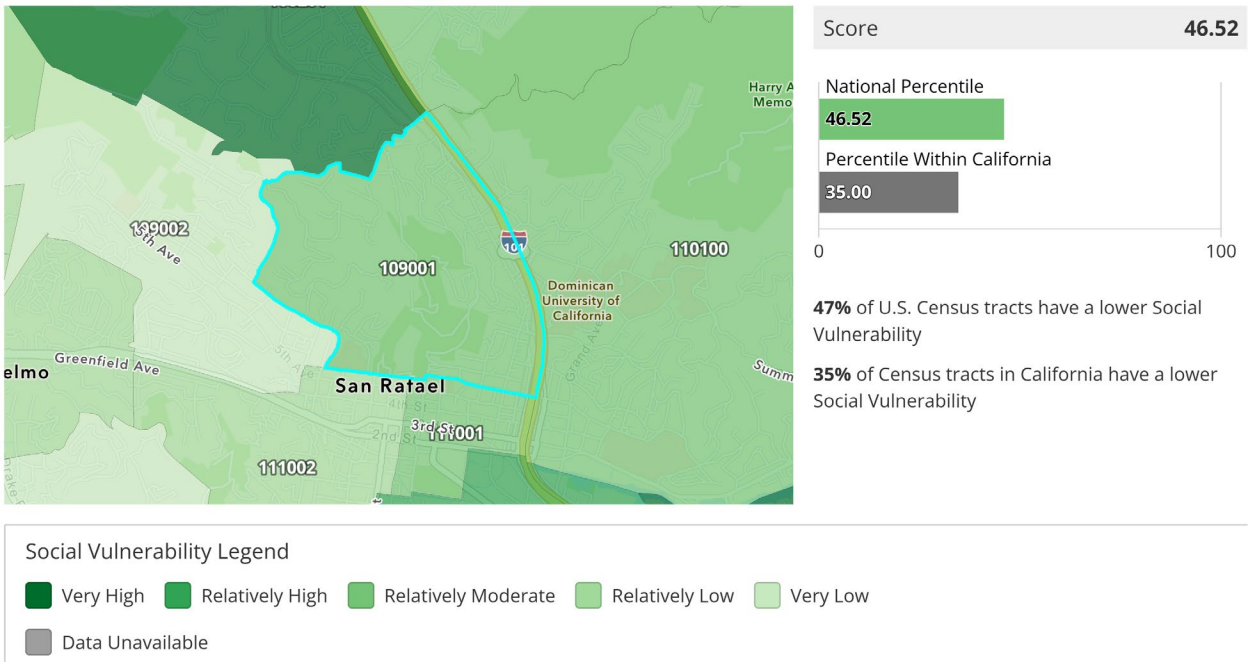


Figure 565: City of San Rafael Social Vulnerability Map Census Tract 1090.01
Source: FEMA National Risk Index 2023

Table 14: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.02						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$878,039	Very Low	Very High	0.77	$676,077	88.5
Landslide	$17,439	Very Low	Very High	0.77	$13,428	97.2
Heat Wave	$6,528	Very Low	Very High	0.77	$5,026	39.9
Wildfire	$5,930	Very Low	Very High	0.77	$4,566	80.1
Tornado	$3,032	Very Low	Very High	0.77	$2,335	5.4
Strong Wind	$211	Very Low	Very High	0.77	$162	6.4
Coastal Flooding	$0	Very Low	Very High	0.77	$0	0
Drought	$0	Very Low	Very High	0.77	$0	0
Riverine Flooding	$0	Very Low	Very High	0.77	$0	0
Tsunami	$0	Very Low	Very High	0.77	$0	0

Table 288: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.02
Source: FEMA National Risk Index 2023

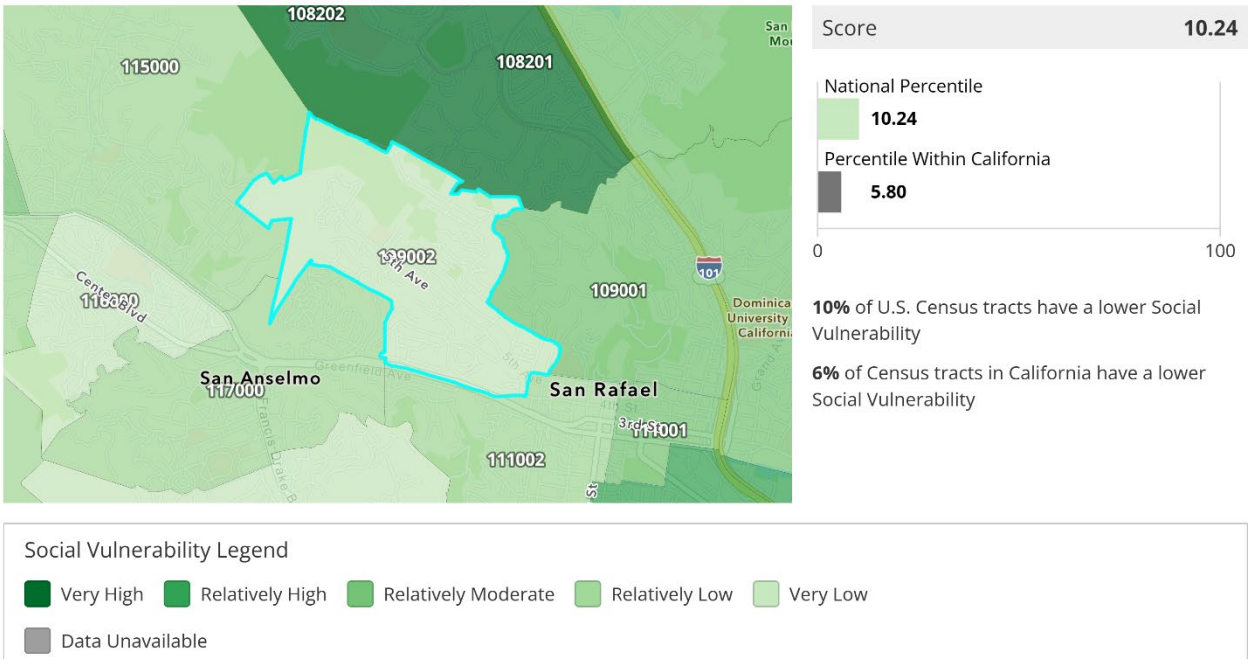


Figure 566: City of San Rafael Social Vulnerability Map Census Tract 1092.02
Source: FEMA National Risk Index 2023

Table 15: NRI Hazard Type Risk Index for San Rafael Census Tract 1101.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,897,762	Relatively Moderate	Very High	1.11	$2,105,437	96.4
Riverine Flooding	$507,837	Relatively Moderate	Very High	1.11	$563,410	96.9
Landslide	$91,056	Relatively Moderate	Very High	1.11	$101,020	99.6
Coastal Flooding	$34,693	Relatively Moderate	Very High	1.11	$38,490	93.9
Heat Wave	$9,626	Relatively Moderate	Very High	1.11	$10,680	52.7
Tornado	$5,822	Relatively Moderate	Very High	1.11	$6,459	15.6
Wildfire	$3,134	Relatively Moderate	Very High	1.11	$3,477	78.6
Tsunami	$1,310	Relatively Moderate	Very High	1.11	$1,453	96.9
Strong Wind	$338	Relatively Moderate	Very High	1.11	$375	11.9
Drought	$0	Relatively Moderate	Very High	1.11	$0	0

Table 289: NRI Hazard Type Risk Index for San Rafael Census Tract 1101.00
Source: FEMA National Risk Index 2023

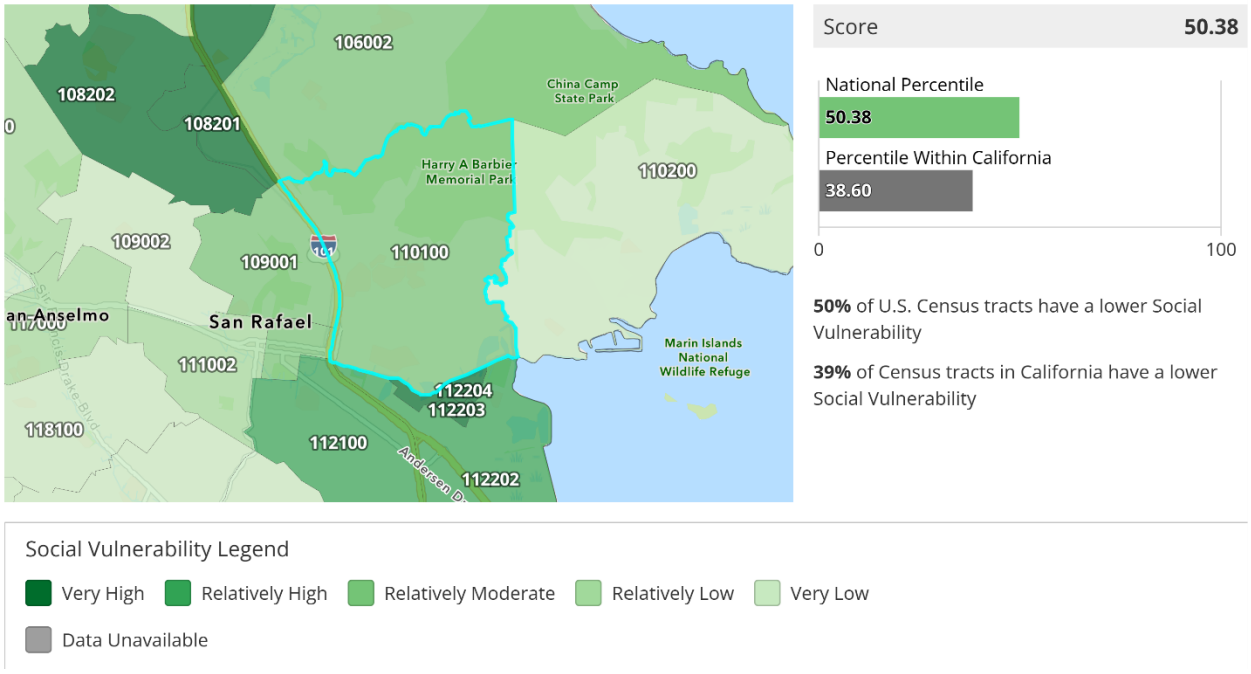


Figure 567: City of San Rafael Social Vulnerability Map Census Tract 1101.00
Source: FEMA National Risk Index 2023

Table 16: NRI Hazard Type Risk Index for San Rafael Census Tract 1102.00						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,454,196	Very Low	Very High	0.65	$939,097	90.8
Riverine Flooding	$689,063	Very Low	Very High	0.65	$444,986	96
Coastal Flooding	$99,874	Very Low	Very High	0.65	$64,497	95.3
Heat Wave	$8,402	Very Low	Very High	0.65	$5,426	41.1
Tornado	$5,938	Very Low	Very High	0.65	$3,835	9
Landslide	$4,229	Very Low	Very High	0.65	$2,731	81.3
Wildfire	$1,521	Very Low	Very High	0.65	$982	64.8
Tsunami	$754	Very Low	Very High	0.65	$487	95
Drought	$672	Very Low	Very High	0.65	$434	80.9
Strong Wind	$313	Very Low	Very High	0.65	$202	7.5

Table 290: NRI Hazard Type Risk Index for San Rafael Census Tract 1102.00
Source: FEMA National Risk Index 2023

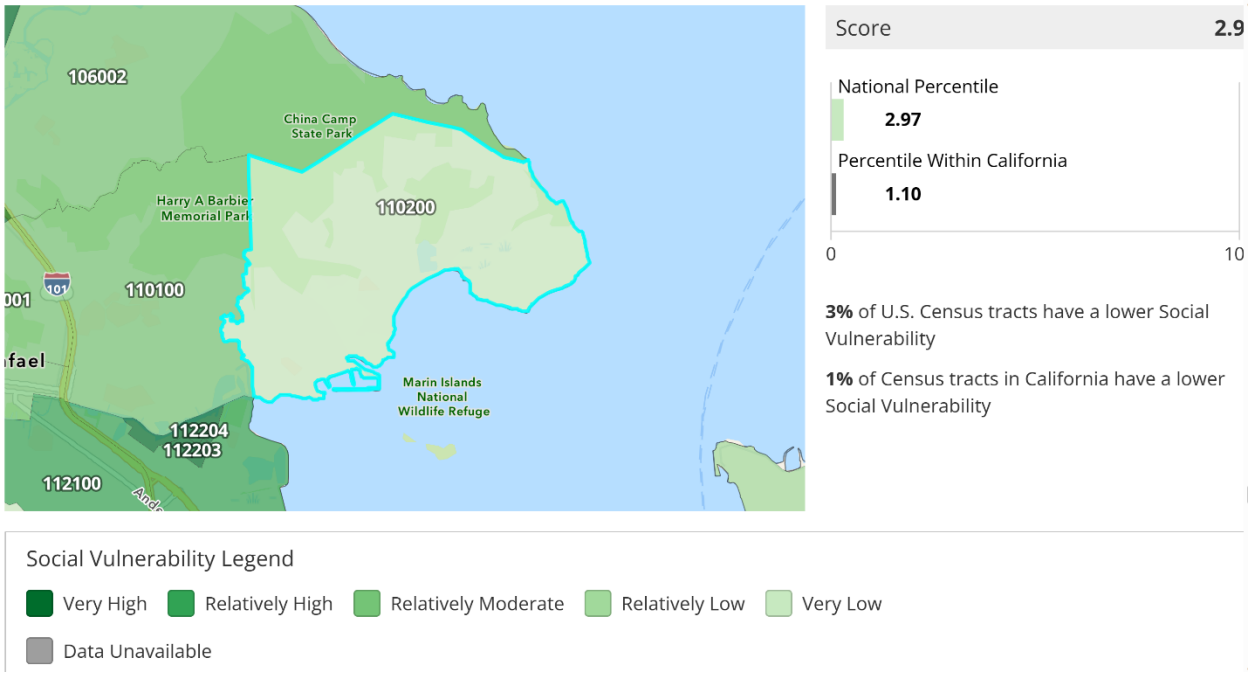


Figure 568: City of San Rafael Social Vulnerability Map Census Tract 1102.00
Source: FEMA National Risk Index 2023

Table 17: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,961,205	Relatively Moderate	Very High	1.07	$2,094,386	96.4
Riverine Flooding	$493,279	Relatively Moderate	Very High	1.07	$526,776	96.6
Landslide	$1,896	Relatively Moderate	Very High	1.07	$2,024	76.3
Heat Wave	$1,889	Relatively Moderate	Very High	1.07	$2,017	28
Tornado	$1,886	Relatively Moderate	Very High	1.07	$2,014	4.8
Coastal Flooding	$1,016	Relatively Moderate	Very High	1.07	$1,085	81.3
Drought	$782	Relatively Moderate	Very High	1.07	$835	83.2
Strong Wind	$82	Relatively Moderate	Very High	1.07	$87	4.2
Tsunami	$0	Relatively Moderate	Very High	1.07	$0	0
Wildfire	$0	Relatively Moderate	Very High	1.07	$0	0

Table 291: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.01
Source: FEMA National Risk Index 2023

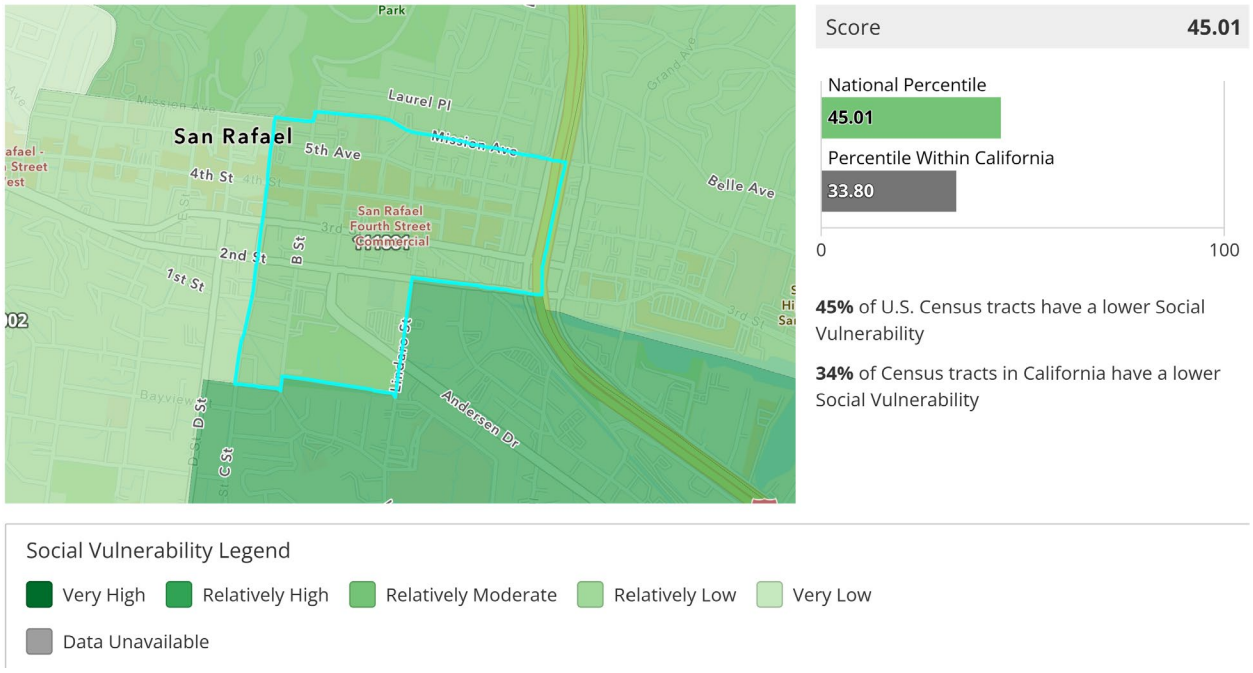


Figure 569: City of San Rafael Social Vulnerability Map Census Tract 1110.01
Source: FEMA National Risk Index 2023

Table 18: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.02						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$2,186,537	Relatively Low	Very High	0.97	$2,113,288	96.5
Riverine Flooding	$157,397	Relatively Low	Very High	0.97	$152,125	89.1
Heat Wave	$7,761	Relatively Low	Very High	0.97	$7,501	46.5
Tornado	$3,666	Relatively Low	Very High	0.97	$3,543	8.2
Landslide	$3,248	Relatively Low	Very High	0.97	$3,140	83.5
Wildfire	$493	Relatively Low	Very High	0.97	$476	54.3
Strong Wind	$252	Relatively Low	Very High	0.97	$243	8.6
Coastal Flooding	$0	Relatively Low	Very High	0.97	$0	0
Drought	$0	Relatively Low	Very High	0.97	$0	0
Tsunami	$0	Relatively Low	Very High	0.97	$0	0

Table 292: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.02
Source: FEMA National Risk Index 2023

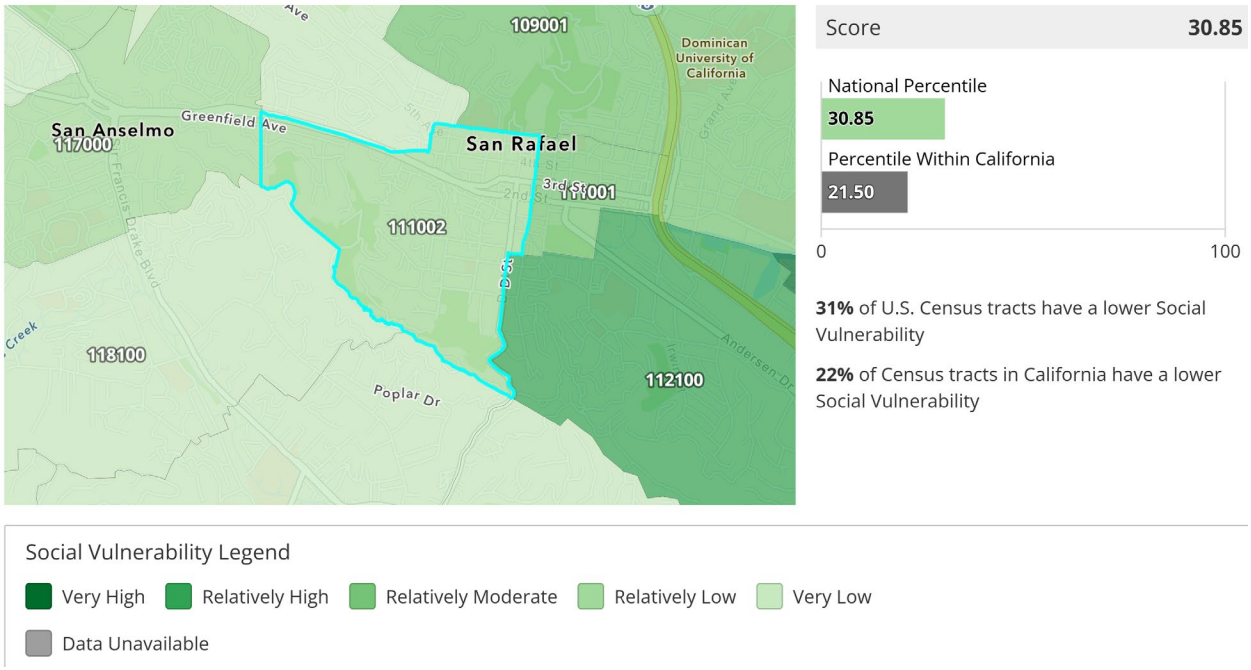


Figure 570: City of San Rafael Social Vulnerability Map Census Tract 1110.02
Source: FEMA National Risk Index 2023

Table 19: NRI Hazard Type Risk Index for San Rafael Census Tract 1121.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$2,953,072	Relatively High	Very High	1.22	$3,592,625	98.6
Riverine Flooding	$1,579,204	Relatively High	Very High	1.22	$1,921,215	99.2
Coastal Flooding	$335,107	Relatively High	Very High	1.22	$407,682	98.6
Heat Wave	$7,205	Relatively High	Very High	1.22	$8,765	49.2
Tornado	$4,348	Relatively High	Very High	1.22	$5,290	12.7
Landslide	$1,412	Relatively High	Very High	1.22	$1,717	73.5
Wildfire	$544	Relatively High	Very High	1.22	$662	59
Strong Wind	$253	Relatively High	Very High	1.22	$308	10.3
Tsunami	$0	Relatively High	Very High	1.22	$1	88.3
Drought	$0	Relatively High	Very High	1.22	$0	0

Table 293: NRI Hazard Type Risk Index for San Rafael Census Tract 1121.00
Source: FEMA National Risk Index 2023

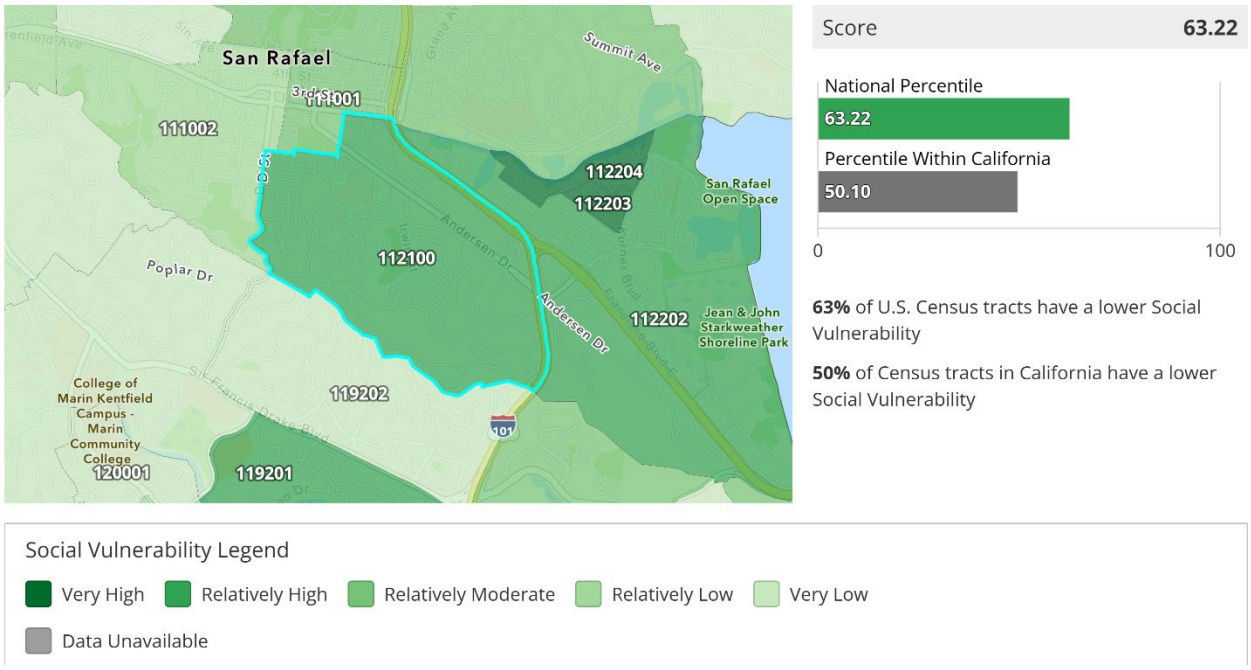


Figure 571: City of San Rafael Social Vulnerability Map Census Tract 1121.00
Source: FEMA National Risk Index 2023

Table 20: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.02						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$4,623,267	Relatively High	Very High	1.38	$6,371,177	99.6
Riverine Flooding	$3,465,093	Relatively High	Very High	1.38	$4,775,134	99.8
Coastal Flooding	$673,143	Relatively High	Very High	1.38	$927,637	99.3
Heat Wave	$6,945	Relatively High	Very High	1.38	$9,571	50.7
Drought	$6,392	Relatively High	Very High	1.38	$8,808	91.4
Tornado	$5,012	Relatively High	Very High	1.38	$6,907	16.7
Landslide	$1,375	Relatively High	Very High	1.38	$1,895	75.2
Tsunami	$787	Relatively High	Very High	1.38	$1,084	96.5
Wildfire	$289	Relatively High	Very High	1.38	$398	51.9
Strong Wind	$261	Relatively High	Very High	1.38	$360	11.6

Table 294: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.02
Source: FEMA National Risk Index 2023

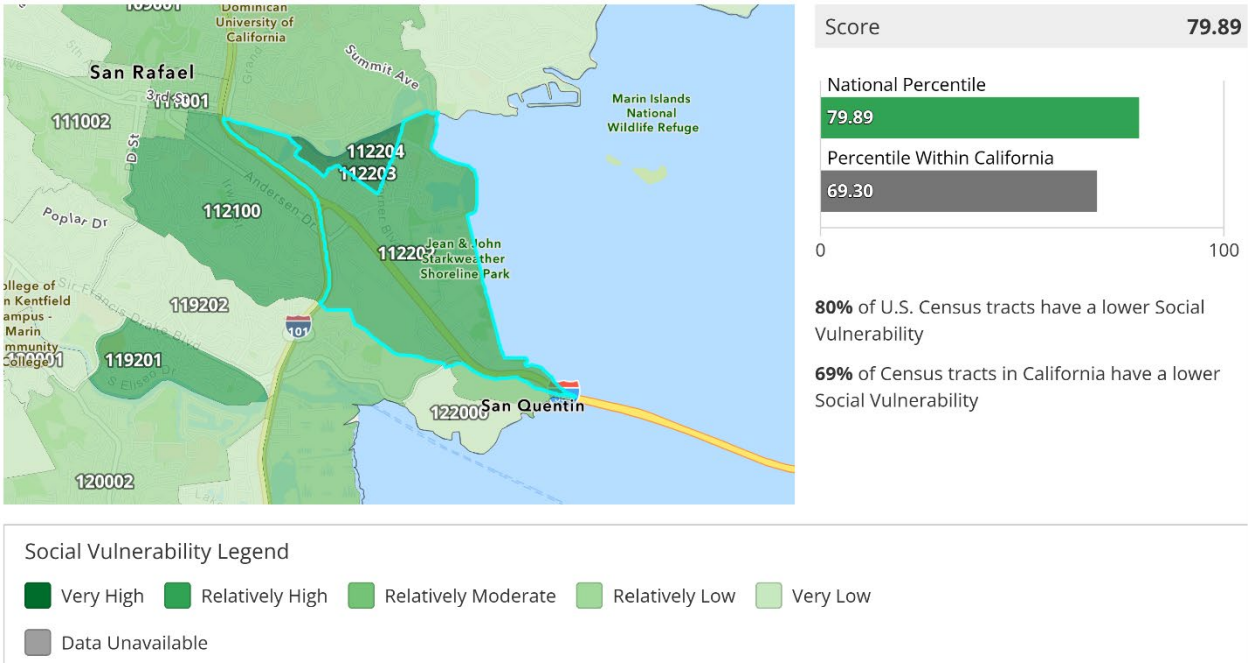


Figure 572: City of San Rafael Social Vulnerability Map Census Tract 1122.02
Source: FEMA National Risk Index 2023

Table 21: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.03						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Riverine Flooding	$949,892	Very High	Very High	1.41	$1,335,333	98.8
Earthquake	$339,205	Very High	Very High	1.41	$476,845	86.4
Coastal Flooding	$104,469	Very High	Very High	1.41	$146,860	97.1
Heat Wave	$4,658	Very High	Very High	1.41	$6,548	44.2
Tornado	$972	Very High	Very High	1.41	$1,367	3.5
Strong Wind	$126	Very High	Very High	1.41	$177	6.8
Lightning	$119	Very High	Very High	1.41	$167	3.6
Hail	$15	Very High	Very High	1.41	$21	3.2
Landslide	$3	Very High	Very High	1.41	$4	39.8
Tsunami	$2	Very High	Very High	1.41	$3	89.2
Cold Wave	$0	Very High	Very High	1.41	$0	0
Drought	$0	Very High	Very High	1.41	$0	0
Wildfire	$0	Very High	Very High	1.41	$0	0
Winter Weather	$0	Very High	Very High	1.41	$0	0

Table 295: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.03
Source: FEMA National Risk Index 2023

Figure 573: City of San Rafael Social Vulnerability Map Census Tract 1122.03
Source: FEMA National Risk Index 2023

Table 22: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.04						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Riverine Flooding	$1,730,596	Very High	Very High	1.59	$2,753,311	99.6
Earthquake	$742,329	Very High	Very High	1.59	$1,181,016	92.5
Coastal Flooding	$201,710	Very High	Very High	1.59	$320,912	98.3
Heat Wave	$7,879	Very High	Very High	1.59	$12,536	55.9
Tornado	$1,813	Very High	Very High	1.59	$2,884	6.6
Tsunami	$991	Very High	Very High	1.59	$1,576	97.1
Landslide	$925	Very High	Very High	1.59	$1,472	71
Strong Wind	$216	Very High	Very High	1.59	$344	11.2
Lightning	$203	Very High	Very High	1.59	$324	6.6
Hail	$25	Very High	Very High	1.59	$40	7.5
Cold Wave	$0	Very High	Very High	1.59	$0	0
Drought	$0	Very High	Very High	1.59	$0	0
Wildfire	$0	Very High	Very High	1.59	$0	0

Table 296: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.04
Source: FEMA National Risk Index 2023

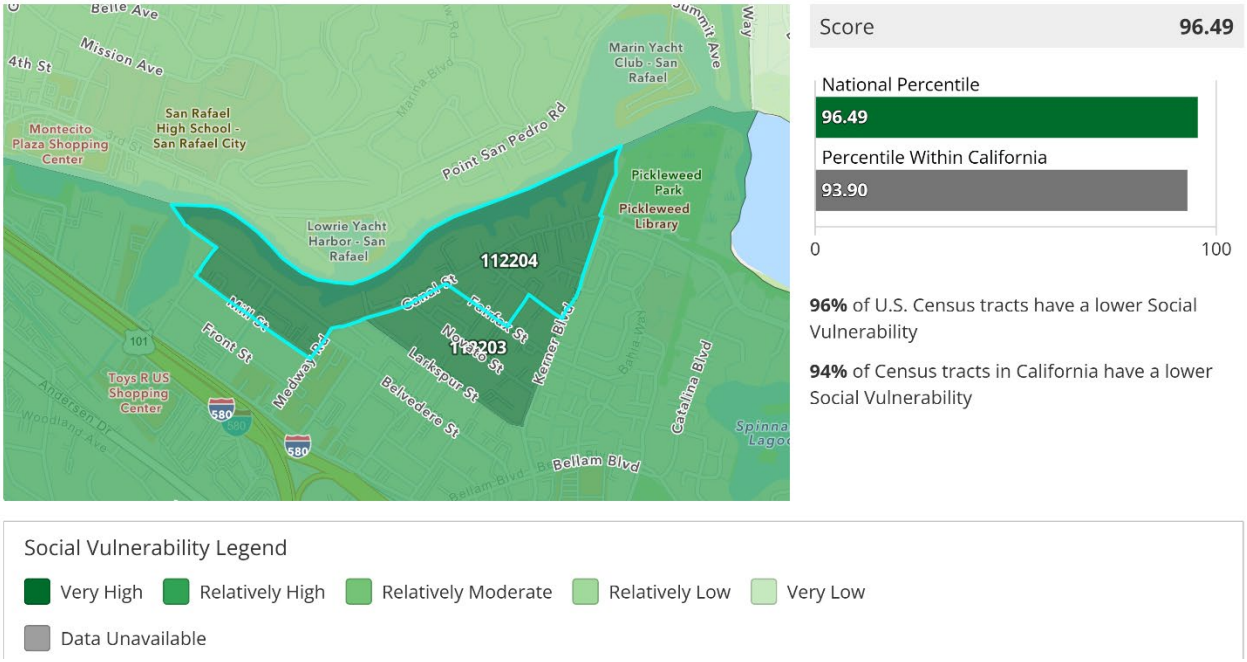


Figure 574: City of San Rafael Social Vulnerability Map Census Tract 1122.04
Source: FEMA National Risk Index 2023

Social Vulnerability in San Rafael and the Marin County OA

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Cold Weather Impact on Vulnerable Populations in San Rafael

In the last 50 years (1974), average temperatures in Marin County have rose by 6 degrees Fahrenheit. The coldest recorded month was December of 1990 at 34.7 degrees (The Californian.com). The term “extreme cold” is defined by the National Weather Service as temperatures below freezing (32 degrees F), however, the impact of cold weather on individuals may vary by location and other conditions the population typically experience, the types of facilities they are in, and what efforts individuals are expected to take. There are several factors:

- Living or working outside of a building
- Having windows that do not provide cold weather protection
- Wind chill
- Rain severity and duration

Cold weather is relevant to the City of San Rafael and Marin County populations in the vulnerability to populations who do not have adequate heating sources, those who are not housed, and those who are institutionalized without adequate heating. Prolonged cold, especially combined with rainfall, can cause hypothermia in vulnerable individuals and those affected by cold weather conditions in being safe during episodes of cold weather.

Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index in San Rafael

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, the Marin County OA is considered to have a “very high” ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show the Marin County OA as a whole to have "Relatively High" risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category ("Very High Risk"), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

However, Marin City is ranked as "Very Low" risk for the National Risk Index. Previous discussion highlighted why the Expected Annual Loss was low, but further discussion is required. As a County, we know Marin City should not be classified as "Very Low" on the NRI. Marin City residents, for example, only have one way in and out of their community and this road floods frequently, making it unsafe to cross and leave the community for work, school, medical resources. Additionally, there is only one "grocery" store, a Target, in Marin City. Both of these elements contribute to the vulnerability of residents as they may be unable to leave or return home and have limited access to groceries, relying on a single store's supply chain. At the local elementary school in Marin City, 47% of students are eligible for free and reduced-price meals (2022 – 2023 school year), a reflection of the financial capacity of local families. All this means, we can expect the social and built capacity of Marin City to be limited.

The City of San Rafael has 14 census tracts and more than half of them rate Very High (5) or Relatively High (2) for Social Vulnerability. The remaining 5 census tracts rate Relatively Moderate (3), Relatively Low (2) and Very Low (2) in Social Vulnerability Index.

The median income for a household in the City was $113,839 and the per capita income for the City was $60,891. Approximately 2.4 percent of families and 5.3 percent of the population were below the poverty line (2022 data, U.S. Census Bureau).

1.8 Economy and Tax Base

The City of San Rafael is one of the Marin County OA's primary retail, service, and commercial center. Table 23 shows income by household in The City of San Rafael as of 2019.

Table 23: Household Income for The City of San Rafael as of 2021

Household Income	Number	Percent
Total Households	23,816	-
Less than $10,000	714	3.0
$10,000 to $14,999	786	3.3
$15,000 to $24,999	1,167	4.9
$25,000 to $34,999	1,000	4.2
$35,000 to $49,999	2,001	8.4
$50,000 to $74,999	3,048	12.8
$75,000 to $99,999	2,620	11.0
$100,000 to $149,999	4,215	17.7

$150,000 to $199,999	2,453	10.3
$200,000 or more	5,787	24.3
Median household income (dollars)	$104,521	
Mean household income (dollars)	$155,715	

Table 297: Household Income for The City of San Rafael as of 2019
Source: US Census Bureau American Community Survey 2021 Estimates

Table 24 shows the percentage of people in The City of San Rafael over the age of 16 employed by industry.

Table 24: City of San Rafael Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	31,411	-
Agriculture, forestry, fishing and hunting, and mining	465	1.48%
Construction	2778	8.84%
Manufacturing	1320	4.20%
Wholesale trade	550	1.75%
Retail trade	3504	11.16%
Transportation and warehousing, and utilities	1313	4.18%
Information	1462	4.65%
Finance and insurance, and real estate and rental and leasing	2295	7.31%
Professional, scientific, and management, and administrative and waste management services	5479	17.44%
Educational services, and health care and social assistance	6391	20.35%
Arts, entertainment, and recreation, and accommodation and food services	2971	9.46%
Other services, except public administration	1759	5.60%
Public administration	1124	3.58%

Table 298 City of San Rafael Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the City of San Rafael to fulfill the requirements of its mission during an emergency:

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Critical Facilities				
Fire	Fire: Marinwood Fire Department (MRW) / Headquarters & Station 58	777 Miller Creek Road 94903	High	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 51	1039 C Street 94901	N/A	X

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Fire	Fire: San Rafael Fire Department (SNR) / Station 52	210 Third Street 94901	N/A	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 54	46 Castro Avenue 94901	N/A	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 55	955 Pt. San Pedro Road 94901	N/A	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 56	650 Del Ganado Road 94903	Moderate	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 57	3530 Civic Center Drive 94903	N/A	X , AE
Fire	Fire: Skywalker Ranch Fire Brigade (SKY)	5858 Lucas Valley Road 94912	Moderate	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 53	30 Joseph Court 94903	N/A	X
Law	County Jail	13 Peter Behr Dr, San Rafael, CA 94903	N/A	X
Law	County 911 Communications Center / PSAP	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	High	X
Law	Marin County Sheriffs Office	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	High	X
Law	San Rafael Police Department	1400 Fifth Avenue, San Rafael, CA 94901	Moderate	X
EOC	Marin County EOC	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	High	X
Local Government	Marin Civic Center	3501 Civic Center Dr, San Rafael, CA 94903	N/A	X
Local Government	Marin County Corporate Yard Building	2 Peter Behr Drive, San Rafael, CA 94903	N/A	X
Local Government	Marin County Fuel Island	2 - 6 Peter Behr Drive, San Rafael, CA 94903	N/A	X
Local Government	Marin County Vehicle Repair Shops/Building	2 - 6 Peter Behr Drive, San Rafael, CA 94903	N/A	X
Local Government	Boro Community Center	50 Canal Street, San Rafael, CA 94901	N/A	AE
Local Government	San Rafael Public Works Yard	111 Morphew St, San Rafael, CA 94901	N/A	X
Local Government	San Rafael Community Center	618 B Street, San Rafael CA 94901	N/A	AH, AE
Local Government	Terra Linda Community Center	670 Del Ganado Rd, San Rafael CA 94903	Moderate	X
Health / Medical	Kaiser Permanente San Rafael Medical Center	99 Montecillo Rd, San Rafael, CA 94903	N/A	X
Health / Medical	Adrian Way Home	306 Adrian Way San Rafael, Ca 94903	N/A	AE
Health / Medical	Aldersly (Snf Unit)	326 Mission Ave 94901	N/A	X
Health / Medical	Casa Allegra - Devon Drive Home	363 Devon Dr 94903	High	X
Health / Medical	Kaiser Foundation Hospital - San Rafael	99 Montecillo Rd 94903	N/A	X
Health / Medical	Smith Ranch Generations (Snf)	1550 Silveira Pkwy 94903	Moderate	X

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Health / Medical	Northgate Post Acute	40 Professional Center Pkwy 94903	N/A	X
Health / Medical	Nova House, Inc.	393 Nova Albion Way 94903	High	X
Health / Medical	Aldersly (Snf Unit)	326 Mission Ave 94901	N/A	X
Health / Medical	Pine Ridge Care Center	45 Professional Center Pkwy 94903	N/A	X
Health / Medical	Professional Post Acute Center	81 Professional Center Pkwy 94903	N/A	X
Health / Medical	Marin Post Acute	234 N San Pedro Rd 94903	Moderate	X
Health / Medical	San Rafael 5th Avenue Health & Wellness	1601 5Th Ave 94901	N/A	X
Health / Medical	Sunrise Ii	48 Golden Hinde Blvd 94903	High	X
Health / Medical	Villa Marin (Rcfe Unit)	100 Thorndale Dr 94903	Moderate	X
Health / Medical	Three Home Village 1, 2, 3	675 Rosal Way, San Rafael, Ca 94903	N/A	AE
Health / Medical	Almavia Of San Rafael	515 Northgate Drive, San Rafael, Ca 94903	High	X
Health / Medical	Nazareth House Of San Rafael, Inc.	245 Nova Albion Way, San Rafael, Ca 94903	N/A	X
Health / Medical	Drake Terrace	275 Los Ranchitos Road, San Rafael, Ca 94903	High	X
Health / Medical	Cogir Memory Care	111 Merrydale Rd, San Rafael, Ca 94903	N/A	X
Health / Medical	Greenwood Assisted Living	233 West End Ave, San Rafael, Ca 94901	Moderate	X
Health / Medical	St. Michael's Extended Care	416 4th Street, San Rafael, Ca 94901	N/A	AE, X
Health / Medical	Golden Home Extended Care, Inc.	1234 Las Gallinas Ave, San Rafael, Ca 94903	High	X
Health / Medical	All Saints Extended Care Inc	1373 Lincoln Ave., San Rafael, Ca 94901	High	X
Health / Medical	D Street Residential Support Services	527 D Street, San Rafael, Ca 94901	N/A	X
Health / Medical	Schon Hyme Rest Home	25 Villa Avenue, San Rafael, Ca 94901	Moderate	X
Health / Medical	A Loving Touch	45 Meriam Drive 94903	N/A	X
Health / Medical	Smith Ranch Homes (Independent Living)	500 Deer Valley Road 94903	High	X
Health / Medical	Luna's Home	1027 Las Pavadas Ave 94903	Moderate	X
Health / Medical	Aldersly (Al) (Rcfe Unit)	326 Mission Ave 94901	N/A	X
Health / Medical	Smith Ranch Skilled Nursing And Rehabilitation Center	1550 Silveira Parkway 94903	N/A	X
Health / Medical	Villa Marin (Snf)	100 Thorndale Dr 94903	Moderate	X
Health / Medical	Dominican Sisters Of San Rafael	1520 Grand Avenue 94901	N/A	X

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Health / Medical	St. Vincent's School For Boys	1 St Vincent's Drive, 94903	High	X, A, AE
Health / Medical	Lighthouse	714 C Street, San Rafael 94901	N/A	AH
Health / Medical	Casa Allegra - Adrian House	306 Adrian Way, San Rafael	N/A	AE
Health / Medical	Long Life Living #1	36 Mt Foraker Drive, San Rafael 94903	High	X
Health / Medical	Dominican Convent - Lourdes Site	77 Locust Ave, San Rafael, 94901	N/A	X
Health / Medical	Dominican Convent - Jane D'anza Site	1540 Grand Ave, San Rafael 94901	N/A	X
Health / Medical	Helen Vine Detox Center	291 Smith Ranch Rd, San Rafael 94903	Moderate	X
Health / Medical	Lifehouse Sunrise Ii	48 Golden Hinde Blvd, San Rafael 94903	High	X
Health / Medical	Bayside Marin Treatment Center	718 4th Street, San Rafael 94901	N/A	X
Health / Medical	Caremax Peachstone Residence	440 Peachstone Terrace, San Rafael 94903	High	X
Health / Medical	Center Point - The Manor	603 D Street, San Rafael 94901	N/A	AE
Health / Medical	Casa Allegra - Happy House	291 Devon Dr, San Rafael, Ca 94901	High	X
Health / Medical	Bay Home Inc.	19 Heatherstone Court, San Rafael 94903	High	X
Health / Medical	Marin Services For Men	501 Whitewood Drive, San Rafael, 94903	N/A	X
Health / Medical	Castle SLE	1363 Lincoln Ave #4, San Rafael, CA 94901	High	X
Health / Medical	Villa Marin (II)	100 Thorndale Dr 94903	Moderate	X
Health / Medical	Parnow Friendship House	164 North San Pedro Road, San Rafael 94903	Moderate	X
Health / Medical	Lifehouse - Knoll Rd	18 Professional Center Parkway, San Rafael 94903	N/A	X
Health / Medical	Newport Academy	5 Maoli Dr, San Rafael, Ca 94903	High	X
Health / Medical	Helen Vine San Rafael House	235 Union Street. San Rafael, Ca 94901	N/A	X
Health / Medical	L'chaim House I	777 Montcillo Rd, San Rafael 94903	High	X
Health / Medical	Long Life Living #3	57 Vallejo Way, San Rafael 94903	High	X
Health / Medical	L'chaim House II	463 Albion Way, San Rafael 94903	High	X
Health / Medical	Lifehouse - Nova	93 Nova Albion Way, San Rafael 94903	N/A	X
Health / Medical	Tender Residential Home	257 Blackstone Dr, San Rafael 94903	Very High	X
Health / Medical	Aldersly (II Unit)	326 Mission Ave 94901	N/A	X

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Health / Medical	Buckelew Mariner Circle	6 Mariner Circle, San Rafael	N/A	AE
Health / Medical	Buckelew - Avanti	7 Le Claire Ct, San Rafael, Ca 94903	N/A	X
Health / Medical	Casa Allegra - 980 Ignacio	35 Mitchell Blvd #8, San Rafael, Ca 94903	N/A	X
Health / Medical	Lifehouse - 1600 Vendola Drive	1600 Vendola Dr, San Rafael, Ca 94903	N/A	AE
Health / Medical	Lifehouse (Supportive Living - Various Sites)	18 Professional Center Parkway, San Rafael, Ca 94903	N/A	X
Health / Medical	Casa Allegra - Reichert Ave	35 Mitchell Blvd. Suite 8 San Rafael, Ca 94903	N/A	X
Health / Medical	Marin Health & Wellness Campus	3253 Kerner Blvd, San Rafael, CA 94901	N/A	AE
Health / Medical	Kaiser Permanente Downtown San Rafael Medical Offices	1033 3rd St, San Rafael, CA 94901	N/A	AH, X
Health / Medical	Marin Community Clinic	3110 Kerner Boulevard, San Rafael, CA	N/A	AE
Health / Medical	Kaiser Permanente San Rafael Medical Offices	1650 Los Gamos Dr., San Rafael, CA 94903	High	X
Health / Medical	MarinHealth Urgent Care	4000 Civic Center Dr, San Rafael, CA 94903	N/A	X
School	Dominican University	50 Acacia Avenue San Rafael, CA 94901	N/A	X
School	Bahia Vista Elementary	125 Bahia Vista, San Rafael CA 94901	N/A	AE
School	Coleman Elementary	800 Belle Ave. San Rafael, CA 94901	N/A	X
School	Glenwood Elementary	25 West Castlewood San Rafael, CA 94901	Moderate	X, AE
School	Laurel Dell Elementary	225 Woodland Ave. San Rafael, CA 94901	N/A	X
School	San Pedro Elementary	498 Point San Pedro San Rafael, CA 94901	N/A	X
School	Sun Valley Elementary	75 Happy Lane San Rafael, CA 94901	High	X
School	Vallecito School	50 Nova Albion Way, San Rafael CA 94903	N/A	X
School	Venetia Valley TK-8	177 N. San Pedro Rd. San Rafael, CA 94903	N/A	X
School	Davidson Middle	280 Woodland Ave. San Rafael, CA 94901	N/A	X, AE
School	San Rafael High	150 Third Street San Rafael, CA 94901	N/A	X
School	Terra Linda High	320 Nova Albion Way San Rafael, CA 94903	Moderate	X
School	Madrone High	185 Mission Ave. San Rafael, CA 94901	N/A	AE, X
Airport/ Heliport	San Rafael - Airport	400 Smith Ranch Rd, San Rafael, CA 94903	N/A	AE
High Potential Loss Facilities				
None				
Critical Infrastructure				

Table 16: City of San Rafael Critical Facilities				
Category	**Name**	**Address**	**Fire Severity Zone**	**Flood Zone**
Water/Wastewater	Central Marin Sanitation & Household Hazardous Waste Facility	1301 Andersen Drive, San Rafael, CA 94901	Moderate	AE, X
Communications	MERA Antenna Site - Dollar Hill	Robert Dollar Dr., San Rafael, CA	High	X
Communications	MERA Antenna Site - EOF	1600 Los Gamos Dr 94903	High	X
Communications	MERA Antenna Site - Forbes Hill	Hepburn Heights Rd, San Rafael, CA	Moderate	X
Communications	MERA Antenna Site - Marin County Radio Shop		N/A	X
Communications	MERA Antenna Site - San Pedro Ridge Site	Mayhills Rd. San Rafael, CA	Moderate	X
Power Utility	PG&E Substation - Las Gallinas	125 N Redwood Dr., San Rafael, CA 94903	High	X
Power Utility	PG&E Substation - San Rafael	2nd St, San Rafael, CA 94901	N/A	AH
Transportation	Marin Transit	711 Grand Ave, San Rafael, CA 94901	N/A	AE
Transportation	Golden Gate Transit: Transit Center Customer Service Center	850 Tamalpais San Rafael, CA 94901	N/A	AH
Transportation	Golden Gate Transit: EOC, Dispatch, Fuel, IT	1011 Andersen Dr., San Rafael, CA 94901	N/A	AE
Transportation	San Rafael Transportation Center (SMART Train & central bus station)	3rd & Hetherton, San Rafael, CA, 94901	N/A	AH, X
Pump Station	San Rafael Stormwater Pump Station - Piombo	**LAT: 37.96 LON: -122.49**	N/A	AE
Communications	MERA Antenna Site - Mt Burdell	38.1449, -122.5941	Moderate	X
Communications	MERA Antenna Site – Big Rock Ridge	38.0591, -122.6039	Moderate	X
Pump Station	San Rafael Stormwater Pump Station – San Quentin	**LAT: 37.96 LON: -122.49**	N/A	VE
Pump Station	San Rafael Stormwater Pump Station – Cayes	**LAT: 37.96 LON: -122.49**	N/A	AE
Pump Station	San Rafael Stormwater Pump Station – Kerner	**LAT: 37.97 LON: -122.50**	N/A	AE
Pump Station	San Rafael Stormwater Pump Station – 400 Canal	**LAT: 37.97 LON: -122.51**	N/A	X
Pump Station	San Rafael Stormwater Pump Station – Rossi	**LAT: 37.97 LON: -122.51**	N/A	X
Pump Station	San Rafael Stormwater Pump Station- Montecito	**LAT: 37.97 LON: -122.52**	N/A	X
Pump Station	San Rafael Stormwater Pump Station – North Francisco	**LAT: 37.97 LON: - 122.52**	N/A	AE
Pump Station	San Rafael Stormwater Pump Station – Corporate Center	**LAT: 37.97 LON: -122.52**	N/A	nN?A
Pump Station	San Rafael Stormwater Pump Station – Lindaro	**LAT: 37.97 Lon: - 122.53**	N/A	AH
Pump Station	San Rafael Stormwater Pump Station – Glenwood	**LAT: 37.98 Lon: - 122.48**	N/A	X
Pump Station	San Rafael Stormwater Pump Station – Peacock	**LAT: 37.98 Lon: - 122.47**	N/A	X, AE

Table 299: City of San Rafael Critical Facilities
Source: City of San Rafael

1.10 HISTORICAL PROPERTIES

The City of San Rafael has twelve registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of San Rafael Chamber of Commerce.
- City of San Rafael website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA). There is a list of numerous other potentially historically significant structures listed in Appendix B of the City's General Plan.

Table 26: Historic Sites In The City of San Rafael

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Boyd House	X			12/17/1974	San Rafael
Bradford House	X			6/6/1980	San Rafael
China Camp (924)	X	X	X	4/26/1979	San Rafael
Dixie Schoolhouse	X			12/26/1972	San Rafael
Robert Dollar Estate	X			12/11/1972	San Rafael
Robert Dollar House	X			7/23/1991	San Rafael
Marin County Civic Center (999)	X			7/17/1991	San Rafael
Erskine B. McNear House	X			1/11/1982	San Rafael
Miller Creek School Indian Mound	X			10/14/1971	San Rafael
Mission San Rafael Arcangel (220)		X	X		San Rafael

Table 26: Historic Sites In The City of San Rafael					
Name/Landmark State Plaque Number	**National Register (NR)**	**State Landmark**	**California Register**	**Date Listed (NR)**	**Jurisdiction**
San Rafael Improvement Club	X			3/29/1984	San Rafael
St. Vincent's School for Boys (630)		X	X		San Rafael

Table 300: Historic Sites In The City of San Rafael
Source: California Office of Historic Preservation and the National Register of Historic Places

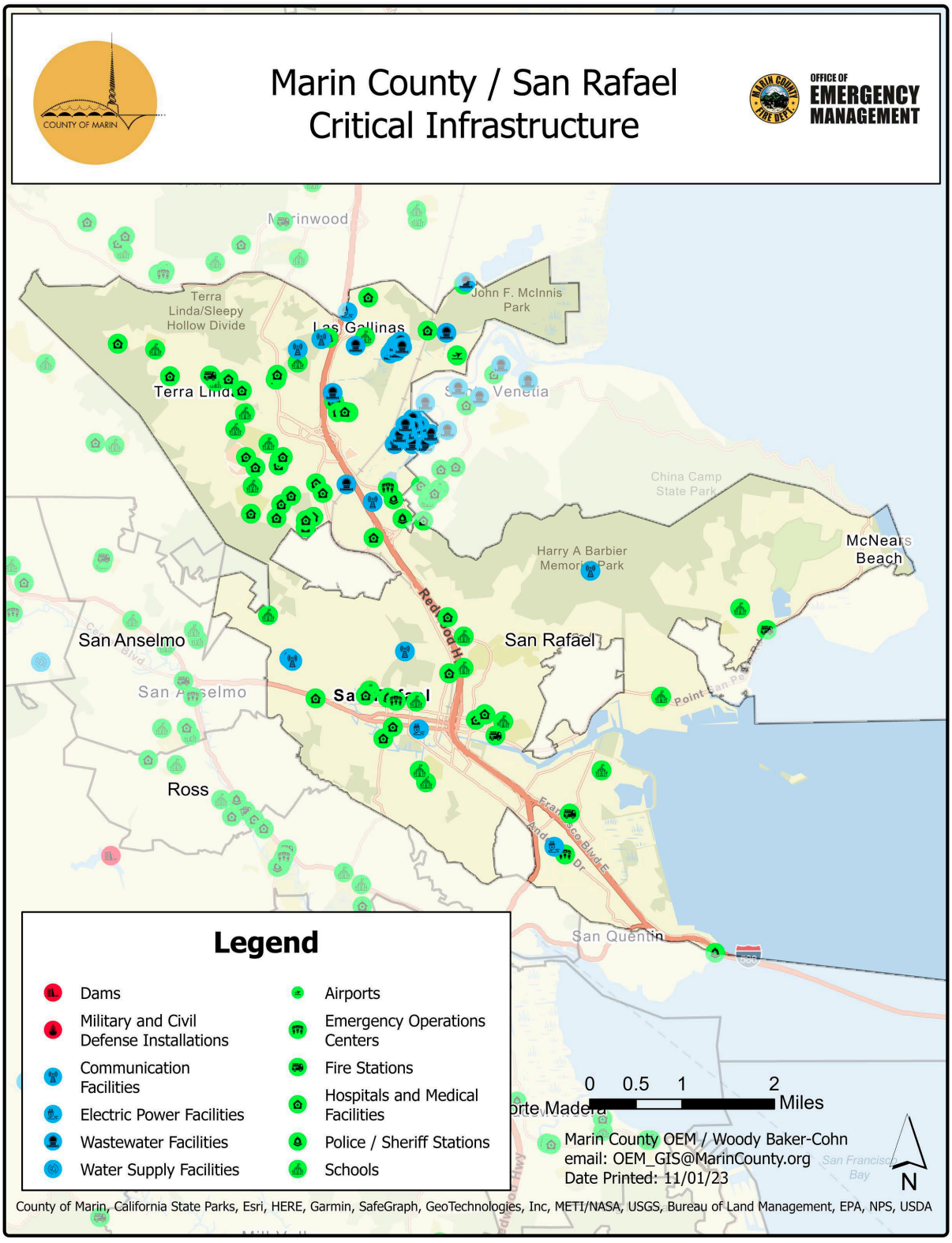


Figure 575: City of San Rafael Critical Facilities and Infrastructure
Source: Marin County OEM

2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of San Rafael identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 25 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

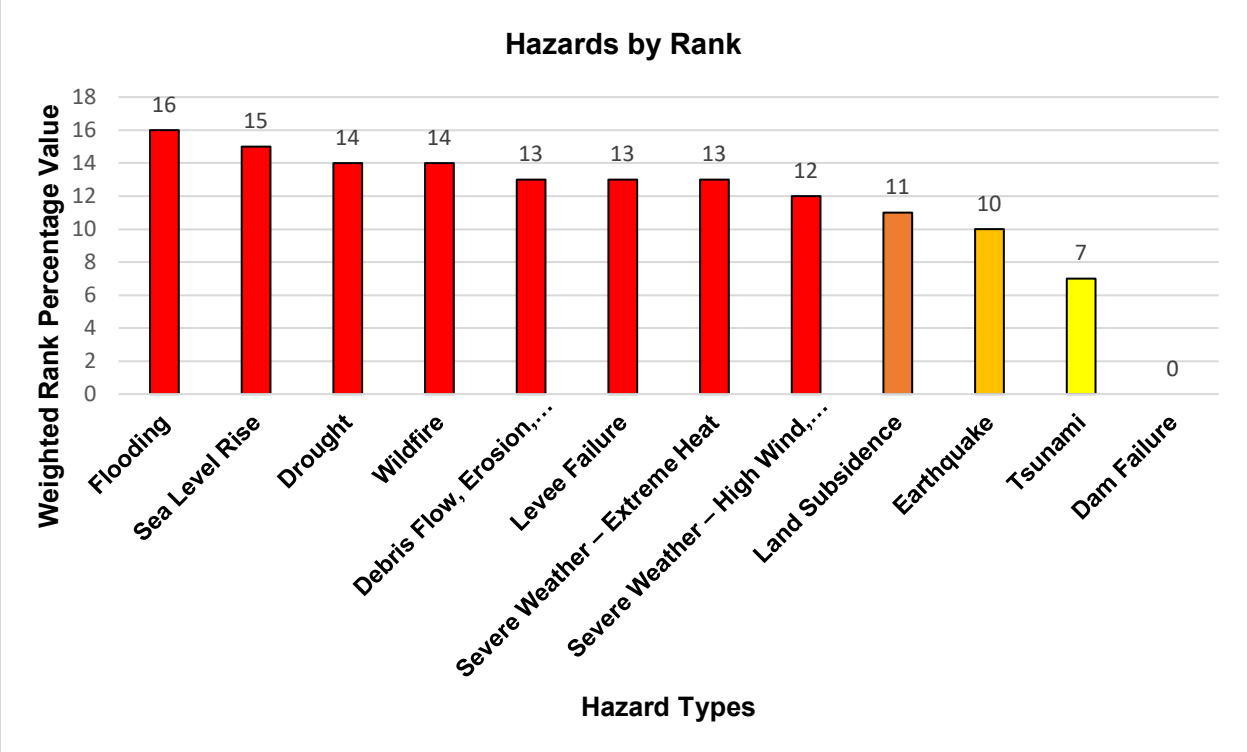


Figure 576: City of San Rafael Hazard Risk Assessment Ranking

Figure 26: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 577: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 27: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 301: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 Climate Change

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

AR6 WGI Headline Statements from the Summary for Policymakers (ipcc.ch)

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

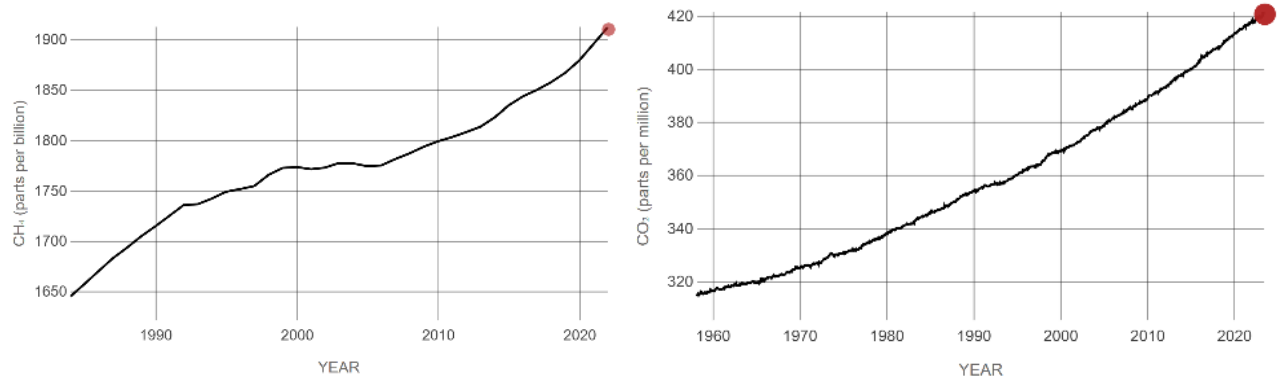


Figure 578: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

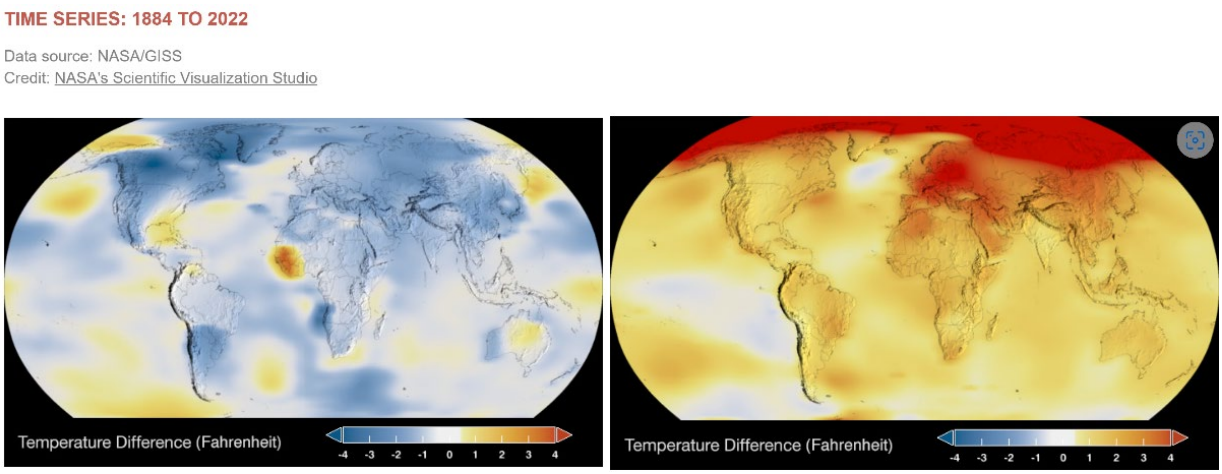


Figure 579: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.

- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

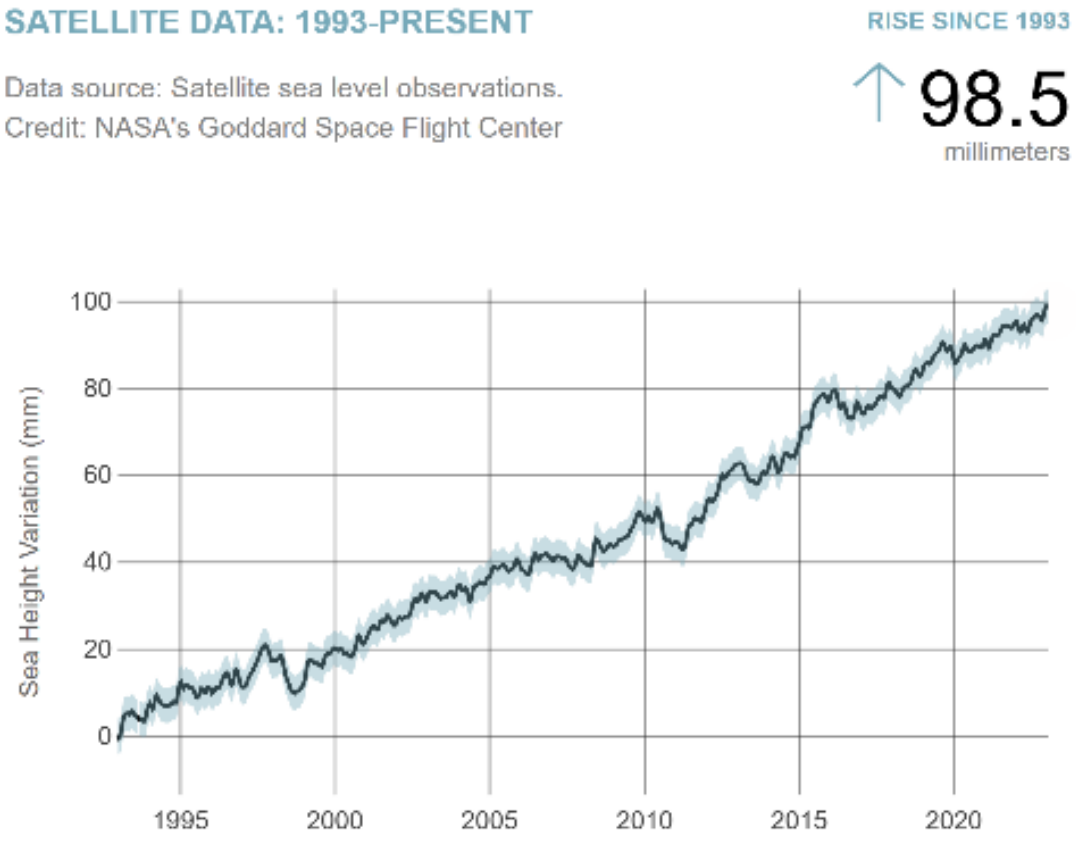


Figure 580: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought. Climate change is having an adverse effect on this type of hazard in the Bay Area, including Marin County, including sea level rise and storm flooding from regular precipitation and atmospheric rivers.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century. For the City of San Rafael, this means more impact on the storm drainage system.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.
- Flooding impacts are intensified during high tides as many of the City storm drains discharge into the Bay below king tide heights. Many outfalls become non-operational during high tides, causing flooding, a problem that will be exasperated with sea level rise.

Cold Weather

- In the last 50 years (1974), average temperatures in Marin County have rose by 6 degrees Fahrenheit. The coldest recorded month was December of 1990 at 34.7 degrees (The Californian.com). The term “extreme cold” is defined by the National Weather Service as temperatures below freezing (32 degrees F), however, the impact of cold weather on individuals may vary by location and other conditions the population typically experience, the types of facilities they are in, and what efforts individuals are expected to take. There are several factors:
    - Living or working outside of a building
    - Having windows that do not provide cold weather protection
    - Wind chill
    - Rain severity and duration
- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.
- Cold weather is relevant to the City of San Rafael and Marin County populations in the vulnerability to populations who do not have adequate heating sources, those who are not housed, and those who are institutionalized without adequate heating. Prolonged cold, especially combined with rainfall, can cause hypothermia in vulnerable individuals.
- Cold weather is relevant to the City of San Rafael and Marin County jurisdictions and partners in aiding those affected by cold weather conditions in being safe during episodes of cold weather.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, seal level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot

be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

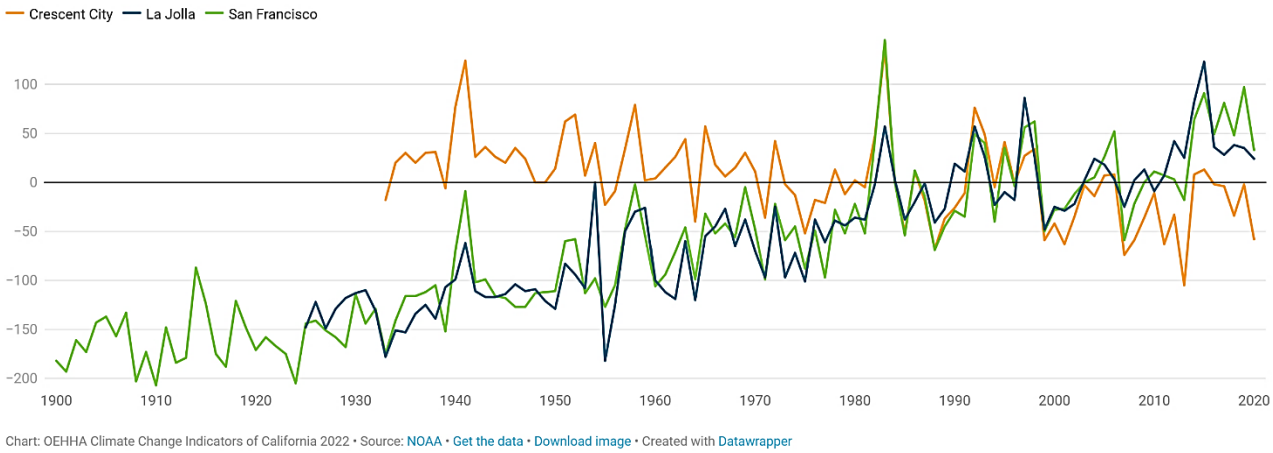


Figure 581: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate changes and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program including numerous Marin County jurisdictions, the County of Marin, and regional agencies, adopted a model Climate Action Plan (CAP) that is intended to support countywide strategic efforts and is currently being used to update or establish climate action plans for additional jurisdictions within Marin County. The adopted Climate Action Plan serves as the adopted plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and reports on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In October 2022, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2020. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation programs and initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the City of San Rafael as per the planning team.

Table 28: City of San Rafael Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Highly Likely	Significant	Moderate	Medium	Medium	**13.00**
Drought	Likely	Extensive	Moderate	High	Medium	**14.00**
Earthquake	Occasional	Significant	Severe	None	Medium	**10.00**
Flooding	Highly Likely	Significant	Severe	High	High	**16.00**
Land Subsidence	Highly Likely	Significant	Weak	Low	Medium	**11.00**
Levee Failure	Unlikely	Significant	Severe	High	High	**13.00**
Sea Level Rise	Highly Likely	Significant	Moderate	High	High	**15.00**
Severe Weather – Extreme Heat	Likely	Extensive	Moderate	High	Low	**13.00**
Severe Weather – Wind, Tornado	Occasional	Extensive	Moderate	Medium	Medium	**12.00**
Tsunami	Unlikely	Limited	Moderate	None	Medium	**7.00**
Wildfire	Likely	Significant	Severe	High	Medium	**14.00**

Table 302: City of San Rafael Hazard Risk Assessment
Source: City of San Rafael

Omitted Hazards

Because San Rafael does not have any dams and is not within a dam flood inundation zone, dam failure is an omitted hazard.

Table 29: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 303: Hazard Risk Assessment
Source: County of Marin

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place

prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 31 shows landslide susceptibility classes.

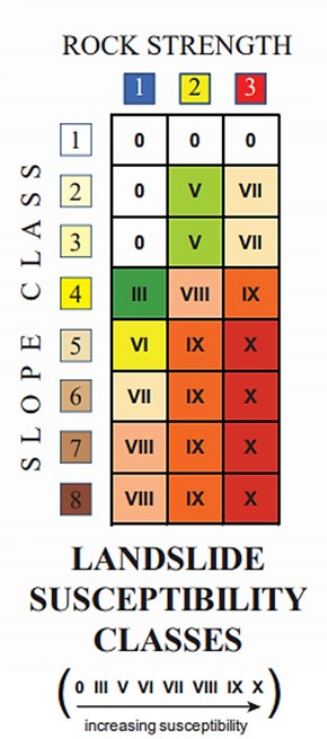


Figure 582: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 32 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

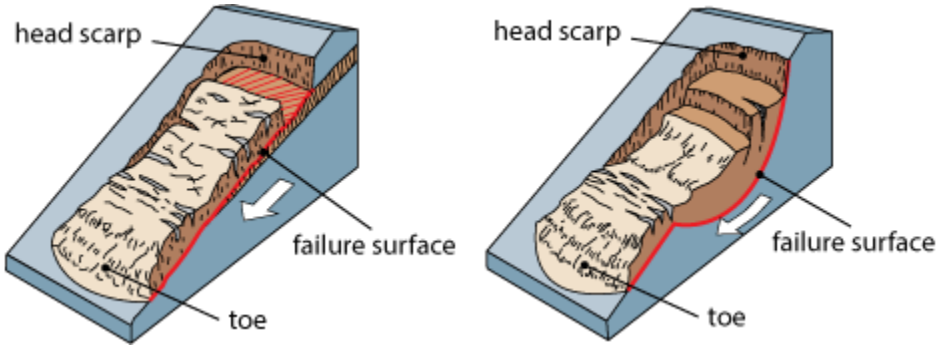


Figure 583: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in San Rafael would most likely occur in the areas of the City where the terrain is steeper and is more susceptible to movement of soil. Most of San Rafael is hilly and lies in an areas of moderate to high landslide susceptibility. Some areas of the city have extreme landslide susceptibility including along the border of Sleepy Hollow and Lucas Valley, north of downtown, and in the southern end near Larkspur. These areas of San Rafael are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. Residences in or on the fringes of open space areas including the San Pedro Mountain Open Space Preserve, Harry A. Barbier Memorial Park, China Camp State Park, the Loma Alta Open Space Preserve and the Terra Linda Open Space Preserve have moderate to high susceptibility to a landslide. There are thousands of residences in these areas. A landslide in any of areas could impact ingress and egress into communities that are at high susceptibility of a landslide. Highway 101 also has high landslide susceptibility through much of central San Rafael, and a landslide on the highway could cause significant transportation challenges that could impact the City. Much of downtown, including commercial buildings, the San Rafael City Hall, the San Rafael Police Department, the San Rafael Fire Station #51 and the Marin Academy lies in an area of moderate landslide susceptibility. Numerous schools in southern San Rafael lie on the fringe of areas with moderate to high land susceptibility and include the Dominican University of California, the Laurel Dell Academy, the Davidson Middle School, the Glenwood School, San Rafael High School, the San Raphael School, and the Sun Valley School. Numerous critical facilities in northern San Rafael lie partly in areas of moderate to high landslide susceptibility and include Gallinas Elementary School, Terra Linda High School, the Vallecito School, the Mark Day School, the San Rafael Fire Station #53 and the Marin County Civic Center. There are dozens of medical facilities throughout San Rafael that lie in areas of moderate to high landslide susceptibility, including the Kaiser Permanente San Rafael Medical Center. The Caulbridge School lies predominantly in an area

of extreme landslide susceptibility. Several radio towers throughout San Rafael lie in areas of moderate to extreme landslide susceptibility.

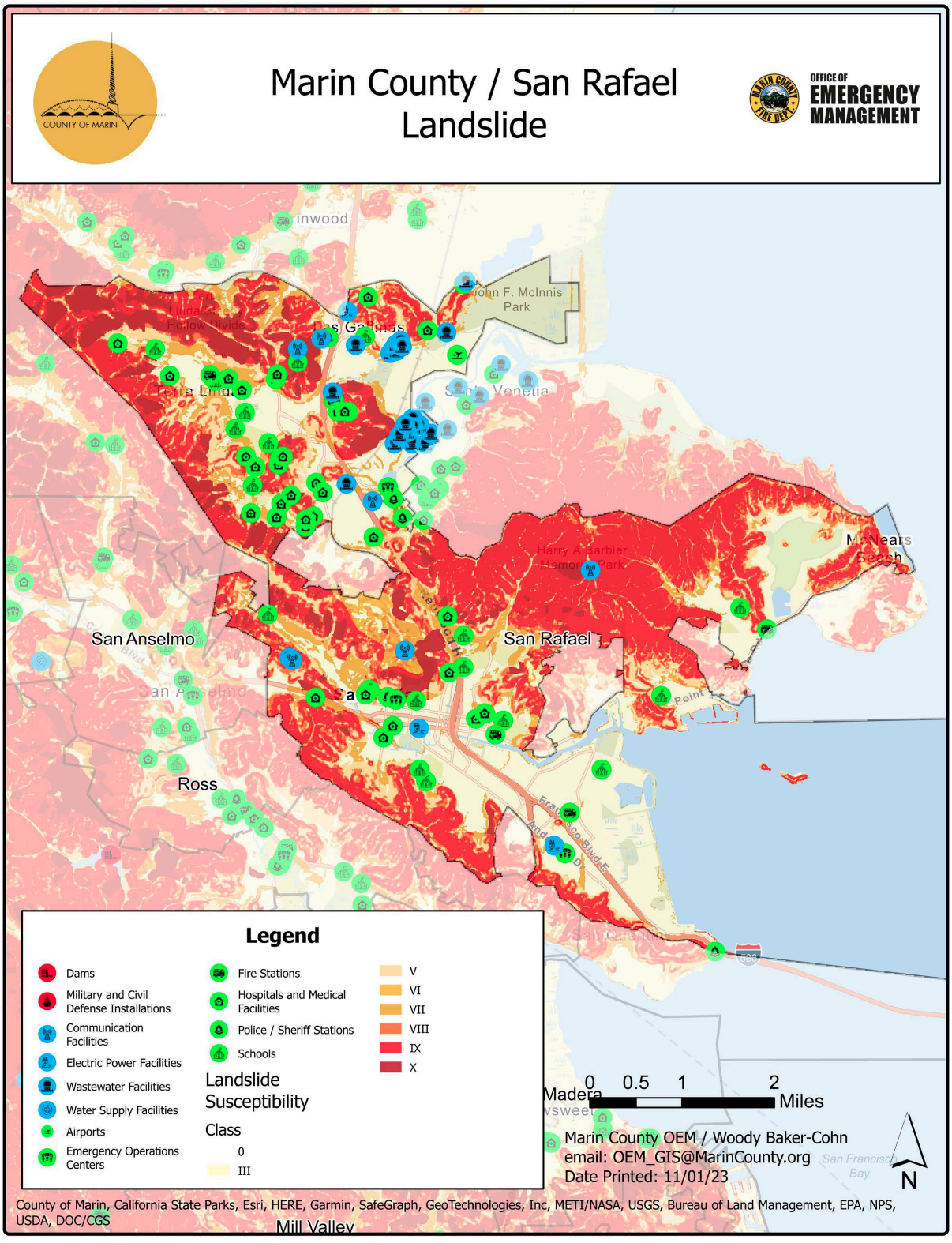


Figure 584: City of San Rafael Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

An earthquake has the potential to cause landslides throughout areas of landslide susceptibility in San Rafael. A wildfire and subsequent rain event in any of the open spaces in and around San Rafael, including in the San Pedro Mountain Open Space Preserve, Harry A. Barbier Memorial Park, China Camp State Park and along the border of Lucas Valley and Sleepy Hollow could cause mudslides that could impact adjacent communities.

On 3/23/2023, a landslide in the 100 block of Bret Harte Avenue sent trees crashing into power lines.

On 3/5/2019, wet weather caused a landslide below Crestview Way, threatening a home.

On 2/7/2017, a severe storm caused a mudslide that resulted in a boulder shearing a house in the 300 block of Mountain View Avenue in two.

On 1/10/2017, a slide along the 30 block of Glenaire Drive in the Bret Harte neighborhood south of downtown San Rafael sent mud cascading 140 feet down onto three homes.

On 1/3–1/5/1982, a severe storm caused a mudslide that collapsed several homes, resulting in fatalities.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[36], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of San Rafael that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in San Rafael could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it

[36] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.

Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of San Rafael, though its effects would be most felt in the mountainous areas around the city where the risk of wildfire would increase. The wetland areas of San Rafael, particularly the marshlands along San Rafael Bay and San Pablo Bay, could become drier during prolonged period of drought and experience marshland fires that could impact local businesses and residences in the area. Dry trees in public open spaces like Harry A. Barbier Memorial Park, Boyd Memorial Park and Jerry Russom Memorial Park can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including San Rafael may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and San Rafael, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around San Rafael. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including San Rafael where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of San Rafael, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of San Rafael

could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including San Rafael can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 34).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 585: Modified Mercalli Intensity Scale
Source: USGS

Figure 35 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 586: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 36). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 587: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around San Rafael due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity

The colors on Figures 32 and 33 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

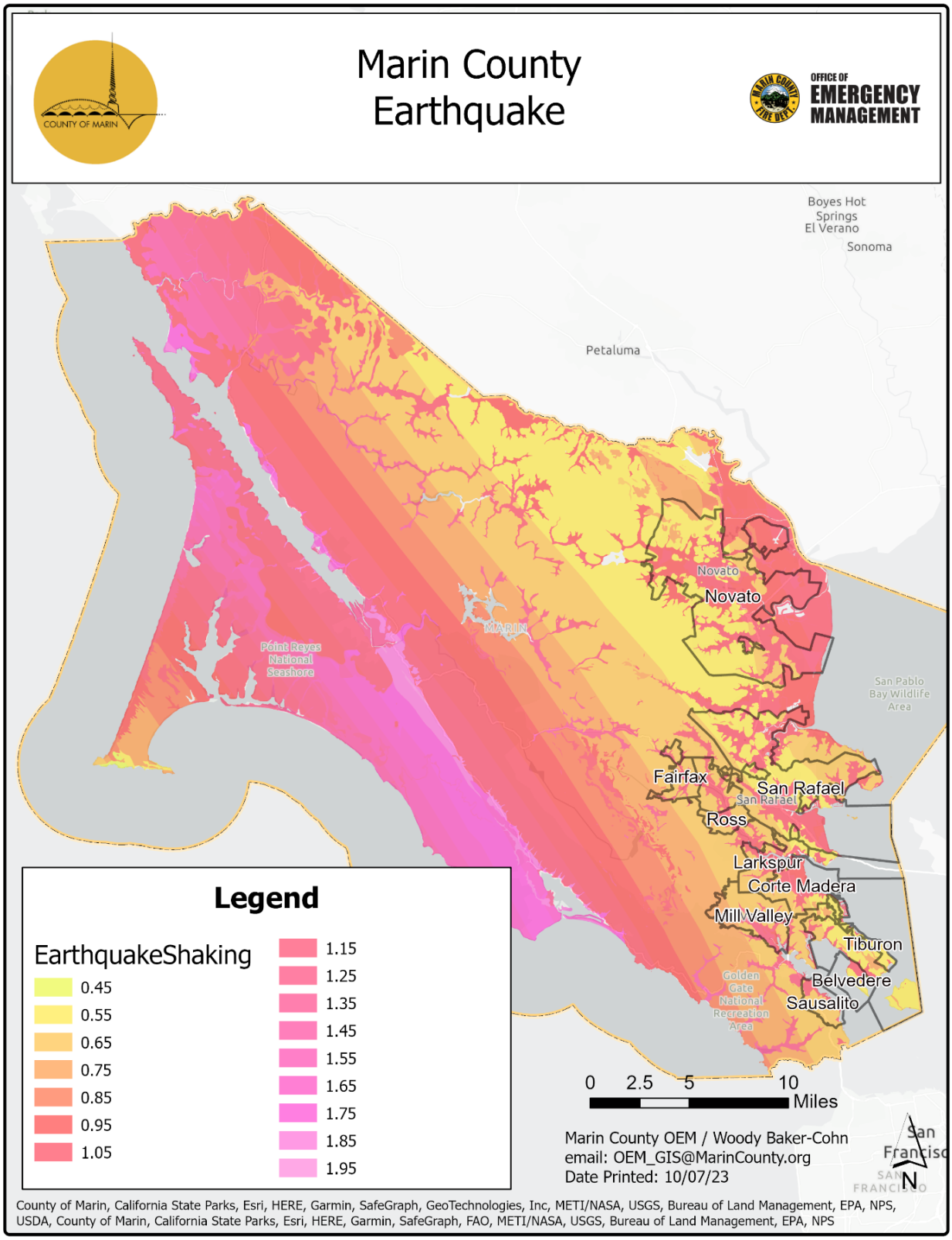


Figure 588: Marin County OA Earthquake Impact and Fault Lines
Source: Marin County OEM

San Rafael is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the City. There is increased risk of shaking and liquefaction throughout San Rafael from an earthquake, particularly in the southern area of the city downtown and along the Highway 101 corridor; the area south of China Camp State Park; the northern area of the city along Manuel T. Freitas Parkway and the Highway 101 corridor, and areas along Galinas Creek and the South Fork of Galinas Creek. These areas include the primary commercial areas of the City including downtown, and numerous residential neighborhoods with thousands of residences. Nearly all of the city's critical facilities lie in areas of moderate earthquake shaking potential with the exception of the Marin County Civic Center, the San Rafael Fire Station #53 and several medical facilities. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the City could be impacted by an earthquake. Most of Highway 101 that runs through the City lies in an area of moderate earthquake shaking potential.

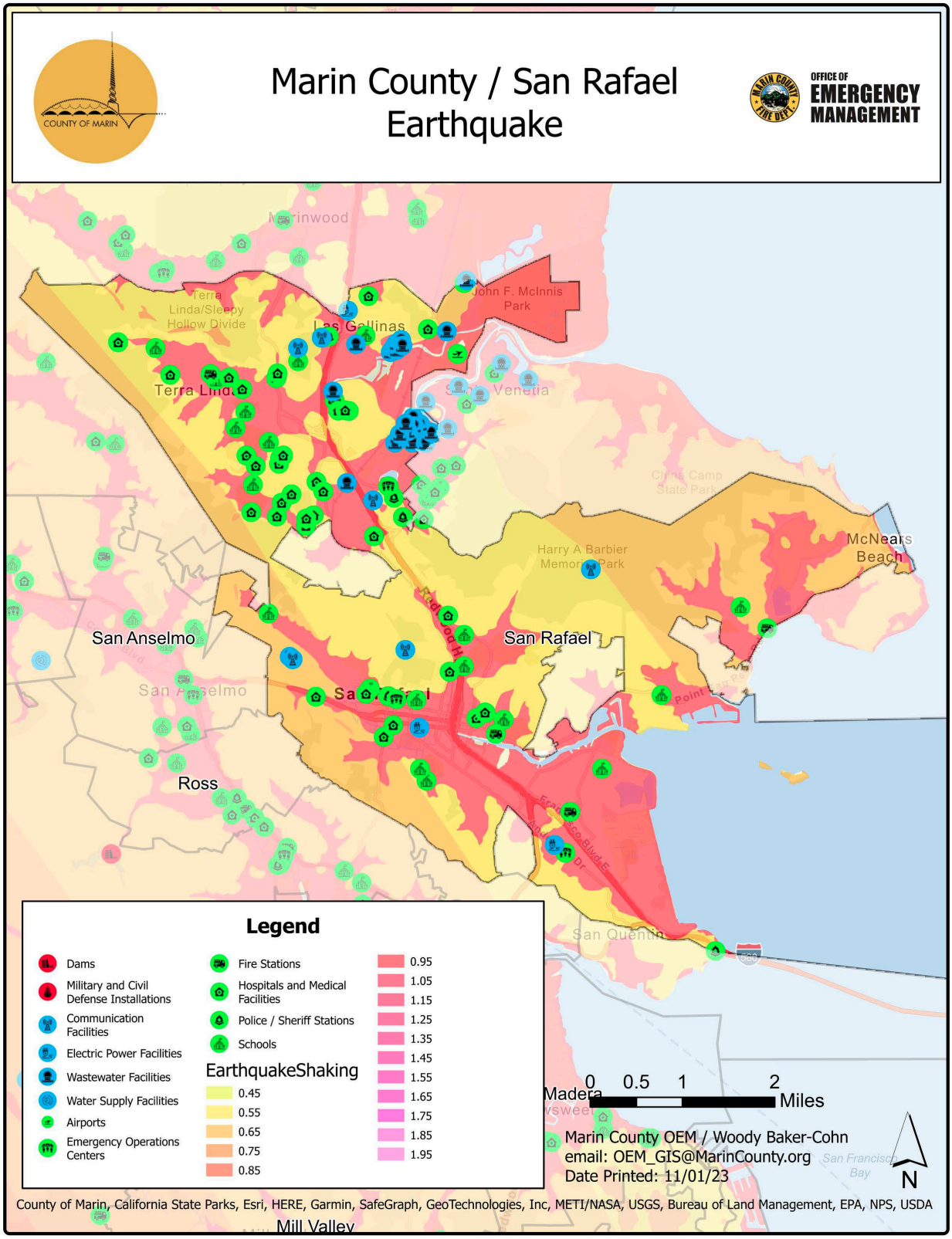


Figure 589: City of San Rafael Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Earthquakes could also cause landslides in the open space areas in and surrounding San Rafael with steeper terrain, causing damage to homes and roads as a result of shifting soils.

San Rafael hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in San Rafael.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including San Rafael, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[37], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including San Rafael. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of San Rafael, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

[37] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow are the most damaging.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or

Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 39.

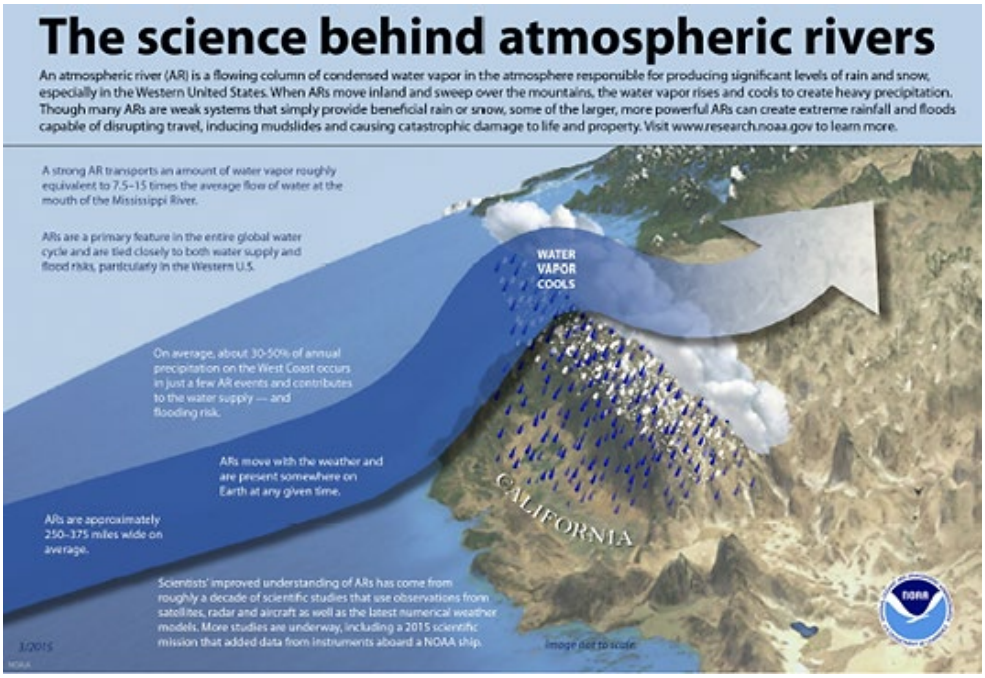


Figure 590: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the stormdrains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in San Rafael generally results from a combination of high tides from San Rafael Bay and San Pablo Bay and creek flooding Gallinas Creek, the South Fork of Galinas Creek and San Rafael Creek in low-lying areas. Local flooding in San Rafael is exacerbated where the storm water drainage network has inadequate capacity for peak flows.

Most of the lowland areas in San Rafael are in the 100-year floodplain, with several areas in the 500-year floodplain. The 100-year floodplain extends mostly along the Highway 101 corridor south of San Rafael Creek for three miles between Gallinas Creek and the South Fork of Gallinas Creek east of Highway 101, and north of Point San Pedro around the San Pedro Lagoon and the Peacock Gap Golf Country Club. This area include part of downtown, hundreds of homes, numerous commercial buildings and shopping plazas, several medical facilities, the Golden Gate, Bridge and Transportation District Emergency Operations Center, the Central Marin Sanitary Agency Wastewater Treatment Plant, a Pacific Gas and Electric yard, the San

Rafael Fire Station #54, the Bahia Vista School, the Davidson Middle School, the San Rafael Fire Station #52, part of the San Rafael High School, the San Rafael Fire Station #55, the Smith Ranch Airport, and nine of the ten pump stations in the Marin Lagoon that could be susceptible to flooding. Approximately three miles of Highway 101 and the SMART railroad tracks lie in the 100-year floodplain and could be susceptible to flooding, presenting transportation challenges for the city. Approximately two miles of San Pedro Road lies in the 100-year floodplain and could be susceptible to flooding, effecting ingress and egress to communities north of Point San Pedro. The 500-year floodplain primarily extends west and north of the 100-year floodplain along San Rafael Creek and west of the 100-year floodplain along Gallinas Creek and the South Fork of Gallinas Creek. This area consists of most of downtown; part of the San Rafael transit center and train station, hundreds of homes and numerous commercial buildings and medical facilities; Laurel Dell Elementary School, Coleman Elementary School, the All Children Academics School; part of the San Rafael High School, Raphael School, Sun Valley Elementary School, the Marin Academy and the Star Academy; the Civic Center North Pump Station, the John Duckett Pump Station, the Northgate Industrial Park Pump Station, all six of the Captain Cove Pump Stations, and the Marin Emergency Radio Authority antenna site that could be susceptible to flooding. A large section of the 500-year floodplain lies north of downtown and extends along several hundred feet of Highway 101, including the SMART railroad tracks which could be susceptible to flooding. The San Rafael City Hall and the Marin County Civic Center lie outside of the 100 and 500-year floodplains, though access may be hindered due to area flooding.

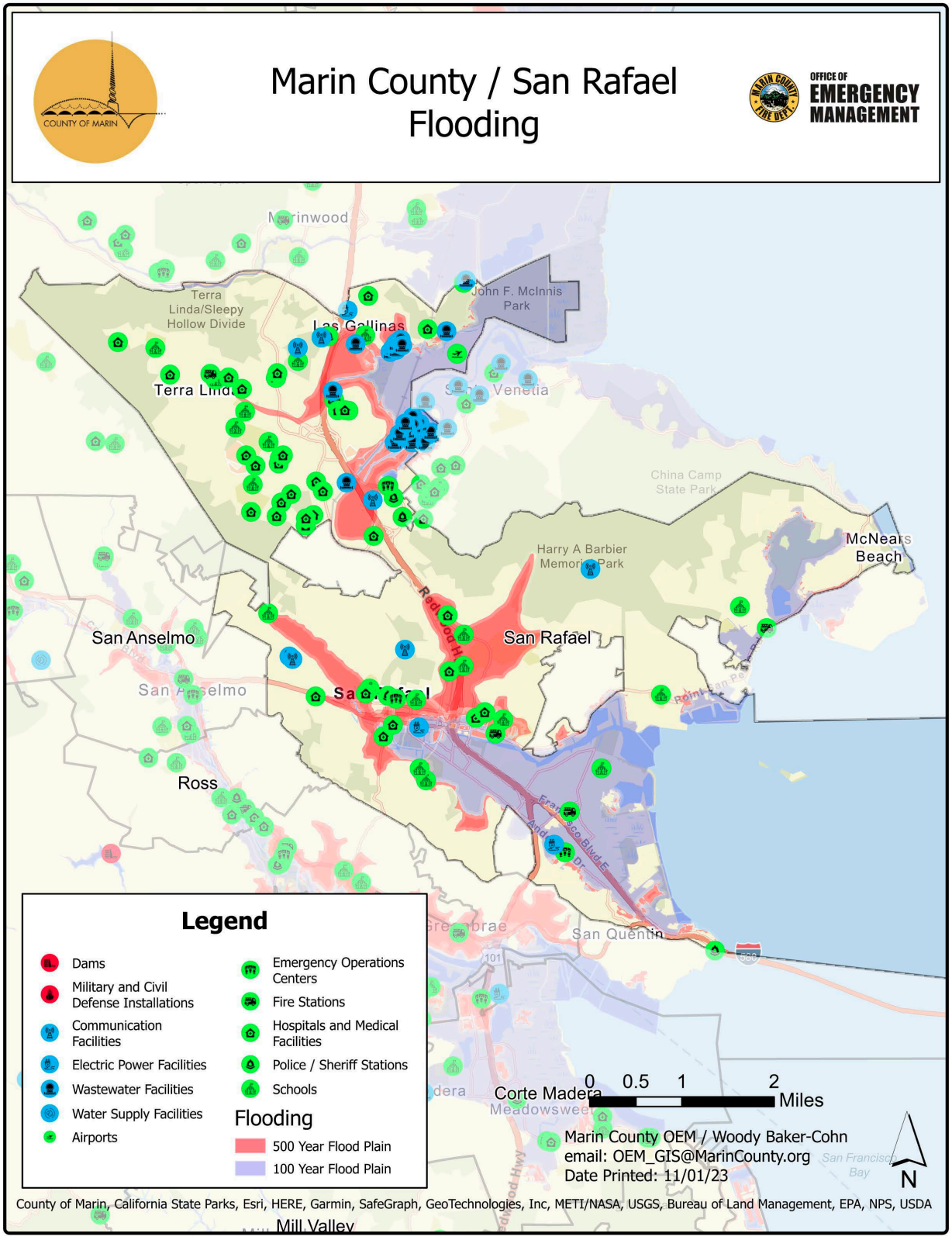


Figure 591: City of San Rafael Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 31 shows the number of City of San Rafael critical facilities by flood zone.

Table 31: City of San Rafael Critical Facilities in the Flood Zones			
Category	**Name**	**Address**	**Flood Zone**
Critical Facilities			
Fire	Fire: Marinwood Fire Department (MRW) / Headquarters & Station 58	777 Miller Creek Road 94903	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 51	1039 C Street 94901	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 52	210 Third Street 94901	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 54	46 Castro Avenue 94901	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 55	955 Pt. San Pedro Road 94901	AE
Fire	Fire: San Rafael Fire Department (SNR) / Station 56	650 Del Ganado Road 94903	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 57	3530 Civic Center Drive 94903	X , AE
Fire	Fire: Skywalker Ranch Fire Brigade (SKY)	5858 Lucas Valley Road 94912	X
Fire	Fire: San Rafael Fire Department (SNR) / Station 53	30 Joseph Court 94903	X
Law	County Jail	13 Peter Behr Dr, San Rafael, CA 94903	X
Law	County 911 Communications Center / PSAP	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	X
Law	Marin County Sheriffs Office	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	X
Law	San Rafael Police Department	1400 Fifth Avenue, San Rafael, CA 94901	X
EOC	Marin County EOC	1600 Los Gamos Drive, Suite 200. San Rafael, CA 94903	X
Local Government	Marin Civic Center	3501 Civic Center Dr, San Rafael, CA 94903	X
Local Government	Marin County Corporate Yard Building	2 Peter Behr Drive, San Rafael, CA 94903	X
Local Government	Marin County Fuel Island	2 - 6 Peter Behr Drive, San Rafael, CA 94903	X
Local Government	Marin County Vehicle Repair Shops/Building	2 - 6 Peter Behr Drive, San Rafael, CA 94903	X
Local Government	Boro Community Center	50 Canal Street, San Rafael, CA 94901	AE
Local Government	San Rafael Public Works Yard	111 Morphew St, San Rafael, CA 94901	X
Local Government	San Rafael Community Center	618 B Street, San Rafael CA 94901	AH, AE
Local Government	Terra Linda Community Center	670 Del Ganado Rd, San Rafael CA 94903	X
Health / Medical	Kaiser Permanente San Rafael Medical Center	99 Montecillo Rd, San Rafael, CA 94903	X
Health / Medical	Adrian Way Home	306 Adrian Way San Rafael, Ca 94903	AE
Health / Medical	Aldersly (Snf Unit)	326 Mission Ave 94901	X
Health / Medical	Casa Allegra - Devon Drive Home	363 Devon Dr 94903	X

Table 31: City of San Rafael Critical Facilities in the Flood Zones			
Category	**Name**	**Address**	**Flood Zone**
Health / Medical	Kaiser Foundation Hospital - San Rafael	99 Montecillo Rd 94903	X
Health / Medical	Smith Ranch Generations (Snf)	1550 Silveira Pkwy 94903	X
Health / Medical	Northgate Post Acute	40 Professional Center Pkwy 94903	X
Health / Medical	Nova House, Inc.	393 Nova Albion Way 94903	X
Health / Medical	Aldersly (Snf Unit)	326 Mission Ave 94901	X
Health / Medical	Pine Ridge Care Center	45 Professional Center Pkwy 94903	X
Health / Medical	Professional Post Acute Center	81 Professional Center Pkwy 94903	X
Health / Medical	Marin Post Acute	234 N San Pedro Rd 94903	X
Health / Medical	San Rafael 5th Avenue Health & Wellness	1601 5Th Ave 94901	X
Health / Medical	Sunrise Ii	48 Golden Hinde Blvd 94903	X
Health / Medical	Villa Marin (Rcfe Unit)	100 Thorndale Dr 94903	X
Health / Medical	Three Home Village 1, 2, 3	675 Rosal Way, San Rafael, Ca 94903	AE
Health / Medical	Almavia Of San Rafael	515 Northgate Drive, San Rafael, Ca 94903	X
Health / Medical	Nazareth House Of San Rafael, Inc.	245 Nova Albion Way, San Rafael, Ca 94903	X
Health / Medical	Drake Terrace	275 Los Ranchitos Road, San Rafael, Ca 94903	X
Health / Medical	Cogir Memory Care	111 Merrydale Rd, San Rafael, Ca 94903	X
Health / Medical	Greenwood Assisted Living	233 West End Ave, San Rafael, Ca 94901	X
Health / Medical	St. Michael's Extended Care	416 4th Street, San Rafael, Ca 94901	AE, X
Health / Medical	Golden Home Extended Care, Inc.	1234 Las Gallinas Ave, San Rafael, Ca 94903	X
Health / Medical	All Saints Extended Care Inc	1373 Lincoln Ave., San Rafael, Ca 94901	X
Health / Medical	D Street Residential Support Services	527 D Street, San Rafael, Ca 94901	X
Health / Medical	Schon Hyme Rest Home	25 Villa Avenue, San Rafael, Ca 94901	X
Health / Medical	A Loving Touch	45 Meriam Drive 94903	X
Health / Medical	Smith Ranch Homes (Independent Living)	500 Deer Valley Road 94903	X
Health / Medical	Luna's Home	1027 Las Pavadas Ave 94903	X
Health / Medical	Aldersly (Al) (Rcfe Unit)	326 Mission Ave 94901	X
Health / Medical	Smith Ranch Skilled Nursing And Rehabilitation Center	1550 Silveira Parkway 94903	X
Health / Medical	Villa Marin (Snf)	100 Thorndale Dr 94903	X

Table 31: City of San Rafael Critical Facilities in the Flood Zones			
Category	**Name**	**Address**	**Flood Zone**
Health / Medical	Dominican Sisters Of San Rafael	1520 Grand Avenue 94901	X
Health / Medical	St. Vincent's School For Boys	1 St Vincent's Drive, 94903	X, A, AE
Health / Medical	Lighthouse	714 C Street, San Rafael 94901	AH
Health / Medical	Casa Allegra - Adrian House	306 Adrian Way, San Rafael	AE
Health / Medical	Long Life Living #1	36 Mt Foraker Drive, San Rafael 94903	X
Health / Medical	Dominican Convent - Lourdes Site	77 Locust Ave, San Rafael, 94901	X
Health / Medical	Dominican Convent - Jane D'anza Site	1540 Grand Ave, San Rafael 94901	X
Health / Medical	Helen Vine Detox Center	291 Smith Ranch Rd, San Rafael 94903	X
Health / Medical	Lifehouse Sunrise Ii	48 Golden Hinde Blvd, San Rafael 94903	X
Health / Medical	Bayside Marin Treatment Center	718 4th Street, San Rafael 94901	X
Health / Medical	Caremax Peachstone Residence	440 Peachstone Terrace, San Rafael 94903	X
Health / Medical	Center Point - The Manor	603 D Street, San Rafael 94901	AE
Health / Medical	Casa Allegra - Happy House	291 Devon Dr, San Rafael, Ca 94901	X
Health / Medical	Bay Home Inc.	19 Heatherstone Court, San Rafael 94903	X
Health / Medical	Marin Services For Men	501 Whitewood Drive, San Rafael, 94903	X
Health / Medical	Castle SLE	1363 Lincoln Ave #4, San Rafael, CA 94901	X
Health / Medical	Villa Marin (Il)	100 Thorndale Dr 94903	X
Health / Medical	Parnow Friendship House	164 North San Pedro Road, San Rafael 94903	X
Health / Medical	Lifehouse - Knoll Rd	18 Professional Center Parkway, San Rafael 94903	X
Health / Medical	Newport Academy	5 Maoli Dr, San Rafael, Ca 94903	X
Health / Medical	Helen Vine San Rafael House	235 Union Street. San Rafael, Ca 94901	X
Health / Medical	L'chaim House I	777 Montcillo Rd, San Rafael 94903	X
Health / Medical	Long Life Living #3	57 Vallejo Way, San Rafael 94903	X
Health / Medical	L'chaim House II	463 Albion Way, San Rafael 94903	X
Health / Medical	Lifehouse - Nova	93 Nova Albion Way, San Rafael 94903	X
Health / Medical	Tender Residential Home	257 Blackstone Dr, San Rafael 94903	X
Health / Medical	Aldersly (Il Unit)	326 Mission Ave 94901	X
Health / Medical	Buckelew Mariner Circle	6 Mariner Circle, San Rafael	AE

Table 31: City of San Rafael Critical Facilities in the Flood Zones			
Category	**Name**	**Address**	**Flood Zone**
Health / Medical	Buckelew - Avanti	7 Le Claire Ct, San Rafael, Ca 94903	X
Health / Medical	Casa Allegra - 980 Ignacio	35 Mitchell Blvd #8, San Rafael, Ca 94903	X
Health / Medical	Lifehouse - 1600 Vendola Drive	1600 Vendola Dr, San Rafael, Ca 94903	AE
Health / Medical	Lifehouse (Supportive Living - Various Sites)	18 Professional Center Parkway, San Rafael, Ca 94903	X
Health / Medical	Casa Allegra - Reichert Ave	35 Mitchell Blvd. Suite 8 San Rafael, Ca 94903	X
Health / Medical	Marin Health & Wellness Campus	3253 Kerner Blvd, San Rafael, CA 94901	AE
Health / Medical	Kaiser Permanente Downtown San Rafael Medical Offices	1033 3rd St, San Rafael, CA 94901	AH, X
Health / Medical	Marin Community Clinic	3110 Kerner Boulevard, San Rafael, CA	AE
Health / Medical	Kaiser Permanente San Rafael Medical Offices	1650 Los Gamos Dr., San Rafael, CA 94903	X
Health / Medical	MarinHealth Urgent Care	4000 Civic Center Dr, San Rafael, CA 94903	X
School	Dominican University	50 Acacia Avenue San Rafael, CA 94901	X
School	Bahia Vista Elementary	125 Bahia Vista, San Rafael CA 94901	AE
School	Coleman Elementary	800 Belle Ave. San Rafael, CA 94901	X
School	Glenwood Elementary	25 West Castlewood San Rafael, CA 94901	X, AE
School	Laurel Dell Elementary	225 Woodland Ave. San Rafael, CA 94901	X
School	San Pedro Elementary	498 Point San Pedro San Rafael, CA 94901	X
School	Sun Valley Elementary	75 Happy Lane San Rafael, CA 94901	X
School	Vallecito School	50 Nova Albion Way, San Rafael CA 94903	X
School	Venetia Valley TK-8	177 N. San Pedro Rd. San Rafael, CA 94903	X
School	Davidson Middle	280 Woodland Ave. San Rafael, CA 94901	X, AE
School	San Rafael High	150 Third Street San Rafael, CA 94901	X
School	Terra Linda High	320 Nova Albion Way San Rafael, CA 94903	X
School	Madrone High	185 Mission Ave. San Rafael, CA 94901	AE, X
Airport/ Heliport	San Rafael - Airport	400 Smith Ranch Rd, San Rafael, CA 94903	AE
High Potential Loss Facilities			
Critical Infrastructure			
Water/Wastewater	Central Marin Sanitation & Household Hazardous Waste Facility	1301 Andersen Drive, San Rafael, CA 94901	AE, X
Communications	MERA Antenna Site - Dollar Hill	Robert Dollar Dr., San Rafael, CA	X
Communications	MERA Antenna Site - EOF	1600 Los Gamos Dr 94903	X

Table 31: City of San Rafael Critical Facilities in the Flood Zones			
Category	**Name**	**Address**	**Flood Zone**
Communications	MERA Antenna Site - Forbes Hill	Hepburn Heights Rd, San Rafael, CA	X
Communications	MERA Antenna Site - Marin County Radio Shop		X
Communications	MERA Antenna Site - San Pedro Ridge Site	Mayhills Rd. San Rafael, CA	X
Power Utility	PG&E Substation - Las Gallinas	125 N Redwood Dr., San Rafael, CA 94903	X
Power Utility	PG&E Substation - San Rafael	2nd St, San Rafael, CA 94901	AH
Transportation	Marin Transit	711 Grand Ave, San Rafael, CA 94901	AE
Transportation	Golden Gate Transit: Transit Center Customer Service Center	850 Tamalpais San Rafael, CA 94901	AH
Transportation	Golden Gate Transit: EOC, Dispatch, Fuel, IT	1011 Andersen Dr., San Rafael, CA 94901	AE
Transportation	San Rafael Transportation Center (SMART Train & central bus station)	3rd & Hetherton, San Rafael, CA, 94901	AH, X
Pump Station	San Rafael Stormwater Pump Station - Piombo	**LAT: 37.96 LON: -122.49**	AE
Communications	MERA Antenna Site - Mt Burdell	38.1449, -122.5941	X
Communications	MERA Antenna Site – Big Rock Ridge	38.0591, -122.6039	X
Pump Station	San Rafael Stormwater Pump Station – San Quentin	**LAT: 37.96 LON: -122.49**	VE
Pump Station	San Rafael Stormwater Pump Station – Cayes	**LAT: 37.96 LON: -122.49**	AE
Pump Station	San Rafael Stormwater Pump Station – Kerner	**LAT: 37.97 LON: -122.50**	AE
Pump Station	San Rafael Stormwater Pump Station – 400 Canal	**LAT: 37.97 LON: -122.51**	X
Pump Station	San Rafael Stormwater Pump Station – Rossi	**LAT: 37.97 LON: -122.51**	X
Pump Station	San Rafael Stormwater Pump Station- Montecito	**LAT: 37.97 LON: -122.52**	X
Pump Station	San Rafael Stormwater Pump Station – North Francisco	**LAT: 37.97 LON: - 122.52**	AE
Pump Station	San Rafael Stormwater Pump Station – Corporate Center	**LAT: 37.97 LON: -122.52**	nN?A
Pump Station	San Rafael Stormwater Pump Station – Lindaro	**LAT: 37.97 Lon: - 122.53**	AH
Pump Station	San Rafael Stormwater Pump Station – Glenwood	**LAT: 37.98 Lon: - 122.48**	X
Pump Station	San Rafael Stormwater Pump Station – Peacock	**LAT: 37.98 Lon: - 122.47**	X, AE

Table 304: City of San Rafael Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that

develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within San Pablo Bay and San Rafael Bay have the potential to significantly impact the San Rafael storm drain system. San Rafael already sees flooding from king tides in San Pablo Bay and San Rafael Bay and this is only expected to increase with sea level rise and climate change.

On 1/9/2023, roads feeding into Highway 101 were flooded in San Rafael after a winter storm.

On 10/24/2021, widespread flooding occurred in San Rafael as a result of an atmospheric river event. Many roadways were under two feet of water and were impassable. Downtown flooding was focused in the area east of A Street. Road closures were in place around 2nd and 3rd street from A street to the freeway onramp. Several power outages impacted some traffic signals and pump stations in the city. The flooding worsened due to high tide.

Figure 592: City of San Rafael Flooding – 10/21/2021
Source: City of San Rafael

On 2/12-2/13/2019, a storm dumped 4.45 inches of rain in San Rafael causing localized flooding. Flooding was reported in the Contempo Marin neighborhood, and Lucas Valley Road was closed at the Highway 101 underpass toward Smith Ranch Road after rainwater began to pool and flood the road.. The closure caused traffic delays on nearby city routes as morning drivers sought access to Highway 101. Power was out into the afternoon to signal lights in the Northgate mall area, and the Northgate One shopping complex was without power.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[38] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including San Rafael. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including San Rafael will likely experience more rain inundation events that lead to flooding and increase the potential threat of levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of San Rafael. Future development in these areas will expose more people and infrastructure to the effects of flooding. Development in the marshland areas of San Rafael would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to storm surge. Development along San Rafael Creek, Gallinas Creek, and the South Fork of Gallinas Creek would expose more people, structures and infrastructure including major roads to creek flooding and storm surge as a result of climate change. Climate change could lead to worse flooding impacts in the downtown area including roads that feed onto Highway 101.

2.2.5 LAND SUBSIDENCE/SINKHOLES

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 42 for a picture and description of how dissolution sinkholes form.

[38] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

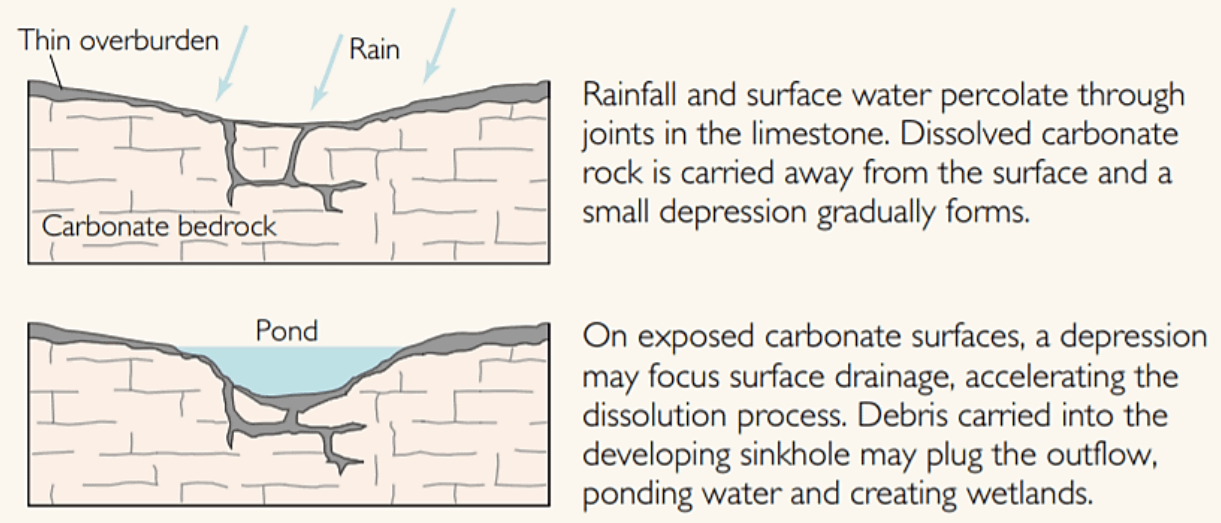


Figure 593: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 43 for a picture and description of how cover-subsidence sinkholes form.

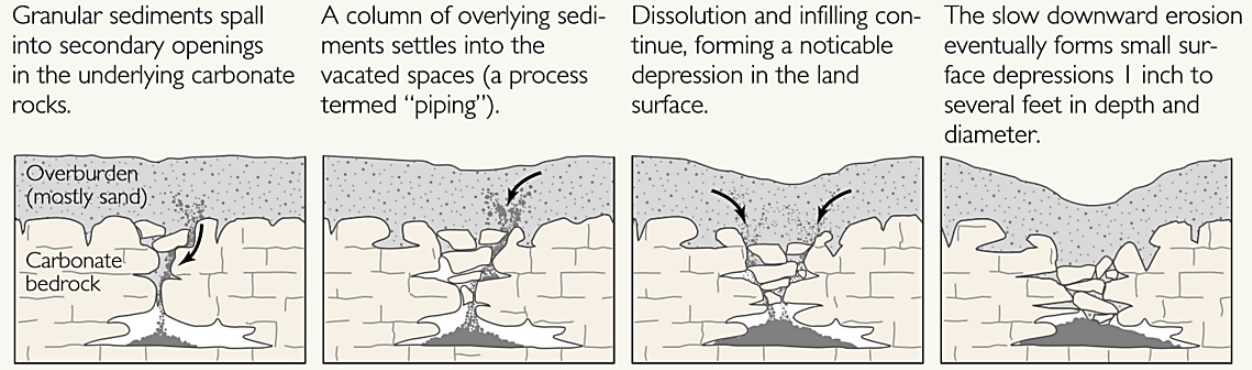


Figure 594: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 44 for a picture and description of how cover-collapse sinkholes form.

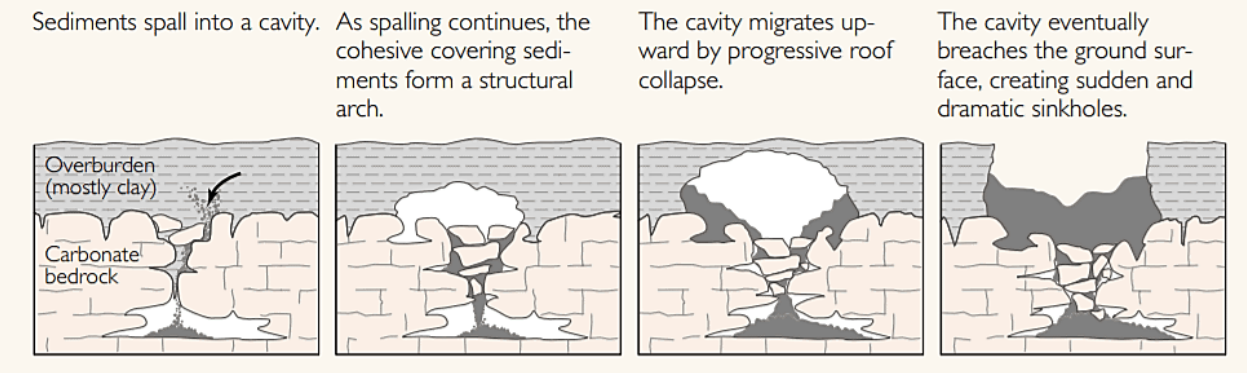


Figure 595: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the lowland areas of San Rafael where superficial deposits and fill are more prevalent, particularly in and around marshland bordering San Rafael Bay and San Pablo Bay. The downtown area, the primary commercial areas of the city along the Highway 101 corridor, and numerous residential neighborhoods with schools and other critical facilities are at increased risk of land subsidence. Land subsidence could have numerous impacts for San Rafael, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the city.

On 1/2016, a sinkhole formed at the Rotary Manor Senior Community as a result of a collapsed culvert that fed into San Rafael Creek. The complex garden was destroyed when the sinkhole appeared.

There have been no major sinkholes in San Rafael since the last plan update.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including San Rafael, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of San Rafael as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in San Rafael could

increase with future development in the lowland populated areas of the city where land subsidence is more likely to occur.

2.2.6 LEVEE FAILURE

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 45 shows a levee and the multiple ways it can fail.

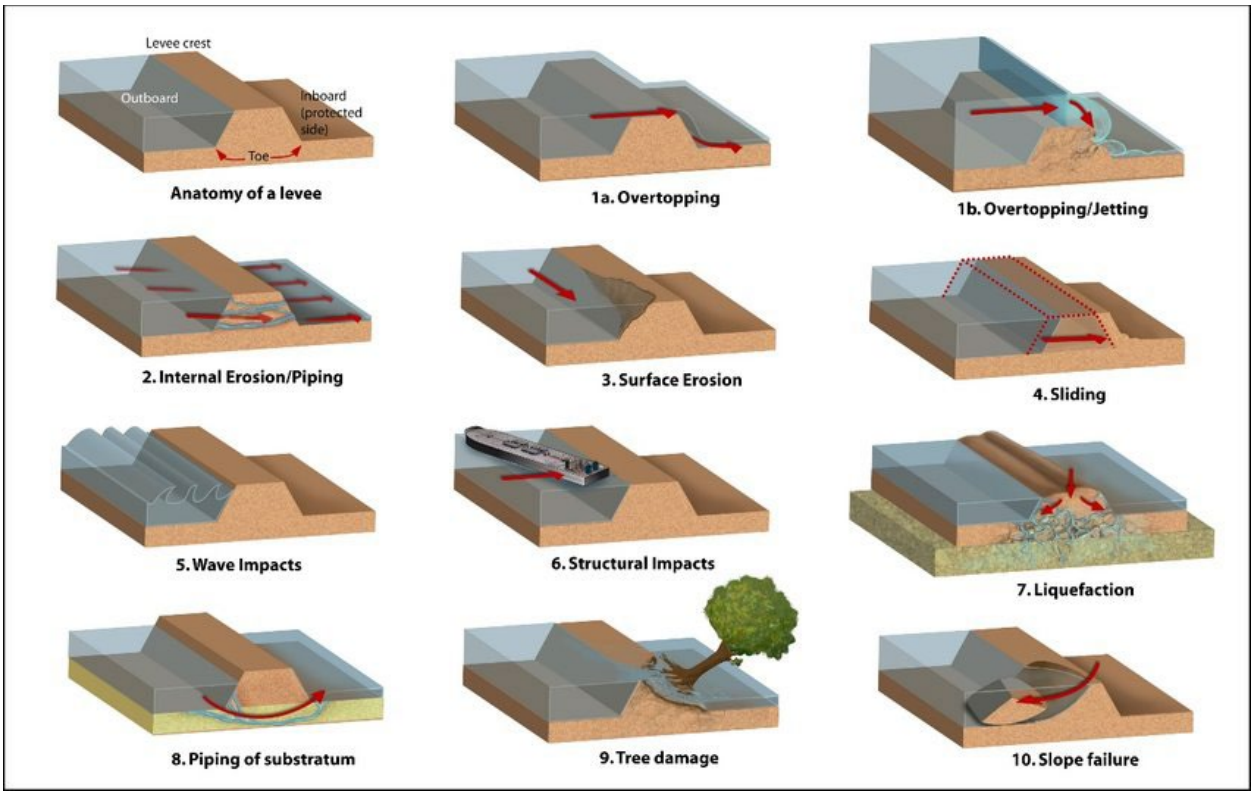


Figure 596: Levee Failure Mechanisms
Source: University of California

San Rafael is protected by non-accredited levees along the Santa Venitia Marsh, Gallinas Creek, the South Fork of Gallinas Creek, San Rafael Creek, and San Rafael Bay. The Marin County Levee 22 along the Santa Venitia Marsh is 3.79 miles long with an undocumented height. Approximately five people and one building with a property value of approximately $190 thousand are a risk of failure of the Marin County Levee 22. The Smith Ranch Levee lies between Gallinas Creek and the South Fork of Galinas Creek and is 2.26 miles long with an undocumented height. Approximately 1,308 people and 211 buildings with a property value of $104 million are at risk of failure of the Smith Ranch Levee, including the Smith Ranch Airport.

The Marin County Levee 3 lies along the South Fork of Gallinas Creek and is 0.9 miles long with an undocumented height. Approximately 501 people and 224 buildings with a property value of $122 million are at risk of failure of Marin County Levee 3, including the entire Marin Lagoon community and its nine pump stations. The McNears seawall lies San Rafael Bay and is 1.4 miles long with an undocumented height. Approximately 604 people 242 buildings with a property value of $169 million in both San Rafael and the unincorporated County of Marin are at risk of failure of the McNears seawall, including hundreds of residences around the Peacock Gap Golf Country Club. The Marin County Levee 2 lies along the south bank of San Rafael Creek and its confluence with San Rafael Bay and is 0.2 miles long with an undocumented height. Approximately seventeen people and four buildings with a property value of $11.7 million is at risk of failure of the Marin County Levee 2, including the area in and around Pickleweed Park. The Marin County Levee 22 lies along San Rafael Creek and San Rafael Bay and is 1.18 miles long with an undocumented height. Approximately 951 people and 436 buildings with a property value of $196 million are at risk of failure of Marin County Levee 22, including the residential community around the Spinnaker Lagoon. Marin County Levee 19 lies along San Rafael Bay and is 0.67 miles long with an undocumented height. Approximately 16,425 people and 1,727 buildings with a property value of $2.44 billion are at risk of failure of the Marin County Levee 19 including several miles of Highway 101.

San Rafael has never experienced a levee failure.

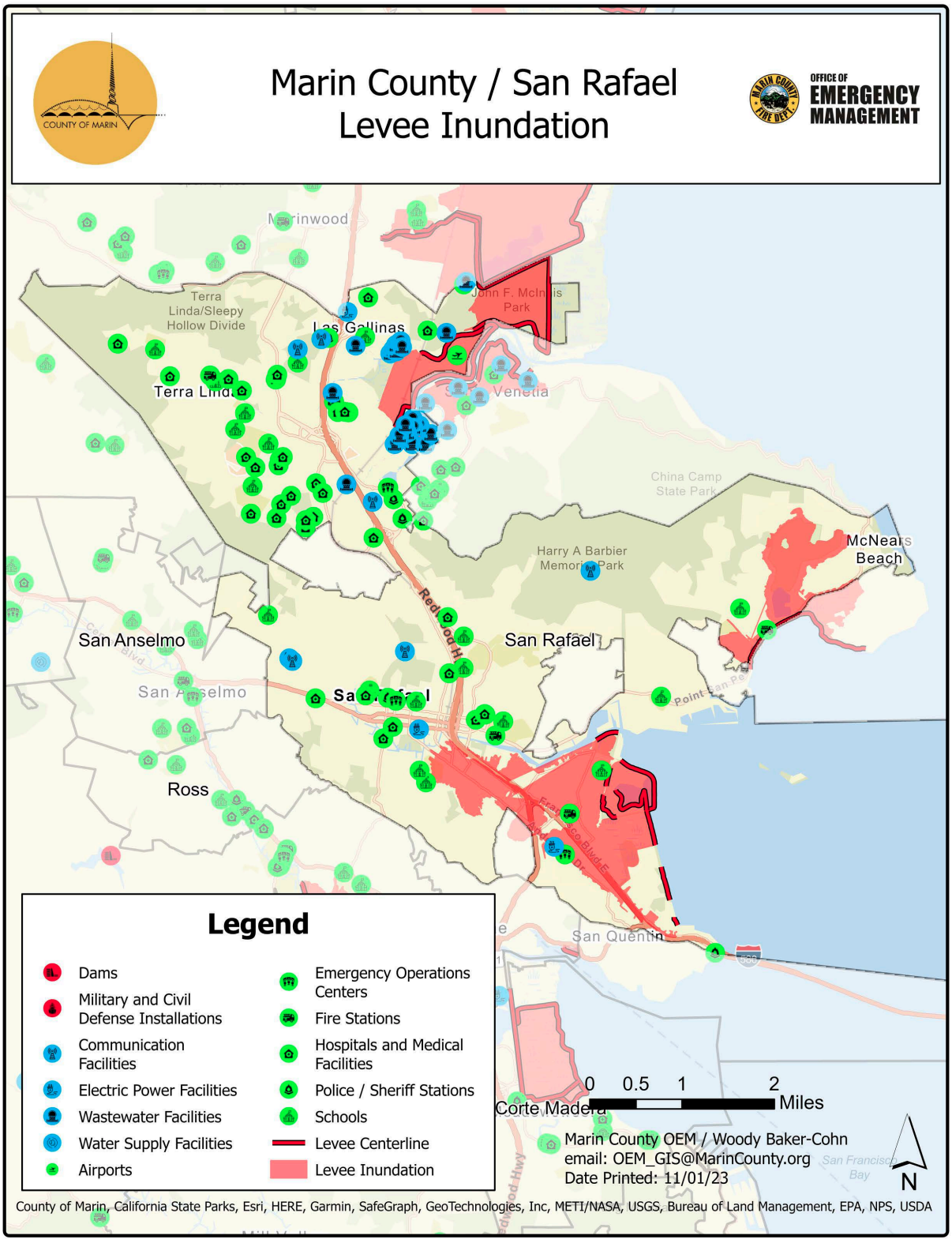


Figure 46: City of San Rafael Levee Inundation Impact
Source: Marin County OEM

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in San Rafael, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in San Rafael, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of San Rafael protected by its levees, particularly along San Rafael Bay and around its marshlands, the potential for significant impacts to residents and infrastructure will only increase.

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In

addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called “storm surge.” The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 “Rising Seas in California, An Update on Sea-Level Rise Science” report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

The lowland areas in San Rafael are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these neighborhoods continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017). Much of this vulnerable land was built on fill that used to be tidal marsh or mud. Sea level rise would likely return this area to tidal habitat again without measures to protect existing land uses. With a 100-year storm surge, downtown and further inland areas within the basin of the valley as far back as Gerstle Park could experience flooding. San Rafael’s vulnerable assets include the entire Canal neighborhood and Kerner Business District, and shoreline development and boating facilities off Point San Pedro Road. In time, the impacts move into downtown San Rafael, Peacock Gap, and Marin Lagoon. Recent construction at the Loch Lomond Marina and surrounding properties helped to elevate the shoreline to offer further protection from sea level rise in those areas. In addition to sea level rise, subsidence is already a significant issue south of Interstate 580 and Highway 101, and in Marin Lagoon, where development is built largely on fill atop bay mud. With sea level rise, subsidence rates could increase. San Rafael’s exposed historic resources could also be vulnerable to both tidal flooding and 100-year storm surge flooding from San Rafael Creek, generally in close proximity to Highway 101. Resources include the Litchfield Sign (local landmark), the French Quarter, two potentially historic areas, Ritter Street and Gerstle Park (partial), and four potentially historic structures.

The following are key issues related to San Rafael sea level rise and a 100-year storm surge:

- Flooding in the Canal area and Kerner Business District could compromise extensive multi-family housing, commercial, industrial, and recreational uses.
- Highway 101 on and off-ramps could anticipate 100-year storm surge flooding in near-term and tidal flooding in the medium-term.
- The San Rafael Transit Center could be vulnerable in the long-term. This could compromise local and regional bus lines, and the new SMART train.

- A significant portion of downtown could face storm surges in the near- and medium-terms and sea level rise in the long-term.
- Golden Gate Bridge, Highway and Transportation District facilities on Andersen Drive could be vulnerable in the medium-term.
- Several schools including Bahia Vista and Glenwood Elementary, Davidson Middle, and San Rafael High schools could be vulnerable.
- Five historic landfills along the shoreline and one closed brownfield site further inland could be subject to inundation.
- Miles of electrical transmission and natural gas pipelines are in the near-term.
- Marinas and other boating facilities could be vulnerable to sea level rise in the medium- to long-term.
- Peacock Gap homes and golf course could be vulnerable to storms in the near-term and sea level rise in the long-term.
- Marin Lagoon and streets in the Las Gallinas area could begin to see peripheral tidal flooding and storm surge flooding in the near-term, and neighborhood scale flooding by the long-term.
- Fire Station 54 is vulnerable to ten inches of sea level rise.

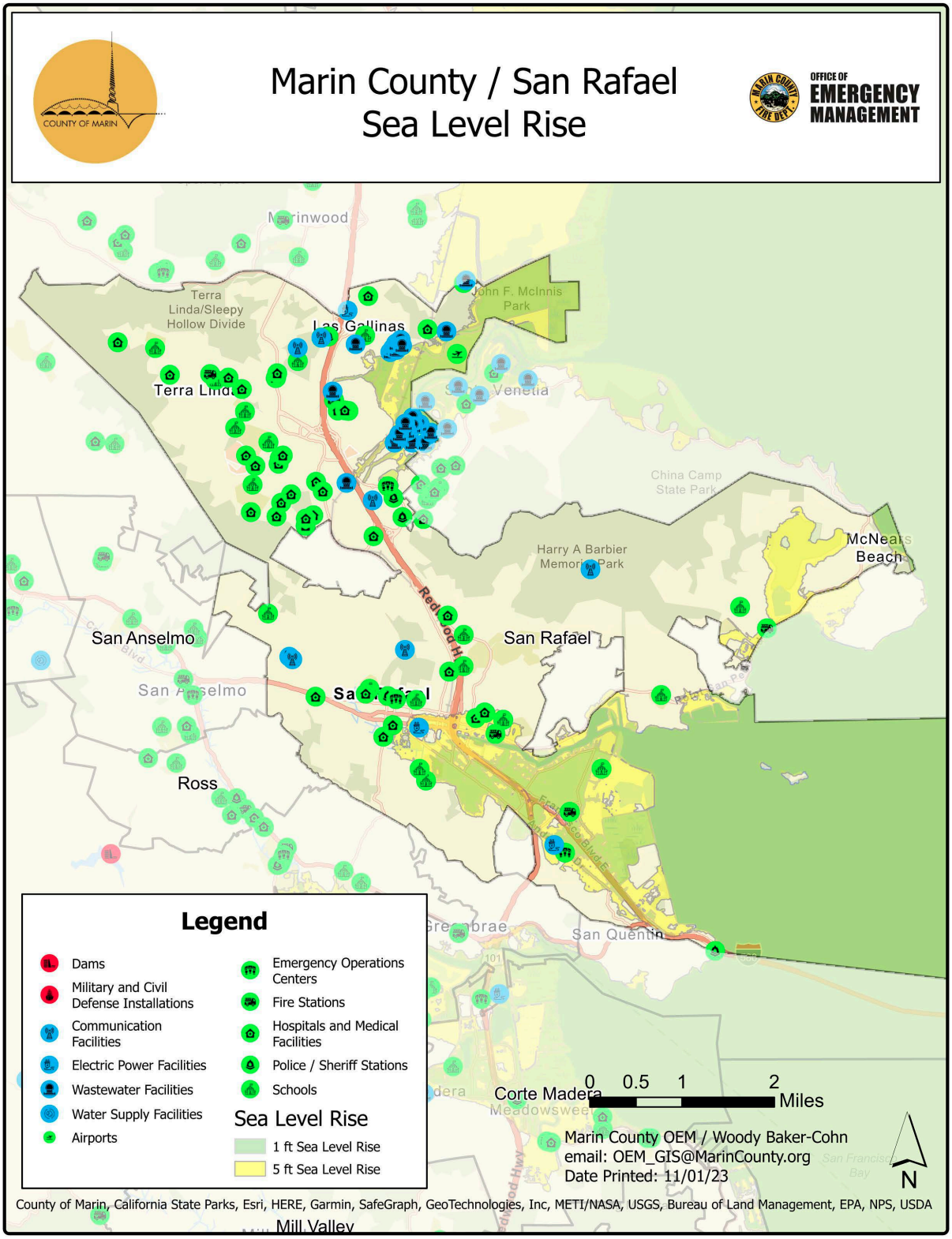


Figure 47: City of San Rafael Sea Level Rise Impact
Source: Marin County OEM

The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that San Rafael could anticipate impacts to over 58,000 people over 4,700 living units with $2.6 billion in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. A majority of privately held parcels contain buildings used for housing, work, entertainment, worship, and commerce. Many public parcels can also contain buildings, especially schools, community centers, and emergency services. Without shelter, many, if not most, of the existing activities on the land would not be feasible. Damages to and destruction of buildings especially several hundred to thousands of buildings at once, would be devastating to the local, regional, and state economy for years afterwards. Buildings in San Rafael are older, and many, especially downtown are unreinforced and could be weakened by flooding. These buildings are primarily mixed-use or commercial. Newer commercial buildings are typically concrete slab tilt-ups or smaller cinder block and stucco buildings. According to a BCDC profile for San Rafael for the Stronger Housing Safer Communities on seismic and flooding safety, most single-family homes in the low-lying areas of San Rafael are one- and two-story homes, built in the Victorian era, the earlier part of the 20th century, post-WWII, and newer modern homes. There are also 2-4 unit dwellings, and medium- and large-sized apartment complexes typically of wood construction. Several critical businesses could be vulnerable to sea level rise. These businesses either contain critical goods like medications and access to medical and building supplies after a major storm or flooding event or house some of the most vulnerable populations in the region. Transportation is a major concern for San Rafael and for the entire region. San Rafael serves as a regional transit center, and nearly all routes stop there, including the newly unveiled SMART line. In the near-term, other major roads impacted are Bellam Boulevard, Francisco Boulevard East, Kerner Blvd, Grand Avenue and Irwin Street. Much like with buildings, many of the roads to be flooded first are in, or are major access ways to, the Canal District and north of Interstate 580. Residents in this area tend to live with scarce financial resources and can be especially burdened by disruptions in the transportation system or damage to their vehicles. In addition, those with health or mobility constraints, who do not own a home or car, or are not proficient in the English language, may also be disproportionally burdened by sea level rise and storms. If these residents are displaced, the upheaval and loss would be significant to the community and the regional economy that depends on their contributions. Further, this area hosts the majority of light industrial and a major portion commercial uses that depend on the transportation network to reach clients, receive and deliver materials, and receive customers. Moreover, already constrained street parking could be flooded with tidal waters. Repeated exposure to saltwater would damage personal and commercial vehicles. Emergency access for fire, ambulance, and police could be limited at a time residents are most vulnerable. Fire Station 54 could be directly flooded, damaging equipment and vehicles in the station. In the medium-term, tidewaters extend under the freeways further into the street grid of downtown and the industrial and commercial Andersen Drive area. While Highway 101 is generally elevated, on and off ramps at grade could be flooded out along most of its course through the city. Unlike 101; however, Interstate 580 could anticipate surface flooding between the medium- and long-terms. In the long-term, streets and homes in the Gerstle Park neighborhood west of downtown and US Highway 101 could flood when Mahon Creek overflows its banks. While previously impacted by storm surges. Pt. San Pedro Road could expect impacts at tidal MHHW by the long-term. Roads bayside of Pt. San Pedro Road, such as Mooring Road, could be vulnerable in the near-term. PG&E has significant assets in San Rafael that could be exposed and vulnerable to sea level rise and storm surge impacts. Underground gas pipes could face buoyancy pressures as the water table

beneath them rises and pushes them to the surface. The pressure can place bending forces on the pipes, especially where they are held down by roads. Moreover, if a road sheltering a natural gas pipe is damaged enough to rupture the pipes the consequences could be severe. The transmission lines are above ground and could be vulnerable to falling trees and high winds. In addition, posts could become damaged over time, from floating debris, and subsidence. The PG&E offices and yard on Andersen Drive could anticipate storm surge impacts in the long-term. The San Rafael public works building and corporate yard may not experience direct impacts until the long-term with a storm surge, and primarily in the parking lots. However, access to and from the site could be compromised in the long-term due to sea level rise alone.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced[39].

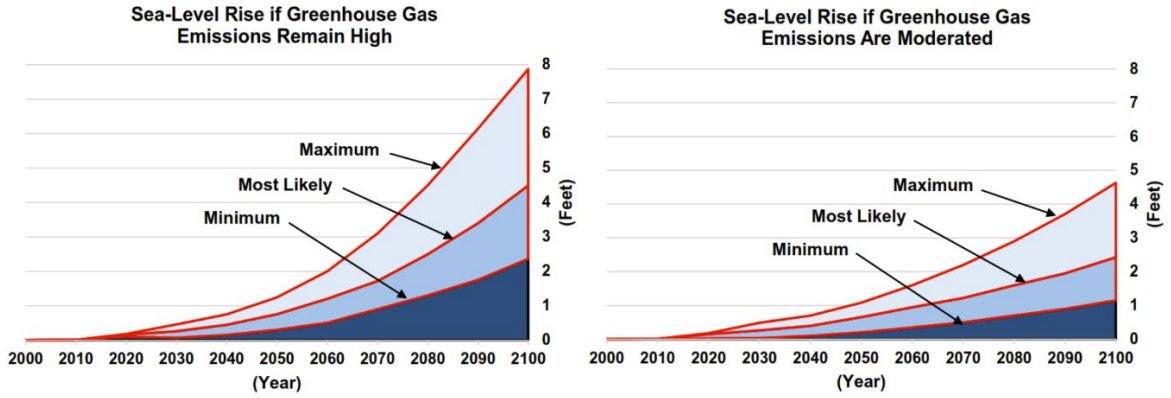


Figure 48: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around San Rafael already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including San Rafael with increased tidal flooding and storm surge, particularly up San Rafael Creek, during severe weather events. Future development in the coastal and lowland areas of San Rafael including the entire Canal neighborhood, Kerner Business District and shoreline development and boating facilities off Point San Pedro Road would only amplify these impacts and will put more people and property at risk from flooding as

[39] 2017 Marin Shoreline Sea Level Rise Vulnerability Assessment. https://www.marincounty.org/-/media/files/departments/cd/planning/slr/baywave/vulnerability-assessment-final/final_allpages_bvbconsulting_reduced.pdf?la=en

a result of sea level rise. Sea level can also lead to increased land subsidence and the potential of levee failure, with billions of dollars in property in San Rafael at risk of a levee failure. The impacts of a tsunami would also be magnified with rising seas. Transportation and utility infrastructure across San Rafael will continue to become inundated.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 49):

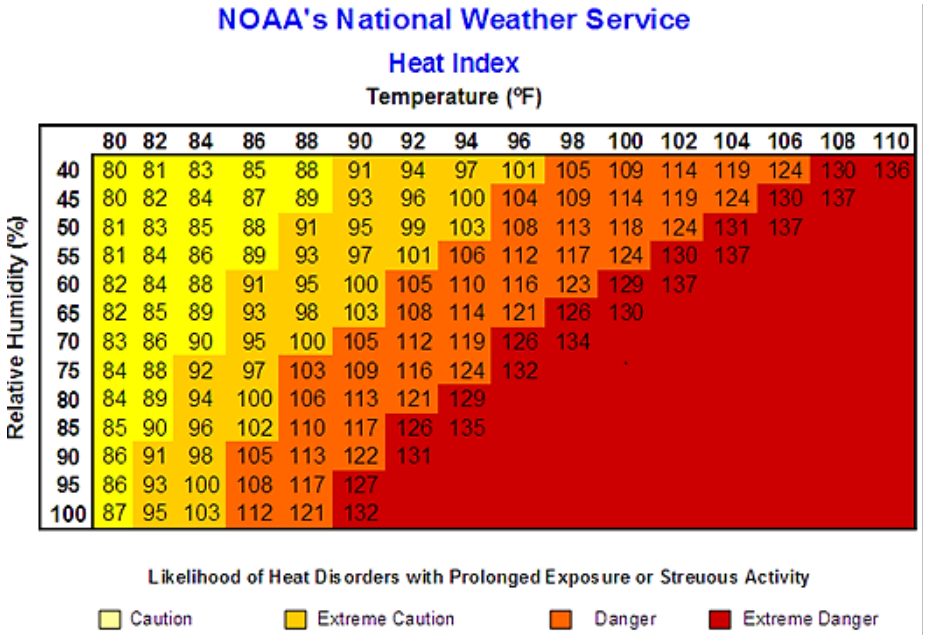


Figure 49: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of San Rafael and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes most of the downtown and commercial area of the city. There are thousands of residences in this area. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the San Rafael experienced an Extreme Heat Event with temperatures exceeding 113 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and

8.8°F by 2100 compared to observed and modeled historical conditions[40]. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

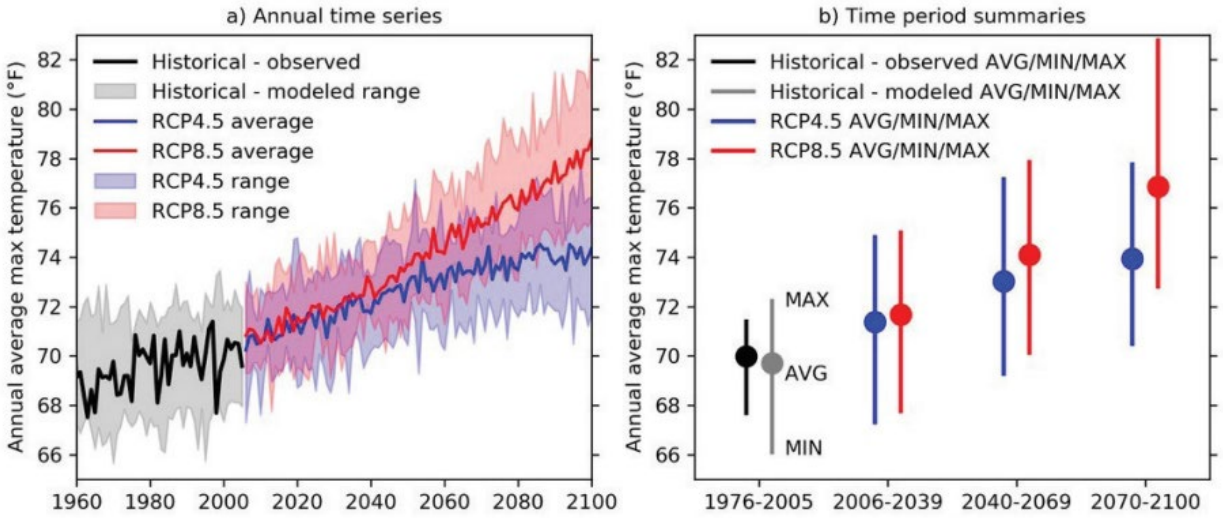


Figure50: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in San Rafael. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of San Rafael where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including San Rafael could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including San Rafael as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas of San Rafael where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around San Rafael could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

[40] California Adaptation Planning Guide

2.2.9 Severe Weather – High Wind and Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 51).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 51: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 52) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 52: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 53597: Waterspout Formation
Source: MarineInsights

All of San Rafael is susceptible to storms and damage from wind and tornadoes, though the mountainous areas surrounding the city and the parks inside the city have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

On 12/2/2012, high winds caused power lines to blow down across Smith Ranch Road. Two power poles were snapped off on Highway 101 in Terra Linda, closing the northbound offramp to Lucas Valley-Smith Ranch Road. Power lines fell at the Park'n'Ride lot and across Redwood Boulevard. Smith Ranch Road was closed between Redwood Boulevard and the Highway 101. A stretch of Redwood Boulevard was closed south of Paul Drive.

On 3/14/2023, high winds caused arcing power lines along Mountain View Avenue, contributing to power outages in the city.

San Rafael has never experienced a tornado.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and San Rafael. Significant wind events and tornados can topple trees, particularly those that may be saturated or drought stressed as a result of climate change. An increase in fallen trees in San Rafael as a result of increased storms due to climate change can lead to an increase in power

outages. Future development in any of the forested areas of San Rafael including in the southern and western mountainous residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by San Rafael would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the city. Much of eastern San Rafael is at a lower elevation. The three areas of San Rafael in a tsunami inundation zone include the southern area of the city protected by Marin County Levee's 12 and 19, the San Pedro Point area protected by the McNears seawall, and the marshlands at the lower end of Gallinas Creek near Santa Venetia. There are hundreds of residences, numerous commercial buildings, several critical facilities, and major roads and highways that lie in these areas and could be susceptible to a tsunami. The San Rafael Fire Station #54, the San Rafael Fire Station #55, the Bahia Vista School, the Golden Gate Bridge, Highway and Transportation District EOC and a Pacific Gas and Electric yard all lie in a tsunami inundation zone and could be susceptible to a tsunami. Several miles of Highway 101 and Interstate 580 lie in an tsunami inundation area and could be susceptible a tsunami, effecting ingress and egress in San Rafael and the greater Marin County OA.

San Rafael has experienced damage to docks in the east San Rafael area from Tsunami associated surges but is generally well protected within the Bay.

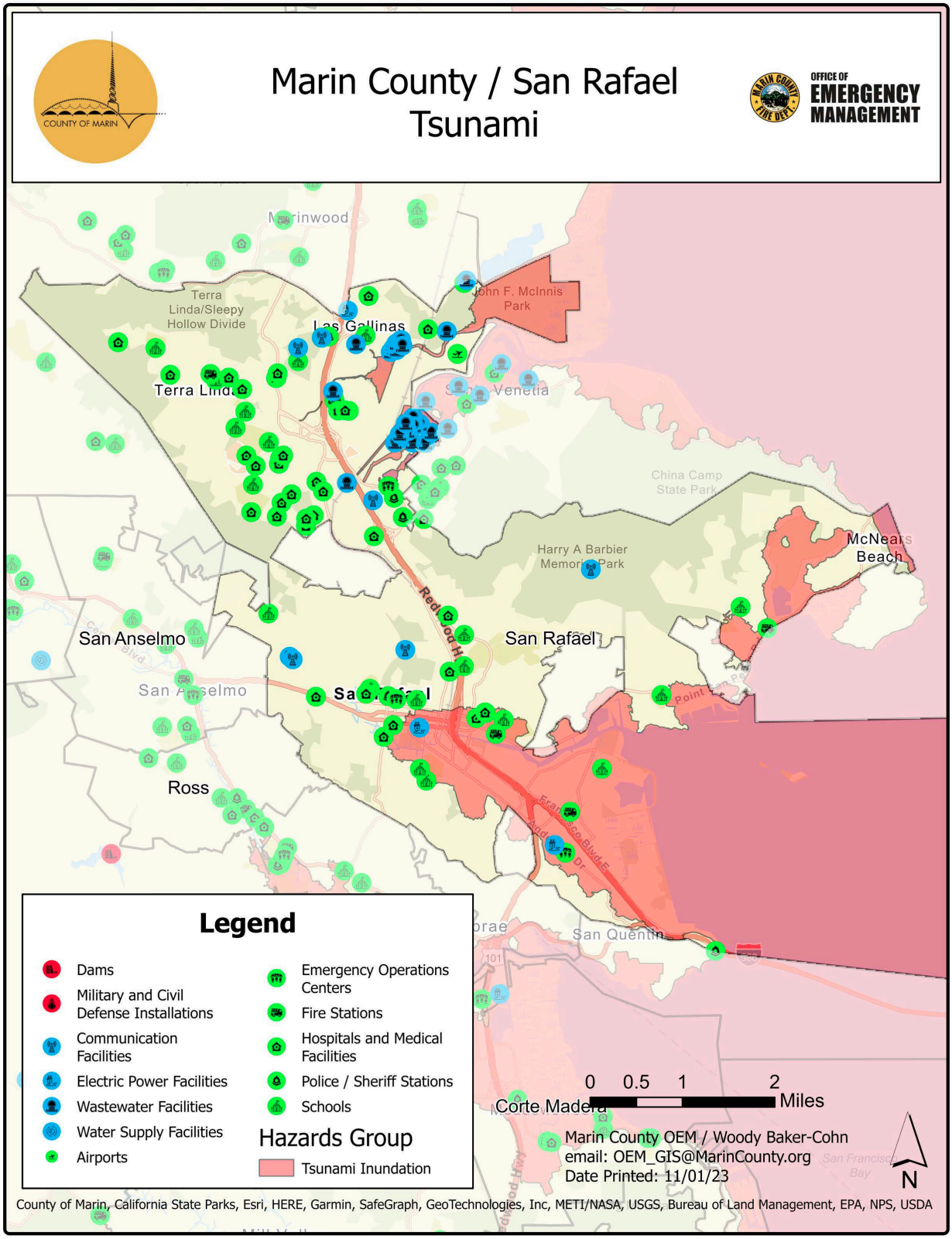


Figure 54: City of San Rafael Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including San Rafael, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including San Rafael. This is particularly true along the mouth of San Rafael Creek and around the marshland areas of Gallinas Creek where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas as well as in the southern area of the city protected by levees will expose more people and infrastructure to the effects of flooding as tsunami inundation areas expand with climate change. Development in marshland in San Rafael would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami. Flooding could be exacerbated in areas where levees could fail along Gallinas Creek and along the shoreline of San Rafael, including the southern area of the city and the area around Point San Pedro as a result of high wave heights associated with a more significant tsunami. A major tsunami as a result of sea level rise caused by climate change could cause additional flooding impacts to Interstate 580 in San Rafael, significantly impacting travel into and out of the Marin County OA.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA. The City of San Rafael has a 38 Point Action Plan aimed at reducing risks associated with wildfire.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government. The San Rafael Fire Department provides first response and wildfire prevention efforts to San Rafael.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. This includes the area of China Camp State Park, in east San Rafael. MCFD also provides similar protection services to approximately

100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 55 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

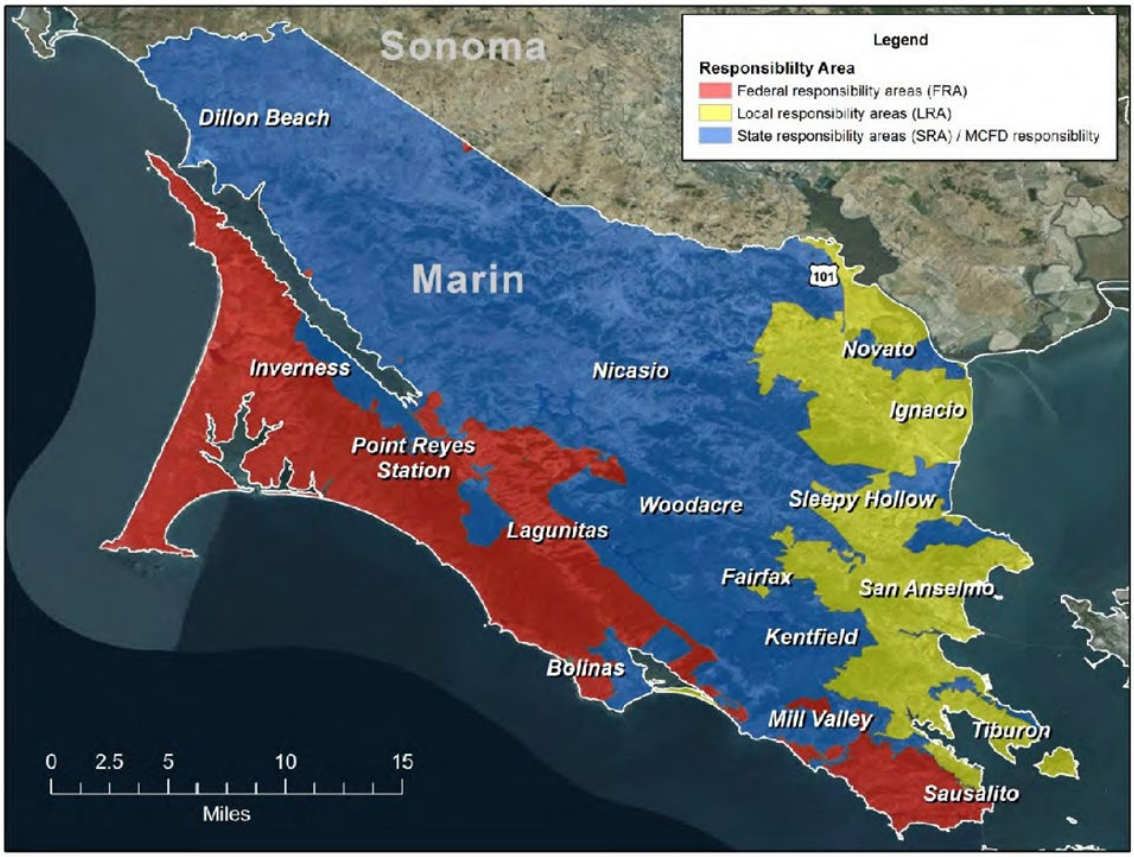


Figure 55: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex

topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the

Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

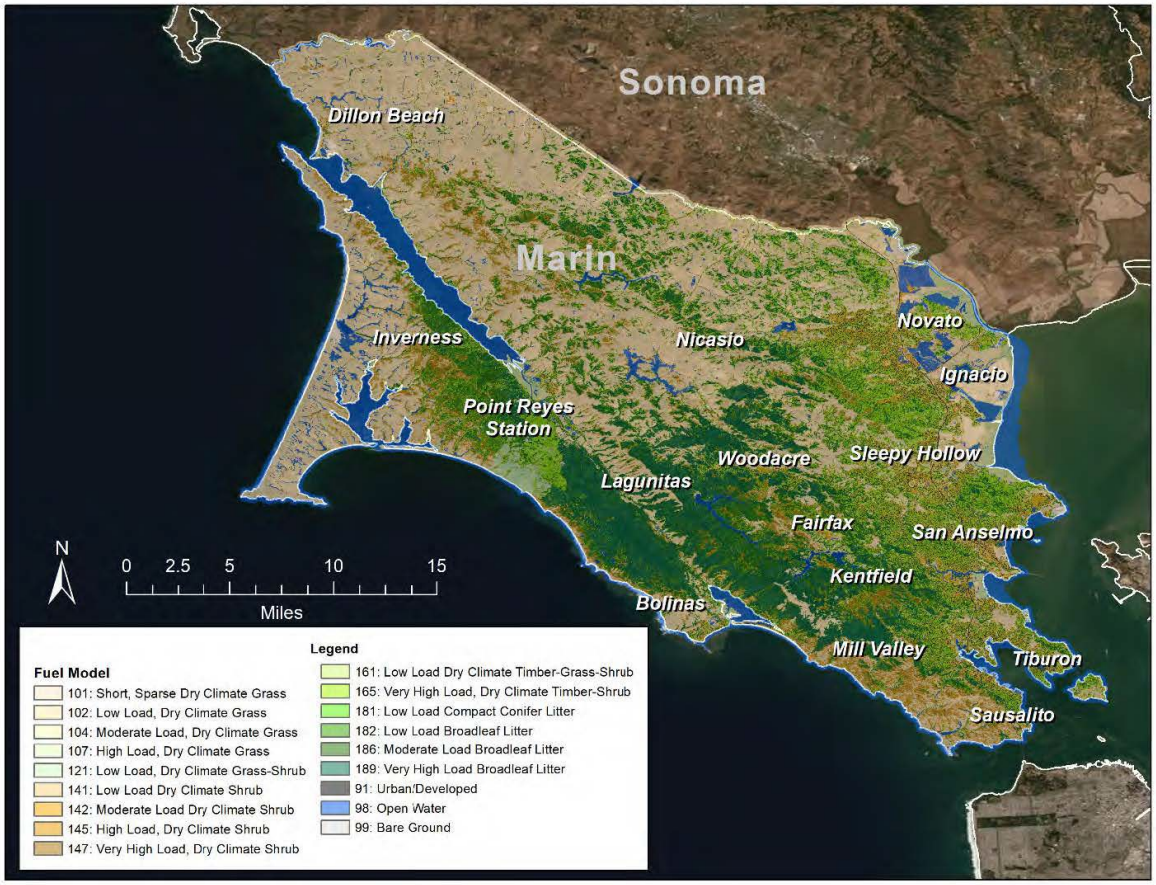


Figure 56598: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species) and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young

Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to 70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 the County of Marin and the City of San Rafael experienced two PSPS events totaling over five days without power.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices,

completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in San Rafael would most likely occur on the central and northwestern areas of the city which is in a high FHSZ and where there is more forested terrain. Open spaces in this area include Boyd Memorial Park and Jerry Russom Memorial Park. Neighborhoods in a high FHSZ include the Smith Ranch area, West End from San Rafael Hill to Ridgewood Avenue and Bret Harte Avenue, the Los Ranchitos areas and Terra Linda neighborhoods. The areas of San Rafael in a high FHSZ are primarily residential with thousands of homes and consists of numerous winding streets and hillside homes that could be damaged or destroyed by a wildfire. Many of the hillside neighborhoods are at risk of wildfires and have extremely limited ingress and egress for residents and emergency services. Part of downtown including numerous businesses and the San Rafael City Hall, San Rafael Police Department, and San Rafael Fire Station #51; the Sun Valley School; part of the Terra Linda School; the Marindale School; the Caulbridge School; the County of Marin Office of Education; the County of Marin 911 Communications Center; the Pacific Gas and Electric Las Gallinas substation; and several Marin Emergency Radio Authority (MERA) towers lie in a high FHSZ and could be susceptible to a wildfire. Pockets of San Rafael including the area around San Pedro Hill and Harry A. Berbier Memorial Park lies in a moderate FHSZ and could be susceptible to a wildfire. This area includes hundreds of residences; part of downtown including numerous businesses, the Marin Academy and the Saint Raphael School; numerous medical facilities; part of the Terra Linda High School; part of the Star Academy; the John Duckett Pump Station; part of the Kaiser Permanente San Rafael Medical Center; the San Rafael Fire Station #56, part of the Pacific Gas and Electric yard; part of the Central Marin Sanitation Agency Wastewater Treatment Plant; several MERA towers; and the radio tower for the Las Gallinas Valley Sanitary District and the Ross Valley Sanitary District.

All of San Rafael could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As wildland areas around San Rafael become drier due to climate change, the risk of a wildfire occurring and impacting the town will continue to increase. Fires in the town may increase over time as marshlands, parks, and other open spaces experience drier conditions.

San Rafael has never had a major wildfire cause significant damage to life or property. However, vegetation fires in San Rafael Open space and along roadways are an annual occurrence.

On 11/2/2023, a quarter–acre grass fire burned on San Rafael Hill. The fire was reported at about 2:30 a.m. near the San Rafael Elks Lodge west of Robert Dollar Drive. Firefighters controlled the blaze within about 20 minutes. No one was evacuated. The cause appeared to be related to unhoused encampments or related activity, due to personal belongings found in the vicinity. The fire's slow rate of spread was influenced by defensible space cleared by the San Rafael Fire Department.

On 10/18/2023, a vegetation fire broke out on San Rafael Hill near Mountain Park. The blaze burned a roughly 40 by 40 square foot area off Coleman Avenue, between Graceland Drive and Vineyard Drive. The fire happened ahead of a broad heat advisory set to take effect and a few

hours before a controlled burn was scheduled to take place on the Mount Tamalpais Watershed.

On 6/6/2022, a vegetation fire burned two acres and prompted home evacuations. The fire in the Dominican-Black Canyon neighborhood was reported at 9:50 p.m. in a eucalyptus grove on a steep hillside between Deer Park Avenue and Highland Avenue. Residents from five structures were asked to evacuate during the fire. The homes were threatened, but not damaged. The nearby Dominican University campus was not evacuated.

On 9/1/2021, residents had to evacuate a section of Lucas Valley near San Rafael after a vegetation fire broke out on a hillside. The fire was reported at about 2:10 p.m. near Mount Lassen Drive. It grew to about 30 acres. Flames burned uphill away from homes. The evacuation zone included the area north of Lucas Valley Road between Las Gallinas Avenue and Bridgegate Drive and north to Marinwood open space. The cause was under investigation.

On 6/9/2018, a vegetation fire ignited in the hills of San Rafael north of downtown, burning in Boyd Memorial Park near Highway 101. The fire was first reported at 3:25 p.m. Evacuation orders weren't issued, but residents in the area were encouraged to shelter in place at one point. The cause was under investigation. The fire moved at a moderate speed and consumed grass and other "flashy fuels" that ignite easily and burn quickly.

Figure 57599: 2018 San Rafael Wildfire in Boyd Memorial Park
Source: SF Gate

On 1/24/2014, a brush fire raced through an east San Rafael marsh behind the Sonnen BMW dealership near Kerner and East Francisco boulevards and Shoreline Parkway, shooting flames 20 feet high as three acres burned. The blaze was doused within 45 minutes. No structures were threatened and no one was injured, but the brush and pampas grass fire was more dangerous than usual. Officials believe sharp "popping" sounds coming from the blaze came from ammunition bursting in the heat. Two people were seen fleeing as firefighters arrived. The fire was apparently the result of a homeless encampment situation. Firefighters had responded to well over 20 brush fires triggered by homeless encampments over the past several months in the area.

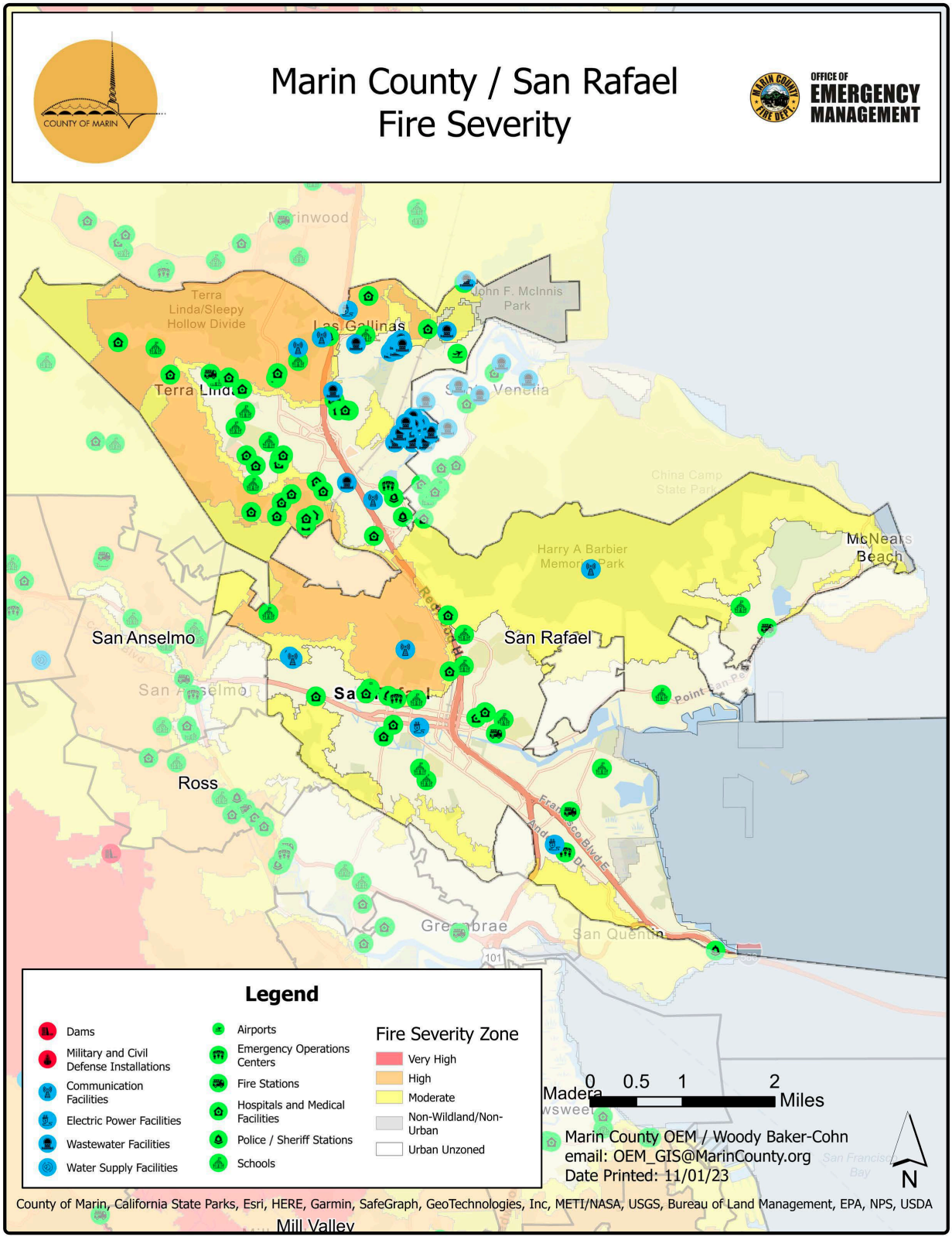


Figure 58: City of San Rafael Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

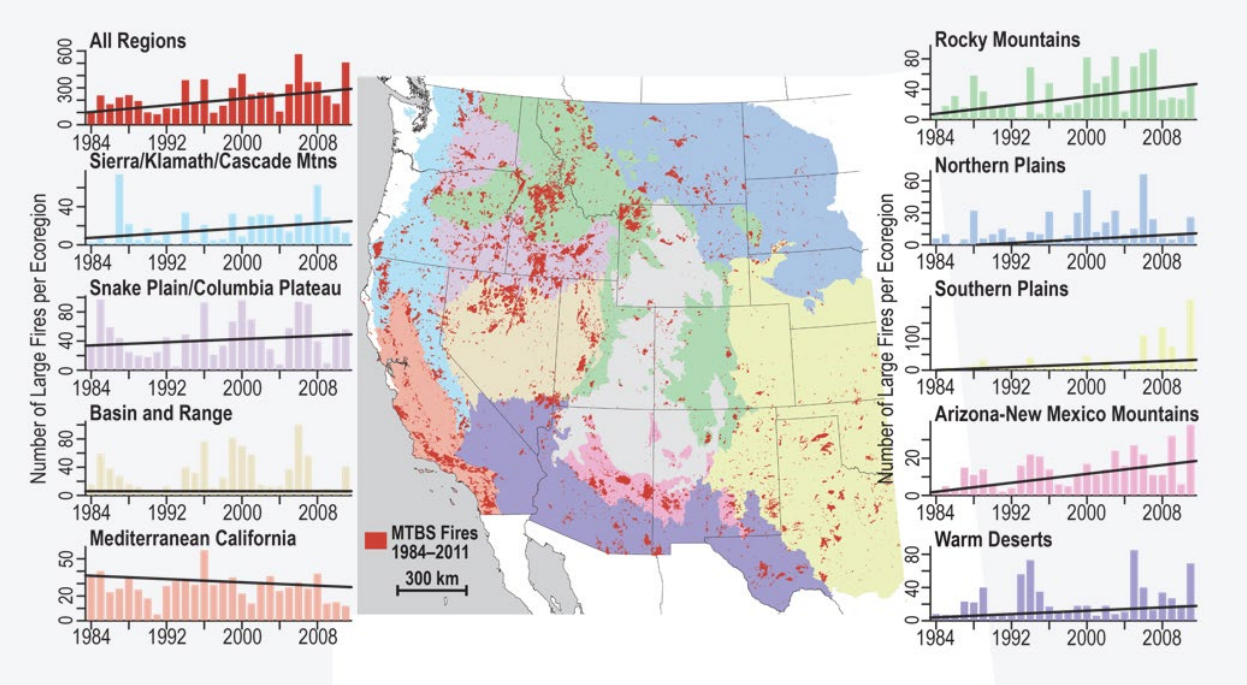


Figure 59: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including San Rafael is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around San Rafael. Future development in the WUI throughout San Rafael will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the San Rafael WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the San Rafael open space parks and marshlands would expose more people to the effects of brush fires as those natural areas dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The overall hazard mitigation priorities in the City of San Rafael have not changed since the 2018 MJHMP update. Marin County understands that hazard exposure may occur in areas of new development, however, the county feels current building standards, municipal codes, and regulations will provide adequate mitigation against hazard vulnerability.

The strategies that support the overall city priorities have changed since the 2018 MJHMP and are reflected in the sections below. There were many projects that were either ongoing day-to-day activities or were response related that were deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed, and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

It is tremendously important to San Rafael residents that growth is well managed and harmonious with community needs. New development and other physical alterations must respect the character and scale of the city. Change and development should be accomplished in ways that enhance and blend with San Rafael's existing physical and social qualities. Development should respect the physical fabric of the city, while improving its social fabric through new housing and economic opportunities that reach all residents.

The City of San Rafael General Plan 2040 leaves in place most zoning standards but makes a few important changes. New Downtown zoning will enable higher densities and more housing without losing the area's hometown character. Northgate Mall and its environs will retain their General Plan Map designations, but policies are more emphatic about future changes that respond to retail trends, the desire for a North San Rafael Town Center, and the need for housing. Greater investment in the Canal area and Southeast San Rafael will improve living conditions for many residents, provide job opportunities, and create additional revenue, while responding to the challenges of rising sea level. Intentionally guiding growth allows areas needing improvement to be enhanced without reducing neighborhood quality.

Though new housing laws at the state level have exempted much residential development from the CEQA process; those laws have preserved all life safety requirements of the building and fire codes. When not usurped by State law, future land use and growth strategies in the City of San Rafael will be consistent with priorities detailed in the 2023 Marin County OA MJHMP and aim to concentrate future development in already developed areas and away from locations where natural characteristics should be avoided such as steep slopes and sensitive habitats. Priority areas for development are those that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and avoidance of conflicting uses.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in San Rafael has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 22: City of San Rafael Projected Growth Areas						
Project Location	**# of Units**	**# of Parcels**	**Project Date**	**Acres**	**Fire Severity Zone**	**Flood Zone**
1130 Mission Ave	13	2	2018	.40	NA	X
980 Lincoln Ave	38	1	2018	.42	NA	AH
21 G ST	1	1	2018	.04	NA	X
809 B ST	41	3	2018	.57	NA	X
21 G Street	1	1	2019	.04	NA	X
215 Belle Avenue	4	3	2019	.28	NA	X
1010 Northgate Drive	0	1	2019	6.94	NA	X
703 3rd Street	0	1	2019	.16	NA	AH
1628 5th Avenue	9	1	2019	0.2	NA	X
496 B Street	6	1	2020	.14	NA	AE
980 Lincoln Avenue	38	1	2020	.42	NA	AH
999 Third Street	5	1	2020	.10	NA	X
350 Merrydale Road	0	1	2020	2.08	NA	X
104 Shaver Street	1	1	2020	.14	NA	X
190 Mill Street	41	1	2020	.33	NA	AE
815 B Street	41	2	2020	.29	NA	X
496 B Street	6	1	2021	.14	NA	AE
1628 5TH AVE units 1-9	9	1	2021	.2	NA	X
21 G ST	1	1	2021	.04	NA	X
1200 IRWIN ST	15	3	2021	.62	NA	X
815 B Street	41	2	2021	.29	NA	X
190 Mill Street	41	1	2021	.33	NA	AE
1628 5TH AVE units 1-9	9	1	2022	.2	NA	X
999 3rd Street	5	1	2022	.10	NA	X
1380 Lincoln Avenue	9	1	2022	.22	NA	X
Los Gamos Drive	-	-	2022	-	-	-
55 Brookdale Avenue	10	1	2022	.2	NA	X
88 Vivian Street	0	1	2022	2.41	NA	AE
Total	**2524**	**28**		**165.37**		

Table 305: City of San Rafael Future Growth Areas
Source: City of San Rafael

3.2 CAPABILITY ASSESSMENT

The overall priorities in the City of San Rafael have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once

approved. The 2018 capability assessments have been successfully incorporated into the City of San Rafael General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 33: City of San Rafael Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan	Y 2021	The City General Plan '2040' was adopted in 2021, which serves as a basis for decisions that affect the City's growth and development such as transportation, land use, streets and infrastructure, parks, housing and neighborhoods, recreation and community facilities, downtown, the environment, public health and safety, and flooding. The General Plan is a strategic and long-term document identifying goals and polices that guide and direct the City in terms of implementing policies, programs, resources and hazard mitigation actions.
Strategic Plan	Y	City has approved annual goals and objectives and general plan.
Capital Improvements Plan	Y	City staff develops a Capital Improvement Program (CIP) for council consideration, which serves as a multi-year planning tool to coordinate the financing and scheduling of major projects to improve and maintain its infrastructure. The CIP directs construction activities for City owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure.
Economic Development Plan	Y	Draft developed in 2023.
Local Emergency Operations Plan	Y 2023	These plans inform priority mitigation actions and programs. The City has updated its EOP and was adopted by City Council in October of 2023
Continuity of Operations Plan	N	Tentatively scheduled for development in late 2024
Flood Mitigation Plan (FMP)	N	City may consider increased staffing for floodplain activities.

Engineering Studies for Streams	N	
Open Space Management Plan	Y	Minor with fuller plan in Progress
Regional Transportation Plan (RTP)	N	City has no specific plan or role in transportation. Relies on County/Agency specific plans.
Stormwater Management Plan/Program	Y	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	Y 2020	Marin County has a CWPP last updated in 2020 and the City has our 38 point 2020 Wildfire Prevention and Protection Action Plan
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Various
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Development Standards	Y	Title 12 – Building Regulations Title 14 – Building Code and Zoning
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	Classification 3 (1 and 2 family dwellings) and 3 (all other)
Fire department ISO rating:	Y	ISO 1
Site plan review requirements	Y	As relevant to the permit
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	Yes, subdivision ordinance, floodplain ordinance, stormwater ordinance Chapter 4.12 – Citywide Vegetation Standards Title 7 – Emergency Services Title 12 – Building Regulations Title 14 – Building Code and Zoning Title 15 – Subdivisions Title 17 – Waters and Waterways Title 18 – Protection of Flood Hazard Areas Title 19 – Open Space
Zoning Ordinance	Y	The Zoning Ordinance sets forth regulations and standards for development to ensure that the policies, goals, and objectives of the General Plan are carried out. Rezoning can be initiated by the City Council, Planning Commission, or by an individual property owner.
Subdivision ordinance	Y	City Ordinance Title 15 – Subdivisions

Floodplain ordinance	Y	City Ordinance Title 18 – Protection of Flood Hazard Areas
Clean Storm Water Ordinance	Y	City Ordinance Title 17 – Waters and Waterways
Natural hazard-specific ordinance (stormwater, steep slope, wildfire)	Y	Citywide Vegetation Standards
Flood insurance rate maps	No	City may consider increased staffing for floodplain management activities.
Elevation Certificates	No	City may consider increased staffing for floodplain management activities.
Acquisition of land for open space and public recreation uses	Y	City Ordinance Title 19 – Open Space
Erosion or sediment control program	Unk	
Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Y 2020	The City General Plan '2020' was adopted in 2004 and been amended several times since. The City is currently undergoing its next General Plan update '2040' and community workshops are being held.
Strategic Plan	Y	City has approved annual goals and objectives and general plan
Capital Improvements Plan	Y	City staff develops a Capital Improvement Program (CIP) for council consideration, which serves as a multi-year planning tool to coordinate the financing and scheduling of major projects to improve and maintain its infrastructure. The CIP directs construction activities for City owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure.

Table 306: City of San Rafael Legal and Regulatory Capabilities
Source: City of San Rafael

City of San Rafael General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of San Rafael General Plan, adopted in 10/27/2020, was prepared over a 12-year period that included an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

City of San Rafael specific goals and policies related to mitigation of natural hazards are as follows:

Table 34: City of San Rafael General Plan	
Goal/Policy/ Program	The San Rafael general plan is the planning guideline for the future of a city. It contains goals, and policies describing the community's vision for economic viability, livable neighborhoods, and environmental protection.
Land Use Element	
Goal	The Land Use Element includes policies guiding the physical form of the city and provides direction on growth management, development, and land use compatibility. It includes the San Rafael Land Use Map, which shows the location and intensity of land uses envisioned for the future. The Element identifies those areas of the city where change will be encouraged as well as those areas where existing uses will be maintained and enhanced. The intent is to direct growth and reinvestment strategically, reinforcing San Rafael's best qualities while revitalizing areas in need of improvement**.** Goal 1: Well-Managed Growth and Change - Grow and change in a way that serves community needs, protects the environment, improves fiscal stability, and enhances the quality of life. Goal 2: A Complete Community - San Rafael is a complete community, with balanced and diverse land uses. Goal 3: Distinctive Neighborhoods - Create and sustain neighborhoods of integrity and distinctive character
Policy	**This plan will guide policy decisions.**
Program	NA
Conservation and Open Space Element	
Goal	The Conservation and Climate Change portion of the San Rafael General Plan addresses the management of San Rafael's natural resources, including soil, minerals, water, air, vegetation, and wildlife. It identifies environmentally sensitive areas in the city and includes policies for their long-term protection. Goal 1 of Conservation – Supporting our natural communities. Goal 2 of conservation – Clean air. Goal 3 of conservation – Clean water Goal 4 of conservation - Management of sustainable energy Goal 5 of conservation – Reduce Greenhouse emissions. Open space defines neighborhood edges and provides a necessary complement to the built environment coordination is a critical part of park and open space management in San Rafael. As noted above, the City is one of several service providers. Others include the County of Marin/Marin Open Space District, the State of California, the Marinwood Community Service District, San Rafael City Schools, and the Miller Creek School District. Goal of Open Space: Protected, Well-Managed Open Space - Manage San Rafael's open spaces for all to enjoy
Policy	Program PROS-3.1A: Criteria for Open Space Protection - Environmental health and safety issues and potential geologic and seismic hazards. *a) Aesthetics (visual backdrop or edge, unique site features, shoreline, ridgelines).* *b) Wildlife resource value (wetlands, creeks, and riparian areas, wildlife habitat and movement* *c) corridors, and habitat for special status species).* *d) Ability to sequester carbon and mitigate potential climate-related impacts, including reduction* *e) of wildfire hazard, drought resilience, and protection from sea-level rise.* *f) Importance to the community as a whole and/or adjoining neighborhoods.*

Table 34: City of San Rafael General Plan	
Goal/Policy/ Program	The San Rafael general plan is the planning guideline for the future of a city. It contains goals, and policies describing the community's vision for economic viability, livable neighborhoods, and environmental protection.
	g) Merits of alternative uses. *h) Ability to connect existing open spaces.* *i) Potential for recreational uses and/or environmental education, especially for economically* *j) disadvantaged communities.* Program PROS-3.3A: Open Space Management Plan *a) Hazard reduction, in accordance with ecologically sound practices and wildfire science,* *including removal of highly flammable invasive species, emergency access, and erosion control. This should be closely coordinated with ongoing efforts by the San Rafael and Marin* *County Fire Departments, Marin Wildfire Prevention Authority, CalFIRE, and non-profit organizations such as FireSafe Marin.*
Program	NA
Public Safety	
Goal	An overarching goal of this is to reduce the economic and social dislocation associated with environmental hazards. Risks can be reduced by considering natural hazards in land use and development decisions, and by implementing policies and programs to reduce losses to life and property. This is especially important for San Rafael's most vulnerable populations, who may find themselves in harm's way without the resources to prepare, respond, and recover. Goal 1 – A safe and more resilient city - Minimize San Rafael's vulnerability to the impacts of hazards and emergencies. Goal 2 – Resilience to geological Hazards - Minimize potential risks associated with geologic hazards, including earthquake-induced ground. shaking and liquefaction, landslides, mudslides, erosion, sedimentation, and settlement. Goal 3 – Resilience to Flooding and Sea Level Rise - Recognize, plan for, and successfully adapt to the anticipated effects of increased flooding and sea level rise. Goal 4 – A Fire-Safe Community - Minimize injury, loss of life, and damage to property resulting from wildland fire hazards. Goal 5 – Protection from Hazardous Materials - Protect those who live, work, and visit San Rafael from risks associated with hazards. materials Goal 6 – Emergency Preparedness - Improve disaster preparedness, resiliency, response, and recovery.
Policy	a) Policy S-1.1: Local Hazard Mitigation Plan (LHMP) b) Policy S-1.2: Location of Future Development c) Policy S-1.3: Location of Public Improvements d) Policy S-1.4: Public Health Emergencies e) Policy S-2.1: Seismic Safety of New Buildings f) Policy S-2.2: Minimize the Potential Effects of Landslides g) Policy S-2.3: Seismic Safety of Existing Buildings h) Policy S-2.4: Post-Earthquake Inspections i) Policy S-2.5: Erosion Control

Table 34: City of San Rafael General Plan	
Goal/Policy/ Program	The San Rafael general plan is the planning guideline for the future of a city. It contains goals, and policies describing the community's vision for economic viability, livable neighborhoods, and environmental protection.
	j) Policy S-3.1: Sea Level Rise Prediction Map k) Policy S-3.2: Data Consistency l) Policy S-3.3: Awareness and Disclosure m) Policy S-3.4: Mitigating Flooding and Sea Level Rise Impacts n) Policy S-4.1: Wildfire Hazards a. Program S-4.1A: Wildfire Prevention and Protection Action Plan b. Program S-4.1B: Fire Hazard Maps o) Policy S-4.2: Fire Resilience in Developed Areas p) Policy S-4.3: New Development in Fire Hazard Areas q) Policy S-5.1: Hazardous Waste Management r) Policy S-6.1: Disaster Preparedness Planning s) Policy S-6.2: Neighborhood Disaster Preparedness Programs t) Policy S-6.3: Improving Evacuation Capacity u) Policy S-6.4: Emergency Operations Centers
Program	NA
Public Facilities Element	
Goal	The Community Services and Infrastructure Element addresses schools, libraries, law enforcement, fire and emergency medical services, water, sewer, storm drainage, solid waste, energy, and telecommunication facilities in San Rafael. Goal CSI-1: Educational Excellence - Promote excellent schools and high-quality, equitable education. Goal CSI-2: Modern, Welcoming Libraries that Meet Community Needs - Enhance library services and facilities to meet the informational and recreational needs of the community. Goal CSI-3: Exceptional Public Safety Services - Provide and maintain exceptional fire, public safety, and paramedic services. Goal CSI-4: Reliable, Efficiently Managed Infrastructure - Support reliable, cost-effective, well-maintained, safe, and resilient infrastructure and utility services. Goal CSI-5: Sound Municipal Financial Practices- Maintain sound financial practices and sufficient revenue sources to provide high-quality City services
Policy	a) Policy CSI-5.1: Cost-Benefit Analysis b) Policy CSI-5.2: Transparent Budgeting c) Policy CSI-5.3: Program Assessments d) Policy CSI-5.4: Diversifying Funding Sources e) Policy CSI-5.5: Local Government Partnerships Policy CSI-5.6: Public-Private Partnerships
Program	NA

Table 307: City of San Rafael General Plan
Source: City of San Rafael General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the City personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person. The City may consider opportunities for future additional training and increased staffing.

Table 35: City of San Rafael Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	The Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Planning Commission	Y	The Planning Commission consists of citizen volunteers appointed by the City Council to make decisions or advise the Council on land use and property development issues. The Commission assures that new development is consistent with our long-range General Plan, State laws and other public policies that advance the interests of our community.
Hazard Mitigation Planning Committee	Y	The City participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee which meets quarterly to review and manage Hazard Mitigation projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	The City of San Rafael utilized MWPA funds to conduct various levels of vegetation removal. Removal is based on the SRMC. The Department of Public Works maintains drainages with annual surveys and clearing.
Mutual aid agreements	Y	San Rafael is part of the greater Marin County mutual aid agreement system.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911.
Hazard data and information	N	
Grant writing	N	
Hazard analysis	Y	San Rafael took part in the county-wide wildfire evacuation Risk assessment.
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	This position in San Rafael is adequately staffed to enforce regulations. The Chief Building official helps the city develop and enforce building standards such as WUI code. The Building Department works in

		coordination with other departments such as Public Works, Fire to develop standards.
Floodplain Administrator	Y/PT	Yes, Public Works Director
Emergency Manager	Y/FT	The City has Staff assigned to Emergency Management Planning, Response, Recovery, and Mitigation.
Community Development	Y/FT	Develops and maintains the General Plan, including the Safety Element. Develops area plans based on the General Plan, to provide more specific guidance for the development of more specific areas. Reviews private development projects and proposed capital improvements projects and other physical projects involving property for consistency and conformity with the General Plan.
Civil Engineer	Y/FT	San Rafael staffs a team of civil engineers to help with the continuation of both short and long-term projects related to hazard mitigation.
GIS Coordinator	Y/PT	The city staffs a part-time GIS specialist.
City Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building-related activities including issuing permits, conducting environmental reviews, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. The Public Works Department is responsible for City-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department.
Police Department Staff	Y/FT	The San Rafael Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Department Staff	Y/FT	The San Rafael Fire Department has responsibility for fire suppression and emergency response in commercial, residential, wildland / urban interface, and parts of the city. The Fire Department supports the implementation of mitigation actions that reduce the risk of wildfire.
Chief Building Official	Y/FT	This position in San Rafael is adequately staffed to enforce regulations. The Chief Building official helps the city develop and enforce building standards such as the WUI code. The Building Department works in coordination with other departments such as Public Works, and Fire to develop standards.

Table 308: City of San Rafael Administrative and Technical Capabilities
Source: **City of San Rafael**

3.2.3 FISCAL CAPABILITIES

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 36: City of San Rafael Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Impact fees for new development	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Stormwater utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.

Table 309: City of San Rafael Fiscal Capabilities
Source: **City of San Rafael**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of San Rafael and the City of San Rafael partnerships utilized to promote those programs.

Table 37: City of San Rafael Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Community Emergency Response Team, Marin Conservation League, City of San Rafael Climate Action Team
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	County Household Hazardous Waste Program, MCSTOPP, Marin County Environmental Health Services, The Bay Institute
Natural disaster or safety related school programs	N	City Emergency Management may consider opportunities work with the school district to support disaster education.
StormReady certification	N	
Firewise Communities certification	Y	Yes
Community Rating System	Y	Yes
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 310: City of San Rafael Community Outreach
Source: **City of San Rafael**

3.2.5 Participation in the National Flood Insurance Program

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Detailed below is a description of City of San Rafael's flood management program to ensure continued compliance with the NFIP.

City of San Rafael has participated in the Regular Phase of the NFIP since July 31, 1971. Since then, the City of San Rafael has administered floodplain management regulations that meet or exceed the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities. The Community Rating System (CRS) was created to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. The City of San Rafael does not currently participate in the CRS program.

As part of the City's efforts to comply with NFIP, the City of San Rafael will make updates and revisions to these regulations periodically to ensure they are most effective at minimizing the threat of harm from flood events. These updates and revisions may be promoted by changes in local demographics, shifts in land use, changes to flood regimes such as frequency and intensity of flood events, and other factors that may warrant action. The City will also continue to incorporate any changes to the locations and designations of mapped floodplains into future planning documents, including future updates to this Plan.

The City of San Rafael will also explore opportunities to enforce or enhance City municipal codes, building code, and other regulatory actions to address substantial improvements/ substantial damage properties. The City of San Rafael will consider developing a Substantial Damage Management Plan.

In addition to the capabilities in the municipal code regarding floodplains, the City of San Rafael has additional capabilities. Table 38 shows the City of San Rafael participation in and continued compliance with the NFIP, as well as identify areas for improvement that could be potential mitigation actions.

Table 38: City of San Rafael NFIP Status	
NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	1,011 policies in force in the City of San Rafael with $15,310,152 in premiums, resulting in $313,460,800 of insurance in force.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	There have been 588 closed paid losses totaling $6,147,345. There were 7 severe repetitive loss properties in the City of San Rafael totaling $950,071.78
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	The exact number of structures within the SFHA is unknown due to limited GIS capabilities; however, as of 2016 there were 2,926 improved parcels within the SFHA.
Describe any areas of flood risk with limited NFIP policy coverage	According to FEMA the estimated insurance penetration rate in the SFHA in Marin County is 39.596%. While an equivalent estimate is not available specifically for the City of San Rafael there are certain demographics that are more likely to be underinsured or uninsured including: elderly residents who no longer have a mortgage, undocumented residents, renters, subletters, small businesses with limited cashflow.
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	The City's Climate Adaptation and Resilience Planner is a CFM.
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Public works staff review permits for compliance with NFIP requirements prior to issuance.
What are the barriers to running an effective NFIP program in the community, if any?	None.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	There are no outstanding compliance issues that are known to the City.
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	The date of the most recent CAV or CAC is unknown.
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	07/31/71
Are the FIRMs digital or paper?	Digital

Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Floodplain development regulations comply with FEMA and State minimum requirements.
Provide an explanation of the permitting process.	Development permits that are submitted to the City are reviewed by trained staff for compliance with applicable NFIP requirements.
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
What categories and activities provide CRS points and how can the class be improved?	N/A
Does the plan include CRS planning requirements	N/A

Table 311: City of San Rafael NFIP Status
Source: FEMA, City of San Rafael

NFIP Insurance Coverage Details

City of San Rafael joined the NFIP on July 31, 1971. The City of San Rafael does not participate in the Community Rating System. NFIP insurance data provided by FEMA indicates that as of 06/21/2023, there were 1,011 policies in force in the City of San Rafael with $15,310,152 in premiums, resulting in $313,460,800 of insurance in force. There have been 588 closed paid losses totaling $6,147,345. There were 46 repetitive loss structures in the City. Thirty-nine were in A zones, and 2 were in B, C, or X zones, and the remainder are unknown. There were seven severe repetitive loss properties in the City of San Rafael totaling $950,071.78.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 46
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 7
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0
- Repetitive Loss Residential Structures: 46
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 4
- Severe Repetitive Loss Non-Residential Structures: 3

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 39 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 39: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
2. Identify the locations and then subsequently equip, stock and train staff in order to establish emergency evacuation shelters used to temporarily house people during major emergencies.		X		X	X
3. Update the San Rafael Emergency Operations Center (EOC) Handbook	X				
4. Outfit and equip the City's new Emergency Operation's Center (EOC) scheduled for operation in Calendar Year 2019		X		X	X
5. Plan, prepare, conduct community outreach and deploy emergency evacuation exercises in neighborhoods prone to wildfire or tidal flooding during extreme wet weather periods.		X		X	
6. Bayside Acres Beach Sewer Relocation/Replacement		X		X	X
7. Beach Drive (Fiberglass) Pump Station and Sewer Rehabilitation		X		X	X
8. Recruit and ultimate appoint a new Emergency Management Coordinator (EMC) to fill vacant post.	X				
9. Evaluate and Implement signal timing for first responders		X		X	X
10. Tree Safety Maintenance Program		X		X	X
11. Purchase and installation of EMTRAC signal control equipment into 17 San Rafael Fire Vehicles and 25 intersections.	X	X		X	X

Table 39: Status of Previous Hazard Mitigation Actions					
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Still Relevant**	**Included in Updated Action Plan**
13. San Rafael Capital Improvement Program (CIP) Implementation		X		X	X
19. Develop a climate adaptation plan, and implement resulting strategies		X		X	X
22. Water Storage Facility Study			X	X	X
23. Leaky Pipe Replacement Program		X		X	X
24. Marin Municipal Water District exploration of desalination plants		X		X	X
25. Evaluate the use of reclaimed water/increase purple pipes		X		X	X
26. Evaluate and enhance conservation measures to reduce water consumption		X		X	X
28. Earthquake Hazard Study					
30. Structural Soft Story Identification and Mitigation Plan		X		X	X
33. Adopt a Drain Program		X		X	X
35. City Storm Drain System Analysis and Improvements		X		X	X
36. City Flood Alert System	X				
39. 70-96 Bret Harte Sewer Easement Repair		X		X	X
40. Landslide Identification and Management Program			X	X	X
41. Fairhills Slide Repair		X		X	X
43. Create a City of San Rafael specific Community Wildfire Protection Plan (CWPP).		X		X	X
44. Create new strategic fuel interruption zones in WUI areas and maintain and expand existing fuel interruption zones already in place.		X		X	X
46. Create new point specific wildfire prevention programs specifically targeting areas where homeless encampments are known to exist.		X		X	X
47. San Rafael Measure A Project Implementation		X		X	X
48. East San Rafael Shore Project: Plan		X		X	X
49. East San Rafael Shore Project: Permitting and Construction			X	X	X

Table 312: Status of Previous Hazard Mitigation Actions
Source: City of San Rafael

"Still Relevant" indicates that the project or program was first proposed in the 2018 MJHMP and remains still relevant to the current 2023 MJHMP hazard vulnerabilities.

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County OA MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the City of San Rafael based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires City Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the City of San Rafael Hazard Mitigation Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The City of San Rafael Hazard Mitigation Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The City of San Rafael Hazard Mitigation Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the City of San Rafael Hazard Mitigation Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. The City of San Rafael Hazard Mitigation Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).

- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

During the five-year update cycle, the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The City of San Rafael will actively participate in this Working Group. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys. Additionally, the City of San Rafael Deputy Director of Emergency Management will work with the various City departments we will oversee the hazard mitigation actions and track the progress of the actions to the City officials and Marin Operational Area Hazard Mitigation Working Group.

The City of San Rafael maintains project worksheets with detailed descriptions of each project. A summary of each project is found in the table below.

Table 40 lists the Current Hazard Mitigation Actions for the City of San Rafael.

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Table 40: City of San Rafael Current Hazard Mitigation Actions							
No.	**Mitigation Action**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
SR-1	Marin Emergency Radio Authority (MERA) Upgrades. MU-13 Protect Infrastructure and Critical Facilities	All Hazards/ 1, 2, 3, 4, 5	Marin County and the City of San Rafael OES	Existing (2018)	Cost TBD; State and/or Federal grants, existing budgets	Ongoing 1-2 years/ High	The city, as a participant, is also studying replacement for the system as it reaches the end of its service life.
SR-2	Update and implement safety and resilience elements of the General Plan. MU-4 Adopt Development Regulations in Hazard Areas	All Hazards/ 1, 2, 4, 5	City of San Rafael Planning Dept.	Existing (2018)	Cost: General Funds	1 – 3 years/ High	An updated General Plan was adopted which includes significant public safety components.
SR-3	Review and complete a study on the effectiveness of current California Building codes for seismic, flood, fire, and other disasters.MU-8 Adopt and Enforce Building Codes	All Hazards/ 1, 2, 4, 5	City of San Rafael Planning Dept.	Existing (2018)	Cost: General Funds	3 - 5 years/ Medium	The city continues to review and adopt current California Building codes.
SR-4	Enhance and promote community and individual emergency preparedness. MU-15 Develop and Conduct a Household Disaster Preparedness Program. ET-2 Increase awareness of extreme temperature risk and safety.	All Hazards/ 3, 4, 5	Marin County and the City of San Rafael OES	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants	1 - 2 years/ High	Focus on signing residents up for Alert Marin and establish a personal evacuation kit and plan.
SR-5	Identify the locations and then subsequently equip, stock, and train staff to establish emergency evacuation shelters used to temporarily house people during major emergencies. MU-13 Protect Infrastructure and Critical Facilities	All Hazard/ 1, 2, 4	City of San Rafael OES	Existing (2019)	Cost TBD: HMGP, BRIC, CDAA, Fire Safe Marin, Private Grants	1 - 2 years/ High	None
SR-6	Evaluate and Implement signal timing for first responders including EMTRAC on 17 fire vehicles. MU-13 Protect Infrastructure and Critical Facilities	All Hazard/ 1, 2, 4	City of San Rafael Fire Dept.	Existing (2020)	Cost TBD: HMGP, BRIC, CDAA, Fire Safe Marin, Private Grants	3-5 years/ medium	This action is in its initial stage with planned expansion.

Table 40: City of San Rafael Current Hazard Mitigation Actions

No.	Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SR-7	Implementation of SRMC code for new construction and substantial renovation projects to implement 7a standards. Codes restricting wood shake roofs. WF-5 Require or Encourage Fire-Resistant Construction Techniques.	Wildfire 1, 3, 4, 5	City of San Rafael Building Dept.	Existing (2018)	Cost: General Funds, MWPA	3-5 years/ medium	None
SR-8	Receive and review Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas. WF-9 Implement a Fuels Management Program. WF-8 Conduct Maintenance to Reduce Risk.	Wildfire 1, 3, 4, 5	City of San Rafael Fire Dept.	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Grants, MWPA	1 - 2 years/ High	This reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire.
SR-9	Removal and/or reduction of hazardous fuels located within COSR jurisdictional boundaries. WF-9 Implement a Fuels Management Program, ET-1 Reduce Urban Heat.	Wildfire 1, 2, 4, 5	City of San Rafael Fire Dept.	New (2023)	Cost TBD: HMGP, BRIC, Private Grants, MWPA	1 - 2 years/ High	Reduces the chance of a wildland fire igniting the structure(s) and reciprocally, wildland ignition from a structure fire. Supports environmental restoration.
SR-10	Hillside neighborhoods adaptation projects to protect against wildfire risk including narrow-street parking restrictions, continuing vegetation management in highest-risk areas, and other projects listed in the CWPP. WF-3 Reduce Risk through Land Use Planning. WF-8 Conduct Maintenance to Reduce Risk.	Wildfire/ 1, 2, 4, 5	City of San Rafael Fire Dept.	New (2023)	Cost TBD: HMGP, BRIC, Private Grants, MWPA	1 - 2 years/ High	None
SR-11	Consider the development of transitional zones where additional fuel management will be conducted.	Wildfire 1, 2, 4, 5	City of San Rafael Fire	New (2023)	Cost TBD: MWPA, HMGP Grants	3-5 years/ medium	Various projects

Table 40: City of San Rafael Current Hazard Mitigation Actions							
No.	**Mitigation Action**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
	WF-7 Create Defensible Space Around Structures and Infrastructure. WF-9 Implement a Fuels Management Program.						
SR-12	Continue efforts to partner with Neighborhood response groups and firewise communities to improve wildfire adaptation. WF-10 Participate in Firewise Program.	Wildfire 1, 3, 4	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: MWPA, Firesafe Marin	3-5 years/ medium	Continued efforts to expand the interest in fire-adapted communities through the local Firewise program.
SR-13	Participate in Countywide evacuation route assessment and mapping study(s). WF-1 Map and Assess Vulnerability to wildfire.	Wildfire 1, 2, 3, 5	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: MWPA, HMGP Grants	1 - 2 years/ High	The study is set to be completed this year.
SR-14	Conduct fuel reduction of hazardous vegetation along evacuation routes. WF-8 Conduct Maintenance to Reduce Risk.	Wildfire 1, 2, 4	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: MWPA, HMGP Grants	1 - 2 years/ High	Annual surveying and mitigation work.
SR-15	Staff Defensible space program to educate the public and support code enforcement efforts to improve city-wide structure ignition potential. WF-7 Create defensible space around structures and infrastructure.	Wildfire 1, 3, 4, 5	City of San Rafael Fire Dept.	Existing (2019)	Cost: MWPA	3-5 years/ medium	The Defensible space program is an ongoing and year round program.
SR-16	Develop and Implement a Fuels Management Program. WF-9 Implement a Fuels Management Program.	Wildfire 1, 2, 4	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: MWPA, HMGP Grants	1 - 2 years/ High	None
SR-17	Conduct a city-wide survey of hazardous trees and vegetation. WF-1 Map and Assess Vulnerability to Wildfire.	Wildfire 1, 3, 5	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: MWPA, HMGP Grants	1 - 2 years/ High	Data collection is conducted through the defensible space inspection program.
SR-18	Develop tools, equipment, and programs to implement a mobile public education and outreach	Wildfire 1,2,3,4,5	City of San Rafael Fire,	Existing (2019)	Cost TBD: MWPA, HMGP Grants	1 - 2 years/ High	The City conducts public education withing San Rafael which is

Table 40: City of San Rafael Current Hazard Mitigation Actions

No.	Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
	program for emergency preparedness, hazard education, and community mitigation input. WF-11 Increases Wildfire Risk Awareness. WF-12 Educate Property Owners about Wildfire Mitigation Techniques.		Firesafe Marin				supplemented by Firesafe Marin.
SR-19	San Rafael adaptation projects to protect against flooding including maintaining, replacing, or new flood control pump stations, maintaining and dredging existing lagoons and canals, maintaining, and improving storm drainage throughout neighborhoods, and other projects listed in the assessment. F-1 Incorporate Flood Mitigation in Local Planning. F-9 Manage the Floodplain Beyond Minimum Requirements. F-15 Elevate or Retrofit Structures and Utilities.	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	City of San Rafael Sustainability Dept., Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	3-5 years/ medium	City's Climate Adaptation Plan
SR-20	Updating or enhancing flood control pump stations, storm force mains, and gravity storm lines around town. This will also include maintaining and dredging existing flood control open channels, canals, and lagoons. F-14 Conduct Regular Maintenance for Drainage Systems and Flood Control Structures. F-17 Protect Infrastructure.	Flooding, Sea Level Rise, Levee, Tsunami/ 1, 2, 4, 5	City of San Rafael Sustainability Dept., Marin County	New (2023)	Cost TBD: HMGP, FMA, CDAA	3-5 years/ medium	None
SR-21	San Rafael Capital Improvement Program (CIP) Implementation. SLR-3 Protect buildings and infrastructure. F-19 Construct flood control	Flooding, Sea Level Rise, Levee, Tsunami/	City of San Rafael Planning	Existing (2019)	Cost TBD: HMGP, FMA, CDAA	3-5 years/ medium	This plan includes various storm drains, creek restoration, and water pump repair projects.

Table 40: City of San Rafael Current Hazard Mitigation Actions							
No.	**Mitigation Action**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
	measures. F-13 Improve storm drain capacity.	1, 2, 4, 5					
SR-22	Develop a "Homeowners Guide to Flood and Tsunami Hazards" to help property owners identify mitigation techniques, preparation practices, and funding opportunities to adapt to sea level rise. TSU-6 Increase Public Awareness of Tsunami Hazards. F-23 Educate property owners about Flood Mitigation Techniques.	Flooding, Sea Level Rise, Levee, Tsunami/ 1, 2, 4, 5	City of San Rafael Planning and Sustainability Departments	Existing (2019)	Cost TBD: HMGP, FMA, CDAA	3-5 years/ medium	None
SR-23	Enhance Community facilities to support energy resiliency and socially vulnerable populations during extreme weather events. ET-3 Assist Vulnerable Population	Severe Weather-Heat 1,2,4,5	City of San Rafael OES	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Grants	1 - 2 years/ High	This action includes heat, rain, poor air quality, and cold weather conditions.
SR-24	Educate the public about severe weather safety, power outages, and powerline safety. SW-7 Increase Severe Weather Risk Awareness.	Severe Weather-Heat 1,3,4	City of San Rafael OES	New (2023)	Cost TBD: HMGP, CDAA	1 - 2 years/ High	Develop community outreach in preparation for severe weather to enhance public safety
SR-25	Coordinate with local government and private organizations to prepare and implement staff shelters during predicted severe weather conditions. SW-6 Retrofit Public Buildings and Critical Facilities.	Severe Weather-Heat 1,4	City of San Rafael Building Dept.	New (2023)	Cost TBD: HMGP, CDAA	1 - 2 years/ High	Open warming and shelter locations for residents experiencing homelessness to improve health and life safety.
SR-26	Fire and Building code amendments and adoption to reduce the damage to structures from earthquakes, landslides, and fire. fire sprinklers for new and substantially remodeled structures. EQ-1 Adopt and Enforce Building Codes. SU-3 Consider Subsidence in Building Design.	Earthquake 1, 2, 4, 5	City of San Rafael Fire & Building Departments	Existing (2021)	Cost TBD: HMGP, CDAA	3-5 years/ medium	Substantial remodels are indicated by more than 50% sheetrock removal during 4 years or conducting more than 50% of the structures assessed value in remodel cost.

Table 40: City of San Rafael Current Hazard Mitigation Actions							
No.	**Mitigation Action**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
SR-27	Train homeowners to locate and shut off gas valves if they smell or hear gas leaking. Prepare citywide education. EQ-7 Increase Earthquake Risk Awareness.	Earthquake 1, 2, 3, 4, 5	City of San Rafael OES	New (2023)	Cost TBD: HMGP, CDAA	1 - 2 years/ High	This action may be implemented in preparation for training programs.
SR-28	Remove non-native plants and trees from all County and City and Town facilities, and replace them with drought-tolerant, native plants. D-8 Enhance Landscaping and Design Measures	Drought 1, 2, 4, 5	City of San Rafael Fire Dept.	Existing (2019)	Cost TBD: HMGP, CDAA	3-5 years/ medium	None
SR-29	Survey and explore the potential of enhancing reclaimed water systems.	Drought 1, 2, 4, 5	City of San Rafael Sustainability	New (2023)	Cost TBD: HMGP, CDAA	3-5 years/ medium	None
SR-30	Landslide Identification and Management Program – LS-1 Map and assess vulnerability to landslides.	Landslide 1, 2, 4, 5	City of San Rafael OES & Public Works	New (2023)	Cost TBD: HMGP, CDAA	3-5 years/ medium	None

Table 313: City of San Rafael Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the City of San Rafael. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 39 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the City of San Rafael identified and prioritized the mitigation actions as detailed in Table 40, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the City of San Rafael will maintain this plan and will serve as a lead staff for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the City of San Rafael will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of San Rafael already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the City. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

City and District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the City.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

25. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
26. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
27. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

San Rafael is a desirable place to live, work, or own a business in part due to the variety of land uses that can be found in the city. It offers older neighborhoods with traditional city blocks and mixed uses, as well as mid- to late- 20th Century suburban areas where residential and commercial uses have been separated. Its neighborhoods are complemented by multiple business districts, ranging from industrial areas to office parks to neighborhood shopping centers. Its developed areas are complemented by a network of open spaces, connecting the city to nature and making it more interesting and scenic. Past land use decisions have maintained a balance of uses that give the city a "hometown" quality and make San Rafael what it is today.

The San Rafael Land Use Element is closely aligned with other elements of the General Plan. The Mobility Element has been calibrated with the Land Use Element to ensure that transportation capacity is adequate to support new development. At the same time, the Land Use Element shifts development patterns to make walking, bicycling, and transit use a more viable way to get around. The Land Use Element similarly aims to reduce the hazards identified in the Safety and Resilience Element, while preserving the natural resources addressed in the Conservation and Climate Change Element.

The Land Use Element guides future change to fit the desired character of San Rafael, preserve the city's historic qualities and natural environment, serve community needs, sustain the local economy, and enhance the quality of life. Its goals and policies provide the direction needed to strengthen San Rafael's sense of place and keep the city a place that feels like "home."

The Land Use Element reflects the Guiding Principles of General Plan 2040. It strategically directs San Rafael's growth to areas where it will strengthen the city, protect natural resources, reduce exposure to environmental hazards, support climate change initiatives, and conserve and strengthen existing neighborhoods. The land use goals and policies are underpinned by a basic belief that change is both inevitable and necessary and should be harnessed to achieve the vision of a thriving city.

It is tremendously important to San Rafael residents that growth is well managed and harmonious with community needs. New development and other physical alterations must respect the character and scale of the city. Change and development should be accomplished in ways that enhance and blend with San Rafael's existing physical and social qualities. Development should respect the physical fabric of the city, while improving its social fabric through new housing and economic opportunities that reach all residents.

The Land Use Element responds to the chronic risks that come from living with natural disasters, including wildfires, earthquakes, and floods. This requires more than just being prepared for emergencies. The Land Use Map (see Figure 60) itself responds to hazard levels in different parts of the city, limiting development in high fire- hazard areas and on steep landslide-prone hillsides. Policies in the General Plan require elevated foundations in low-lying areas, and flood-proofing buildings where sea level rise is an issue. The Land Use Map includes a sea level rise overlay area, providing a reminder of where extra steps may be necessary to ensure the safety of life and property.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in San Rafael has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

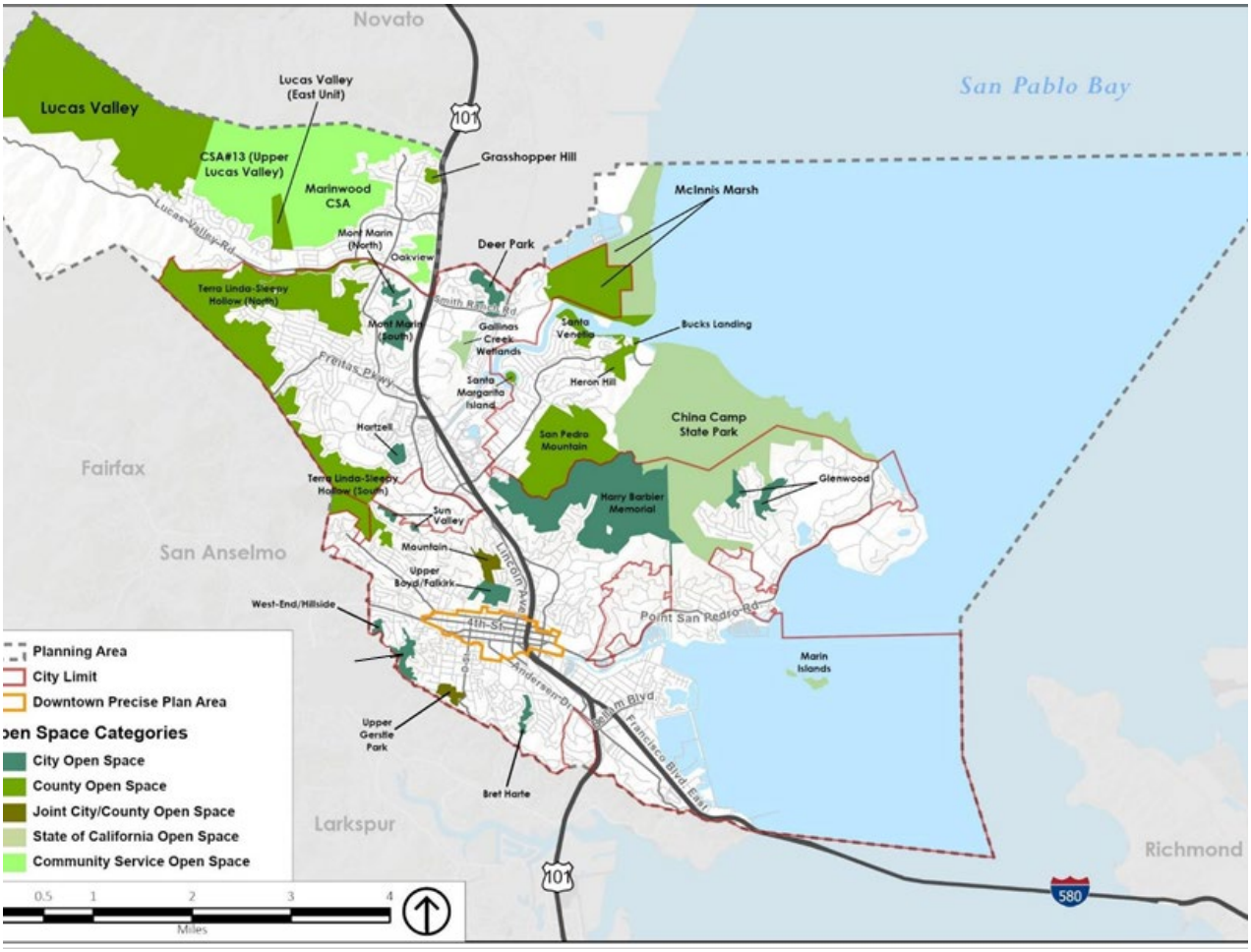

Figure 60: City of San Rafael Land Use Map – Open Space
Source: City of San Rafael General Plan 2040 (Aug. 2021)

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of San Rafael.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of San Rafael Community Profile Annex of the Marin County OA MJHMP will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of San Rafael plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of San Rafael is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of San Rafael Public Works Director will monitor and update the City of San Rafael Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase

engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of San Rafael, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of San Rafael, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of San Rafael Public Works Director will monitor and update the City of San Rafael Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of San Rafael and the Marin County Office of Emergency Management will hold quarterly update

meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 12-19
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 12-20
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 12-21
Figure 4: Hazard Mitigation Plan Survey 12-23
Figure 5: Map of City of San Rafael in Marin County 12-26
Figure 6: Map of the City of San Rafael 12-27
Figure 7: The City of San Rafael Precipitation and Monthly Temperatures 12-29
Figure 8: Races in San Rafael 12-30
Figure 9: City of San Rafael Land Use Map 12-32
Figure 10: City of San Rafael Social Vulnerability Map Census Tract 1060.01 12-35
Figure 11: City of San Rafael Social Vulnerability Map Census Tract 1081.00 12-36
Figure 12: City of San Rafael Social Vulnerability Map Census Tract 1082.01 12-37
Figure 13: City of San Rafael Social Vulnerability Map Census Tract 1082.02 12-38
Figure 14: City of San Rafael Social Vulnerability Map Census Tract 1090.01 12-39
Figure 15: City of San Rafael Social Vulnerability Map Census Tract 1092.02 12-40
Figure 16: City of San Rafael Social Vulnerability Map Census Tract 1101.00 12-41
Figure 17: City of San Rafael Social Vulnerability Map Census Tract 1102.00 12-42
Figure 18: City of San Rafael Social Vulnerability Map Census Tract 1110.01 12-43
Figure 19: City of San Rafael Social Vulnerability Map Census Tract 1110.02 12-44
Figure 20: City of San Rafael Social Vulnerability Map Census Tract 1121.00 12-45
Figure 21: City of San Rafael Social Vulnerability Map Census Tract 1122.02 12-46
Figure 22: City of San Rafael Social Vulnerability Map Census Tract 1122.03 12-47
Figure 23: City of San Rafael Social Vulnerability Map Census Tract 1122.04 12-48
Figure 24: City of San Rafael Critical Facilities and Infrastructure 12-59
Figure 25: City of San Rafael Hazard Risk Assessment Ranking 12-60
Figure 26: Hazard Risk Categorization 12-60
Figure 27: NASA Global Temperature Change CO2 Gas 12-64
Figure 28: NASA Global Temperature Change 1884 to 2022 12-64
Figure 29: NASA Global Temperature Change Sea Level 12-65
Figure 30: Annual Mean Sea Level Trends 12-68
Figure 31: Landslide Susceptibility Classes 12-73
Figure 32: Mud Flow Areas 12-74
Figure 33: City of San Rafael Debris Flow Critical Facilities and Infrastructure 12-76
Figure 34: Modified Mercalli Intensity Scale 12-79
Figure 35: Mercalli Scale vs. Magnitude 12-80
Figure 36: Soil Types 12-80
Figure 37: Marin County OA Earthquake Impact and Fault Lines 12-82
Figure 38: City of San Rafael Earthquake Critical Facilities and Infrastructure 12-84
Figure 39: Diagram of an Atmospheric River Event 12-87
Figure 40: City of San Rafael Flooding Critical Facilities and Infrastructure 12-89
Figure 41: City of San Rafael Flooding – 10/21/2021 12-95
Figure 42: Dissolution Sinkhole Formation 12-97
Figure 43: Cover-Subsidence Sinkhole Formation 12-97

Figure 44: Cover-Collapse Sinkhole Formation 12-98
Figure 45: Levee Failure Mechanisms 12-99
Figure 46: City of San Rafael Levee Inundation Impact.....12-101
Figure 47: City of San Rafael Sea Level Rise Impact 12-105
Figure 48: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 12-107
Figure 49: Heat Index..... 12-108
Figure 50: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 12-109
Figure 51: Beaufort Wind Scale 12-110
Figure 52: Enhanced Fujita Scale 12-111
Figure 53: Waterspout Formation.....12-112
Figure 54: City of San Rafael Tsunami Critical Facilities and Infrastructure 12-114
Figure 55: Federal, State and Local Responsibility Areas in the Marin County OA.....12-117
Figure 56: Fuel Model Map for the Marin County OA 12-121
Figure 57: 2018 San Rafael Wildfire in Boyd Memorial Park 12-125
Figure 58: City of San Rafael Wildfire Critical Facilities and Infrastructure 12-126
Figure 59: Trends in the Annual Number of Large Wildfires in the United States..... 12-127
Figure 60: City of San Rafael Land Use Map – Open Space..... 12-158

List of Tables

Table 1: City of San Rafael Local Hazard Mitigation Planning Team Members 12-8
Table 2: 2023 MJHMP Local Planning Team Members..... 12-12
Table 3: City of San Rafael & Marin County OA MJHMP Planning Meetings 12-16
Table 4: City of San Rafael Estimated Jurisdictional Population 12-29
Table 5: Population Change of The City of San Rafael..... 12-29
Table 6: Languages Spoken in San Rafael..... 12-30
Table 7: Marin County OA Jurisdictional Housing Stock 12-31
Table 8: NRI Hazards and Marin County OA MJHMP Hazards..... 12-33
Table 9: NRI Hazard Type Risk Index for San Rafael Census Tract 1060.01..... 12-35
Table 10: NRI Hazard Type Risk Index for San Rafael Census Tract 1081.00..... 12-36
Table 11: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.01 12-37
Table 12: NRI Hazard Type Risk Index for San Rafael Census Tract 1082.02..... 12-38
Table 13: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.01..... 12-39
Table 14: NRI Hazard Type Risk Index for San Rafael Census Tract 1090.02..... 12-40
Table 15: NRI Hazard Type Risk Index for San Rafael Census Tract 1101.00..... 12-41
Table 16: NRI Hazard Type Risk Index for San Rafael Census Tract 1102.00..... 12-42
Table 17: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.01 12-43
Table 18: NRI Hazard Type Risk Index for San Rafael Census Tract 1110.02 12-44
Table 19: NRI Hazard Type Risk Index for San Rafael Census Tract 1121.00..... 12-45
Table 20: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.02..... 12-46
Table 21: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.03..... 12-47
Table 22: NRI Hazard Type Risk Index for San Rafael Census Tract 1122.04..... 12-48
Table 23: Household Income for The City of San Rafael as of 2019..... 12-51
Table 24 City of San Rafael Civilian Employed Population 16 years+ by Industry 12-51
Table 25: City of San Rafael Critical Facilities 12-56
Table 26: Historic Sites In The City of San Rafael 12-58

Table 27: Select Hazards Magnitude/ Severity Scale or Index 12-61
Table 28: City of San Rafael Hazard Risk Assessment 12-70
Table 29: Hazard Risk Assessment 12-71
Table 30: City of San Rafael Critical Facilities in the Flood Zones 12-90
Table 31: City of San Rafael Critical Facilities in the Flood Zones 12-94
Table 32: City of San Rafael Future Growth Areas 12-129
Table 33: City of San Rafael Legal and Regulatory Capabilities 12-132
Table 34: City of San Rafael General Plan 12-135
Table 35: City of San Rafael Administrative and Technical Capabilities 12-137
Table 36: City of San Rafael Fiscal Capabilities 12-138
Table 37: City of San Rafael Community Outreach 12-139
Table 38: City of San Rafael NFIP Status 12-142
Table 39: Status of Previous Hazard Mitigation Actions 12-146
Table 40: City of San Rafael Current Hazard Mitigation Actions 12-154

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

13. City of Sausalito Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The City of Sausalito and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) Steering Committee provided the oversight and dedication to this project that was required and without their commitment; this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the City of Sausalito more disaster resistant and sustainable.

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TABLE OF CONTENTS

CITY OF SAUSALITO COMMUNITY PROFILE 13-1
Acknowledgements 13-3
Table of Contents 13-5
Section 1.0: Introduction 13-7
1.1 Introduction 13-7
1.2 Planning Process 13-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 13-8
1.2.2 Steering Committee Planning Process 13-9
1.2.3 Coordination with Stakeholders and Agencies 13-10
1.2.4 Public Engagement 13-16
1.3 Overview and History 13-23
1.4 Government 13-26
1.5 Weather and Climate 13-26
1.6 Demographics 13-27
1.7 Social Vulnerability and Risk 13-31
1.8 Economy and Tax Base 13-36
1.9 Critical Facilities 13-37
1.10 Historical Properties 13-40
Section 2.0: Hazard Identification and Risk Assessment 13-41
2.1 Climate Change 13-43
2.2 Hazards 13-50
2.2.1 Debris Flows 13-51
2.2.2 Drought 13-57
2.2.3 Earthquake 13-59
2.2.4 Flooding 13-65
2.2.5 Land Subsidence 13-72
2.2.6 Levee Failure 13-74
2.2.7 Sea Level Rise 13-75
2.2.8 Severe Weather – Extreme Heat 13-79
2.2.9 Severe Weather – High Wind & Tornado 13-81
2.2.10 Tsunami 13-85
2.2.11 Wildfire 13-87
Section 3.0: Mitigation Strategy 13-100

3.1 Changes in Development 13-100
3.2 Capability Assessment 13-102
3.2.1 Regulatory Capabilities 13-102
3.2.2 Administrative and Technical Capabilities 13-107
3.2.3 Fiscal Capabilities 13-109
3.2.4 Community Outreach 13-110
3.2.5 Participation in the National Flood Insurance Program 13-111
3.3 Mitigation Goals 13-116
3.4 Status of Previous Mitigation Actions 13-118
3.5 Hazard Mitigation Actions 13-118
3.6 Progress in Local Mitigation Efforts 13-128
3.7 Plan Integration 13-128
3.8 Future Development Trends 13-129
Section 4.0: Plan Review, Evaluation, and Implementation 13-131
4.1 Plan Adoption 13-131
4.2 Plan Monitoring 13-131
4.3 Plan Evaluation 13-132
4.4 Plan Update 13-132
Figures and Tables 13-134
Acronyms/Abbreviations 13-136

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The City of Sausalito, Community Profile has been prepared in conjunction with the Marin County Operational Area (OA) Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the City of Sausalito.

1.2 PLANNING PROCESS

The majority of the Marin County OA is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population, both incorporated and unincorporated, is concentrated in the Eastern portion of the county. There are a total of 11 incorporated jurisdictions within Marin County. The Marin County OA MJHMP Steering Committee and broader Planning Team approached the development of the Marin County OA MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County and other jurisdictions to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

The Marin County OA is very different from most California Counties in that the populated portion of the County where the jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Steering Committee to establish a more robust Planning Team representing local, countywide, regional, state, and federal stakeholders servicing the Marin County OA planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County OA MJHMP Steering Committee, the City of Sausalito involved additional internal planning team members to support the broader planning process. The City of Sausalito jurisdictional representatives for the

coordinated Marin County OA MJHMP Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Kevin McGowan, Public Works Director
Telephone: 415-289-4176
E-mail Address: kmcgowan@sausalito.gov

Alternate Point of Contact
Brandon Phipps, Planning Director
Telephone: 415-289-4180
E-mail Address: adavidson@sausalito.gov

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: City of Sausalito Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Sausalito	Chris Zapata	City Manager	415-289-4166	czapata@sausalito.gov
Sausalito	Kevin McGowan	Public Works Director	415-289-4176	kmcgowan@sausalito.gov
Sausalito	Brandon Phipps	Planning Director	415-289-4142	bphipps@sausalito.gov
Sausalito	Abbot Chambers	Communications Director/Library Director	415-289-4120	achambers@sausalito.gov
Sausalito	Chris Tubbs	Southern Marin Fire Chief	415-388-8182	ctubbs@smfd.org
Sausalito	Andrew Davidson	Senior Engineer/ Public Works	415-289-4180	adavidson@sausalito.gov
Sausalito	Ali Iqbal	Assistant Civil Engineer/ Public Works	415-289-4191	aiqbal@sausalito.gov
Sausalito	Marshal Nua	Southern Marin fire Marshal	415-388-8182	mnua@smfd.org
Sausalito	Tom Welch	Southern Marin Fire	415-388-8182	twelch@smfd.org
Sausalito	Neal Toft	Sausalito Planning Department	415-388-4137	ntoft@sausalito.gov
Sausalito	Stacey Gregory	Acting Sausalito Police Chief	415-289-4188	sgregory@sausalito.gov

Table 314: City of Sausalito Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of the unincorporated County of Marin, five special districts, and the eleven incorporated jurisdictions to include the City of Sausalito. All participating jurisdictions are within the geographical boundary of the Marin County OA and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and

appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County website. The County website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County OEM and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OEM website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and City of Sausalito Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the City of Sausalito communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and City of Sausalito Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the City of Sausalito and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	County of Marin	Steven Torrence	OEM Director
20	County of Marin	Hannah Tarling	Emergency Management Coordinator

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
21	County of Marin	Chris Reilly	OEM Project Manager
22	County of Marin	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	County of Marin	Leslie Lacko	Community Development Agency
24	County of Marin	Hannah Lee	Senior Civil Engineer
25	County of Marin	Felix Meneau	Project Mgr./ FCWCD
26	County of Marin	Julia Elkin	Department of Public Works
27	County of Marin	Beb Skye	Department of Public Works
28	County of Marin	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	County of Marin	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	County of Marin	Koblick, Kathleen	Marin Health & Human Services
31	County of Marin	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Assistant Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 315: 2023 MJHMP Local Planning Team Members

Several opportunities were provided for the groups listed above to participate in the City of Sausalito's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: City of Sausalito & Marin County OA MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment

Table 3: City of Sausalito & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website.

Table 3: City of Sausalito & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County OA Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update

Table 3: City of Sausalito & Marin County OA MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 316: City of Sausalito & Marin County OA MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by the County and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the County website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. The County of Marin intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 600: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County OAMJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center,

3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County OA MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

Figure 601: Marin County OA MJHMP Public Town Hall Meeting

SOCIAL MEDIA

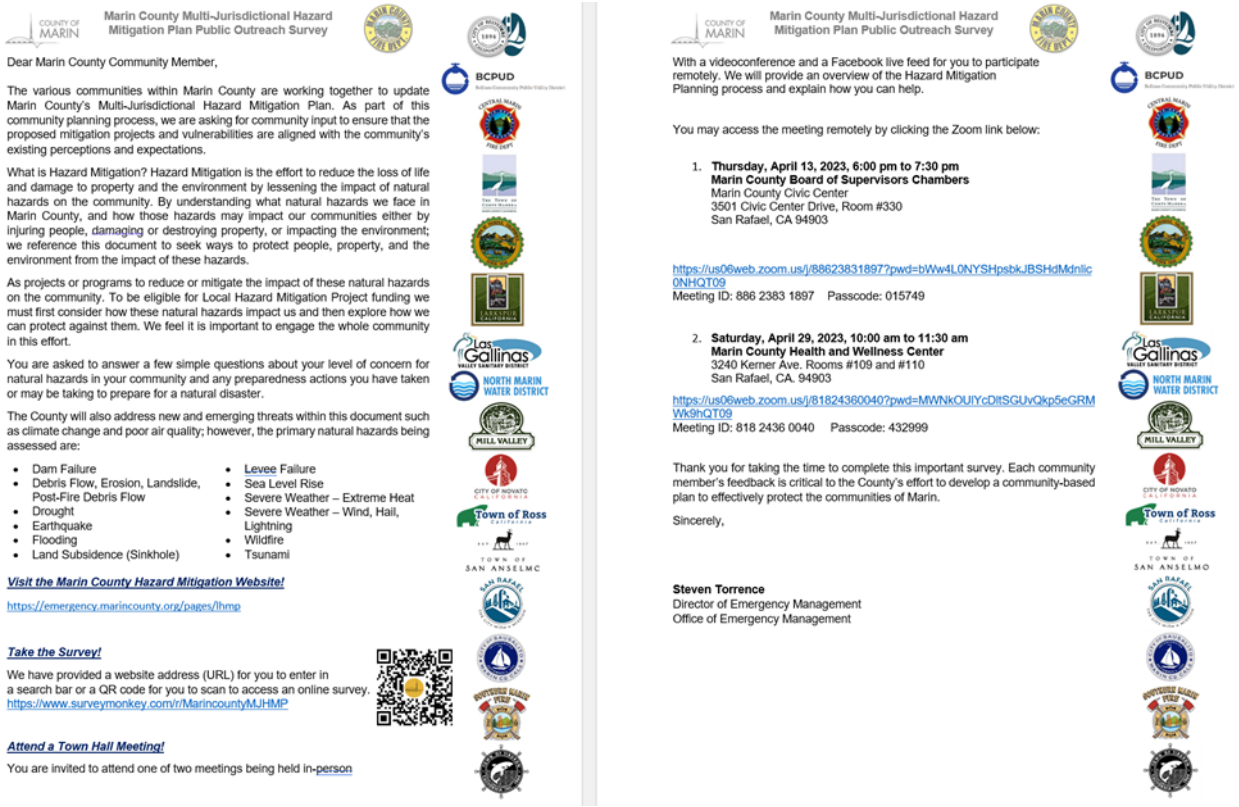
The Marin County OA utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 602: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

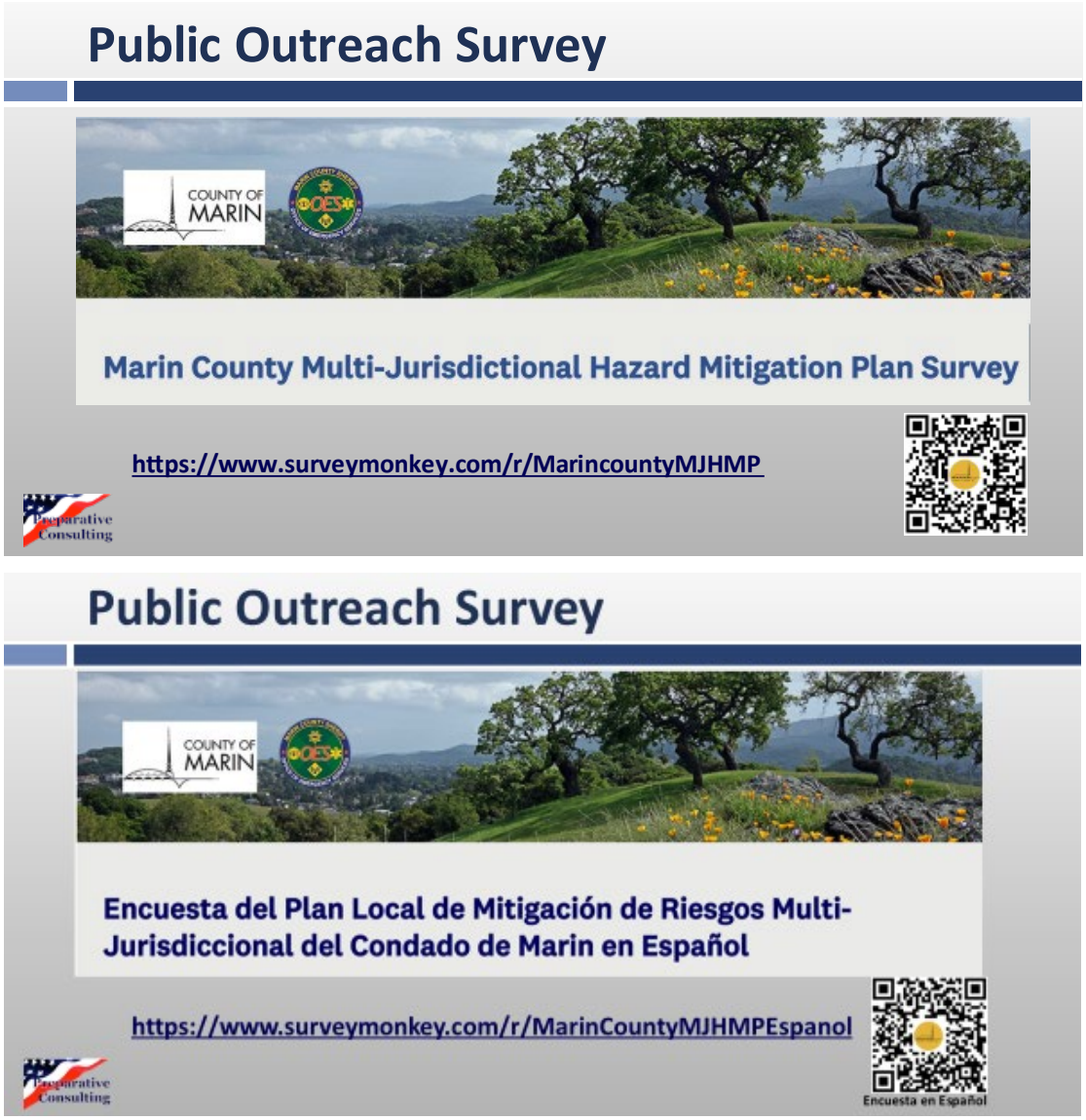


Figure 603: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media. The Marin Independent Journal (Marin IJ) used the press release to write an article about the MJHMP development. Social media accounts were updated four times with an initial ask for public involvement, two reminders, and a closing announcement were sent. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to planning partner jurisdictions to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The City of Sausalito had an additional 14-day comment period for the City of Sausalito Community Profile where their profile was posted on the City website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

The City of Sausalito also implemented out-reach effort by posting a draft version of this report on the city's website and requesting comments from the public. The city council was also made aware of the document and provided comments to city staff on December 5, 2023.

These comments as well as comments from the public where appropriate were incorporated into this document.

Public Comments Considered by the Planning Team
The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The City of Sausalito distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions

1.3 Overview and History

Sausalito (Spanish for "small willow grove") is located approximately about 2 miles (3 km) north of the Golden Gate Bridge and 4 miles north of San Francisco.

The City of Sausalito was incorporated as a city on September 4, 1893, had an estimated population of 7,269 in 2020, with 4,425 housing units in the city. The median income for a household in the city was $140,410 and the per capita income for the city was $111,167. Approximately 0 percent of families and 7.3 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). The city has a total area of 2.257 square miles, only 1.8 square miles (4.7 km2) of it is land, and is situated near the northern end of the Golden Gate Bridge. Prior to the building of the Golden Gate Bridge, the community served as a terminus for rail, car, and ferry traffic.

Sausalito developed rapidly as a shipbuilding center in World War II, with its industrial character giving way in postwar years to a reputation as a wealthy and artistic enclave, a picturesque residential community (incorporating large numbers of houseboats), and a tourist destination. The city is adjacent to, and largely bounded by, the protected spaces of the Golden Gate National Recreation Area as well as the San Francisco Bay.

Sausalito was once the site of a Coast Miwok settlement known as Liwanelowa. The branch of the Coast Miwok living in this area were known as the Huimen (or as Nación de Uimen to the Spanish). It transitioned from a fishing village to a town in 1870, when the North Pacific Coast Railroad extended southward to the ferry terminal—which is still in use today for trips to and from San Francisco. Pre-war Sausalito was small in scale but diverse, crowded with the San Francisco elite, smugglers from throughout the Pacific, fishermen, and craftswomen. The United States' entry into World War II changed the city by introducing industrial-scale shipbuilding. The Bechtel Corporation transformed 210 acres of railyards and wetlands into the Marinship, which employed around 20,000 men and women to construct nearly 100 ships over the course of the war—averaging more than two ships built every month.

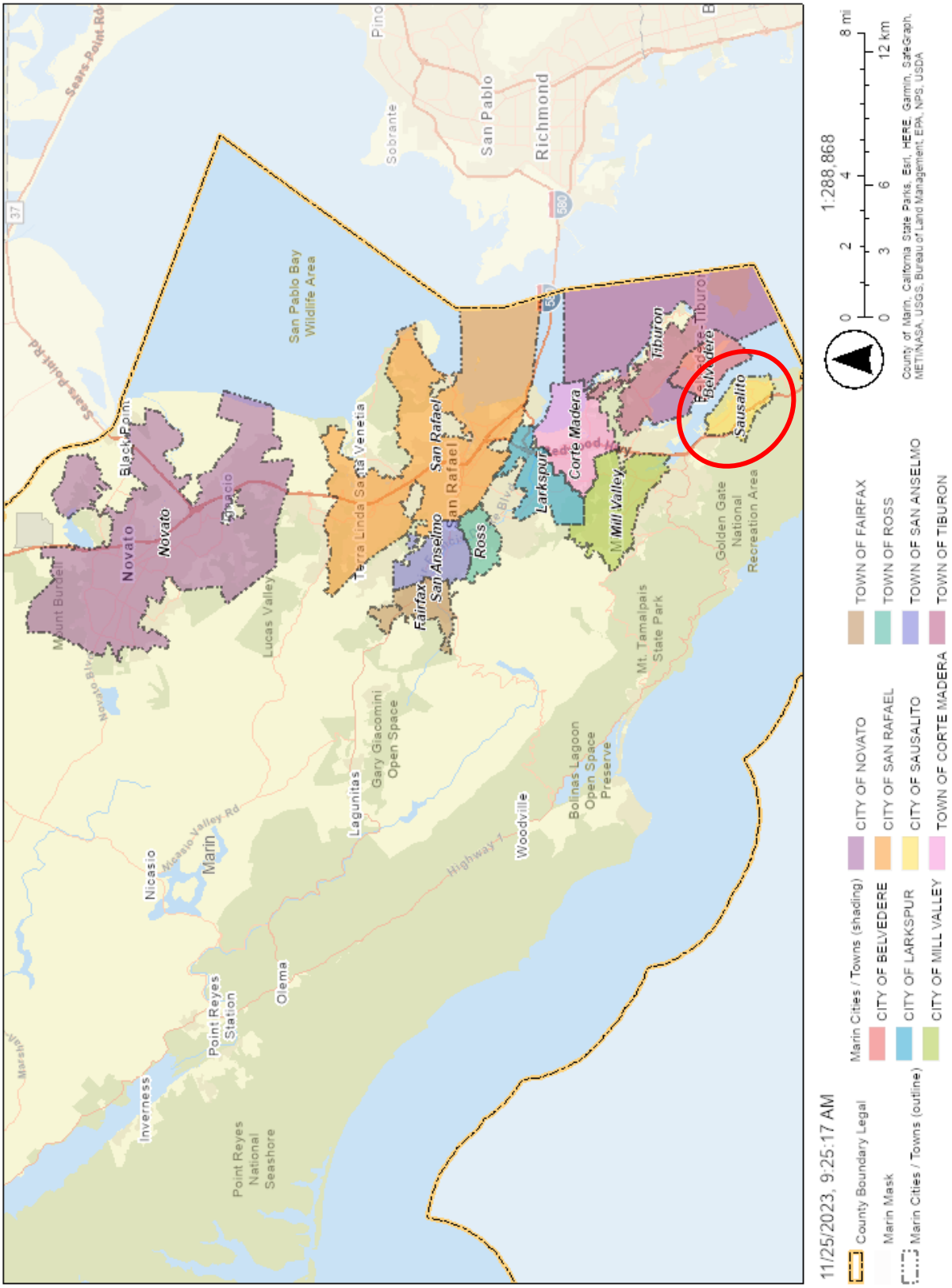


Figure 604: Map of the City of Sausalito in Marin County
Source: Marin County OEM

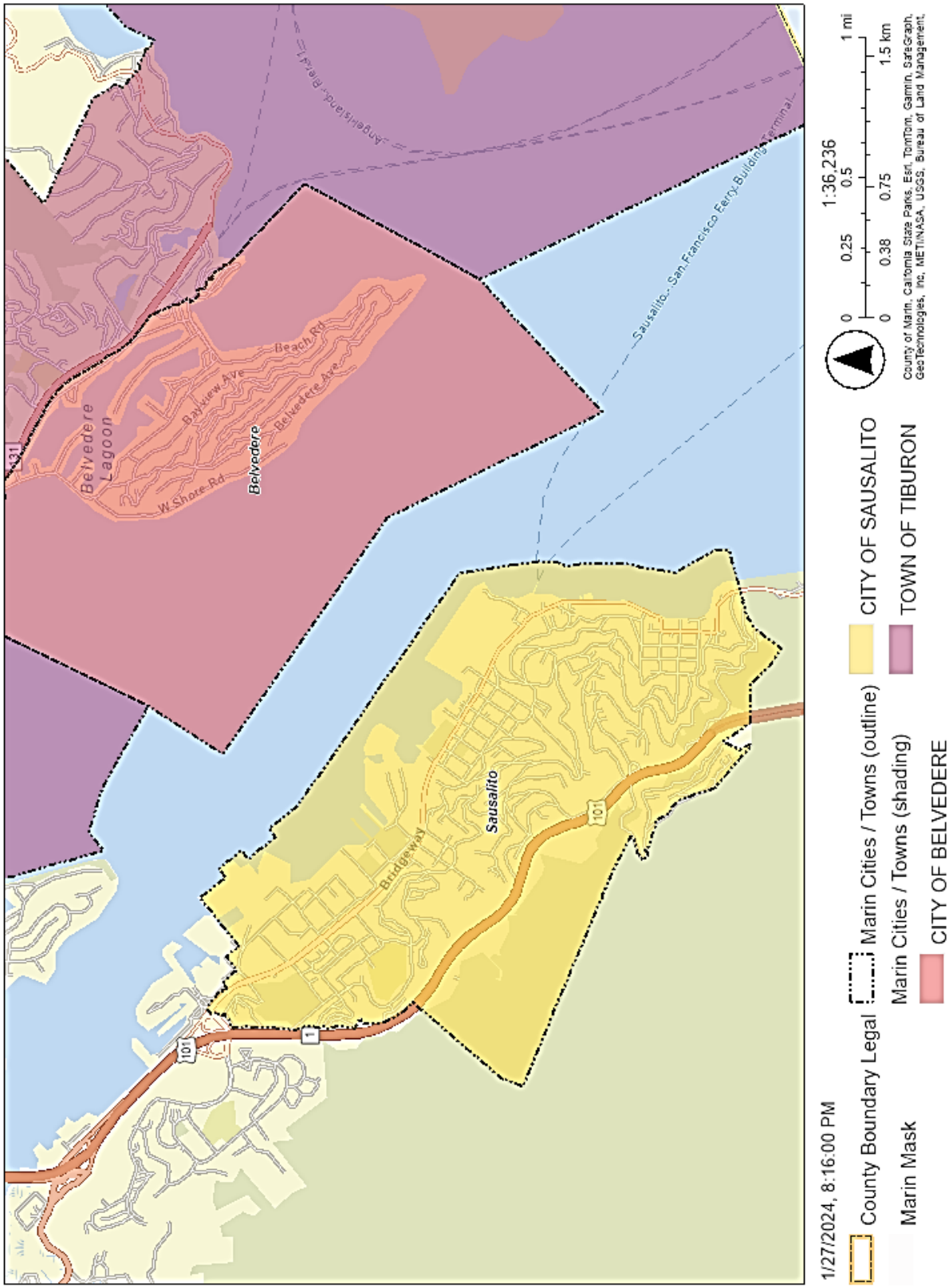


Figure 605: Map of the City of Sausalito
Source: Marin County OEM

1.4 GOVERNMENT

The City of Sausalito is governed by an elected five-person City Council responsible for passing local ordinances, approving the City budget, and setting strategic priorities for the City. The city council elects a mayor and vice mayor each year from its membership, the executive head of the City; and appoints a City Manager, the administrative head of the City. The city consists of 7 departments: the Administration, Community Development, Library, Parks and Recreation, Police, Public Works and has consolidated its fire department with other southern Marin jurisdictions as Southern Marin Fire.

The City Council assumes responsibility for the adoption of this plan; and the City Manager will oversee its implementation.

Southern Marin Fire Protection District is an independent special district established by the Marin County Board of Supervisors in July of 1999. The District was formed by the merger of the Alto-Richardson Fire Protection District and the Tamalpais Fire Protection District. On June 24, 2012, the City of Sausalito Fire Department was annexed into the fire District. The District has 63.5 full time employees.

The Sausalito Police Department was established in 1893 and is a full-time police department. Sausalito Police provides a professional and proactive response through Patrol, Investigations, Communications, Parking services, Training, various special assignments, and disaster preparedness.

1.5 WEATHER AND CLIMATE

The low areas City of Sausalito are approximately 10 feet above sea level. The majority of housing is located on the adjacent hillsides well above sea level. the industrial areas of Sausalito known as the Marinship are approximately 10 feet above sea level. In Sausalito, the summers are long, comfortable, arid, and mostly clear with the exception of fog sometimes occurring daily in the summers. The winters are relatively short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 43°F to 73.1°F. The difference in precipitation between the driest month and the wettest month is 4 inches. The annual rainfall is 33 inches. The month with the highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	113 (4)	118 (4)	83 (3)	40 (1)	21 (0)	6 (0)	2 (0)	2 (0)	3 (0)	25 (0)	57 (2)	111 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	2	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.9	6.5	7.8	9.1	9.1	9.3	7.4	6.8	7.6	7.3	6.8	5.8

Figure 606: The City of Sausalito Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of the Marin County OA and the City of Sausalito since the last plan update in 2018. Of the total estimated 257,135 residents of the Marin County OA in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The City of Sausalito had an estimated population of 7,449 in the 2018 plan. 2020 U.S. Census Survey estimated the City's population at 7,269. However, revised estimates for 2022 estimate the population to decrease to 7,072 population.

Table 4: City of Sausalito Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County OA	257,135	262,321	262,179	-1.92%
City of Sausalito	7,072	7,269	7,449	-5.06%

Table 317: City of Sausalito Estimated Jurisdictional Population
Source: California Department of Finance

According to the U.S. Census, the population of the City of Sausalito is 7,269 as of 2020.

Table 5 shows the population growth comparison of the State of California, County of Marin and the City of Sausalito between 2010 – 2020.

Table 5: Population Change of The City of Sausalito				
Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County OA	252,409	262,321	9,912	3.9%
Sausalito, City	7,449	7,269	180	-5.06%

Table 318: Population Change of The City of Sausalito
Source: City of Sausalito Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the City of Sausalito.

Table 6: Languages Spoken in Sausalito	
Primary Language Spoken	% of Population
English only	89.2%
Spanish	1.4%
Other Indo-European languages	6.6%
Asian and Pacific Islander languages	2.0%
Other languages	0.9%

Table 319: Languages Spoken in Sausalito
Source: US Census Bureau (2020)

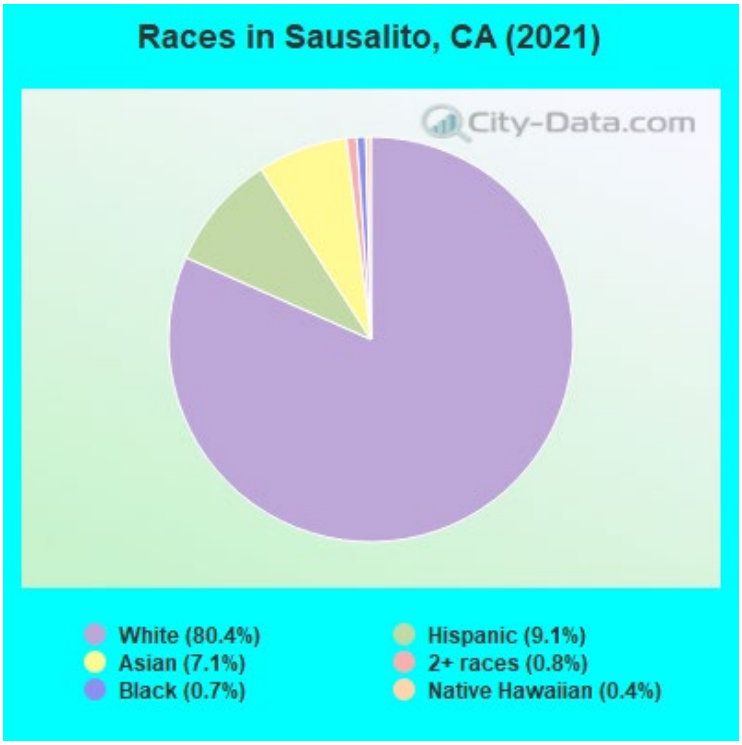


Figure 607: Races in Sausalito
Source: City-Data.com

Table 7: Marin County OA Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County OA							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
City of Sausalito							
2022	Number	4,435	1,711	802	934	906	82
	Percent	100.00%	38.58%	46.87%	116.46%	97.00%	9.05%
2018	Number	4,581	1,776	829	953	938	85
	Percent	100.00%	38.77%	46.68%	114.96%	98.43%	9.06%

Table 320: Marin County OA Jurisdictional Housing Stock
Source: California Department of Finance

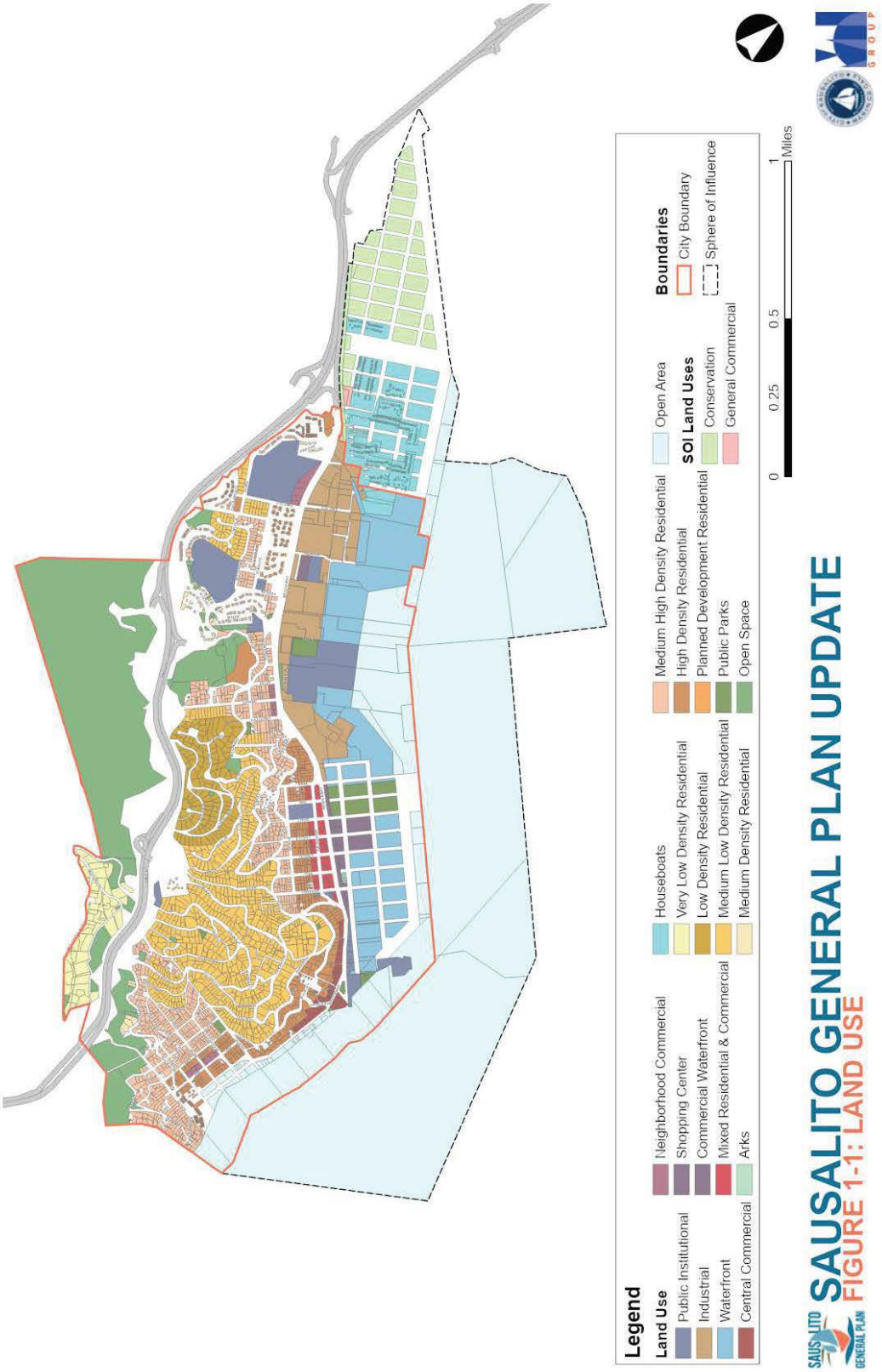


Figure 608: City of Sausalito Land Use Map
Source: City of Sausalito 2021 General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County OA MJHMP Hazards

NRI Hazards	Marin County OA MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 321: NRI Hazards and Marin County OA MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

Table 9 illustrates the NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03.

Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$704,009	Very Low	Very High	0.79	$553,971	87.3
Riverine Flooding	$48,101	Very Low	Very High	0.79	$37,850	72.8
Coastal Flooding	$5,117	Very Low	Very High	0.79	$4,026	86.2
Landslide	$3,202	Very Low	Very High	0.79	$2,519	80
Tornado	$3,181	Very Low	Very High	0.79	$2,503	5.8
Heat Wave	$359	Very Low	Very High	0.79	$282	17.1
Strong Wind	$188	Very Low	Very High	0.79	$148	6
Tsunami	$1	Very Low	Very High	0.79	$1	88.4
Drought	$0	Very Low	Very High	0.79	$0	0
Wildfire	$0	Very Low	Very High	0.79	$0	0

Table 322: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01
Source: FEMA National Risk Index 2023

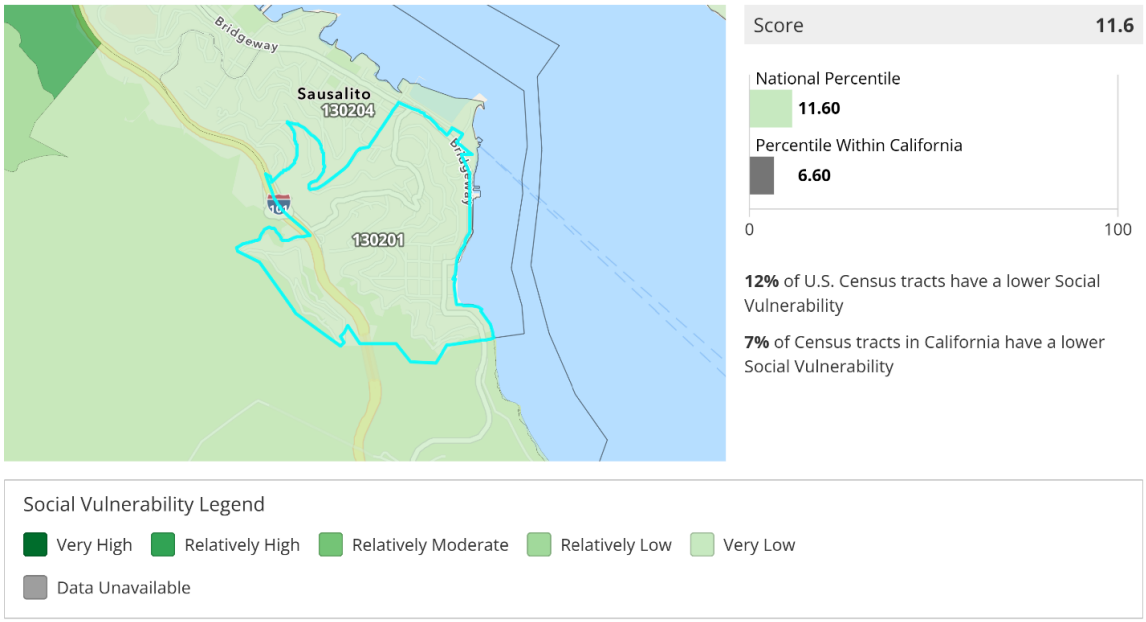


Figure 609: City of Sausalito Social Vulnerability Map Census Tract 1302.01
Source: FEMA National Risk Index 2023

Table 10 illustrates the NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03.

Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1022.03						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$277,560	Very Low	Very High	0.81	$224,222	82.3
Landslide	$7,589	Very Low	Very High	0.81	$6,131	92.2
Tornado	$1,283	Very Low	Very High	0.81	$1,037	2.9
Tsunami	$1,239	Very Low	Very High	0.81	$1,001	96.4
Wildfire	$200	Very Low	Very High	0.81	$162	40.9
Heat Wave	$176	Very Low	Very High	0.81	$142	16.4
Strong Wind	$86	Very Low	Very High	0.81	$70	3.6
Coastal Flooding	$10	Very Low	Very High	0.81	$8	71.8
Drought	$0	Very Low	Very High	0.81	$0	0
Riverine Flooding	$0	Very Low	Very High	0.81	$0	0

Table 323: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03
Source: FEMA National Risk Index 2023

Figure 10 illustrates the Social Vulnerability Map for Sausalito Census Tract 1302.03.

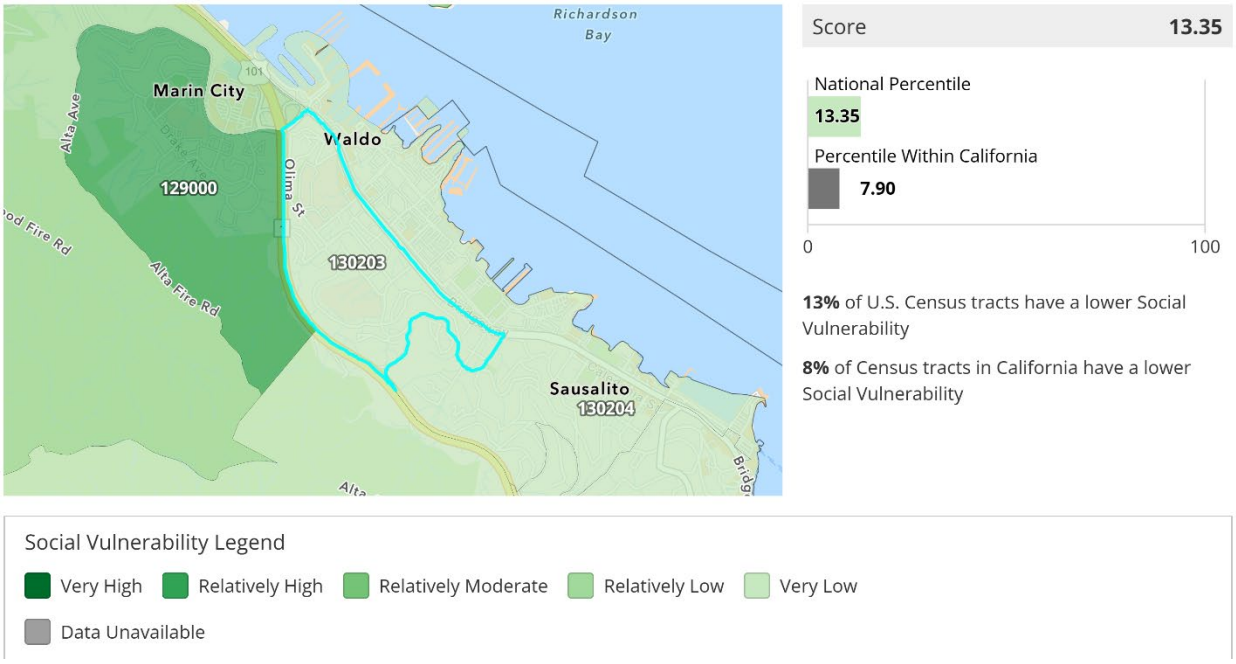


Figure 610: City of Sausalito Social Vulnerability Map Census Tract 1302.03
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,169,125	Very Low	Very High	0.58	$683,563	88.5
Riverine Flooding	$778,574	Very Low	Very High	0.58	$455,216	96.1
Coastal Flooding	$124,477	Very Low	Very High	0.58	$72,779	95.6
Tsunami	$14,622	Very Low	Very High	0.58	$8,549	99.1
Tornado	$3,340	Very Low	Very High	0.58	$1,953	4.6
Landslide	$2,262	Very Low	Very High	0.58	$1,322	69.1
Heat Wave	$852	Very Low	Very High	0.58	$498	18.3
Strong Wind	$166	Very Low	Very High	0.58	$97	4.5
Wildfire	$15	Very Low	Very High	0.58	$9	26.5
Drought	$0	Very Low	Very High	0.58	$0	0

Table 324: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04
Source: FEMA National Risk Index 2023

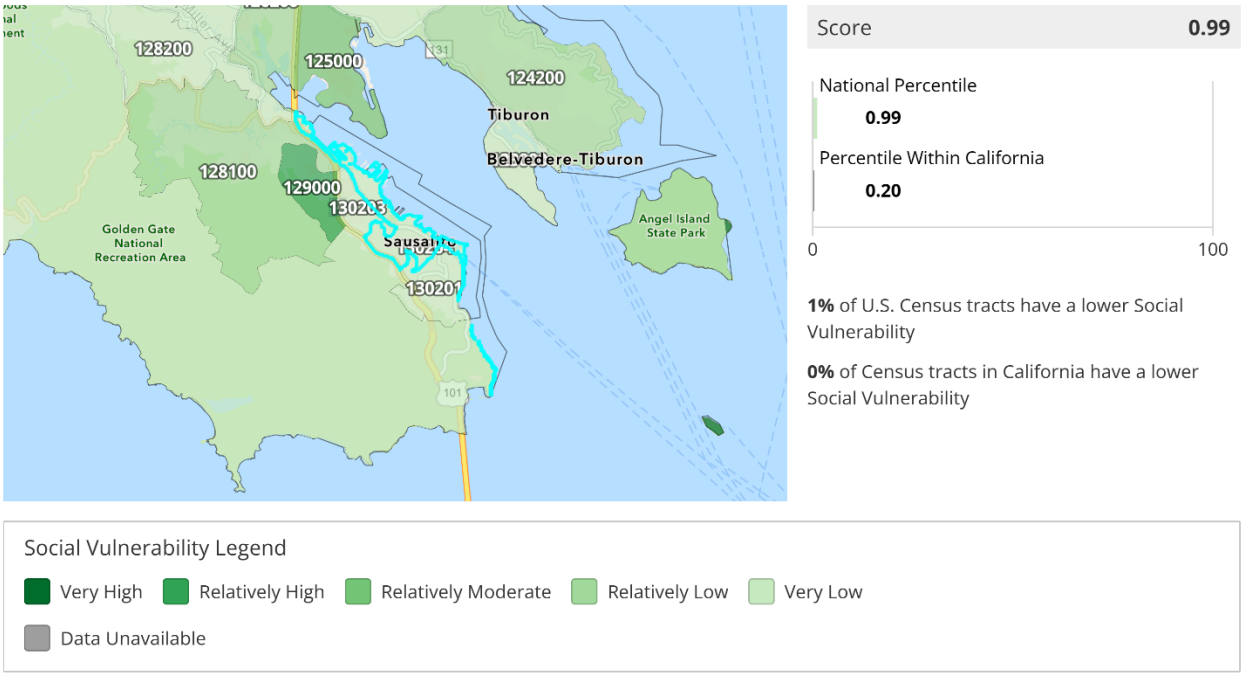


Figure 611: City of Sausalito Social Vulnerability Map Census Tract 1302.04
Source: FEMA National Risk Index 2023

Social Vulnerability in Sausalito and the Marin County OA

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

The median income for a household in the City of Sausalito was $140,410 and the per capita income for the City was $111,167. Approximately 0 percent of families and 7.3 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

Sausalito is committed to social equity, diversity, and racial justice and will focus its efforts to meet these challenges. The ultimate goal of this work is to eliminate racial inequities and improve outcomes for all racial groups, including removing barriers in policies and regulations that perpetuate inequity in our community.

Strengthening Sausalito's diversity will strengthen Sausalito. Communities with greater economic, racial, and social diversity are more resilient and sustainable, as well as more welcoming places to live and work. We will take action to ensure that Sausalito values and supports diversity and inclusion and will actively seek to develop a social and built environment that nurtures a diverse community, including providing attainable housing so that those who contribute to our community can also live in our community.

An equitable future requires that Sausalito incorporate social equity and racial justice in all of its work. Another area of particular concern is Climate Justice. Climate Change and environmental pollution disproportionately affects disadvantaged communities. In order for Sausalito to address the climate crisis, it will require a persistent regional approach on climate mitigation and resiliency that is inseparable from a commitment to social justice and racial equity. For example, the creation of attainable homes for anyone who works in the city will reduce our largest contributor to GHG emissions, which is transportation.

1.8 ECONOMY AND TAX BASE

Table 12 shows income by household in The City of Sausalito as of 2019.

Table 12: Household Income for The City of Sausalito as of 2021		
Household Income	Number	Percent
Total Households	4,117	-
Less than $10,000	111	2.7
$10,000 to $14,999	119	2.9
$15,000 to $24,999	78	1.9
$25,000 to $34,999	231	5.6
$35,000 to $49,999	136	3.3
$50,000 to $74,999	301	7.3
$75,000 to $99,999	391	9.5
$100,000 to $149,999	803	19.5
$150,000 to $199,999	618	15.0
$200,000 or more	1330	32.3
Median household income (dollars)	$140,417	
Mean household income (dollars)	$194,263	

Table 325: Household Income for The City of Sausalito as of 2019
Source: US Census Bureau American Community Survey 2021 Estimates

Table 13 shows the percentage of people in The City of Sausalito over the age of 16 employed by industry.

Table 13: City of Sausalito Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	4,126	-
Agriculture, forestry, fishing and hunting, and mining	27	0.65%
Construction	19	0.46%
Manufacturing	268	6.50%
Wholesale trade	114	2.76%
Retail trade	378	9.16%
Transportation and warehousing, and utilities	82	1.99%
Information	272	6.59%
Finance and insurance, and real estate and rental and leasing	524	12.70%
Professional, scientific, and management, and administrative and waste management services	1246	30.20%
Educational services, and health care and social assistance	760	18.42%
Arts, entertainment, and recreation, and accommodation and food services	241	5.84%

Other services, except public administration	139	3.37%
Public administration	56	1.36%

Table 326 City of Sausalito Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2021 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the City of Sausalito to fulfill the requirements of its mission during an emergency:

Table 14: City of Sausalito Critical Facilities

Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	VH	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	VH	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	H	X
Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	VH	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	H	X
School Lycee Francais	Private School, K-6	100 Ebbtide, Sausalito, CA	H	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	H	X
High Potential Loss Facilities				
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	H	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	M	X
Critical Infrastructure				
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	VH	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	M	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	U	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	H	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	H	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	VH	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	VH	X

Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	VH, H, M	X, VE, AE
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	H	X
Communications	MERA Radio Antenna Site - GGNRA nr Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	H	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	M, L	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	H	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	M	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	VH	X
Transportation	32 miles of City Roadways	Sausalito CA	VH, H, M	X, AE
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	H	D
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	H	X, AE
Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	M, H	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	VH	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	VH, H	X

Table 327: City of Sausalito Critical Facilities
Source: City of Sausalito

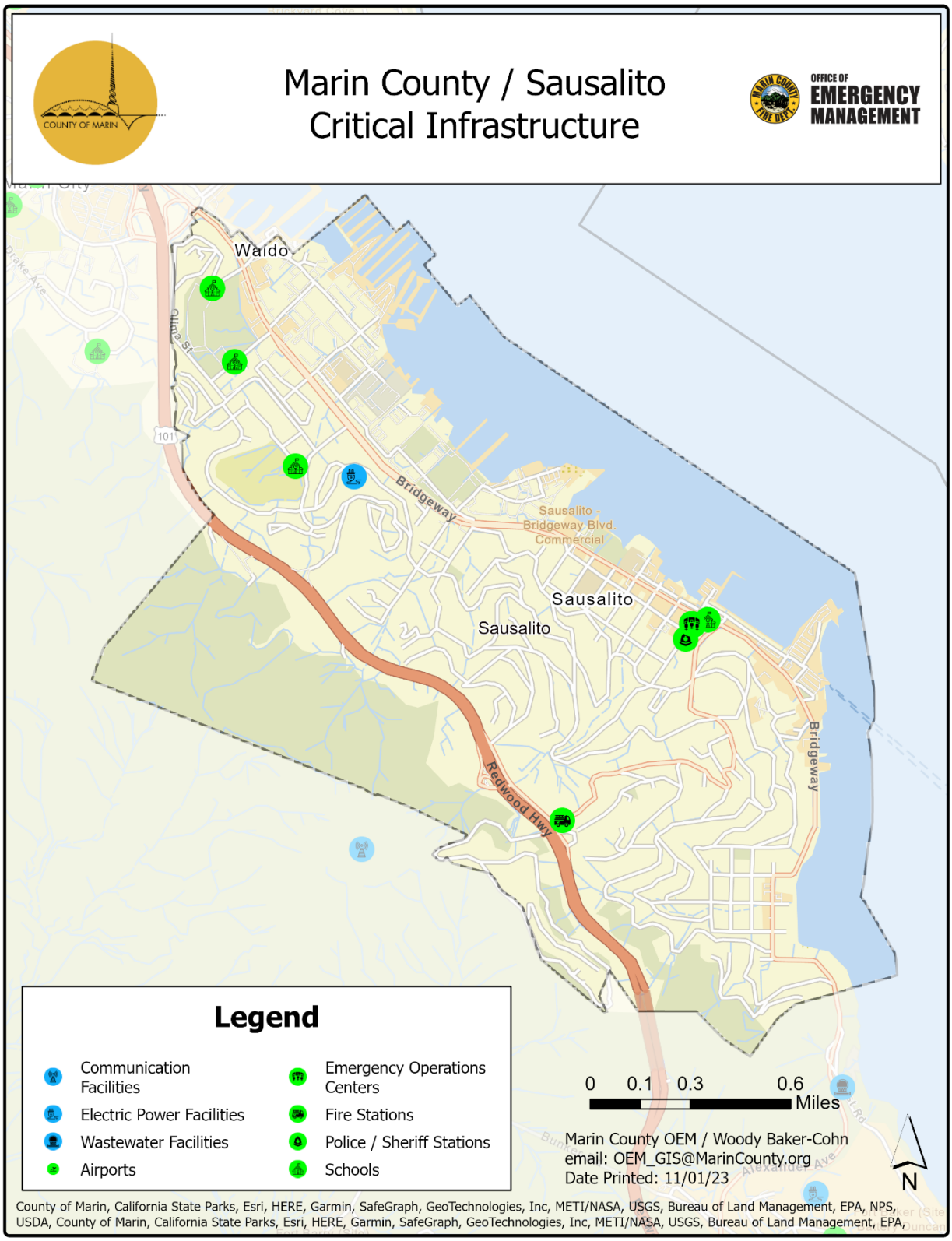


Figure 612: City of Sausalito Critical Facilities & Infrastructure
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The City of Sausalito has three registered historically significant homes, public buildings, or landmarks. To inventory these resources, the HMPC collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- City of Sausalito Chamber of Commerce.
- City of Sausalito website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

Table 15: Historic Sites In The City of Sausalito

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
William G. Barrett House	X			6/17/1980	Sausalito
Griswold House	X			9/12/1985	Sausalito
Point Bonita Light Station	X			9/3/1991	Sausalito

Table 328: Historic Sites In The City of Sausalito
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The City of Sausalito identified hazards that affect the city and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 14 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

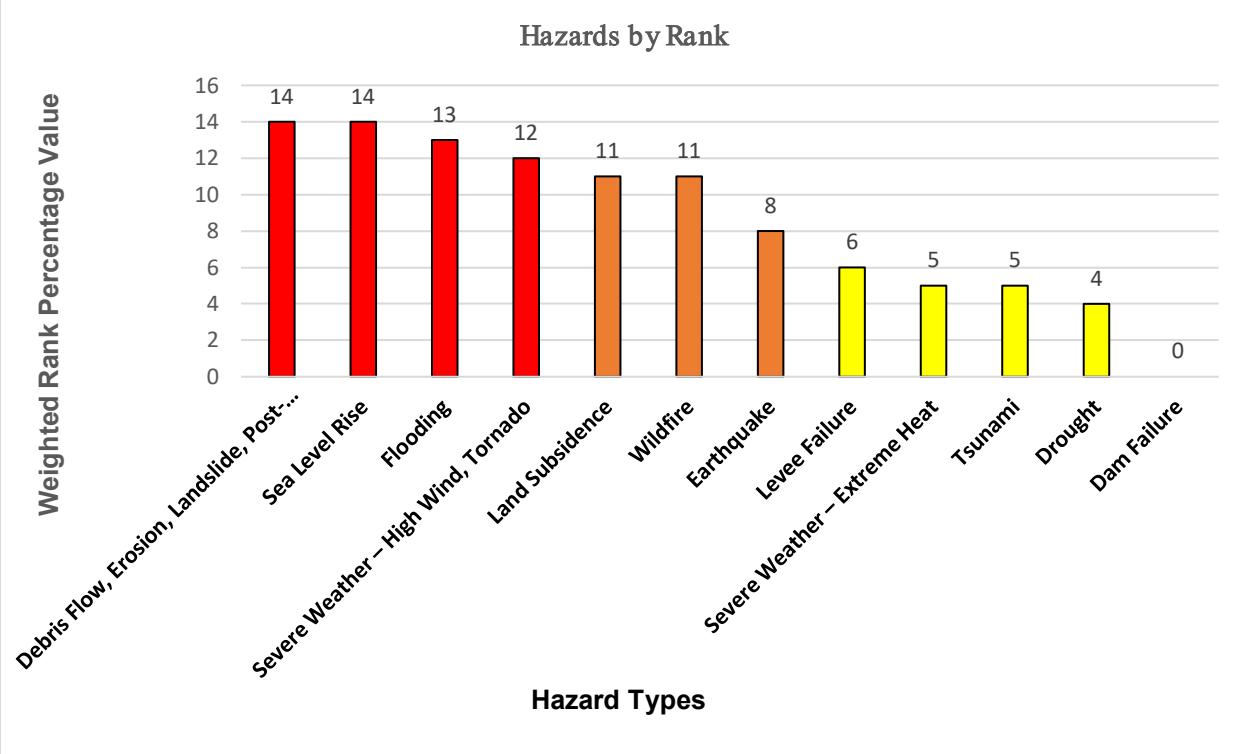


Figure 613: Marin County OA & City of Sausalito Risk Assessment – Planning Team Top Hazards

Figure 15: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 614: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 16: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 329: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

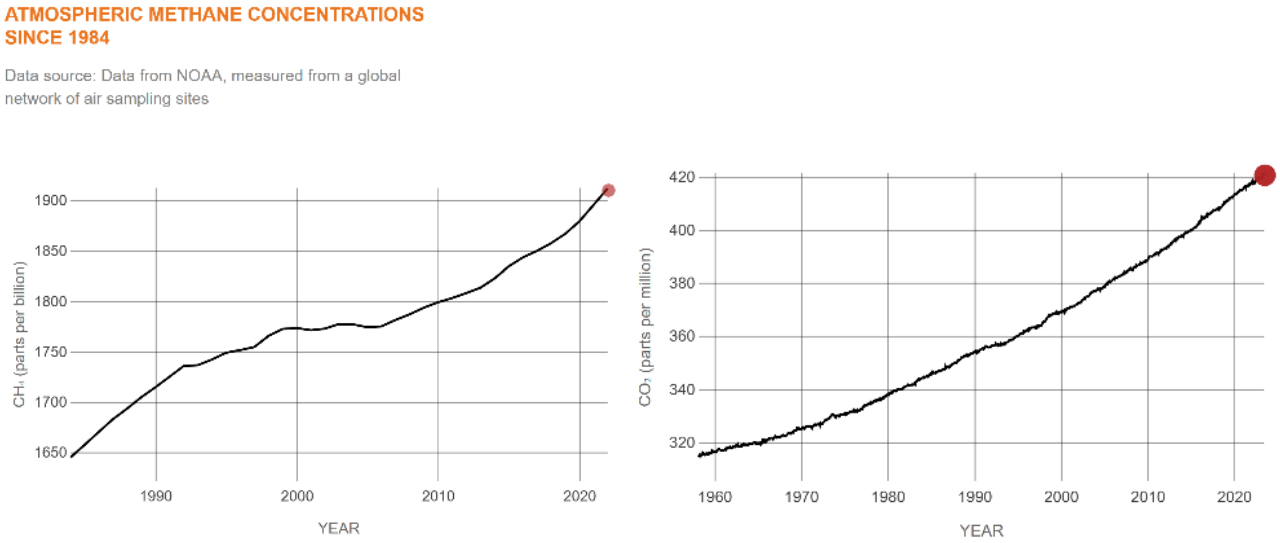


Figure 615: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

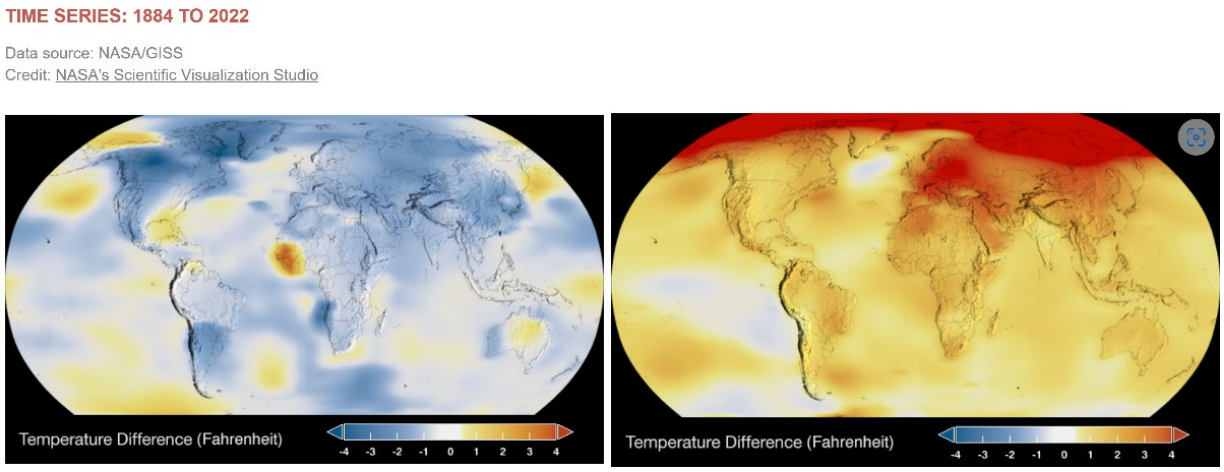


Figure 616: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

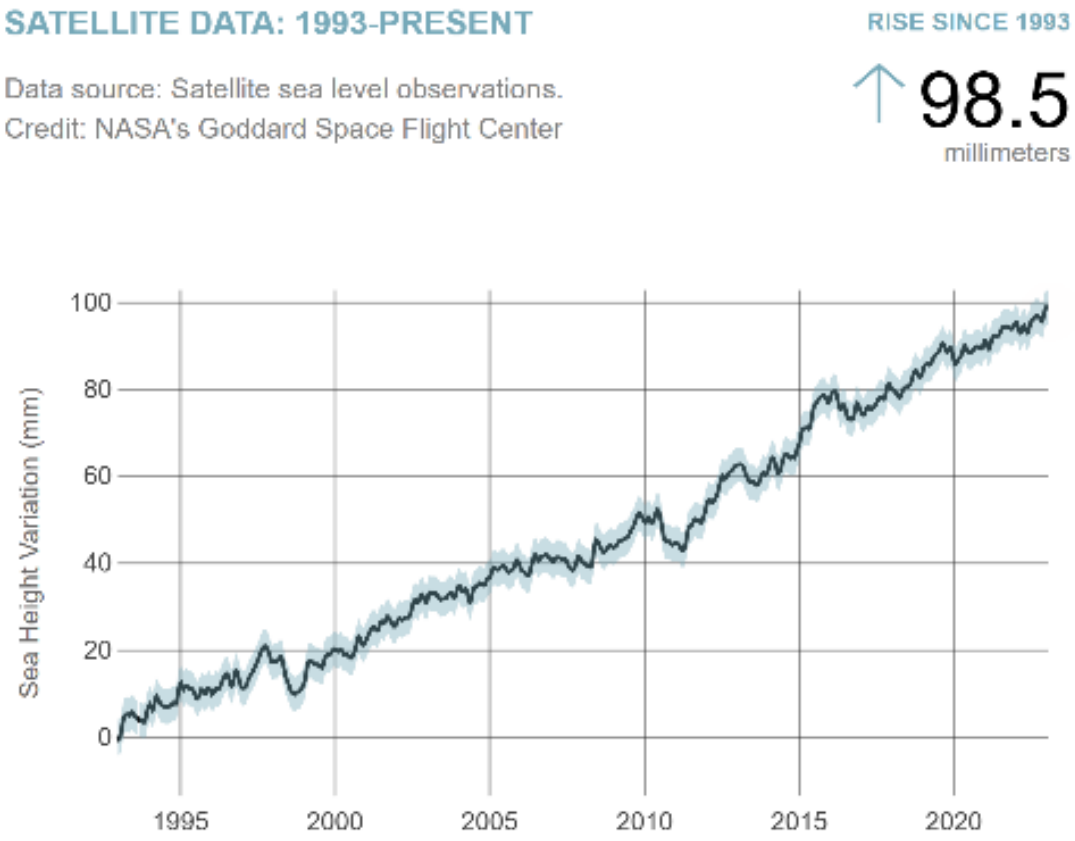


Figure 617: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.

- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, increased intensity of rain fall may occur and may become more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.

- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

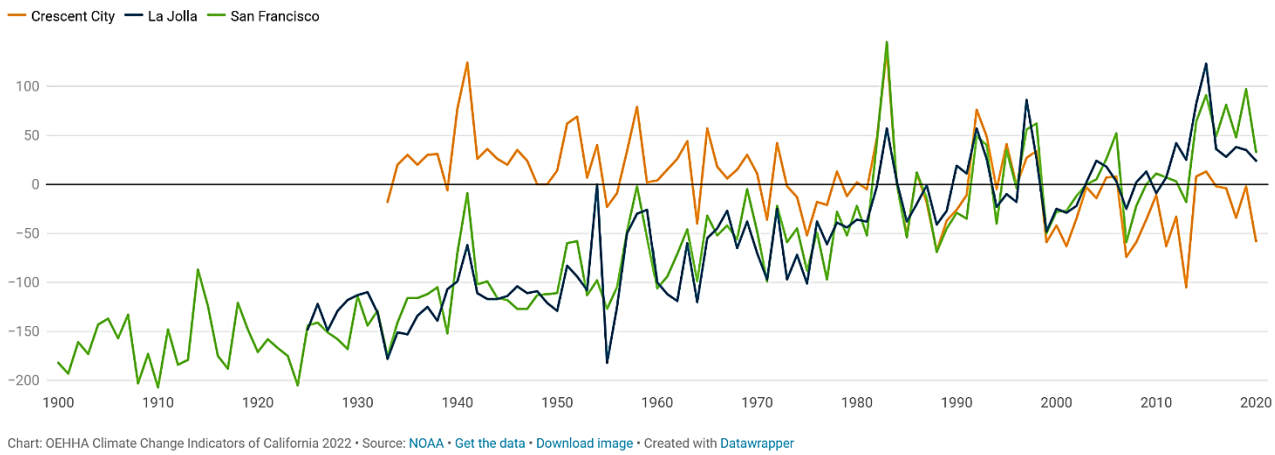


Figure 618: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable.

Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead

to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in the Marin County OA increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days

Climate change may continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations may also increase as they feel the immediate impacts of climate change more significantly and maybe less able to adapt to these changes and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of the Marin County OA and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in the Marin County OA. The model CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions by 40% below 1990 levels prior to 2030. The Marin County OA also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the City of Sausalito as per the planning team.

Table 17: Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Likely	Significant	Severe	Medium	High	**14.00**
Drought	Unlikely	Negligible	None	Low	Low	**4.00**
Earthquake	Occasional	Limited	Moderate	Low	Low	**8.00**
Flooding	Likely	Significant	Moderate	High	Medium	**13.00**
Land Subsidence	Likely	Limited	Moderate	Medium	Medium	**11.00**
Levee Failure	Occasional	Negligible	Weak	Low	Low	**6.00**
Sea Level Rise	Likely	Significant	Severe	High	Medium	**14.00**
Severe Weather – Extreme Heat	Unlikely	Negligible	Weak	Low	Low	**5.00**
Severe Weather – Wind, Tornado	Likely	Significant	Moderate	Medium	Medium	**12.00**
Tsunami	None	Limited	Weak	Low	Low	**5.00**
Wildfire	Occasional	Limited	Moderate	High	Medium	**11.00**

Table 330: City of Sausalito Hazard Risk Assessment
Source: City of Sausalito

Omitted Hazards

Dam Failure: The City of Sausalito does not have any exposure to flood water inundation resulting from a dam failure.

Table 18: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow, Erosion, Landslide, Post-Fire Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence (Sinkhole)	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 331: County of Marin Hazard Risk Assessment
Source: County of Marin

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 20 shows landslide susceptibility classes.

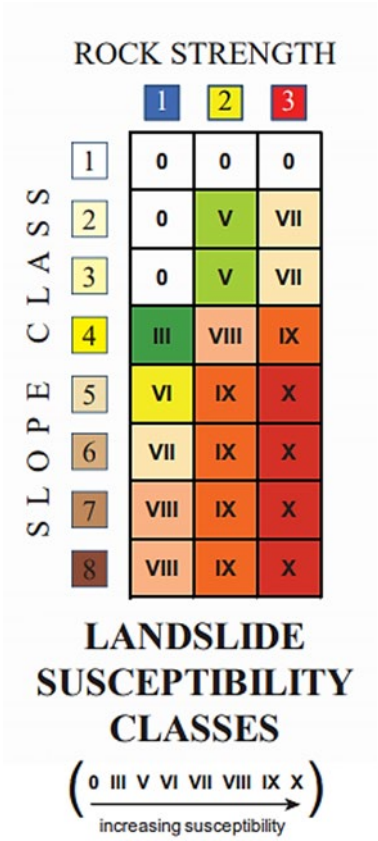


Figure 619: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. A mud flow can occur at anytime and are sometimes triggered by heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 21 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

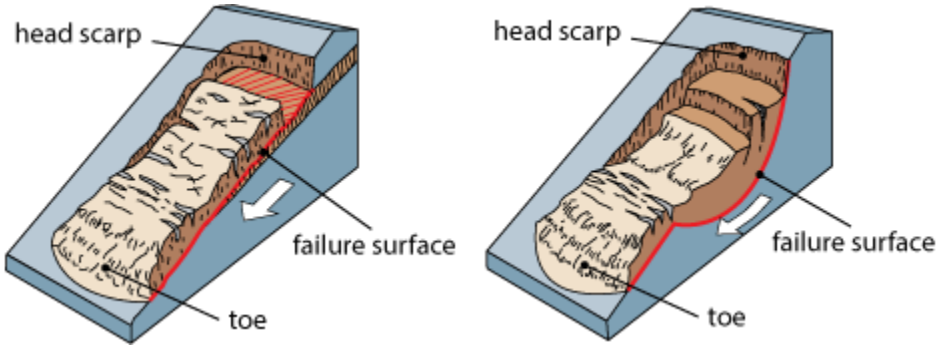


Figure 620: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

Parts of Sausalito are extremely susceptible to landslides due to the steepness of the terrain in the City. A landslide in Sausalito may occur on the western side of the city between Highway 101 and the Bridgeway where the terrain is steep and may be susceptible to soil movement. The western side of Sausalito is primarily residential with some businesses along sections of the Bridgeway. It consists of numerous winding streets and hillside homes that may sustain damage from soil movement in the area. All of Sausalito's critical facilities lie in areas of low landslide susceptibility but are adjacent to areas of high landslide susceptibility. Transportation challenges may be of particular concern with a landslide in the Sausalito. Major roads that traverse Sausalito, including all of Highway 101 and sections of the Bridgeway along with roads that connect Bridgeway with Highway 101 including Spencer Avenue/San Carlos Avenue and Rodeo Avenue/Nevada Street are located on steep hillsides which may be susceptible to landslides. Ingress and egress into part of Sausalito may be impacted by a landslide.

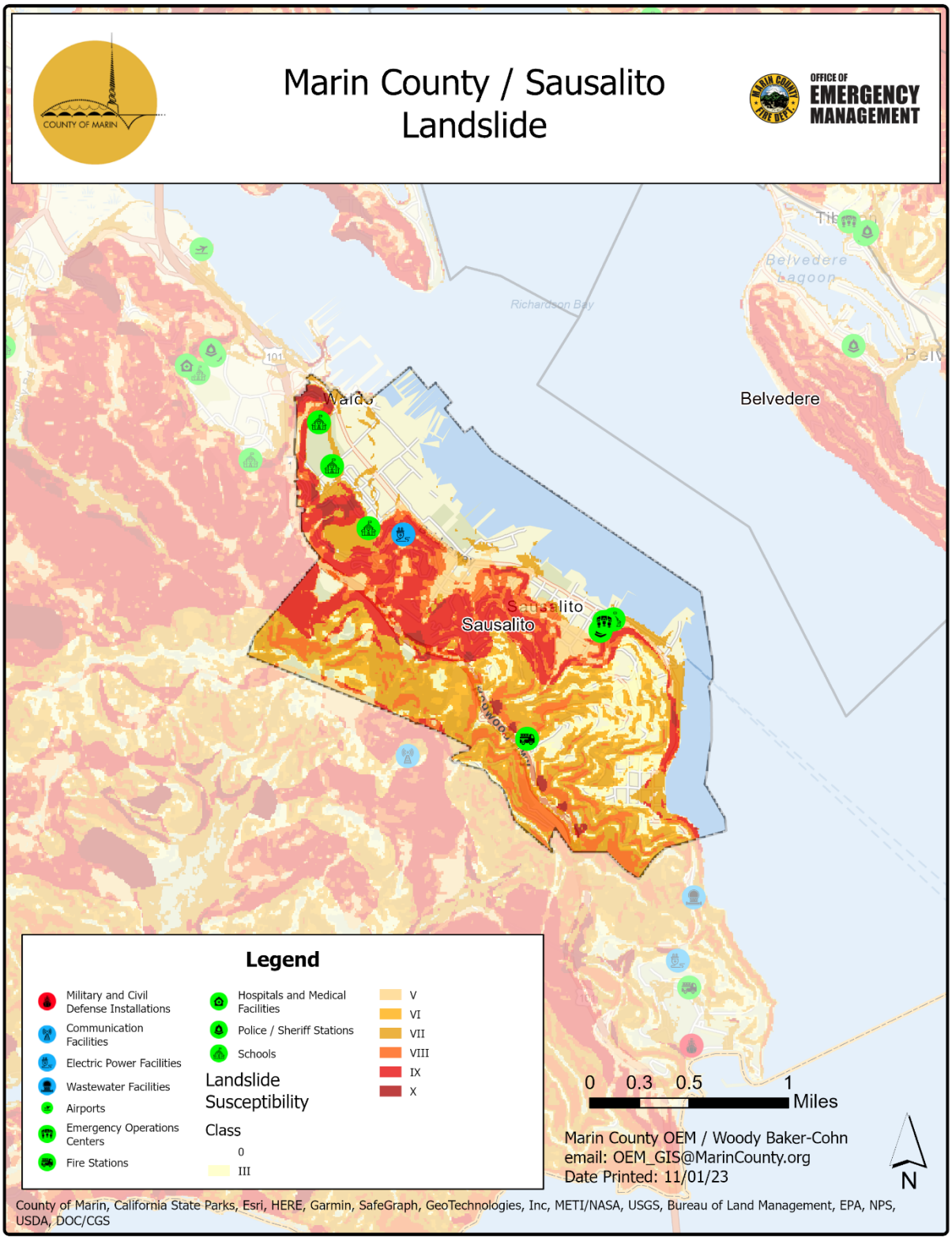


Figure 621: City of Sausalito Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads in this area could affect the ability of residents' ingress and egress to their property. Earthquakes also have a potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Sausalito may contribute to soil instabilities and pose a risk to properties and infrastructure in Sausalito's jurisdiction. several small watersheds originate above Sausalito in the Golden Gate National Park's jurisdiction and flow towards San Francisco Bay through Sausalito's jurisdiction. Erosion from these small watersheds can add to soil instability.

During the storms of 1982 severe storm caused numerous mudslides across the city and within the County of Marin. One such slide impacted a private home by moving the structure off its foundation and sending it into and adjacent structure which resulted in a fatality. The same storm event impacted Highway 101, above Sausalito, by developing a slide that closed Highway 101 which closed the main County of Marin highway. Further weakening of saturated soils threatened to destabilize a 250,000-gallon water tank.. Other soils instabilities occurred during this event including the north slope of the Waldo Grade area, weakening Highway 101 and threatening collapse of the Robin Williams (then Waldo) Tunnel which is located above the city. On 2/14/2019 a storm caused 50 homes to be evacuated after a mudslide occurred on National Park Property in the Hurricane Gulch neighborhood, sending at least one home sliding 75 yards down a hill. Sausalito Boulevard and Crescent Avenue were inundated with mud during the event. The landslide caused hundreds of thousands of dollars in damage. The City as well as the state and federal government declared the event a disaster .

Figure 622: Mudslide in Sausalito – 2019
Source: San Jose Mercury News

12/12/2022 – A landslide closed all southbound lanes of Highway 101, affecting traffic.

The city of Sausalito formed a Landslide Task Force following the events of 2019. The task force developed recommendations for the city to consider including but not limited to the development of a Geologic Hazard Study of Sausalito. That study has been initiated and is expected to be completed in early 2024. Other recommendations from the Landslide Task force may be considered such as establishing geologic hazard areas or possible code changes to address known instabilities.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry

stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[41], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Sausalito that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Sausalito could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris after a major rain event, particularly in the area between Highway 101 and the Bridgeway. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls

[41] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of Sausalito and Marin, though its effects would be most felt in the hillside areas where the risk of wildfire may increase. Dry trees throughout the City may become a safety hazard to the public due to falling trees or its limbs.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Sausalito may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and the Sausalito, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Sausalito. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including Sausalito where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Sausalito, increasing the chances of brush fires there. Future development in this area and in the mountainous areas of Sausalito could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Sausalito can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 24).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 623: Modified Mercalli Intensity Scale
Source: USGS

Figure 25 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 624: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 26). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 625: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning, there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. An earthquake could occur anywhere in and around Sausalito due to the number of active faults within and near the Marin County OA.

Earthquake Shake Intensity

The colors on Figures 27 and 28 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

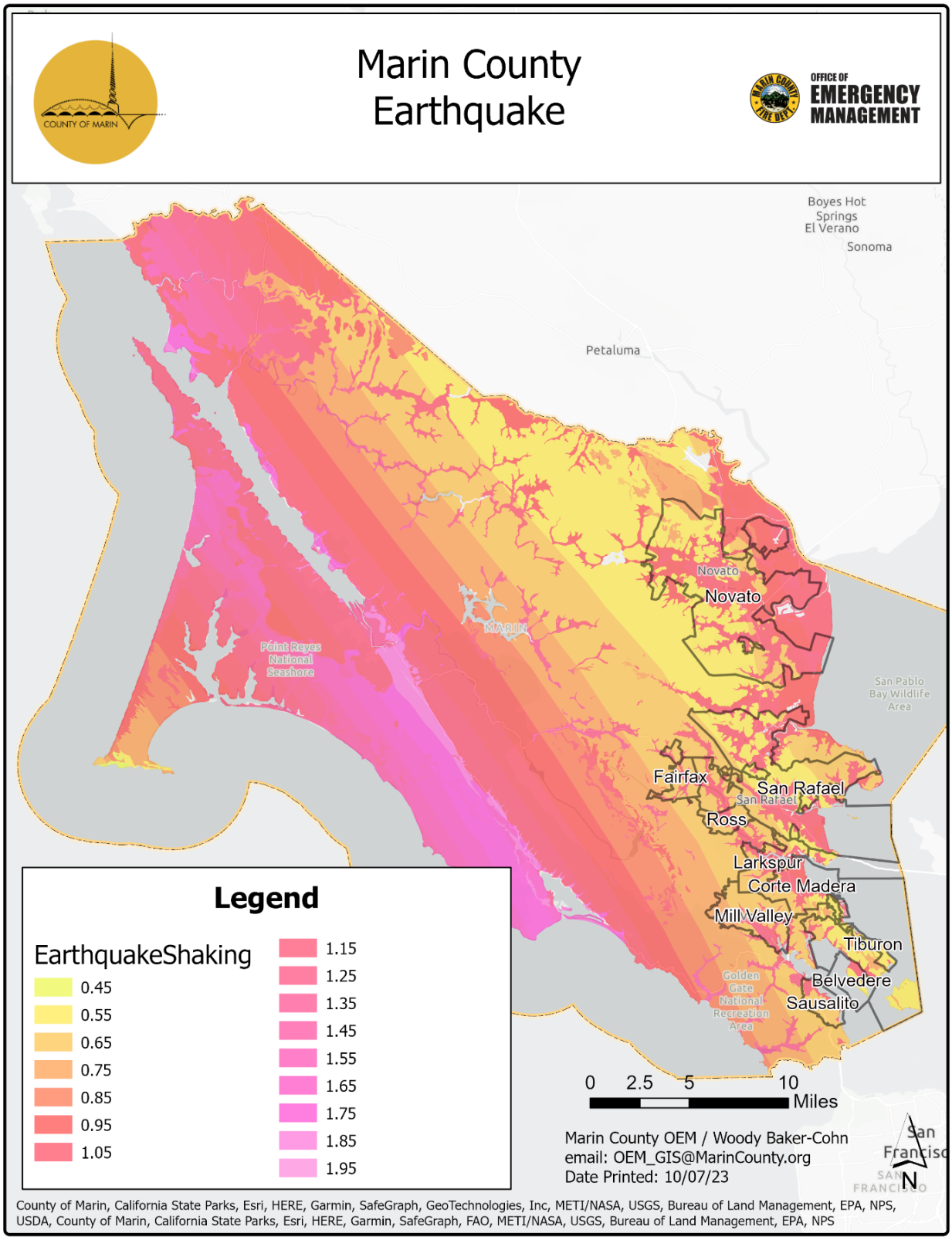


Figure 626: Marin County OA Earthquake Impact and Fault Lines
Source: Marin County OEM

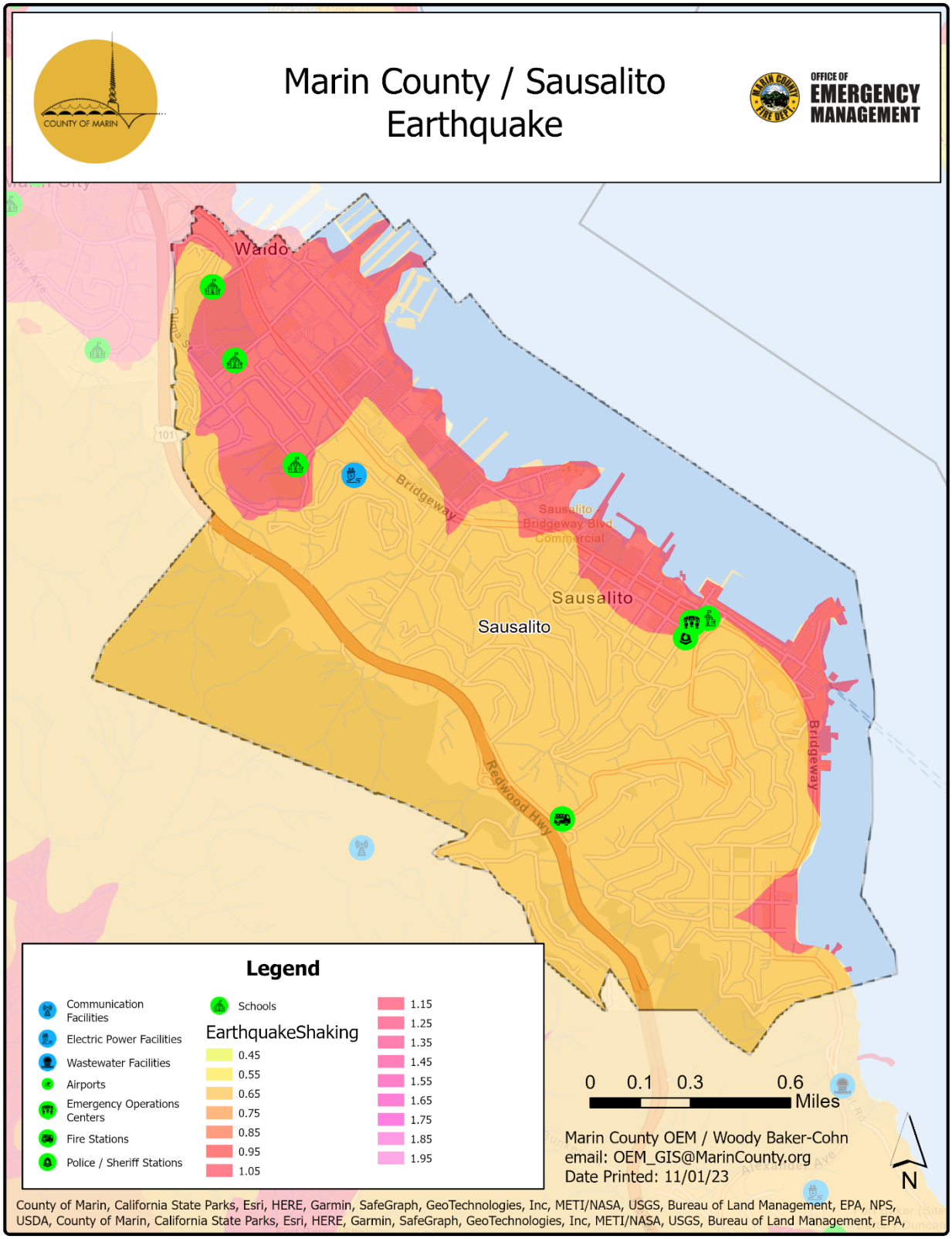


Figure 627: City of Sausalito Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Sausalito is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region may have major impacts to the City. There is increased risk of shaking and liquefaction in Sausalito from an earthquake, particularly in the lowland areas north and east of Bridgeway where superficial deposits and fill are more prevalent. This includes residences and the primary commercial areas the Bridgeway corridor where there are numerous businesses, marinas and other docking facilities. A residential neighborhood that includes the Lycee Francais de San Francisco and the Dr. Martin Luther King Jr. Academy also lies in this area, along with the part of the Southern Marin Fire District Station #1 and the City's Police Station. The highest risk areas due to liquefaction are in the Marinship area, which was filled in for the building of the wartime Marinship shipyards in 1942. Other areas along Bridgeway in the downtown area were also filled to create new space for housing and businesses in the late 1800's. There may also be increased risk of landslides in Sausalito due to an earthquake based on the steepness of the terrain throughout the city. This includes most of the residential area of Sausalito west of Bridgeway and central part of the City between Highway 101 and the Bridgeway. Vulnerable structures include a bridge and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the city may also be impacted by an earthquake.

Landslides in Sausalito as a result of an earthquake may cause damage to homes and roads as a result of shifting soils.

Sausalito hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Sausalito.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Sausalito, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[42], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Sausalito. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Sausalito downtown, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

[42] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally resulting from prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity of rainfall and distribution of overland flow, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization and geomorphology. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by intense and continued rains, sometimes combined with snowmelt, increased discharges from upstream dams, and intense flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures such as culverts and bridges. Flooding is more severe when antecedent rainfall has resulted in saturated soil conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of intense rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious

surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk of flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause soil saturation, extensive flooding and other impacts such as landslides. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 29.

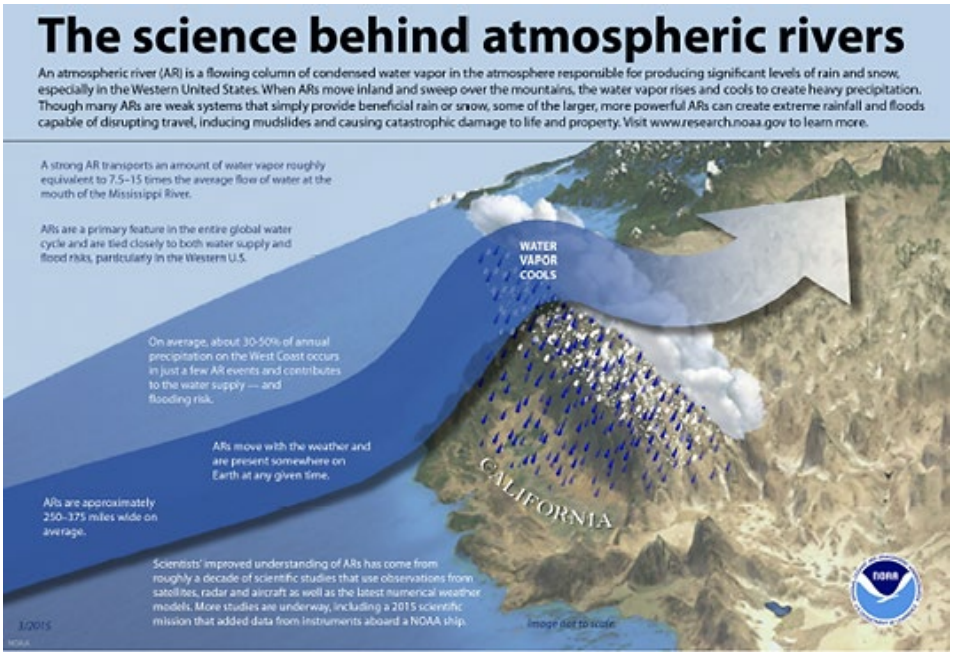


Figure 628: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Sausalito has a total of five primary drainage basins which lead to small riparian streams which drain to San Francisco Bay. Flooding in Sausalito generally results from a combination of high tides and storm runoff in low-lying areas along Richardson Bay. Sunny-day king tide flooding has become a common occurrence in Sausalito. Several lowland areas in Sausalito are in the 100-year floodplain, with several areas in the 500-year floodplain. The central commercial area of Sausalito and a southern area along both sides of the Bridgeway lies in the 500-year floodplain. A large commercial area, known as the Marinship, in the northern part of the City between the Bridgeway and Richardson Bay lies in the 100-year floodplain. There are numerous commercial buildings and businesses in this area, along with some residences that could be susceptible to flooding. Most of Sausalito's critical facilities lie outside of the floodplain, but part of the Southern Marin Fire Protection District Station #1 lies in the 500-year floodplain and could be susceptible to flooding.

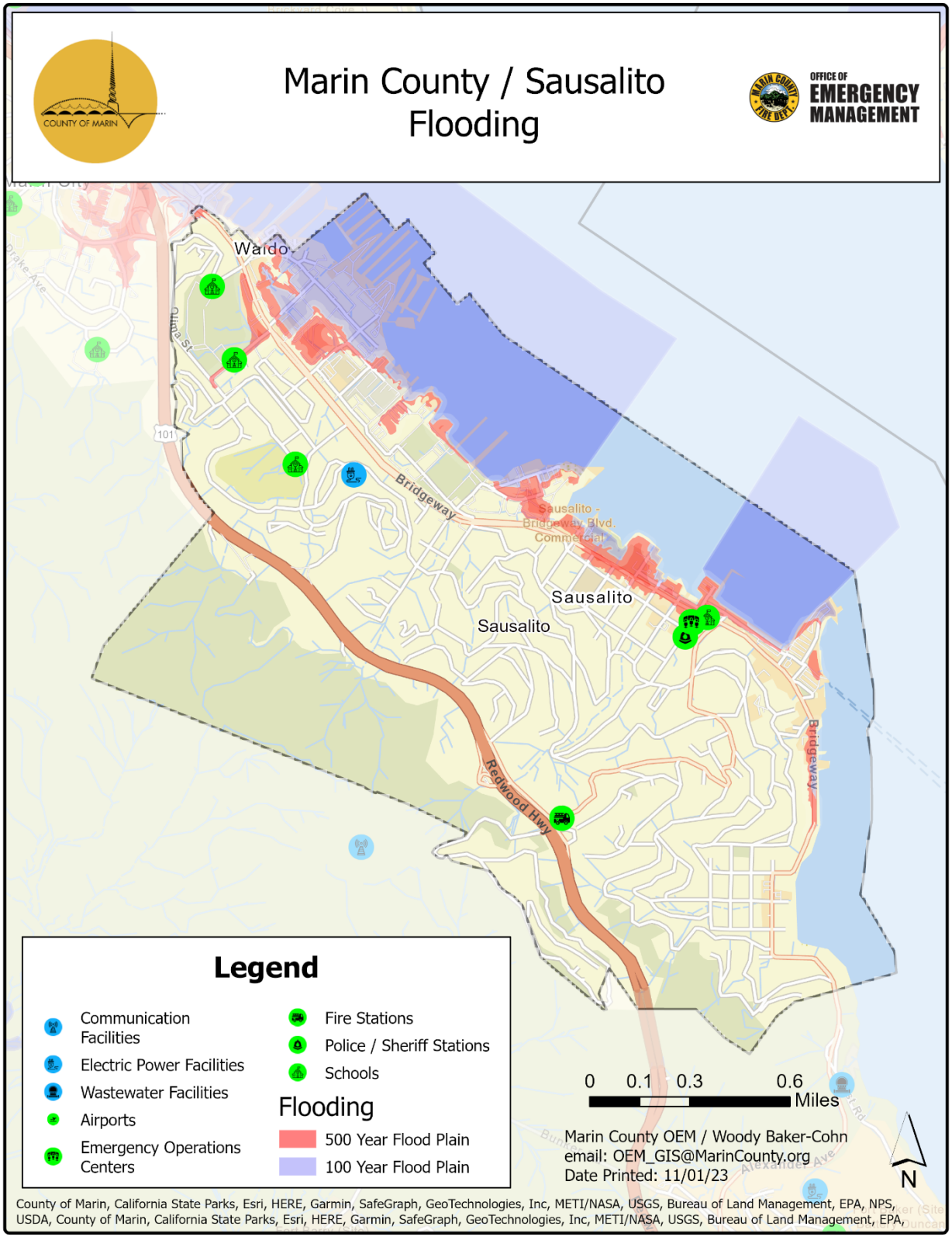


Figure 629: City of Sausalito Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 19 shows the number of City of Sausalito critical facilities by flood zone.

Table 19: City of Sausalito Critical Facilities

Category	Name	Address	Flood Zone
Critical Facilities			
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	X
Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	X
School Lycee Francais	Private School, K-6	100 Ebbtide, Sausalito, CA	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	X
High Potential Loss Facilities			
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	X
Critical Infrastructure			
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	X
Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	X, VE, AE
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	X
Communications	MERA Radio Antenna Site - GGNRA near Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	X
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	X
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	X, AE

Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	X

Table 332: City of Sausalito Critical Facilities in the Flood Zones
Source: County of Marin/FEMA DFIRM

Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay have the potential to significantly impact the Sausalito storm drain system. Sausalito already sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. There is frequent flooding of Gate 5 Road and Swede's Beach.

On 12/21/2022, king tides in Sausalito caused flooding along the San Francisco Bay Trail. The City worked to ensure that drains and debris were clear.

Figure 630: Sausalito Flooding – San Francisco Bay Trail - 2022
Source: Marin Independent Journal

On 1/3/2018, a king tide caused flooding in Sausalito, inundating the shoreline in several places.

Figure 631: Sausalito Flooding – San Francisco Bay Trail - 2028
Source: Marin Herald

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Figure 632: Sausalito Flooding – Gate 5 Road - 2010
Source: Sausalito Waterfront

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[43] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Sausalito. Climate change is expected to alter rainfall patterns in Northern California,

[43] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Sausalito will likely experience more rain inundation events that lead to flooding and increase the potential threat of levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding and storm surge in the lowland areas of the Marin County OA including the shoreline areas of Sausalito. Future development in these areas will expose more people and infrastructure to the effects of flooding.

2.2.5 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, changes in subsurface water levels, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

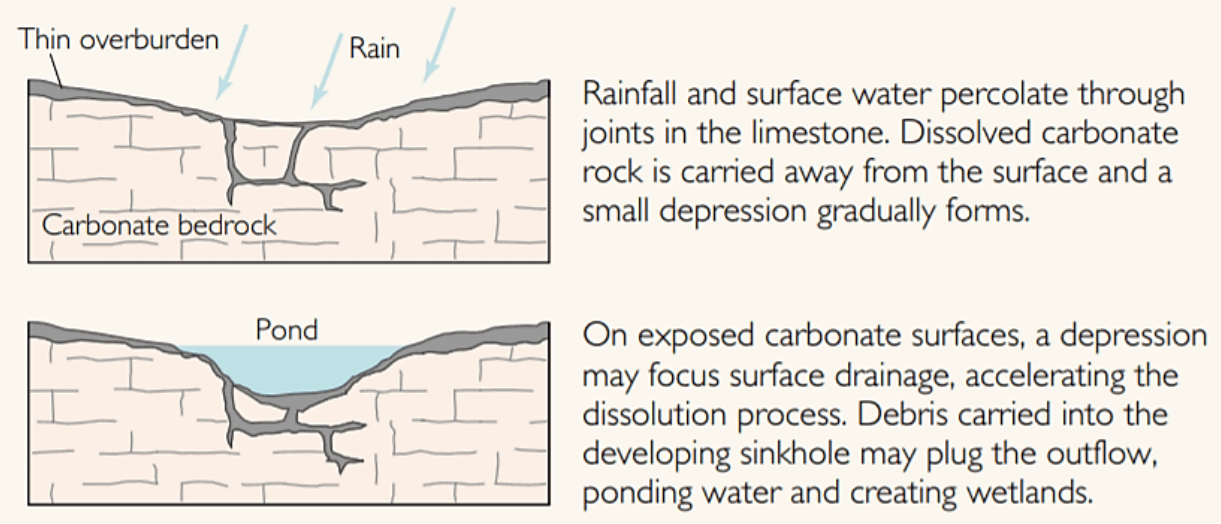


Figure 633: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 35 for a picture and description of how cover-subsidence sinkholes form.

Subsidence can also occur in bay mud areas which are prevalent around San Francisco Bay. Bay Mud, which has very little strength, can move and shift over long periods of time and is also affected by other natural events such as earthquakes, storm activities, water pressure and composition. Older construction of buildings placed on fill material on Bay Mud are susceptible to differential settlement which affects the service life of the structures as well as utilities, roadways and other infrastructure that supports these areas. The Marinship area and other low elevation areas built on bay mud have experienced significant differential settlement over time.

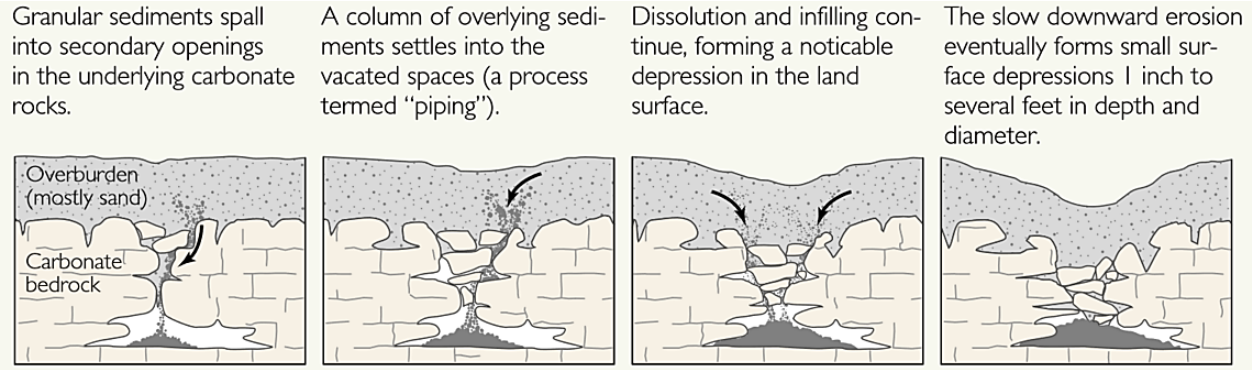


Figure 634: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 36 for a picture and description of how cover-collapse sinkholes form.

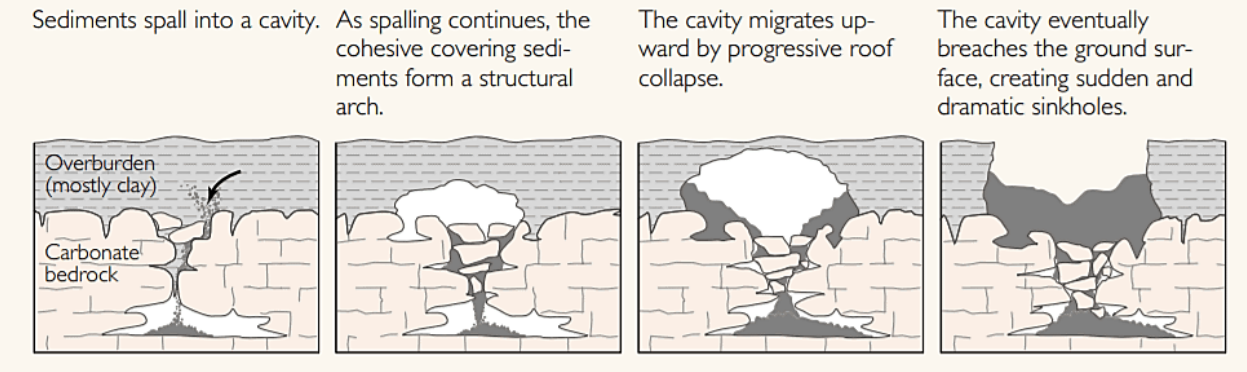


Figure 635: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed, and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the lowland areas of Sausalito along Richardson Bay where superficial deposits and fill are more prevalent. This includes the primary commercial area of City along the Bridgeway where Marinship was located. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for Sausalito, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

On 8/24/2020, a small sinkhole formed at the corner of Spring Street and the Bridgeway. It was caused by a leaky corrugated storm drainpipe under the Bridgeway.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Sausalito, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Sausalito as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Sausalito could increase with future development in the lowland populated areas of the city, particularly the downtown shoreline area, where land subsidence is more likely to occur.

2.2.6 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides which places excessive loading on the levee system. During a period of intense rainfall, the water on the water-body side of the levee can build up and either flow over the top (“overtopping”) or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water may wash away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

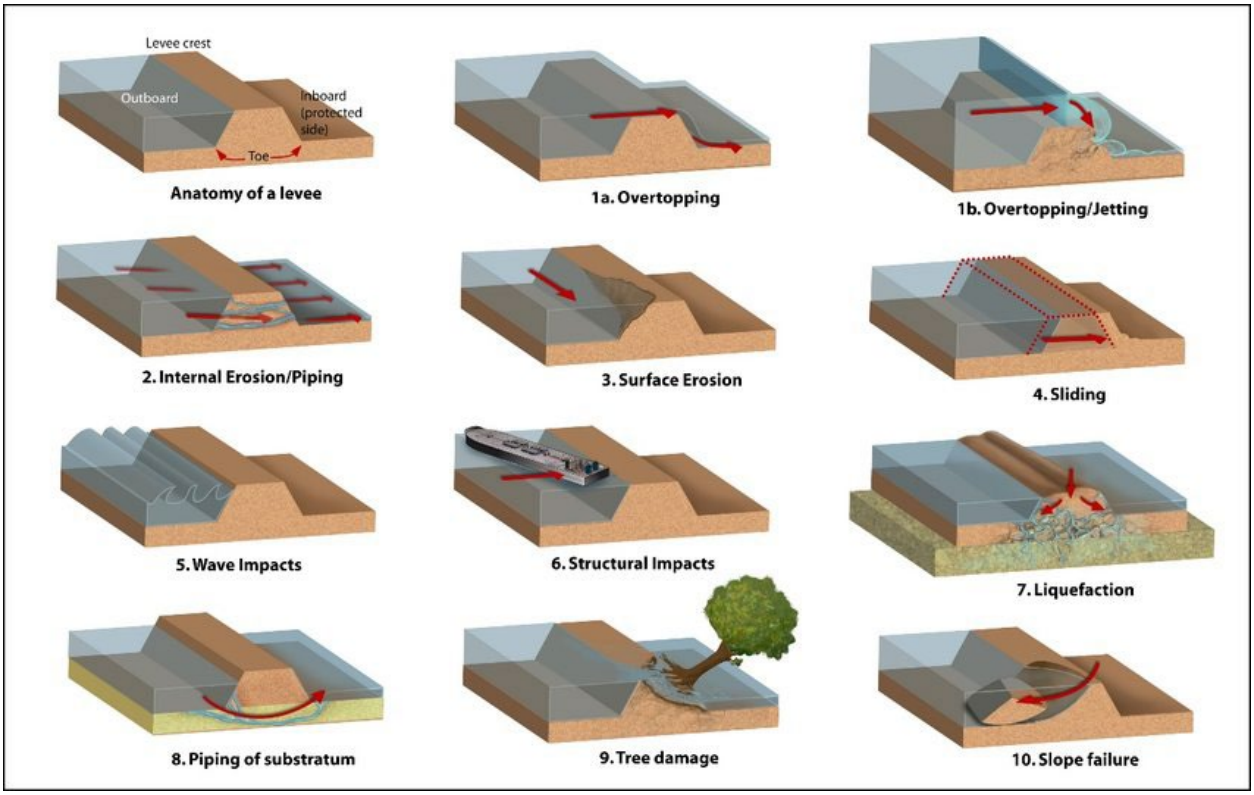


Figure 636: Levee Failure Mechanisms
Source: University of California

Sausalito has no certified levee systems; however, certain areas utilize roadways which are above the mean high tide level which may act as levee systems to protect inland properties. There has never been a failure of any of these systems.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Sausalito, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Sausalito, particularly during a major tidal event and potential tsunami.

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

The lowland areas of Sausalito, including the Marinship area and areas located on the east side of Bridgeway Blvd. including several commercial areas and harbor facilities, are vulnerable to sea level rise may experience between one and six feet of inundation based latest predictions of sea level rise in this area in the next 100 years.

Numerous businesses and residences and part of the Southern Marin Fire Protection District Station #1 lie in areas of Sausalito susceptible to sea level rise. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates t that Sausalito could anticipate impacts to over 7,000 people and over 265 living units with $400 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, twenty-six acres of the city could be exposed to sea level rise. In the long-term, 84 acres of the city could be exposed to sea level rise; and 150 acres could be exposed with an additional 100-year storm surge. Several shoreline restaurants, hotels, and business could be vulnerable to flooding in the near-term. Numerous assets in the low-lying areas primarily east of Bridgeway may be vulnerable to storm surges and sea level rise. Northerly access to Sausalito could be blocked in the Waldo Point community near Gate 6 Road. Shoreline homes in Old Town could be impacted by erosion, storm surges, and high tides. Bridgeway leading to Old Town is also vulnerable in the long-term. The main wastewater force main leading to Sausalito Marin City Sanitary District treatment plant is in places under Bridgeway Blvd. Swede's and Tiffany beaches, and all other shoreline parks, could be vulnerable in the near term. Inflow and infiltration of tide waters into underground pipes could increasingly burden the wastewater treatment facilities. Several small shoreline parks and festival areas at Schoonmaker Point are susceptible to flooding, degrading public facilities and impeding public use. Several residents live in boats in marinas and unauthorized boats out in Richardson's Bay that are especially vulnerable during storms and could be vulnerable to damage at the marinas that host them. Sea level rise is projected to inundate parts of Sausalito's Downtown Historic District in the near term, with storms expanding the vulnerable area and exacerbating impacts. Both water and land routes to Sausalito's Downtown Historic District could be vulnerable in the near-term. The Sausalito Ferry terminal could experience inundation in the near-term. In the long-term, parts of Bridgeway could be tidally flooded, and impacts will worsen with storms. In other parts of Sausalito, a handful of private properties on the city's Historic Resources Inventory could also be vulnerable to sea level rise. Sausalito's Ark Row District includes seven noteworthy properties vulnerable to more than six feet of water in the near-term and more than six feet of water in the long-term. An additional ten other properties could be vulnerable in the long-term, including the original firehouse. Two of Sausalito's landmark buildings, Castle by the Sea and the Ice House, could be vulnerable to a 100-year storm surge in the long-term. Marinship was built on bay fill on top of bay mud, and some areas, such as Heath Way, have experienced approximately five feet of subsidence since 1943 based on photographic records and are more susceptible to sea level rise. This is a primary employment area in the city.

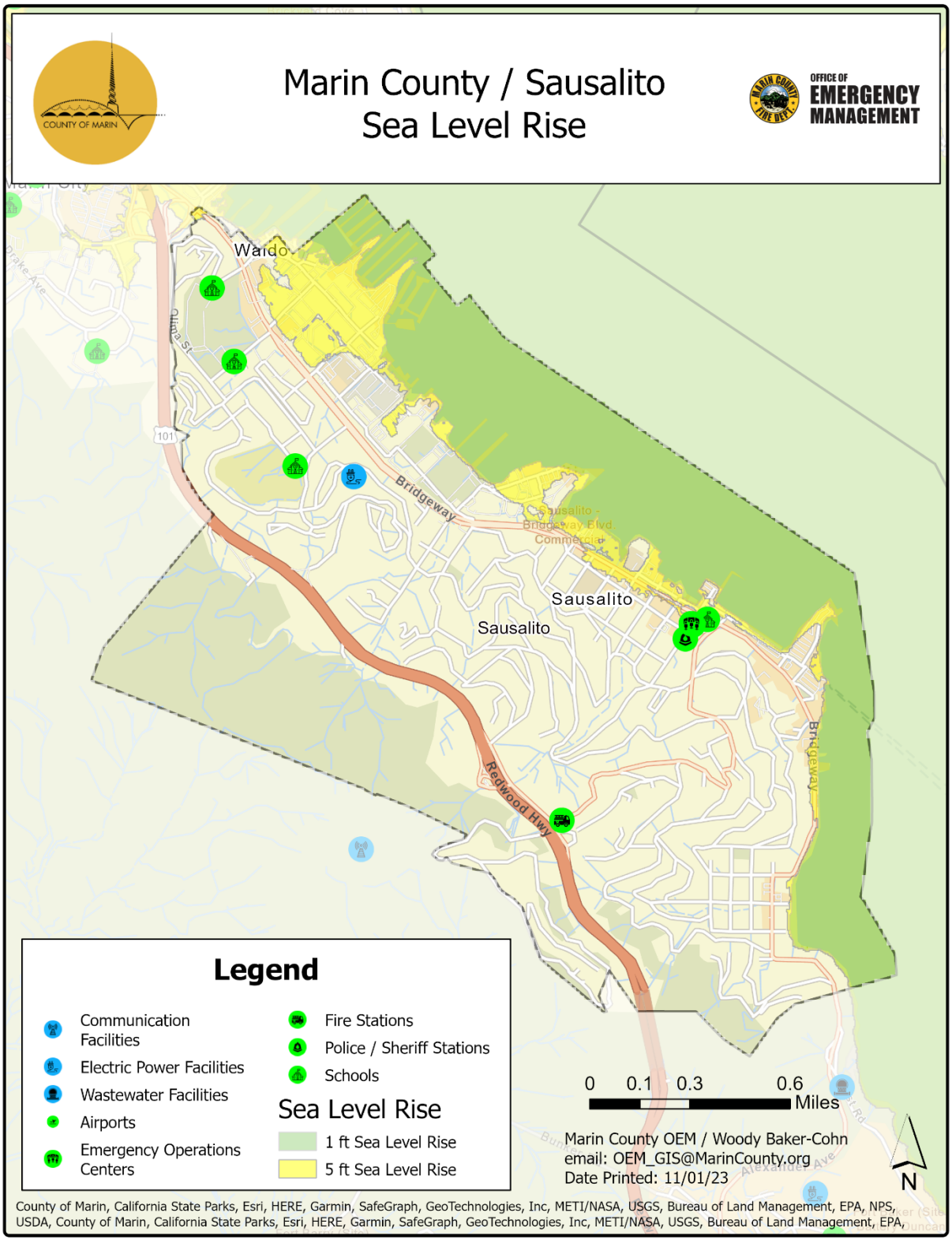


Figure 637: City of Sausalito Sea Level Rise Impact
Source: Marin County OEM

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

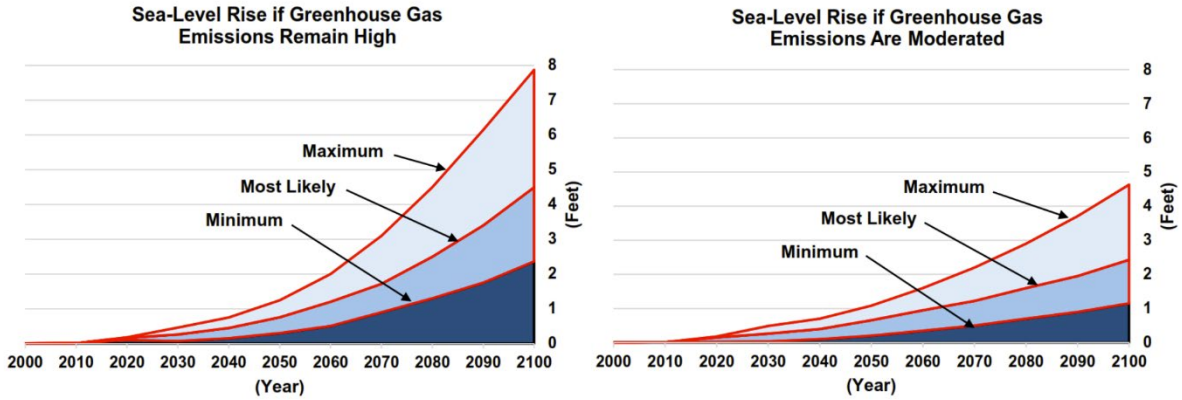


Figure 638: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Sausalito already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Sausalito with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Sausalito will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Sausalito will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across Sausalito will continue to become inundated.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 40):

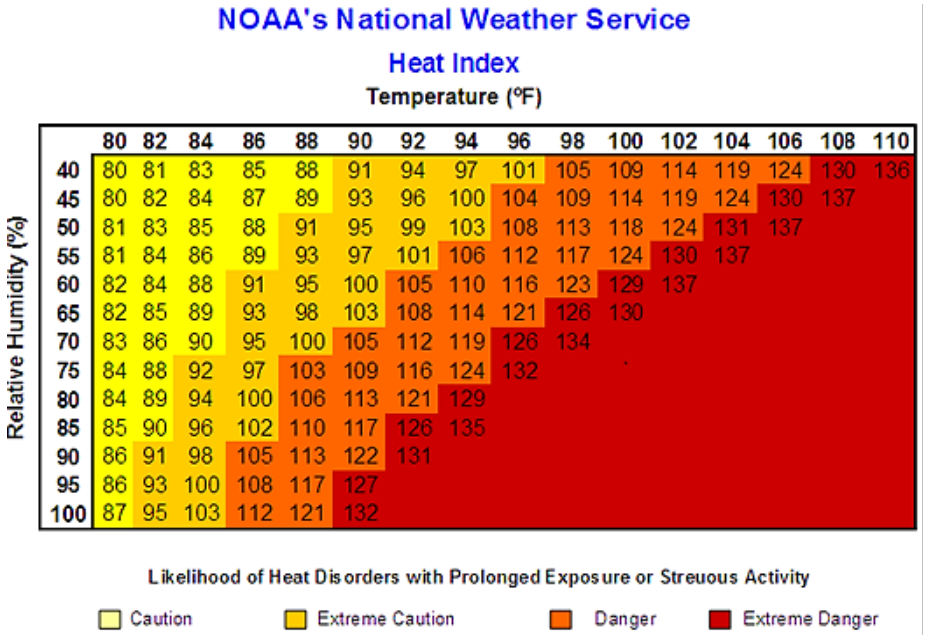


Figure 639: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Sausalito and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. Fortunately for Sausalito, most of the areas lie along Richardson Bay where summer fog and cool bay breezes would help mitigate the effects of high temperatures. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA including the City of Sausalito experienced an Extreme Heat Event with temperatures exceeding 113 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

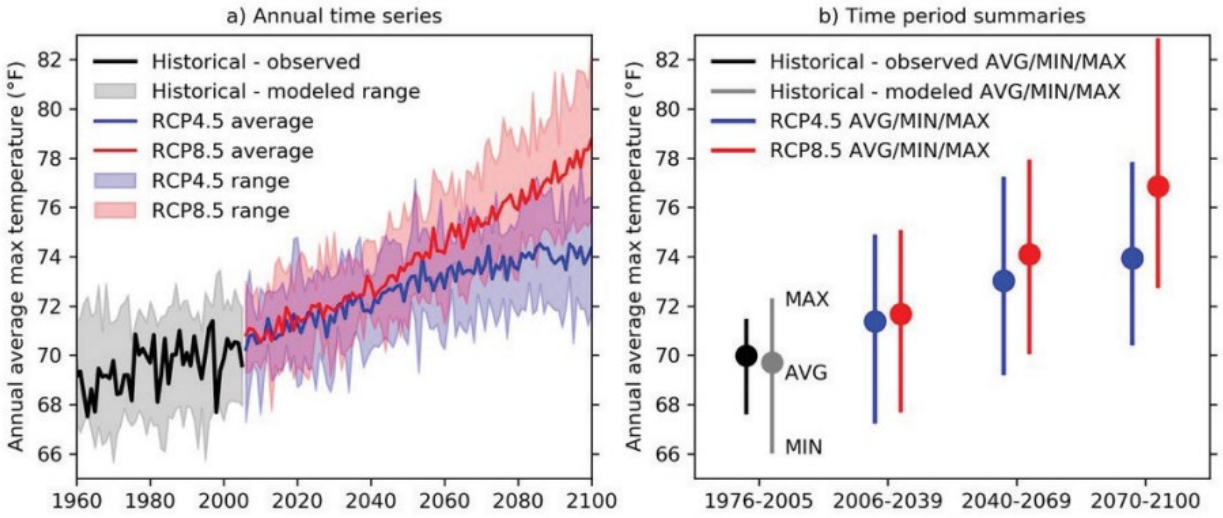


Figure 640: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Sausalito. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Sausalito where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Sausalito could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Sausalito as conditions become hotter and drier. Future development near the many open spaces around Sausalito could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 42).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 641: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Sausalito is susceptible to high winds during summer months when high temperatures in the central valley tend to pull in colder temperature air from the Pacific Ocean in the form of fog and winds. Some areas of Sausalito have the are named “Hurricane Gultch” which are areas where the wind associated with the marine layer rolls over the upper hillsides and proceeds to impact properties, trees and infrastructure in the city.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a

thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 43) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 642: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 643: Waterspout Formation
Source: MarineInsights

All of Sausalito is susceptible to storms and damage from wind, though the mountainous areas on the western side of City have increased susceptibility due to a higher presence of trees. Sausalito is unlikely to experience a tornado due to its terrain but it could experience a waterspout originating from Richardson Bay. Drought coupled with high winds which frequently occur may increase the susceptibility of trees toppling and falling branch damages to property. Fallen trees may damage homes and other facilities. Power lines may be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

On 3/21/2023, a torrent of powerful winds caused several trees to topple throughout the City with only minor damage. Damage occurred at Harrison Street and along Bridgeway Blvd. Wind gusts reached 68 mph on Wolfback Ridge in the City with slightly less wind throughout the City of Sausalito. Sausalito reported that 1,778 meters lost power in the City and in Fort Baker and the Marin Headlands in the unincorporated County of Marin.

On 1/19/2021, winds reached 61 mph in Sausalito, causing numerous boats to come adrift in Richardson Bay. One boat came to shore on Schoonmaker Beach, another behind the Pelican Yacht Harbor and a third near the Sausalito Cruising Club. Over 7,200 meters in the City lost power.

On 2/14/2019, a severe storm with high winds caused significant power outages and numerous tree to topple across the City.

Figure 644: Sausalito Wind Damage - 2019
Source: San Francisco Chronicle

On 12/16/2017, strong winds and high waves caused a boat in Richardson Marina in Sausalito to flip over. Multiple people were rescued. A nearby buoy recorded winds peaking at 31 mph.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Sausalito. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Sausalito as a result of increased storms due to climate change can lead to an increase in

power outages. Future development in any of the forested areas of Sausalito's mountainous residential areas with high tree cover will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Sausalito would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the city. The entire shoreline of Sausalito is in a lowland area and lies in a tsunami hazard area. This includes the entire commercial area of the city along both sides of the Bridgeway and the main commercial area on both sides of Caledonia Street. There are numerous residences, businesses, marinas and other docking facilities in this area that could be susceptible to a tsunami. The Southern Marin Fire Protection District, the Sausalito Police Department and the Headlands Preparatory School also lie in this area and could be susceptible to a tsunami.

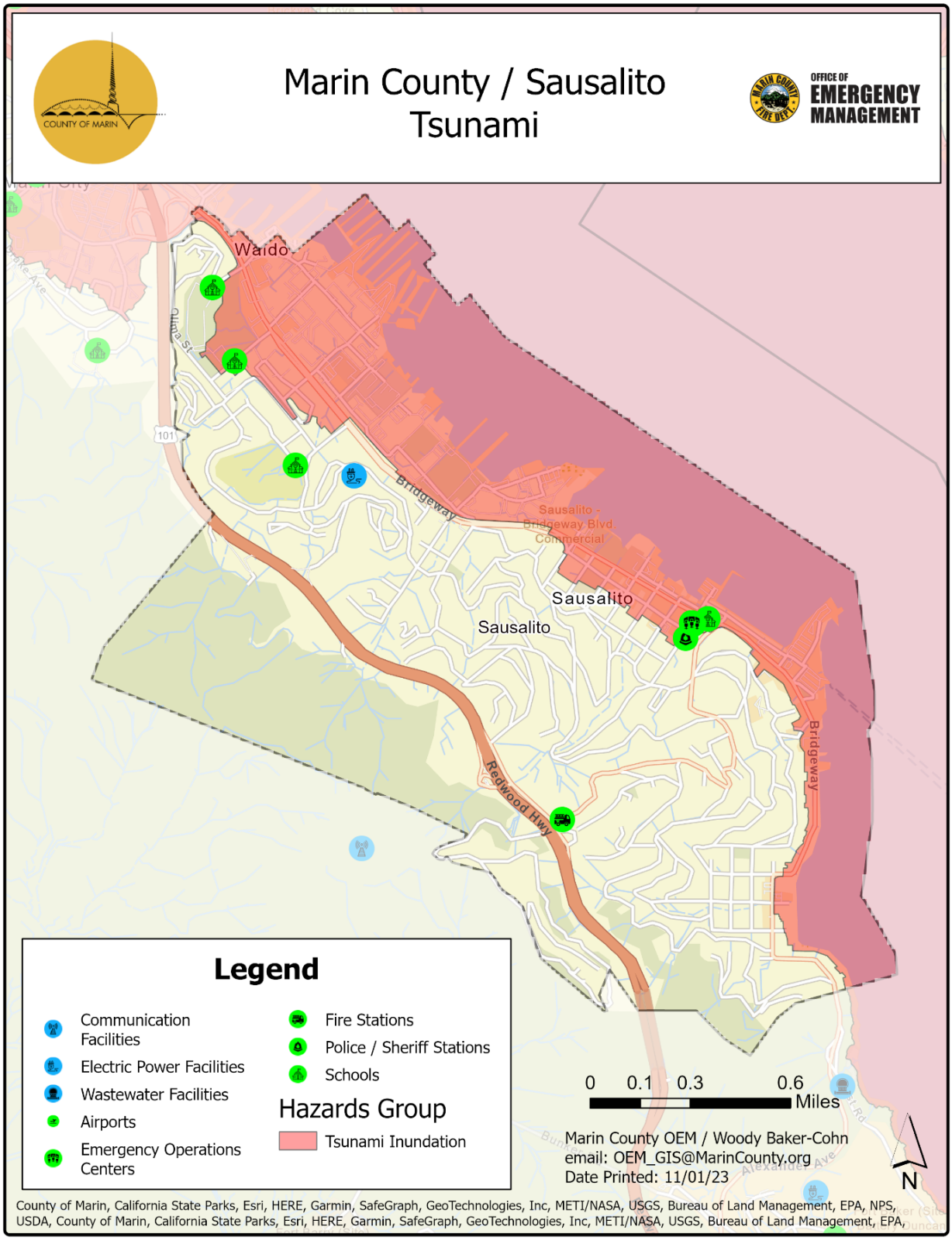


Figure 645: City of Sausalito Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Sausalito has experienced minor tsunamis in the past. Similar of other San Francisco Bay fronting community's major tsunami wave energy is dissipated by the fact that these waves would have to propagate through the water way under the Golden Gate Bridge. Nevertheless, Major Tsunamis may occur in Sausalito. Flooding from a tsunami may be similar to king tide flooding already experienced by the city with the exception that a tsunami occurs in a shorter time frame and may impact the City's vibrant harbor systems. Roadways and City infrastructure may become inundated with salt water, causing transportation issues and utility disruptions.

On 1/15/2022, an undersea volcano erupted in the Pacific Ocean near Tonga causing a minor surge in Sausalito from Richardson Bay. Rough waters were reported with no significant damage.

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Sausalito, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Sausalito. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Flooding could be exacerbated in areas along the shoreline of Sausalito as a result of high wave heights associated with a more significant tsunami.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 47 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

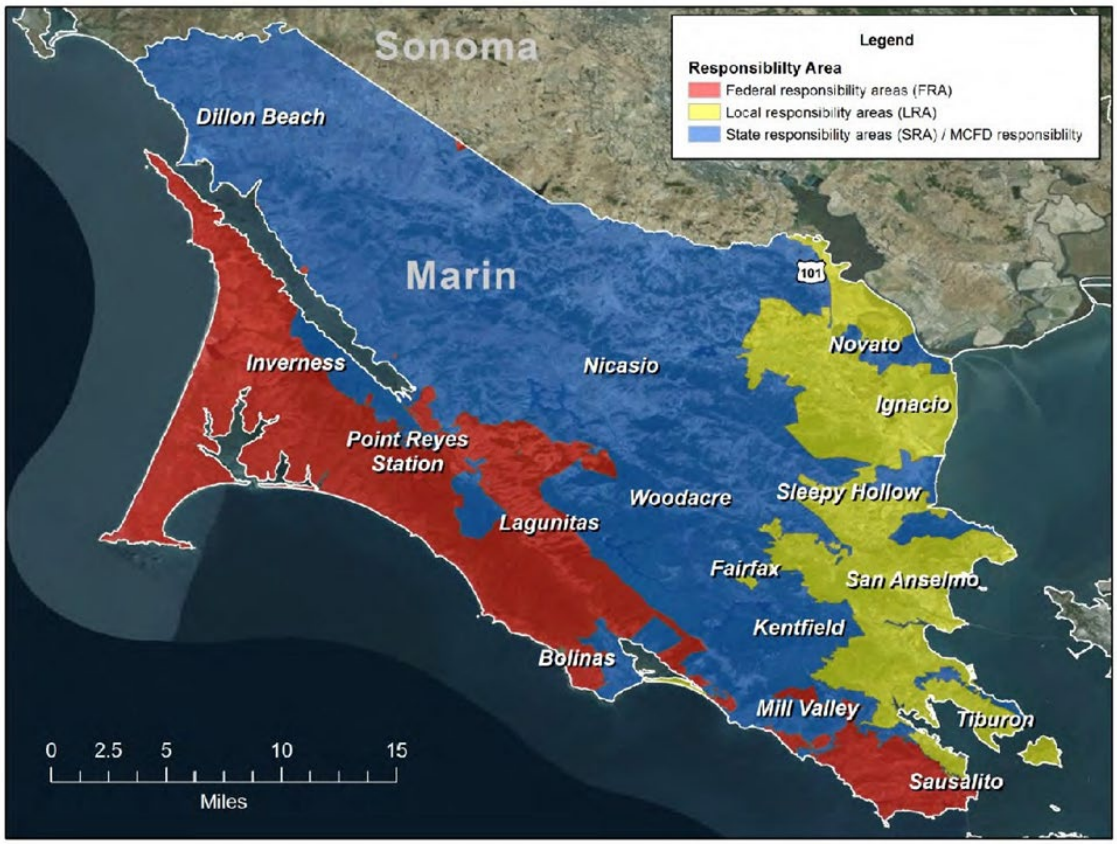


Figure 646: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet

winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Sausalito and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak,

California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the CWPP, an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

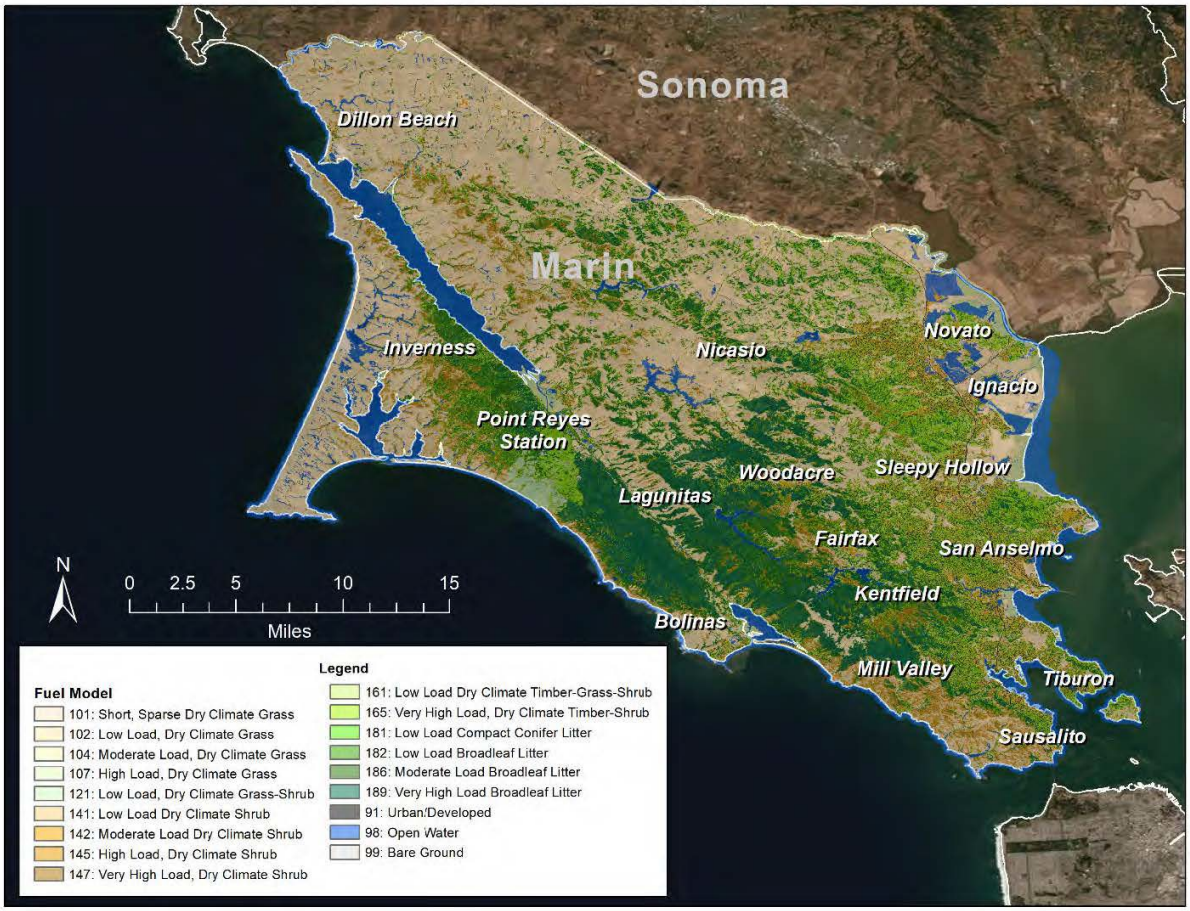


Figure 647: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is a concern since this specific disease can impact vegetation through Marin including the WUI; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular, appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease

largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher, and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Sausalito's upper areas are generally Golden Gate National Park and are heavily vegetated with various fuel types. In addition, a significant number of properties and structures are located on existing steep hillsides which are also heavily vegetated. Sausalito experiences strong winds throughout the summer months and into the fall with the marine layer crossing over the hill from the Pacific Ocean.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including the Marin County OA) to help prevent the start of future wildfires. PG&E will, and have, initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass-through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A PSPS event has occurred in Sausalito and other areas of Marin in years Past. While PG&E continues to address safety issues with their systems by installing equipment that can segregate their system in order to continue to provide power to their customers wildfires from overhead electrical systems. While wildfires can start anywhere, the high fuels high winds and high abundance of fuels above the jurisdictional boundary of Sausalito may be the most likely location for a wildfire to occur. In addition, areas just down slope from Highway 101 which are also heavily vegetated and are primarily residential and consists of numerous winding streets and hillside homes may be damaged or destroyed by a wildfire.

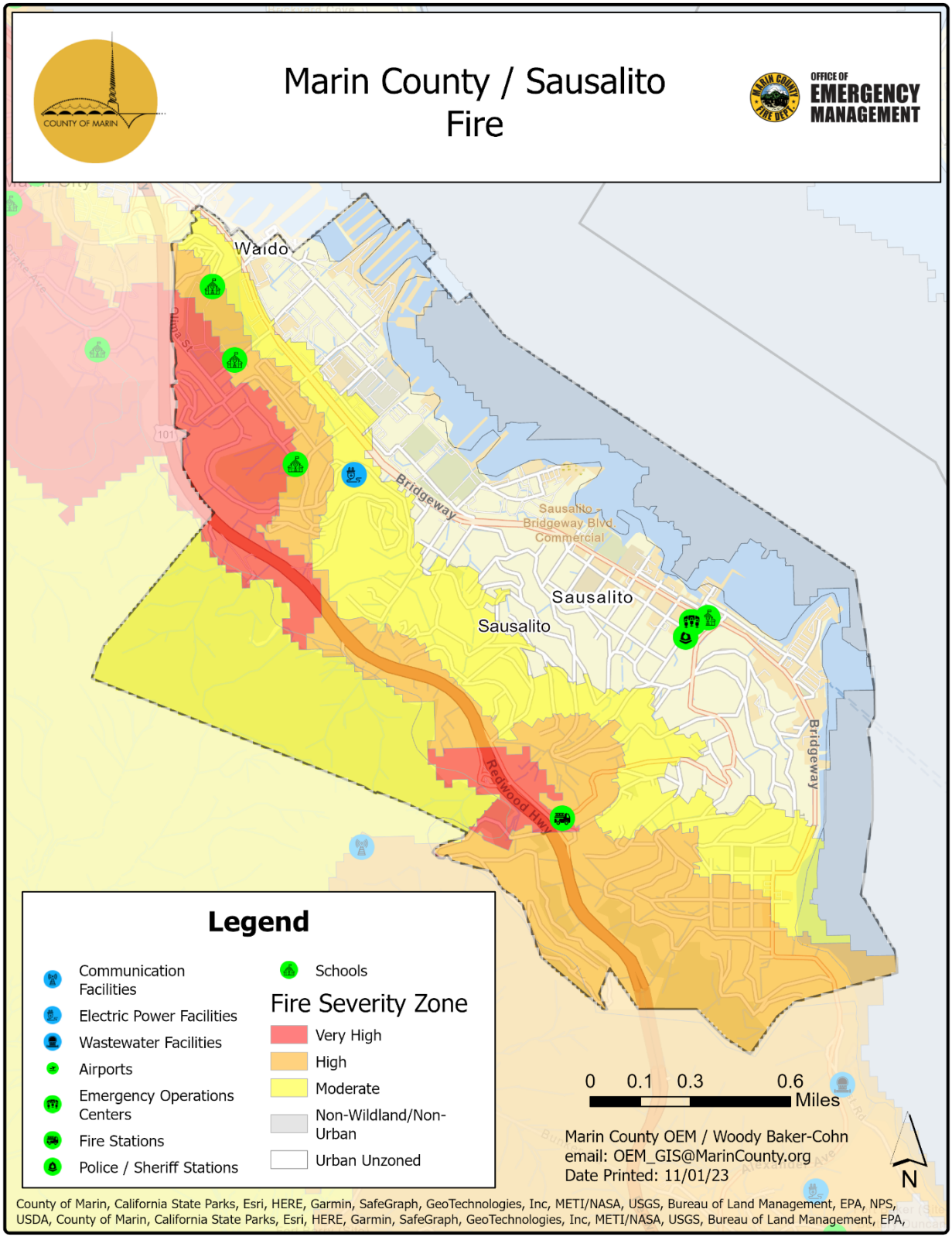


Figure 648: City of Sausalito Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Specific communities in Sausalito are in a Very High FHSZ and are at a higher risk of wildfire. This area includes the Wolfback Ridge neighborhood and the residential area along Lincoln Drive between Highway 101 and Nevada Street. Part of the Lycee Francais de San Francisco lies in this area. Hundreds of homes in Sausalito lie in a High FHSZ and could be susceptible to a wildfire. Most of the commercial area of Sausalito, including most of the Citys critical facilities lie outside a FHSZ though there are some commercial buildings along the Bridgeway in the northern part of the City that like in a Moderate FHSZ and could be susceptible to a wildfire. All of Sausalito could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Sausalito, including in the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City may continue to increase. Brush fires in the City may increase over time as parks, and other open spaces experience drier conditions.

On 7/18/2022, a brush fire broke out near Sausalito closing northbound Highway 101, Golden gate National Park area south of Marin City. Residents in the Anchorage Apartments in Sausalito, off Lincoln Drive, were advised to shelter in place. The fire emitted a large plume of smoke.

On 2/10/2022, an arson fire and explosion at a homeless encampment in Marinship Park caused the City to declare a local emergency. One tent fully was engulfed in flames that spread to another tent causing minimal damage. No injuries were reported.

On 9/12/2021, the a Fire broke out in the Golden Gate National Recreation Area near Sausalito. Between five to ten acres were burned with no damage to structures.

On 10/17/2017, two small vegetation fires broke out in Sausalito along Rodeo Avenue near Highway 101, causing southbound lane closures on the highway. The flames spread into eucalyptus trees and headed uphill toward the Wolfback Ridge neighborhood. People living near the fires were asked to evacuate. No residential damage or major injuries were reported. Air quality readings were classified as either unhealthy or unhealthy for sensitive groups from this event.

Figure 649: Sausalito Brush Fire - 2017
Source: Marin Independent Journal

Sausalito's largest fire in its history occurred on September 19, 1919. A raging fire originating from an outdoor burn pile caused the loss of twelve homes and five stores. Fires on the roofs of multiple homes and businesses were extinguished before any significant damage. The Holy Family Hall on Third Street was totally destroyed. The South End Grocery Store was saved with slight fire damage. Many grass fires and roof fires were also promptly extinguished. A spark landed on and set fire to the canvas covering on a power boat cruiser moored five hundred feet offshore.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

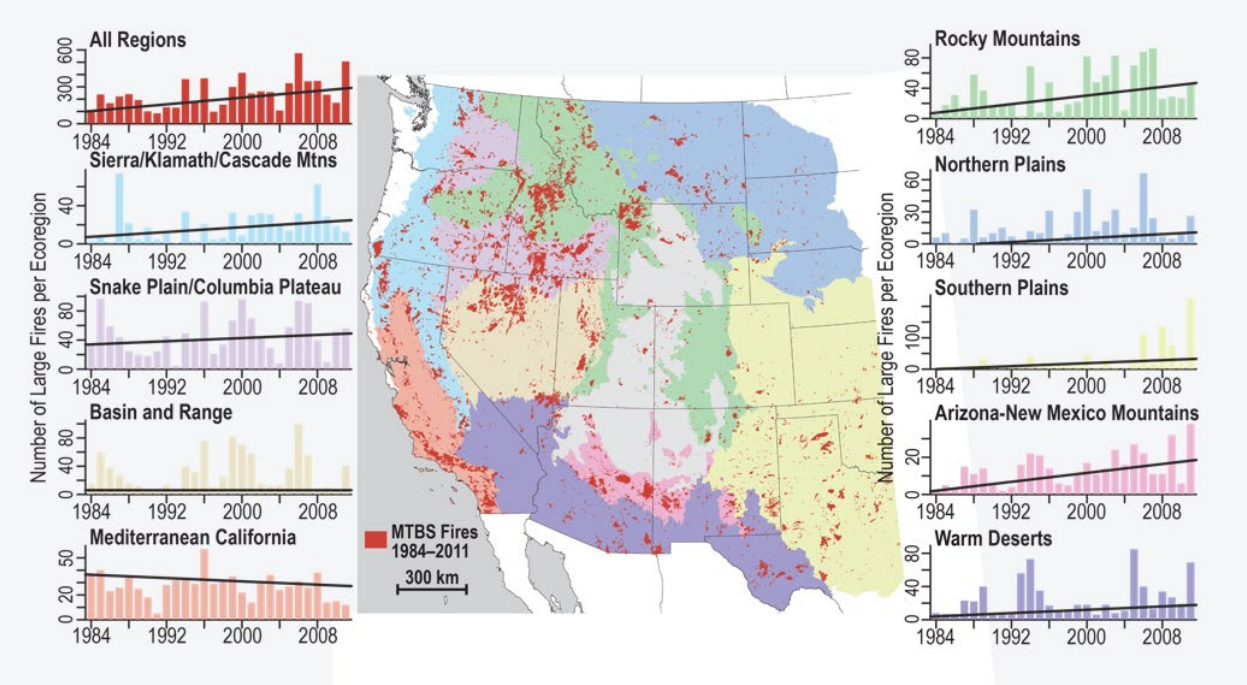


Figure 650: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Sausalito is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Sausalito. Future development in the WUI throughout Sausalito will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Sausalito WUI can increase risk to life, property and public health as a result of a wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County OA's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character.

Since the last plan update in 2018, planning for the State's 6th Cycle housing allocations has occurred. The county-wide combined number for Marin was 14,405 new housing units. All jurisdictions must ensure that their general plans can accommodate their allocation, or they must update the General Plan to accommodate the growth.

Since 2018, there has been a moderate amount of development within the City of Sausalito, most of the new development has been residential. All of the development has been designed and/or conditioned to comply with general plan and zoning standards as well as compliance with the building code.

Though new housing laws at the state level have exempted much residential development from the CEQA process, those laws have preserved all life safety requirements of the building and fire codes. When not usurped by State law, future land use and growth strategies in the City of Sausalito will be consistent with priorities detailed in the 2023 Marin County OA MJHMP and aim to concentrate future development in already developed areas and away from locations where natural characteristics should be avoided such as steep slopes and sensitive habitats. Priority areas for development are those that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and avoidance of conflicting uses.

The best indicator of future growth areas is the location of currently proposed development projects and locations identified in the 2021 Housing Element update as either potential sites or sites identified to be rezoned for residential development. Those sites are listed in the following table. Unit counts are either those proposed/approved through the development review process, or the maximum number allowed under current or proposed zoning.

Since the adoption of the 2018 LHMP, new development within the City of Sausalito has not increased the overall hazard vulnerability to the city.

Table 20: City of Sausalito Projected Growth Areas						
Project Location	**# of Units**	**# of Parcels**	**Application Status**	**Acres**	**Fire Severity Zone**	**Flood Zone**
265 Gate 5 Road APN: 063-152-05	Office 12,000 sq. ft.	1	Approved	50,965 sq. ft. 1.7 acres	Urban Unzoned	AE
1755 Bridgeway APN: 064-151-02 and 03	19	2	Approval Pending	24,000+/- .55 acre	Urban Wildlife Interface	X
70-74 Liberty ship Way APN: 063-152-05	50,000 sq ft Industrial/ Commercial Bldgs.	1	Final Action Pending. Project is under revision.	3.9 acres (partially underwater)	Urban Unzoned	X
300 Spencer Avenue APN 065--181-44	26 Multifamily Units	1	Pending Opportunity Site	0.98 Acres	High	X
100 Spinnaker Drive APNs 065-041-04, 05, 06, & 10	43 Multifamily Units	4	Pending Opportunity Site	1.91 Acres	Urban Unzoned	X / X 0.2 / AE
300 Locust Street APN 064-087-07	13 Units	1	Pending Opportunity Site	0.51 Acres	Urban Unzoned	X 0.2%
420 Litho Street (City Hall Site) APN 064-165-12	37 Multifamily Units	1	Pending Opportunity Site	1.7 Acres	Urban Unzoned	X
2320 Marinship Way APN 063-110-31	47 Multifamily units	1	Pending Opportunity Site	1.92 Acres	Urban Unzoned	X
2330 Marinship Way APN 063-110-37	106 Multifamily Units	1	Pending Opportunity Site	4.35	Urban Unzoned	X / X 0.2%
636 Nevada Street (Sausalito School District) APN 064-322-01	27 Units	1	Pending Opportunity Site	13.15	High / Very High	X
530 Tomales Street	31 Multifamily units	2	Pending Opportunity Site	0.61 Acres	High	X
100 Ebbtide APN 063-170-03	140 Multifamily Units	1	Pending Opportunity Site	17.20 Acres	Mod / High / Very High	X

Table 333: City of Sausalito Future Growth Areas
Source: City of Sausalito

3.2 CAPABILITY ASSESSMENT

The overall priorities in the City of Sausalito have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall City priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the City of Sausalito General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the City's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 21: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Yes 2-9-21	Yes, the GP addresses Hazards. The GP addresses programs and projects at a High level. While most of the Programs noted are at a high level, there are some listed that can be considered as mitigation action.
Strategic Plan	Yes 2-2020	Yes Yes. Some projects must be implemented in phases however. Yes, the plan can be used to implement mitigation actions.
Capital Improvements Plan	Yes Updated Annually	Yes, the CIP addressed Hazards. Yes, the CIP addresses and identifies projects and can be use to implement mitigation actions.
Economic Development Plan	No	This is included in the General Plan update and no separate plan is provided.

Local Emergency Operations Plan	Update 2024	The plan is being developed to include a collaborative EOC between Sausalito, Mill Valley, and SMFD. Details of the plan may be able to be implemented as a mitigation strategy once completed.
Continuity of Operations Plan	Yes	In 2022, SMFD adopted a Continuity of Operations Plan for Infectious Respiratory Pandemics. This could benefit from additional support with the LHMP. Yes, the plan can be used to implement mitigation actions.
Flood Mitigation Plan (FMP)	Yes	We are part of the community rating system initiated through FEMA
Engineering Studies for Streams	Yes	Yes, we have some documentation regarding our watersheds and streams
Open Space Management Plan	No	Sausalito does not have a significant amount of open space.
Regional Transportation Plan (RTP)	Yes	This is managed through the Transportation Authority of Marin
Stormwater Management Plan/Program	No	Sausalito has mapping of existing systems but does not have a full storm water management plan
Community Wildfire Protection Plan	Yes Updated annually	Sausalito is represented through SMFD with the County of Marin CWPP. Multiple hazard mitigation projects are identified in the plan. Directly tied to mitigation efforts.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Yes	Sausalito is working on developing a geologic hazard plan and a sea level rise plan.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	Yes. Projects are reviewed for compliance with building code standards. Building permit applications are routed to various departments for review (Building, Planning, Fire, and Public Works) as necessary to ensure compliance with applicable codes and standards.
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	Y	The Southern Marin Fire District has an ISO rating of 2.
Site plan review requirements	Y	Yes. Projects are reviewed for compliance with development standards, including required setbacks. The majority of building permit applications submitted to the Town are required to provide a site plan.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The municipal code has many sections including but not limited to section dedicated to compliance with Special Flood Hazard Areas, Compliance with Storm Water Ordinances and adoption of the building code which further addresses hazard impacts. These municipal code are

		adequately administered and enforced.
Zoning ordinance	Y	Sausalito's zoning ordinance works systematically with the Municipal Code and integrates key components which reduce hazards and impacts to the community.
Subdivision ordinance	Y	The City's subdivision ordinance is compliant with the state and federal guidelines related to the subdivision map act.
Floodplain ordinance	Y	Specific sections of the municipal code are dedicated to compliance with flood plain management
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Yes
Flood insurance rate maps	Y	Specific sections of the municipal code are dedicated to compliance with flood plain management
Elevation Certificates	Y	Elevation certificates are required in compliance the flood plain management section of the municipal code.
Acquisition of land for open space and public recreation uses	Y	Yes
Erosion or sediment control program	Y	Sausalito's building process includes a review of erosion control measures in compliance with state and county standards for the Stormwater Protection Program

Table 334: City of Sausalito Legal and Regulatory Capabilities
Source: City of Sausalito

City of Sausalito General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The City of Sausalito General Plan, adopted in 02/09/2021, was prepared involving an extensive public review process. The General Plan is the most important policy and planning document in the city and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

City of Sausalito specific goals and policies related to mitigation of natural hazards are as follows:

Table 22: City of Sausalito General Plan	
Goal/Policy/ Program	**Explanation**
Land Use Element	
Goals	The requirements of the land use element are met in the following sections of the General Plan: water resources, community development, planning areas. The goals for these elements can be described as: To support healthy watersheds and provide clean and adequate water for wildlife and humans. To utilize the Environmental Corridor Land Use Framework, coordinate with other jurisdictions, and map land use designations. To establish land use policies for the seven planning areas.
Policies	Overall policies for land use can be described as protecting, improving, and restoring resources, including, directing land use to appropriate areas, reducing impacts, establishing land use designations and categories, and setting land use standards.
Programs	Programs for land use include, setting standards, monitoring and assessing programs, coordinating with other jurisdictions, following best practices, maintaining urban, agricultural, and natural corridors, consider amending urban service areas preserve resources, consider sea level rise. Programs also include, updating plans, reviewing codes, and revising zoning maps.
Conservation and Open Space Element	
Goal	To sustainably manage and preserve open space and biological resources for the benefit of the environment and Marin residents.
Policy	Policies for Conservation and Open Space include; support efforts and continue to acquire open space, balance shoreline protection and access, protect natural resources, support vegetation and wildlife disease management, control non-native plants and species, and restrict use of toxic chemical substances in habitats.
Program	Conservation programs include mapping natural communities, developing monitoring programs, and partnering with local actors. Open space programs include, coordinating with partners, establish compatible policies, inform and enforce, research, and acquire and protect lands.
Public Safety	
Goals	To reduce risk, increase safety, and bolster resilience in an equitable manner.
Policies	Policies in the Safety Element represent an inclusive, community led approach to bolstering resilience. Furthermore, policies are evidence of an all-hazard informed, approach to protection, planning, and regulation.
Programs	Programs in the Safety Element include specific outreach and support to vulnerable populations, working with local leaders, coordinating with private and public partners, improving hazard information sharing with residents, improving infrastructure and systems to support/improve emergency response, and utilizing planning functions.
Program	PSH-8.2.f: Subdivision Design. Condition subdivision and lot line adjustment approvals to assure that lots on hillsides are large enough to provide flexibility in finding a stable buildable site and driveway location.
Policy	PSH-8.3. Conduct landslide repair operations in conjunction with new development
Program	PSH-8.3.a: Landslide Mitigation. Where known landslide areas exist, require comprehensive landslide mitigation actions to improve slope stability. This can include, with affected property owner support, landslide repair extending beyond the boundaries of a proposed development project site. As part of the review and approval of development and public works projects, the planting of vegetation on unstable slopes to protect structures at lower elevations or other appropriate measures shall be incorporated into the project design. Native plans may be required for landscaping in areas with landslide

Table 22: City of Sausalito General Plan	
Goal/Policy/ Program	**Explanation**
	potential to eliminate the need for supplemental water and to reduce the risk of landslide.
Policy	PSH-8.4. Maintain current information on seismic hazards and landscaping.
Program	PSH-8.4.a: Seismic and Landslide Hazards. Develop and periodically update City maps and information on seismic and landslide hazards for use in evaluating development proposals.
Public Facilities Element	
Goal	To provide adequate public facilities and services to accommodate the level of development planned by cities and towns and the County.
Policies	Policies to support the County's Public Facility Element include requiring cost sharing, effective planning, discouraging privatization, and reducing demand on public facilities.
Programs	Programs include requiring fair share contributions, planning for service expansion, preparing naming and sponsorship guidelines, and reducing demand on public facilities.
Goal	Well-distributed and maintained system of park and recreational facilities. A range of recreation programs that offers opportunities to participate for all City residents. Community trails system that will promote non-automotive, environmentally sound circulation. Adequate access to open space.
Policy	Policy PR-3.2. Identify linkages, corridors and other connectors to provide a functional network of parks, open space areas, and bicycle paths through City.
Program	Program PR3.2:b: Habitat Protection. Protect and retain existing natural habitats when planning a City-wide trail system.
Policy	PR-4.1. Encourage the provision of access to open space areas in the design of adjacent development projects.
Program	PR-4.1.a: Subdivision Requirements. Identify access paths and parking areas as part of development approvals. Design access paths to avoid neighborhood and user disputes; minimize intrusion into sensitive wildfire habitat areas.
Program	PR-4.1.b: Marsh and Preserve Access. Coordinate access to and use of the City's varied open spaces, canals and ecological preserves with policy and implementation actions in Chapter 3 (Resource Conservation).

Table 335: City of Sausalito General Plan
Source: **City of Sausalito** General Plan

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the City personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 23: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Planning Commission	Y	Municipal Code and preparation of the General Plan
Administrative Services	Y	Yes
Hazard Mitigation Planning Committee	Y	City utilizes a Sea Level Rise Task force, a Landslide Task Force (*Geologic Hazard Committee*) and a Community Safety/Disaster Preparedness Committee to assist with identifying and prioritizing project
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Sausalito has a maintenance division who addresses hazards related to public spaces including but not limited to storm drain cleaning programs, sanitary system cleaning, vegetation clearing and trimming, hazard identification and other. The City also has an Engineering division who develop and manage civil engineering improvements to address hazards.
Mutual aid agreements	Y	Sausalito's fire services are consolidated into the Southern Marin Fire District. The city works closely with the Sausalito Marin City sanitary district and other local jurisdictions during emergencies to address impacts. The city is considering consolidation of the sanitary collection facilities into the Sausalito Marin City Sanitary District.
Planning Commission	Y	Municipal Code and preparation of the General Plan
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	N	
Hazard data and information	Y	Currently developed plans for sea level rise and geologic hazard studies will include data that can be utilized in the future.
Grant writing	Y	The City does apply for grants. Applications and management are addressed with current staff and no specific staff member is responsible for all grants.
Hazardus analysis	N	
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?

Chief Building Official	Y PT	Yes
Floodplain Administrator	Y FT	Yes
Emergency Manager	Y FT	Yes, Managed through Southern Marin Fire
Community Planner	Y FT	Yes
Civil Engineer	Y FT	Yes, Managed through the Public Works Department
Engineer(s), project manager(s), technical staff, equipment operators, and maintenance and construction staff.	Y FT	The City has 3 FTE dedicated licensed engineers which includes the Department of Public Works Director. Many of our projects are designed and administered by outside engineering firms. DPW has equipment and licensed operators.
GIS Coordinator	N	Sausalito does not have FTE fully dedicated to GIS however we do utilize Marin Map to assist us with details associated with properties and infrastructure in our jurisdiction.
Community Development Staff	Y	Yes
City Planning, Building, and Public Works Staff	Y	Yes
Police Department Staff	Y	Yes
Fire Protection District Staff	Y	Yes, Southern Marin Fire

Table 336: City of Sausalito Administrative and Technical Capabilities
Source: **City of Sausalito**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 24: Fiscal Capabilities		
Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Authority to levy taxes for specific purposes	Y	The City has the ability to levy taxes in compliance with state standards; however, funding has not been pursued in this fashion in the past for mitigation but could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Sausalito's levees fees for its sanitary collection system. Other utilities are administered by separate entities (MMWD, PG&E, AT&T, SMCSD)
Impact fees for new development	Y	The city may have the ability to secure fees from developments in compliance with state and federal environmental processes. Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	The city of Sausalito has utilized this method to funding improvements in the past
Incur debt through private activities	N	
Community Development Block Grant	Y	City participates with the County of Marin to received funding.
Other federal funding programs	Y	FHWA, FTA, FEMA grants
State funding programs	Y	Measure A, AA and other state funds.

Table 24: City of Sausalito Fiscal Capabilities
Source: **City of Sausalito**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the City of Sausalito and the City of Sausalito partnerships utilized to promote those programs.

Table 25: City of Sausalito Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	This is managed through various commissions and interaction with local interest groups.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	Addressed through commissions and outreach associated with the city's web site and local weekly publication.
Natural disaster or safety related school programs	Y	Annually, SMFD visits schools during Fire Prevention week to educate K- Second graders. Building a school ambassador program that could be supported by LHMP. Yes, this program could enhance and benefit future efforts for mitigation efforts.
StormReady certification	N	Marin County Certificate
Firewise Communities certification	Y	The City of Sausalito has a single Firewise USA site that was established in 2019. Yes, the Firewise USA plan identifies local hazards to the site. Yes, the plan can be mitigated by larger projects and requests the community to implement mitigation identified in the plan.
Community Rating System	Y	Sausalito is CRS certified
Public-private partnership initiatives addressing disaster-related issues	Y	This is addressed through committees and various private local organizations

Table 338: City of Sausalito Community Outreach
Source: **City of Sausalito**

3.2.5 PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM

City of Sausalito has participated in the Regular Phase of the NFIP since May 1, 2019. Since then, the City of Sausalito has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. City of Sausalito has been in the CRS program since May 1, 2019. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, City of Sausalito is currently ranked Class 9 community, which gives a 5% premium discount to individuals in the City of Sausalito Special Flood Hazard Area (SFHA).

Presently, the City of Sausalito manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the City's participation in the NFIP. The City's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the City.

The City of Sausalito will continue to manage their floodplains in continued compliance with the NFIP. An overview of the City's NFIP status and floodplain management program are discussed in Table 26. Additional information on the City's CRS program follows.

The activities credited by the CRS program provide direct benefits to the Marin County OA and its residents,

including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that City of Sausalito implements and receives CRS credits include:

Activity 310 (Elevation Certificates) - We maintain Elevation Certificates for new and substantially improved structures in SFHA. There are occasions that homeowners submit their elevation certificates when they are not making any improvements to their property. We post the elevation certificates online and also we keep hard copies in the office in a binder. (36 Points)

Activity 320 (FIRM mapping data) - We provide basic flood information to inquirers. We also provide additional information like flood depth, Historical flood information and etc.

We also send a Notice to Lending Institutions and Real Estate and Insurance agents letting them know that we can provide them and that the City can make a flood zone determination for any particular property within the City.

Activity 330- Outreach program. We send a flyer to all the properties in the flood zone. In the flyer we have some language for the history of flooding, if their property is insured, protection of their property, protection and clean local creeks and stormdrains, build responsibly for flooding and City floodplain information services.

Activity 340 (flood hazard area disclosure) - This is Hazard Disclosure. We used to have resale inspection. We were disclosing whether a property was or was not in the flood zone. (169 Points)

Activity 350 (Performing outreach: pamphlets, fliers regarding flood preparedness) - Our Public Library maintains flood protection materials. Also, we conduct an annual review and update of the information and links on our flood protection website. (57 Points)

Activity 360 (flood protection assistance) – Give inquiring property owners technical advice on how to protect their building from flooding, and publicize this service.

Activity 370 (technical assistance) – Assess flood insurance coverage within the community and implement a plan to promote flood insurance.

Activity 410 (flood plain hazard mapping (tsunami) - Maintain FEMA elevation certificates for new construction in the floodplain.

Activity 420 (open space preservation) - This activity is preserving our open space in the floodplain. (229 Points)

Activity 430 (higher regulatory standards) - We enforce the floodplain management provisions of our zoning, subdivision and building code ordinances. Examples of this activity are requiring the lowest floors of residences to be higher than the base floor elevation. If the cost of improvements or repairs are more than 50% of the building's value, the owner needs to bring the building to compliance. Also, requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings. (32 Points)

Activity 450 (storm water management) - This activity is about stormwater management. (57 Points)

We regulate development on a case-by-case basis to ensure we treat runoff before it leaves the site and also ensure that the peak flow of stormwater runoff from each site will not exceed the pre-development. There are instances that the post-development peak flow rates for the developed area have been slightly increased from pre-development conditions however, onsite bio-retention areas or other treatment facilities have been provided to mitigate the increase in flow rate. We enforce regulations to minimize erosion from land disturbance due to construction.

Activity 501-505 (Tracking repetitive loss data) - This is about repetitive loss Category-Properties that have had losses and reported to FEMA for these losses. We are in Category B. Category B means we are a community with at least one, but fewer than 50 repetitive loss properties that have not been mitigated. We have a map of the areas. We send a notice every year to those properties letting them know about flood prevention and insurance information. We have 38 repetitive loss properties however we send notices to 65 properties.

Activity 510- Floodplain Management Planning- The City of Sausalito has adopted the County of Marin Multi-Jurisdictional Hazard Mitigation Plan which has flood related sections like Dam Failure, Severe Storm, Flooding, Repetitive Loss Properties and Safety Warning/Evacuation Systems.

Activity 540 (City codes prohibiting litter/debris/refuse dumping) - This activity is about drainage system maintenance - Community's drainage system is inspected regularly throughout the year and maintenance is performed as needed. We enforce a regulation prohibiting dumping in the drainage system.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 5
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0
- Repetitive Loss Residential Structures: 5
- Repetitive Loss Non-Residential Structures: 0
- Severe Repetitive Loss Residential Structures: 0
- Severe Repetitive Loss Non-Residential Structures: 0

Table 26: City of Sausalito NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	117 Active Policies with $125,300 total premium cost. The total premium is $125,300. The average premium is $2,054, and the total coverage is $36,751,000.
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	5 claims for repetitive loss; $223,969.87.
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	32
Describe any areas of flood risk with limited NFIP policy coverage	Primarily near Gate 5 Road and Varda Landing
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	CFA is not certified
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Providing public with: Elevation Certificates (310), FIRM mapping data (320), flood plain hazard mapping (tsunami) (410), open space preservation (420), higher regulatory standards (430)

	Performing outreach: pamphlets, fliers regarding flood preparedness (350), flood protection (350), flood assistance (360), storm water management (450), technical assistance (370) and flood hazard area disclosure (340) posted in City Hall Tracking repetitive loss data (501-505), City codes prohibiting litter/debris/refuse dumping (540)
What are the barriers to running an effective NFIP program in the community, if any?	Limited information (much remains with insurance provided and homeowner) which the City is not privy to. Limited staff to dedicate to the program.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	City virtually met with CRS Specialist (Teresa Alvelo) on March 30, 2023.
Is a CAV or CAC scheduled or needed?	Yes
Regulation	
When did the community enter the NFIP?	May 1, 2019
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	City has revised floodplain language to meeting FEMA standards (currently in review with FEMA – Antoinette Stein); increase FF height to at least one-foot above BFE.
Provide an explanation of the permitting process.	Building Permits applied for in SFHA are flagged. For substantial improvements, new FF to be raised to at least 1' above BFE. Venting will also be required, if applicable. Elevation Certificates will be required, reviewed and stored with DPW and placed on website.
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	9
What categories and activities provide CRS points and how can the class be improved?	Providing public with: Elevation Certificates (310), FIRM mapping data (320), flood plain hazard mapping (tsunami) (410), open space preservation (420), higher regulatory standards (430) Performing outreach: pamphlets, fliers regarding flood preparedness (350), flood protection (350), flood assistance (360), storm water management (450), technical assistance (370) and flood hazard area disclosure (340) posted in City Hall

	Tracking repetitive loss data (501-505), City codes prohibiting litter/debris/refuse dumping (540) Class can be improved by providing step by step instructions. Provide real life examples of simple (and difficult) activities where points can be achieved.
Does the plan include CRS planning requirements	City has not yet implemented the floodplain management plan

Table 339: City of Sausalito NFIP Status
Source: FEMA, City of Sausalito

NFIP Insurance Coverage Details

City of Sausalito joined the NFIP on May 1, 2019. The City of Sausalito does participate in the Community Rating System. NFIP insurance data provided by DWR indicates that as of January 27, 1983, there were 5 policies in force in the City of Sausalito, resulting in $223,969.87 of insurance in force. Zero (0) claims were considered substantial damage losses. Of these losses, all 5 parcels were in V01 zone. Of the 5 claims, zero (0) claims were associated with pre-FIRM structures and 5 with post-FIRM structures. There were 5 repetitive loss structures in the City. Zero (0) were in A zones, and zero (0) were in B, C, or X zones. These repetitive loss structures account for $223,969.87 of the total losses in the City of Sausalito. There were zero (0) severe repetitive loss properties in the City of Sausalito totaling $0.

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting the Marin County OA. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by the Marin County OA and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in the Marin County OA.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout the Marin County OA.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 27 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 27: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Still Relevant	Included in Updated Action Plan
Develop and maintain an improvements and property value database as a hazard mitigation planning activity.			X		X
Incorporate Historic Preservation into adaptation, mitigation and recovery activities.			X		X
Design and Construct Nature Based living shorelines and breakwaters to attenuate wave amplitude			X		X
Develop tools and policies for adapting to subsidence			X		X

Table 340: Status of Previous Hazard Mitigation Actions
Source: City of Sausalito

3.5 Hazard Mitigation Actions

The 2023 Marin County MJHMP and City of Sausalito Annex were revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the City of Sausalito based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires Town Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Marin County and City of Sausalito Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 28 lists the Current Hazard Mitigation Actions for the City of Sausalito.

Table 28: City of Sausalito Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
Policies, Codes and Standards						
S-1 Climate Action Plan. Implement a detailed Climate Action Plan and implementation strategies.	All Hazards/ 1, 2, 3,4	Sausalito City Council, Planning + Building Dept, others as ID'd in the CAP	New (2023)	Outstanding cost for EIR: (General Fund)	1-10 years/ Medium	Expand the City's General plan element to address more detail measures to address climate change. Incorporate these improvements into the Capital Improvement Program.
S-2 Building and Fire Code. Review and adopt current California Building and Fire codes. Amend Fire Code to reduce damage to structures from hazard risk specific to Sausalito. [FEMA Project MU-8 Adopt and Enforce Building Codes]	Wildfire/All Hazards/ 1, 2, 4, 5	Sausalito Planning + Building Dept, SMFD	Ongoing (2018)	Cost: TBD (General Fund)	1 – 3 years/ High	Fire code was most recently updated December 2022. Sausalito continues to review and adopt current California Building and Fire codes with updates specific to Sausalito as necessary.
S-3 Energy Reach Code. Explore amending Building Code to adopt reach code requiring all-electric for new buildings.	All Hazards/ 1, 2, 4, 5	Sausalito Planning + Building Dept	New (2023)	Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	1 – 3 years/ High	
S-4 NFIP. Continue to maintain good standing and compliance under National Flood Insurance Program through implementing floodplain management programs. [FEMA Project F-8 Join or Improve Compliance with NFIP]	Flooding, Sea Level Rise/ 1, 2, 3, 4, 5	Sausalito Planning + Building Dept	Existing (2020)	See floodplain management projects.	Ongoing/ High	Continue with the CRS program to assist residents.
S-5 Geologic Instability Standards. Develop a policies and procedures to restrict development on know geologic instabilities.	Debris Flow, Earthquake/ 1, 2, 4, 5	Sausalito Planning + Building + DPW Dep	New (2024)	Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	1 – 2 Years/ High	

Table 28: City of Sausalito Current Hazard Mitigation Actions

Mitigation Action		Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
S-6	**Erosion Policies and Procedures. Develop an internal policy and procedure to development and improvements that effect erosion with Sausalito watersheds.**	Debris Flow, Earthquakes/ 1, 2, 3, 4	Sausalito Planning + Building + DPW Dep	New (2025)	Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	1 – 2 Years/ High	
	Private Development						
S-7	**Soft-Story Buildings. Assessment and retrofit of soft-story buildings (non-City owned). [FEMA Project EQ-2 Incorporate Earthquake Mitigation into Local Planning]**	Earthquake/ 1, 2, 4, 5	Sausalito Planning Dept	New (2023)	Cost will be covered by Plan Check and Building Permit Fees	1 – 6 years/ Medium	
S-8	**Building Safety. Reduce hazard vulnerabilities for buildings throughout Sausalito. Enforce as properties come in for retrofits. [FEMA Project EQ-1: Adopt and Enforce Buildings Codes]**	All Hazards/ 1, 2, 4, 5	Sausalito Planning + Building Dept, SMFD	Existing (2018)	Cost is covered by Plan Check and building Permit fees.	Ongoing/ High	Planning and Building Permit plan check process includes review for code compliance by Planning, Building, DPW, and SMFD.
S-9	**Vegetation Management. Reduce fire risk in existing and new private development in the Wildland Urban Interface through Vegetation Management Plans. [FEMA Project WF-9 Implement a Fuels Management Program]**	Wildfire/ 1, 2, 3, 4, 5	SMFD	Existing (2018)	Cost is covered by plan check fees. Grant funding needed for larger projects	Ongoing/ High	VMPs are required for new buildings and substantial remodel projects, reducing the chance of a wildland fire igniting structures and reciprocally, wildland ignition from a structure fire.
S-10	**Geologic Hazard Remediation: improvements on private property to address known soil instabilities identified with the geologic hazard study.**	Landslide, Earthquake/ 1, 2, 4, 5	Sausalito DPW/Building	New (2024)	Cost is overed by the property owners submitting a building permit.	Ongoing /High	Private property identified in the Geologic hazard study as having some instability will require special consideration for development to address all instabilities.
S-11	**Erosion Mitigation. Properties located within drainage basis that are subject to significant erosion shall be required to install improvement to address hazards caused by that erosion**	Debris Flow Earthquake/ 1, 2, 3, 4	Sausalito DPW/Building	New (2024)	Grant funding (HMGP, BRIC, CDAA, Private Grants)	Ongoing /medium	Private property development will be required to address erosion with steep hillsides and implement improvements to address future instabilities.

Table 28: City of Sausalito Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
City Facilities and Infrastructure						
S-12 MERA. Conduct Marin Emergency Radio Authority (MERA) Upgrades. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	All Hazards/ 1, 2, 3, 4, 5	County of Marin and City of Sausalito	New (2023)	Cost: TBD HMGP, BRIC, CDAA, FMA Grants	Ongoing/ High	City is a participanting in astudying of replacing the system as it reaches the end of its service life.
S-13 City Facility Assessment Study and Implement Improvements. Perform appropriate facility assessment study which identifies deficiencies in seismic and fire safety and mechanical devices on current and future use for all City-owned facilities and structures. Strengthen and/or replace city-owned buildings in the identified prioritized order as funding is available. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	Earthquake, Wildfire, All Hazards/ 1, 2, 4, 5	Sausalito Public Works and Planning + Building Depts, SMFD	Existing (2018)	$250,000/year (General Fund)	Ongoing/ Medium	City facilities will need to be updated to meet current needs and to provide safe facilities that act as shelters and community centers. City Hall was retrofitted in 1990s. Additional assessment is needed including the MLK facility with is utilized as a shelter facility during disasters. Examples include the assessment of leased Buildings and an assessment of the MLK buildings.
S-14 Community Refuge Centers. Enhance Community facilities to support the socially vulnerable population during extreme heat and other extreme weather events. [FEMA Project ET-3 Assist Vulnerable Population]	All Hazards, Severe Weather – Extreme Heat/ 1,2,3	Sausalito Public Works Dept, SMFD	New (2023)	Cost TBD (HMGP, BRIC, CDAA, Private Grants)	1 - 2 years/ High	Provide community refuge centers with AC and other accommodations for emergencies. Example: Sausalito Library
S-15 Energy Resilience. Enhance resilience of power supply for city facilities during emergencies. [FEMA Project MU-13 Protect Infrastructure and Critical Facilities]	All Hazards/ 1, 2, 4, 5	Sausalito Public Works Dept, SMFD, PG&E	Existing (2018)	Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	Ongoing/ Medium	Several critical facilities do not have generators such as the Corporation Yard. Additional power supplies are needed for these critical facilities as well as signal systems and pump stations.

Table 28: City of Sausalito Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
S-16 Roadway Instabilities. Reduce Sausalito's vulnerability to severe landslides by addressing both downhill and uphill road instabilities[FEMA LS-3 Prevent Impacts to Roadways]	Debris Flow/ 1, 2, 3, 4	Sausalito Public Works Dept	Existing (2018)	Cost TBD (General Fund, construction impact fees, HMGP, BRIC, CDAA, grants)	Ongoing/ Medium	Example projects: Sausalito Blvd. Slide Repair Bridgeway Blvd. Road Repair below Woodward. North Street Steps Slipout Repair Hecht Avenue Slope Study and Stability Improvements
S-17 Subsidence Study. Analyze and monitor subsidence in low elevation areas of Sausalito [FEMA Project SU-4]	Subsidence/ 1, 2, 4, 5	Sausalito Public Works Dept	New (2024)	Cost TBD (General Fund)	Every 5 years	Evaluate subsidence over time in Sausalito's bay side areas.
S-18 Tsunami Analysis and Improvements: Develop an analysis, recommendations and improvements to address Tsunami impacts and Sea Level Rise along Sausalito's Shoreline [FEMA Project TSU-5, F-19]	Tsunami, Flooding, Sea Level Rise/ 1,2,3, 4	Sausalito Public Works Dept	New (2024)	Cost TBD (General Fund, HMGP, BRIC, CDAA, FMA, Grants)	Ongoing /High	Example Projects: Installation of a Sea Wall on the east side of Bridgeway between Princess and Richardson. Installation of protective measures on Humboldt and along the entire Sausalito waterfront.
S-19 Severe Storms. Reduce Sausalito's vulnerability to severe storms and associated hazards. [FEMA Project SW-4 Protect Power Lines and Infrastructure]	Severe Weather- Wind, Tornado/ 1, 2, 4, 5	Sausalito Public Works Dept	Existing (2018)	Cost TBD (General Fund, HMGP, BRIC, CDAA grants as needed)	Ongoing/ Medium	Example projects: Undergrounding power lines on Bridgeway. Replace signal systems on Bridgeway that are impacted by Wind. Install preemption and changeable message signs on signals to alert the public of evacuation routes.
S-20 Storm Water System. Rehabilitate, increase capacity of the City's storm water system to reduce local flooding caused by inadequate storm drainage. [FEMA Project F-13 Improve	Flooding, Severe Weather – Wind, Hail, Lightning, sea Level Rise/2	Sausalito Public Works Dept	Existing (2018)	Specific projects are costed out in the CIP, cost covered by General Fund,	Ongoing/ Medium	Example projects: Coloma Street Storm Drain system Improvements Gate 5 Storm Drain system analysis and upgrades.

Table 28: City of Sausalito Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
Stormwater Drainage System Capacity]				HMGP, BRIC, CDAA Grants		
S-21 Flood Control Pumps. Analyze and install flood pump systems in the Gate 5 Area to address localized flooding This will also includes maintaining this infrastructure.[FEMA Project F-14 Conduct Regular Maintenance for Drainage Systems and Flood Control Structures]	Flooding, Sea Level Rise/1, 2, 4, 5	Sausalito Public Works Dept, SASM	New (2025)	Cost TBD (HMGP, FMA, CDAA)	Ongoing/ Medium	This new project is intended to address localized flooding on Gate 5 road and may require raising the roadway as well as driveways to several properties to address the issue.
S-22 Sewer System. Implement Annual Sewer Rehabilitation Program. [FEMA Project F-18 Protect Critical Facilities]	Flooding	Sausalito Public Works Dept	Annual	Cost TBD (Annual Sewer Service Charge)	Ongoing/ Medium	Annually the city designs and constructs sewer projects around the city.
S-23 Sanitation Pumps. Implement Sanitation Pump Station Improvement Program. [FEMA Project F-18 Protect Critical Facilities]	Flooding	Sausalito Public Works Dept	New (2023)	Cost TBD: (HMGP, BRIC, CDAA, Private Grants)	Ongoing/ Medium	Consider improvements that address possible flooding of current systems.
S-24 Sea Level Rise. Adaptation projects to protect against flooding and sea level rise including raising structures out of the flood zone, raising road elevations, and other projects implementing and building on the Sea Level Rise Vulnerability Assessment which is currently underway for Sausalito. [FEMA Project F-15 Elevate or Retrofit Structures and Utilities]	Flooding, Sea Level Rise/ 1, 2, 4, 5	Sausalito Public Works and Planning + Building Depts	New (2024)	Cost TBD (Flood Control Zone 3, HMGP, BRIC, CDAA, FMA, Grant funding)	1 - 5 years/ Medium	Project examples include: Improvements to Gate 5 Road and sections of Bridgeway Blvd. specifically between Princess and Richardson are known project areas that need addressing. Improvements can include the installation a new sea wall on Bridgeway as well as raising the roadway on Gate 5.
S-25 Water Supply. Work with MMWD to ensure an adequate water supply during emergencies and for disaster recovery. [FEMA	All Hazards/ 1, 2, 4, 5	Sausalito Public Works Dept, MMWD	Existing (2018)	This work is funded through MMWD	Ongoing/ High	DPW reviews MMWD plans for upgrades in Sausalito.

Table 28: City of Sausalito Current Hazard Mitigation Actions

Mitigation Action	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
Project D-3 Monitor Water Supply]						
S-26 Sausalito Spring/Storm Waters Capture System. Analysis, design and development of a water collection system to be utilized as a alternative water source for the City's parks and medians. [FEMA Project D-2, D-3 monitor water supply]	Drought/ 1, 2, 4	Sausalito Public Works Dept,	New (2023)	Cost: TBD General Fund, HMGP, BRIC, CDAA, Grants	1-5 years/ Medium	Sausalito's springs and storm water can be used for municipal purposes and may be used in emergency situations in conjunction with MMWD treatment approvals.
S-27 Recycled Water Program: Investigate and implement improvements to utilize recycled water supplies to assist with watering medians and public facilities. [FEMA Program ET-1 reduce Urban Heat Island Effect]	Drought/ 1, 2, 4, 5	Sausalito DPW	New (2025)	Cost TBD: HMGP, BRIC, CDAA, Private Grants	3-10 years/ Medium	Utilization local processed sanitary water and install specific pipe systems to within the city to utilize this resource.
S-28 Fire Engine Access Improvements. Hillside neighborhoods adaptation projects to protect against wildfire risk including widening narrow roads and adding road pullouts, increasing number of emergency egress roads from neighborhoods, continue vegetation management in highest risk areas, and other projects listed in the assessment.	Wildfire/ 1, 2, 4, 5,	Sausalito Public Works Dept, SMFD	New (2023)	$100,000/year (General CIP Fund, Municipal Service Tax), HMGP, BRIC, CDAA, grants	Ongoing/ High	
S-29 Annual Vegetation Maintenance Program. Conduct maintenance to reduce fuel sources and maintain evacuation routes on City ROW and on City owned lands. [FEMA Project WF-10	Wildfire/ 1, 2, 4, 5	SMFD	New (2023)	$550,000/year (MST, Marin Wildfire Prevention Authority Measure C)	Ongoing/ High	Ongoing program since 1997

Table 28: City of Sausalito Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
Implement a Fuels Management Program]						
S-30 Power Line Vegetation Maintenance. Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E. [FEMA Project WF-7 Create Defensible Space Around Structures and Infrastructure]	Wildfire/ 1, 2, 4, 5,	Sausalito DPW, County of Marin, SMFD	New (2023)	Cost TBD(HMGP, BRIC, CDAA, Private Grants)	1 - 2 years	
S-31 Steps, Lanes and Paths. Maintain and improve SLP pedestrian evacuation network through the SLP Annual Maintenance Program and SLP Design and Construction Program.	All Hazards/ 1,2	Sausalito Public Works Dept	New (2023)	Maintenance: Cost: TBD General CIP Fund	Ongoing/ Medium	Replace damage stair systems utilized as evacuation routes as funding is available.
S-32 Develop and Maintain Evacuation Routes: Maintain access routes in and out of the city to ensure evacuation of all residents. [FEMA Project LS-3, F-17, WF-8]	Wildfire, Flooding, Severe Weather / 1, 2, 3, 4	Sausalito Public Works Dept	New (2023)	Maintenance: Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	Ongoing/ Medium	Example projects: Resurfacing Bridgeway Blvd. and major arterials that serve as evacuation routes
S-33 Graphic Information System Integration: Develop a City Specific Graphic information system that includes information in hazards for the public to utilize as well a city officials to coordinate emergency response. [FEMA Project MU-14]	All Hazards/ 1, 2	Sausalito Public Works Dept	New (2023)	Maintenance: Cost: TBD General Fund, HMGP, BRIC, CDAA, FMA Grants	Ongoing/ Medium	Replace damage stair systems utilized as evacuation routes as funding is available.
Outreach and Coordination						
S-34 Hazard Information. Collect, analyze and share information with the Sausalito community about Sausalito hazards and associated risk reduction activities. [FEMA Project MU-14	All Hazards/ 1, 2, 3	SMFD, Emergency Preparedness Commission, CERT	Existing (2018)	$10,000 (EPC Budget), SMFD costs for outreach as needed	Ongoing/ High	Activities include EPC meetings and trainings, SMFD trainings and demonstrations, CERT trainings, Neighborhood Response Group meetings

Table 28: City of Sausalito Current Hazard Mitigation Actions						
Mitigation Action	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
Increase Hazard Education and Risk Awareness]						
S-35 Partnerships. Ensure that City provides leadership and coordinate with the private sector, public institutions, and other public agencies in disaster mitigation.	All Hazards/ 4	Sausalito City Manager, Public Works and Planning + Building Depts, EPC, SMFD	Existing (2018)	$10,000 (EPC Budget), additional budget as needed	Ongoing/ Medium	
S-36 Water Security. Collaborate with local, state, regional and federal partners to increase the security and capacity of Sausalito's water supply from climate change impacts.	Drought/ 1	Sausalito City Manager, Public Works and Planning + Building Depts, MMWD	Existing (2018)	Cost TBD: HMGP, BRIC, CDAA, Private Grants	Ongoing/ Medium	MMWD leads this effort.
S-37 Cybersecurity. Enhance resiliency of city systems to cyberattacks to improve resiliency in an emergency.	All Hazards/ 4	Sausalito City Manager	New (2023)	Cost TBD (General Fund, Private Grants)	1-5 years/ Medium	

Table 341: City of Sausalito Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the City of Sausalito. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 27 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the City of Sausalito identified and prioritized the mitigation actions as detailed in Table 28, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the City of Sausalito will maintain this plan and will serve as a lead staff for grant project applications on City projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into city plans and mechanisms. Where possible the City of Sausalito will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the City of Sausalito already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County OA MJHMP:

City General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the city. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

City Emergency Operations Plans – Integrates hazard mitigation through the consideration of the City's planned response to hazards most likely to impact the city.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

28. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
29. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
30. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

Residential Buildout
The City of Sausalito Housing Element of the 2021 General Plan Buildout projects 304 new housing units ("Additional Residential Capacity") in Sausalito over the Project period. This projection is based on the City's 2015-2023 Housing Element and additional Accessory Dwelling Unit (ADU) growth. These 304 units represents 6.3 percent growth over the 4,830 Existing Residential Units, meaning that there will be a projected 5,134 Total Units at the end of the project period in 2040.

Buildout projections for potential residential units rely on the analysis done for Sausalito's 2015-2023 Housing Element, which identified capacity for 250 potential units. The Housing Element projected that only 79 of these 250 units would be developed during the 2015-2023 planning period. The buildout projection assumes that the Housing Element capacity analysis represents the maximum buildout projections for the purposes of the EIR, not including ADUs.

Potential growth exists for additional ADUs past the 2015-2023 Housing Element period – especially as the State eases restrictions on ADU development. This buildout projection assumed that ADUs would continue to be built at the Housing Element assumed rate of 5 units per year from Housing Element adaptation through the General Plan Update planning period.

All Additional Residential Capacity in the buildout table, besides ADUs and Liveaboards in marina berths in the Waterfront (W) area, were distributed proportionally across Land Use

Designations within a Zoning District. For example, the 50 potential units the Housing Element projected in the R-2-2.5 Zoning District were distributed according to the number of existing residential units in the MLR, MR, and MHR Land Use Designations. However, there are only 3 unbuilt parcels available in the LR-Designated area of Sausalito, so the majority of R-1 unit capacity is placed in the VLR-Designated area of the City.

Sausalito currently averages 1.54 residents per unit. This factor was multiplied by Total General Plan Units to project Sausalito's 2040 population.

Non-Residential Buildout

The non-residential buildout projections look at potential growth in Sausalito work spaces and open space over the planning period. The General Plan Buildout projects 734,084 square feet Additional Non-Residential Built Capacity, a 35 percent increase over the 2.1 million square feet in Existing Non-Residential Capacity for a projected 2.8 million square feet Maximum Built Capacity.

In order to determine Existing Non-Residential Capacity and Maximum Built Capacity, existing and potential residential units had to be subtracted from the gross square footage numbers in non-residential areas (except for in Waterfront areas, because those residential units are liveaboards in berths, not buildings). With an assumption of typical 850 square feet apartment units, the unit areas were subtracted from the Gross Building Area calculations to determine Total Non-Residential Building and

Maximum Built Capacity square footages. Maximum Built Capacity was determined by calculating how much more square footage could be built if Sausalito's Maximum Floor-Area Ratio ("Max. FAR") limits were the only limits on development. In the Marinship (Industrial and Waterfront Land Use Designations), 15 percent of gross square footage was also subtracted to approximate the amount of each parcel consisting of undevelopable right-of-way.

No development is projected for Shopping Center or Public Institutional-Designated parcels, and no expansion of Open Space or Open Area is projected. In addition, no development is projected on any parcel with an average slope greater than 40 degrees.

Since the adoption of the 2018 LHMP, new development within the City of Sausalito has not increased the overall hazard vulnerability to the city.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the City of Sausalito.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County OA MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying City of Sausalito Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and City of Sausalito plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The City of Sausalito is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The City of Sausalito Public Works Director will monitor and update the City of Sausalito Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the City of Sausalito, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the City of Sausalito, to evaluate the plan after each update meeting.

4.4 Plan Update

The City of Sausalito Public Works Director will monitor and update the City of Sausalito Annex to the Marin County OA MJHMP. During the five-year update cycle, the City of Sausalito and the

Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 13-18
Figure 2: Marin County OA MJHMP Public Town Hall Meeting 13-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 13-20
Figure 4: Hazard Mitigation Plan Survey 13-21
Figure 5: Map of the City of Sausalito in Marin County 13-24
Figure 6: Map of the City of Sausalito 13-25
Figure 7: The City of Sausalito Precipitation and Monthly Temperatures 13-27
Figure 8: Races in Sausalito 13-28
Figure 9: City of Sausalito Land Use Map 13-30
Figure 10: City of Sausalito Social Vulnerability Map Census Tract 1302.01 13-32
Figure 11: City of Sausalito Social Vulnerability Map Census Tract 1302.03 13-33
Figure 12: City of Sausalito Social Vulnerability Map Census Tract 1302.04 13-34
Figure 13: City of Sausalito Critical Facilities & Infrastructure 13-39
Figure 14: Marin County OA & City of Sausalito Risk Assessment – Planning Team Top Hazards 13-41
Figure 15: Hazard Risk Categorization 13-41
Figure 16: NASA Global Temperature Change CO2 Gas 13-45
Figure 17: NASA Global Temperature Change 1884 to 2022 13-45
Figure 18: NASA Global Temperature Change Sea Level 13-46
Figure 19: Annual Mean Sea Level Trends 13-48
Figure 20: Landslide Susceptibility Classes 13-53
Figure 21: Mud Flow Areas 13-54
Figure 22: City of Sausalito Debris Flow Critical Facilities and Infrastructure 13-55
Figure 23: Mudslide in Sausalito – 2019 13-56
Figure 24: Modified Mercalli Intensity Scale 13-59
Figure 25: Mercalli Scale vs. Magnitude 13-60
Figure 26: Soil Types 13-60
Figure 27: Marin County OA Earthquake Impact and Fault Lines 13-62
Figure 28: City of Sausalito Earthquake Critical Facilities and Infrastructure 13-63
Figure 29: Diagram of an Atmospheric River Event 13-66
Figure 30: City of Sausalito Flooding Critical Facilities and Infrastructure 13-68
Figure 31: Sausalito Flooding – San Francisco Bay Trail - 2022 13-70
Figure 32: Sausalito Flooding – San Francisco Bay Trail - 2028 13-71
Figure 33: Sausalito Flooding – Gate 5 Road - 2010 13-71
Figure 34: Dissolution Sinkhole Formation 13-72
Figure 35: Cover-Subsidence Sinkhole Formation 13-73
Figure 36: Cover-Collapse Sinkhole Formation 13-73
Figure 37: Levee Failure Mechanisms 13-75
Figure 38: City of Sausalito Sea Level Rise Impact 13-78
Figure 39: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 13-79
Figure 40: Heat Index 13-80
Figure 41: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 13-81
Figure 42: Beaufort Wind Scale 13-82

Figure 43: Enhanced Fujita Scale 13-83
Figure 44: Waterspout Formation 13-83
Figure 45: Sausalito Wind Damage - 2019 13-84
Figure 46: City of Sausalito Tsunami Critical Facilities and Infrastructure 13-86
Figure 47: Federal, State and Local Responsibility Areas in the Marin County OA 13-89
Figure 48: Fuel Model Map for the Marin County OA 13-93
Figure 49: City of Sausalito Wildfire Critical Facilities and Infrastructure 13-97
Figure 50: Sausalito Brush Fire - 2017 13-98
Figure 51: Trends in the Annual Number of Large Wildfires in the United States 13-99

List of Tables

Table 1: City of Sausalito Local Hazard Mitigation Planning Team Members 13-8
Table 2: 2023 MJHMP Local Planning Team Members 13-12
Table 3: City of Sausalito & Marin County OA MJHMP Planning Meetings 13-16
Table 4: City of Sausalito Estimated Jurisdictional Population 13-27
Table 5: Population Change of The City of Sausalito 13-28
Table 6: Languages Spoken in Sausalito 13-28
Table 7: Marin County OA Jurisdictional Housing Stock 13-29
Table 8: NRI Hazards and Marin County OA MJHMP Hazards 13-31
Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01 13-32
Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03 13-33
Table 11: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04 13-34
Table 12: Household Income for The City of Sausalito as of 2019 13-36
Table 13 City of Sausalito Civilian Employed Population 16 years+ by Industry 13-37
Table 14: City of Sausalito Critical Facilities 13-38
Table 15: Historic Sites In The City of Sausalito 13-40
Table 16: Select Hazards Magnitude/ Severity Scale or Index 13-42
Table 17: City of Sausalito Hazard Risk Assessment 13-50
Table 18: County of Marin Hazard Risk Assessment 13-51
Table 19: City of Sausalito Critical Facilities in the Flood Zones 13-70
Table 20: City of Sausalito Future Growth Areas 13-101
Table 21: City of Sausalito Legal and Regulatory Capabilities 13-104
Table 22: City of Sausalito General Plan 13-106
Table 23: City of Sausalito Administrative and Technical Capabilities 13-108
Table 24: City of Sausalito Fiscal Capabilities 13-109
Table 25: City of Sausalito Community Outreach 13-110
Table 26: City of Sausalito NFIP Status 13-115
Table 27: Status of Previous Hazard Mitigation Actions 13-118
Table 28: City of Sausalito Current Hazard Mitigation Actions 13-127

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EIR	Environmental Impact Report
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance

FMP	Flood Mitigation Plan
FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department

MCOSD	Marin County Open Space District
MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management

OHP	Office of Historic Preservation
OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System

UCERF2	Uniform California Earthquake Rupture Forecast, Version 2
UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

14. Southern Marin Fire Protection District Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Southern Marin Fire Protection District and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities and district of the Southern Marin Fire Protection District more disaster resistant and sustainable.

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TABLE OF CONTENTS

SOUTHERN MARIN FIRE PROTECTION DISTRICT PROFILE 14-1
Acknowledgements 14-3
Table of Contents 14-5
Section 1.0: Introduction 14-7
1.1 Introduction 14-7
1.2 Planning Process 14-7
1.2.1 Steering Committee Members (District Representatives) 14-8
1.2.2 Steering Committee Planning Process 14-9
1.2.3 Coordination with Stakeholders and Agencies 14-10
1.2.4 Public Engagement 14-16
1.3 Overview and History 14-25
1.4 Service Area 14-26
1.5 Administration 14-29
1.6 Financing 14-29
1.7 Weather and Climate 14-29
1.8 Social Vulnerability and Risk 14-30
1.9 Critical Facilities 14-40
Section 2.0: Hazard Identification and Risk Assessment 14-46
2.1 Climate Change 14-48
2.2 Hazards 14-55
2.2.1 Debris Flows 14-56
2.2.2 Drought 14-63
2.2.3 Earthquake 14-65
2.2.4 Flooding 14-72
2.2.5 Land Subsidence/Sinkholes 14-83
2.2.6 Levee Failure 14-86
2.2.7 Sea Level Rise 14-90
2.2.8 Severe Weather – Extreme Heat 14-97
2.2.9 Severe Weather – High Wind & Tornado 14-98
2.2.10 Tsunami 14-102
2.2.11 Wildfire 14-105
Section 3.0: Mitigation Strategy 14-120
3.1 Changes in Development 14-120

3.2 Capability Assessment 14-120
3.2.1 Regulatory Capabilities 14-120
3.2.2 Administrative and Technical Capabilities 14-123
3.2.3 Fiscal Capabilities 14-125
3.2.4 Community Outreach 14-126
3.2.5 Participation in the National Flood Insurance Program 14-127
3.3 Mitigation Goals 14-128
3.4 Status of Previous Mitigation Actions 14-130
3.5 Hazard Mitigation Actions 14-130
3.6 Progress in Local Mitigation Efforts 14-138
3.7 Plan Integration 14-138
3.8 Future Development Trends 14-139
Section 4.0: Plan Review, Evaluation, and Implementation 14-140
4.1 Plan Adoption 14-140
4.2 Plan Monitoring 14-140
4.3 Plan Evaluation 14-141
4.4 Plan Update 14-142
Figures and Tables 14-143
Acronyms/Abbreviations 14-145

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Southern Marin Fire Protection District (SMFD) Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the SMFD.

1.2 PLANNING PROCESS

The majority of Marin County is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Marin County and SMFD Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small participating jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County, the SMFD and the other participating planning areas to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving the SMFD and all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County is very different from most California Counties in that the populated portion of the County where the participating jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Marin County and SMFD Steering Committee to establish a more robust Planning Team representing local Corte Madera, countywide, regional, state, and federal stakeholders servicing the Marin County and SMFD planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County and SMFD Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the SMFD involved additional internal planning team members to support the broader planning process. The SMFD jurisdictional representatives for the coordinated Marin County Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (District Representatives)

Primary Point of Contact
Marshal Nau, Deputy Fire Marshal
Telephone: 415-388-8182
E-mail: mnau@smfd.org

Alternate Point of Contact
Chris Tubbs, Fire Chief
Telephone: 415-388-8182
E-mail: ctubbs@smfd.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and 2.

Table 1: SMFD Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
SMFD	Chris Tubbs	Fire Chief/Southern Marin Fire Protection District	415-388-8182	ctubbs@smfd.org
SMFD	Fred Hilliard	Fire Marshal/Southern Marin Fire Protection District	415-388-8182	fhilliard@smfd.org
SMFD	Matt Barnes	Deputy Chief/Southern Marin Fire Protection District	415-388-8182	mbarnes@smfd.org
SMFD	Marshall Nau	Deputy Fire Marshal/Southern Marin Fire Protection District	415-388-8182	mnau@smfd.org
Mill Valley	Patrick Kelly	Department of Planning & Building	415-388-4039	pkelly@cityofmillvalley.org
Mill Valley	Daisy Allen	Senior Planner	415-384-4811	daisy.allen@cityofmillvalley.org
Mill Valley	Jared Barrilleaux	Deputy Director of Engineering	415-384-4818	jbarrilleaux@cityofmillvalley.org
Sausalito	Kevin McGowan	Public Works Director	415-289-4176	kmcgowan@sausalito.gov
Sausalito	Brandon Phipps	Planning Director	415-289-4142	bphipps@sausalito.gov

Table 342: SMFD Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the Southern Marin Fire Protection District. All participating jurisdictions and districts are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.
- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Marin County and Southern Marin Fire Protection District Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Marin County and Southern Marin Fire Protection District Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Marin County and Southern Marin Fire Protection District Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County and Town websites. The County and City website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Southern Marin Fire Protection District Steering Committee reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Southern Marin Fire Protection District communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Southern Marin Fire Protection District Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Southern Marin Fire Protection District and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Daisy Allen	Senior Planner
35	Southern Marin Fire Protection District	Chris Tubbs	Fire Chief/Southern Marin Fire Dist.
36	Southern Marin Fire Protection District	Marshall Nau	Fire Marshall/Southern Marin Fire Dist.
37	North Marin Water District	Eric Miller	Asst. General Manager
38	North Marin Water District	Tim Fuette	Senior Engineer
39	Novato	David Dammuller	Engineering Services Mgr.
40	Novato	Dave Jeffries	Consultant/JPSC
41	Ross	Richard Simonitch	Public Works Director
42	San Anselmo	Sean Condry	Public Works & Building Director
43	San Anselmo	Erica Freeman	Building Official
44	San Anselmo	Scott Schneider	Asst. PW Director
45	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
46	San Rafael	Cory Bytof	Sustainability
47	San Rafael	Joanna Kwok	Senior Civil Engineer
48	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
49	Sausalito	Andrew Davidson	Senior Engineer/ DPW
50	Sausalito	Kevin McGowan	Director of Public Works
51	Sausalito	Brandon Phipps	Planning Director
52	Tiburon	Sam Bonifacio	Assistant Planner
53	Tiburon	Dina Tasini	Director of Community Development
54	Tiburon	Laurie Nilsen	Emergency Services Coord.
Special Districts & Partner Agencies			
55	Bolinas Fire Protection District	Stephen Marcotte	Assistant Fire Chief
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	California Department of Public Health	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 343: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Southern Marin Fire Protection District's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their Southern Marin Fire Protection District website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 344: SMFD & Marin County MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM and the Southern Marin Fire Protection District, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release from Marin County and

the Southern Marin Fire Protection District informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by Marin County, the Southern Marin Fire Protection District, and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the Marin County and Southern Marin Fire Protection District website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Marin County and Southern Marin Fire Protection District Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations

- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Marin County and Southern Marin Fire Protection District Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

COUNTY OF MARIN
Emergency Portal
Get Alerted
Stay Informed
Weather
Prepare
COVID-19
More
Marin County Multi-Jurisdictional Hazard Mitigation Update
The various communities and service providers within Marin County are working together to update our Marin County Multi-Jurisdictional Hazard Mitigation Plan. As part of this update process, we are asking for community insight and input.
NATURAL HAZARDS
Location
Extent (Magnitude/Strength)
Previous Occurrences
Future Probability
RISK
COMMUNITY ASSETS
Population
Built Environment
Natural Environment
Economy
https://emergency.marincounty.org/pages/alerts

Marin County is updating the Multi-Jurisdictional Hazard Mitigation Plan for 2024

Post Date: 01/30/2024 10:00 AM

The Southern Marin Fire Protection District (SMFD) has been working with other Marin County jurisdictions to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. This plan, which is updated every five years, assesses natural hazard risks and identifies and prioritizes projects to reduce those risks. Completion of this plan qualifies SMFD for FEMA Hazard Mitigation Grant Program funding.

At this time, the overall County plan as well as SMFD's profile (an appendix to the plan) are available for public review. Review this link to see the 2024 SMFD Hazard Profile document.

Want to learn more? Visit the project website. The Marin County Office of Emergency Management (OEM) is taking direct public comments online, or one can send comments directly to SMFD staff: mnau@smfd.org.

Figure 651: Marin County OEM MJHMP and SMFD Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” Each Town Hall Meeting included, live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

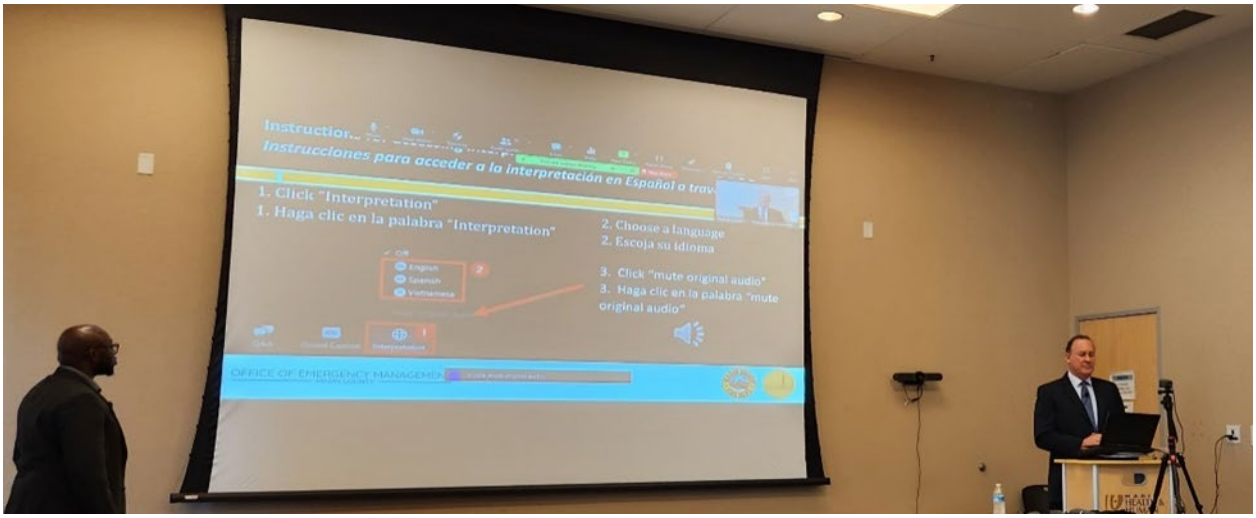


Figure 652: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

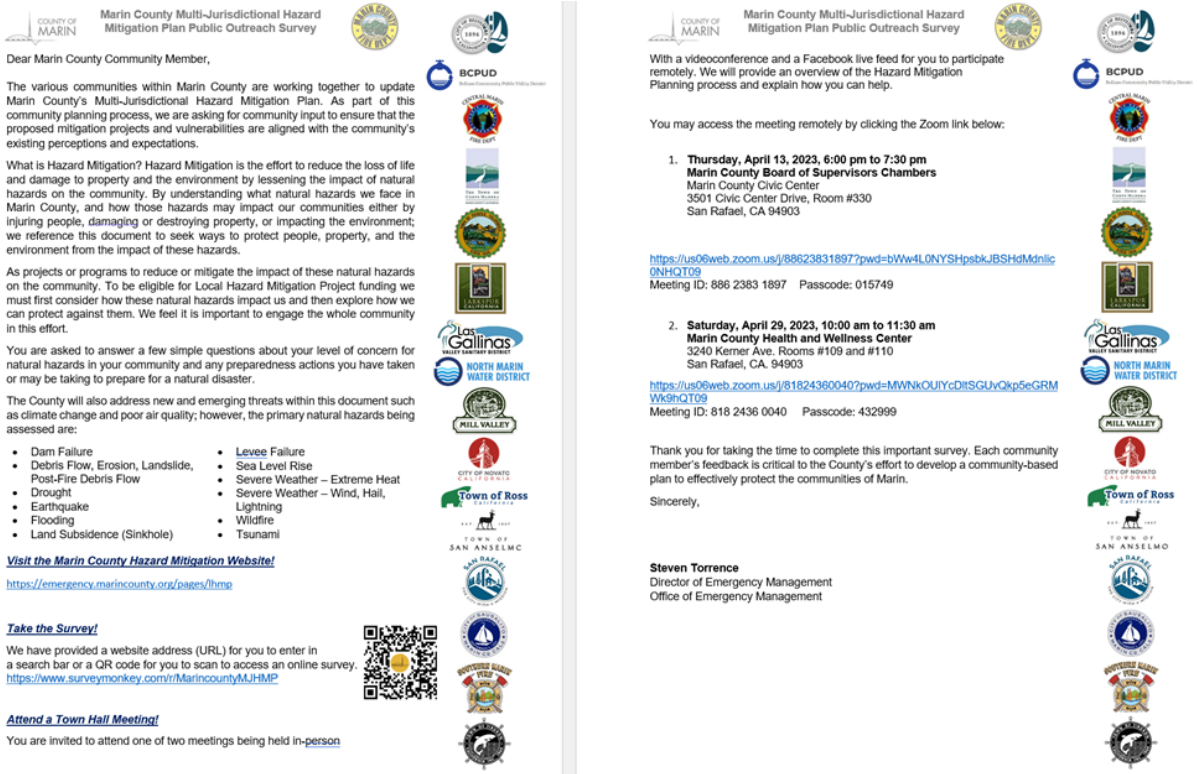
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County OA MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey.
https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 653: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.
- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

Figure 654: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org. The website additionally asked for feedback in a survey in English and Spanish, the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's

traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The SMFD had an additional 14-day comment period for the SMFD Community Profile where their profile was posted on the District website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team
The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Southern Marin Fire Protection District distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

The Southern Marin Fire Protection District is an independent special district established by the Marin County Board of Supervisors in July of 1999. Its statutory authority is provided through the California Fire District Law of 1987, (Health & Safety Code §13800, et seq). The District was formed by the merger of the Alto-Richardson Fire Protection District and the Tamalpais Fire Protection District.

On June 24, 2012, the City of Sausalito Fire Department was annexed into the Fire District. In October of 2010 the District signed a contract with the National Park Service to provide services to the Marin Headlands and Fort Baker areas of the Golden Gate National Recreation Area. On July 1, 2023, the City of Mill Valley was annexed into the Fire District.

The District has 95 full time employees including a Fire Chief, 2 Deputy Fire Chiefs, 1 Fire Marshal, 1 Deputy Fire Marshal, 4 Battalion Chiefs, 15 Fire Captains, 17 Engineer Firefighters, 17 Engineer Paramedics, 7 Firefighter Paramedics, 16 Firefighters, 1 HR Manager, 1 Finance Manager, 1 Finance Assistant, 1 Communications Coordinator, 1 IT Coordinator, 1 Administrative Aide, 3 Fire Inspector/Plan Reviewers, 2 Wildfire Mitigation Specialists, and 2 Vegetation Management Specialists, and 1 NRG Coordinator.

1.4 SERVICE AREA

The Southern Marin Fire Protection District serves the cities of Sausalito, and Mill Valley, and communities of Tamalpais Valley, Almonte, Homestead Valley, Alto, Strawberry, approximately 1/4 of the town of Tiburon, the City of Mill Valley, Fort Baker and the Marin Headlands. The District covers over 25.3 square miles, a population of approximately 41,576 and over 20,500 homes and commercial properties. Each of our zones is protected by one Type I engine with each of the zones cross-staffing at least one specialty piece of equipment such as a Ladder Truck, Rescue, Fire Boat, Jet Skis, Inflatable Rescue Boat, and Type 3 Engine. The District also provide ALS transport services. The District has 2 ambulances and 1 ALS Medium Rescue.

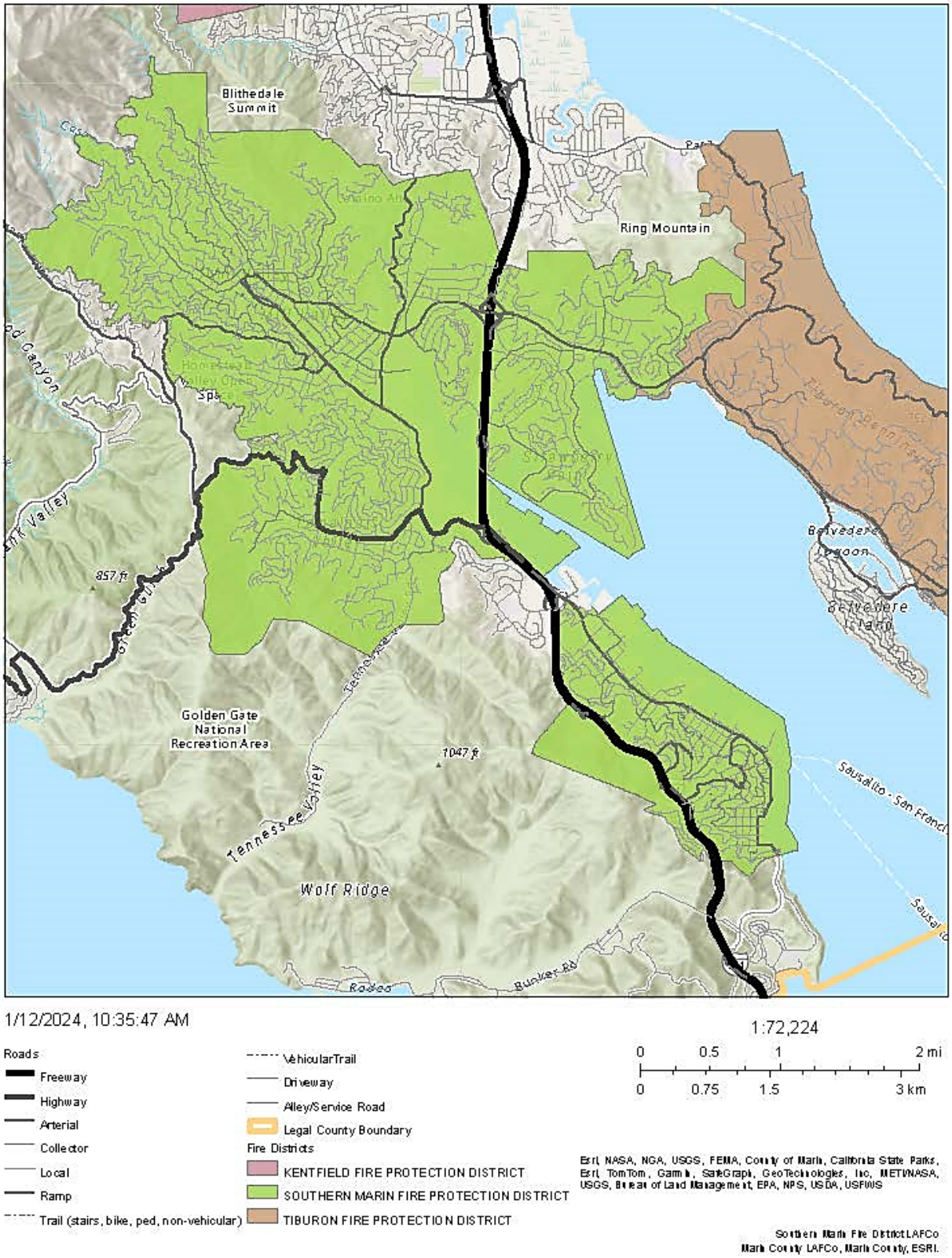


Figure 655: Map of the Southern Marin Fire Protection District
Source: SMFD, LaFCO

Figure 6 illustrates the Southern Marin Fire Protection District service area in purple with the red circle in relation to the other Marin County Fire Districts.

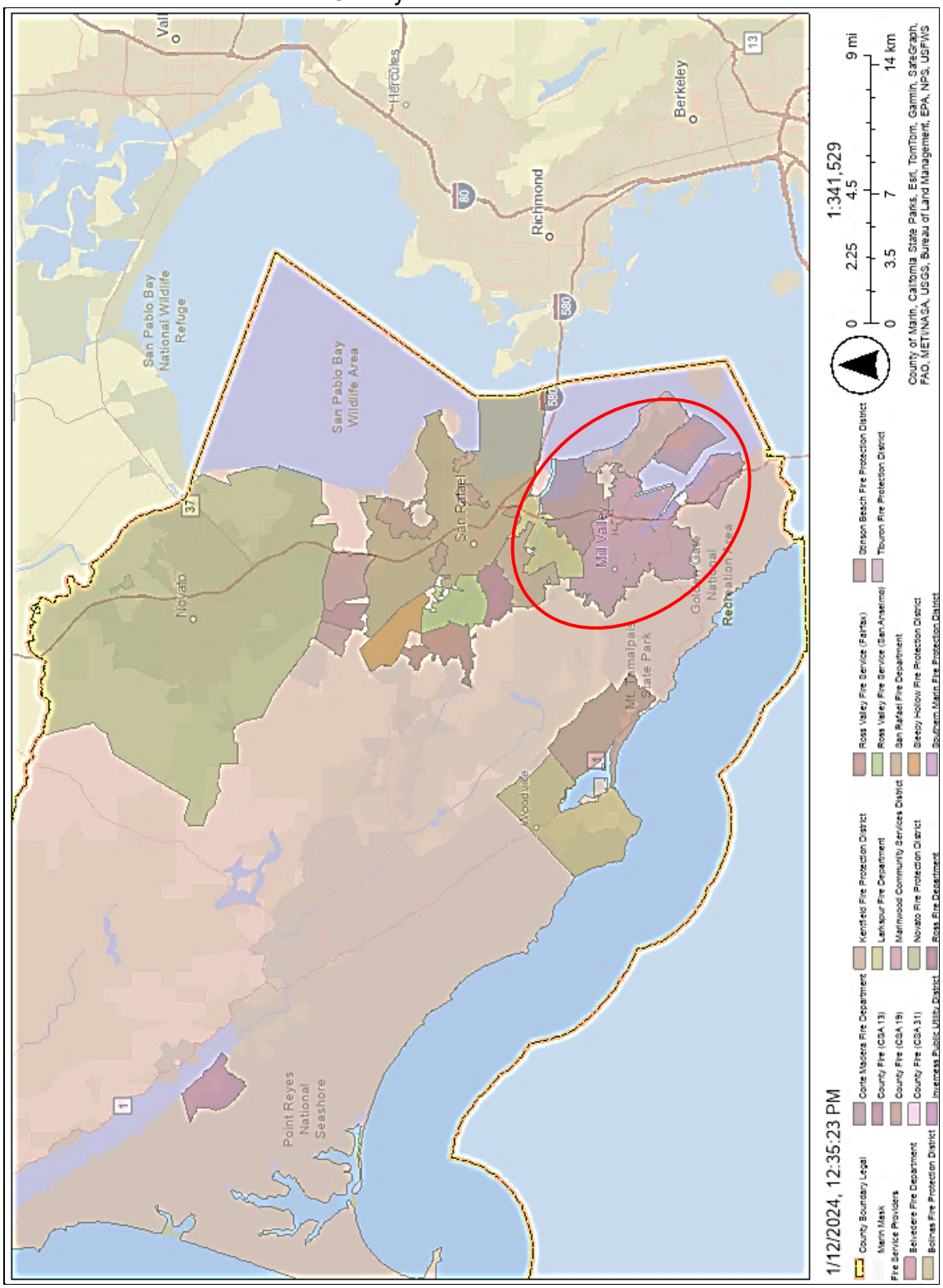


Figure 656: Map of the Southern Marin Fire Protection District and Other Fire Districts
Source: Marin County OEM

1.5 ADMINISTRATION

The Southern Marin Fire Protection District is governed by a seven-member Board of Directors. Board Directors are elected by the residents, serve four-year terms and Board members must live within the Fire District boundaries. The SMFD Board of Directors meets on the fourth Wednesday of each month at the Administration Headquarters located at 28 Liberty Ship Way, Suite 2800, Sausalito, California 94965. The public is encouraged to attend and participate in District Board Meetings.

Fire District elections are managed by the Marin County Election's office. Board members are elected or re-elected every four years during the Uniform District Elections in November. The terms of office are four-year, staggered terms. SMFD Board Directors must live within the District boundaries.

1.6 FINANCING

The primary economic drivers of the District's finances are property tax revenue and personnel costs. The District's Board of Directors is committed to long-term financial resiliency, and a thorough understanding of these aforementioned primary drivers is required in order to achieve and maintain long-term fiscal resiliency. The recent passage of Measure U was a major accomplishment towards increasing the District's revenues and thereby maintaining an organization with long-term financial resiliency. The District utilizes long-range financial planning tools to measure the District's financial health, identify potential fiscal challenges and guide current decision making, and keep the District on a fiscally sustainable path going forward. Two of the tools the District uses are a ten-year general operating cash flow model, and a twelve-year Capital Improvement Plan (CIP). In addition to the adoption of Measure U, the District has implemented a number of other cost-saving measures to ensure the long-term resiliency of the organization, such as:

- To address the OPEB liability, the District eliminated OPEB for employees hired after 1/1/2014, instead offering retiree health savings accounts.
- Prior to PEPRA, the District's safety members were the first in the County to modify retirement benefits from 3%@50 to 3%@55.
- Submitted winning grants in excess of $1.3 million.
- The District started making contributions to a trust for OPEB liabilities in 2011, and in 2019 made its first pension contribution. The combined balance of this trust as of June 30, 2021 exceeded $6.2M.
- Implemented employee cost-sharing of medical premium costs.
- The Board of Directors formally adopted a Reserve Policy to ensure the District has adequate working capital to cover operational costs and mitigate against potential adverse impacts stemming from an economic downturn. This policy calls for a minimum of 40% of current year operating and equipment expenditures to be in a separate cash fund. As of June 30, 2021, this cash fund balance was $6.7M.

1.7 WEATHER AND CLIMATE

The Southern Marin Fire Protection District serves the communities of Mill Valley and Sausalito. The City of Mill Valley is approximately 79 feet above sea level and while the low areas City of Sausalito are approximately 10 feet above sea level. The majority of housing is located on the adjacent hillsides well above sea level and the industrial areas of Sausalito known as the

Marinship are approximately 10 feet above sea level. In the Cities of Mill Valley and Sausalito, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, partly cloudy and mostly clear with the exception of fog sometimes occurring daily in the summers. Over the course of the year, the temperature typically varies from 43°F to 73°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is between 33- 45 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 657: The Southern Marin Fire Protection District Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.8 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 4: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 345: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:
Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

The following Tables and Figures illustrates the NRI Hazard Type Risk Index and the Social Vulnerability Map for the Southern Marin Fire Protection District for the various Census Tracts within their service area.

Tables 5 – 12 illustrate the NRI Hazard Type Risk Index for the SMFD service area Census Tracts.

Table 5: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,347,641	Very Low	Very High	0.66	$894,146	90.4
Riverine Flooding	$893,441	Very Low	Very High	0.66	$592,789	97.1
Wildfire	$14,195	Very Low	Very High	0.66	$9,418	83.6
Heat Wave	$9,305	Very Low	Very High	0.66	$6,173	43.2
Tornado	$5,176	Very Low	Very High	0.66	$3,434	8
Landslide	$3,082	Very Low	Very High	0.66	$2,045	76.5
Coastal Flooding	$1,675	Very Low	Very High	0.66	$1,112	81.4
Tsunami	$505	Very Low	Very High	0.66	$335	94.3
Drought	$0	Very Low	Very High	0.66	$0	0

Table 346: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00
Source: FEMA National Risk Index 2023

Figures 8 - 15 illustrate the Social Vulnerability Maps for the SMFD service area Census Tracts.

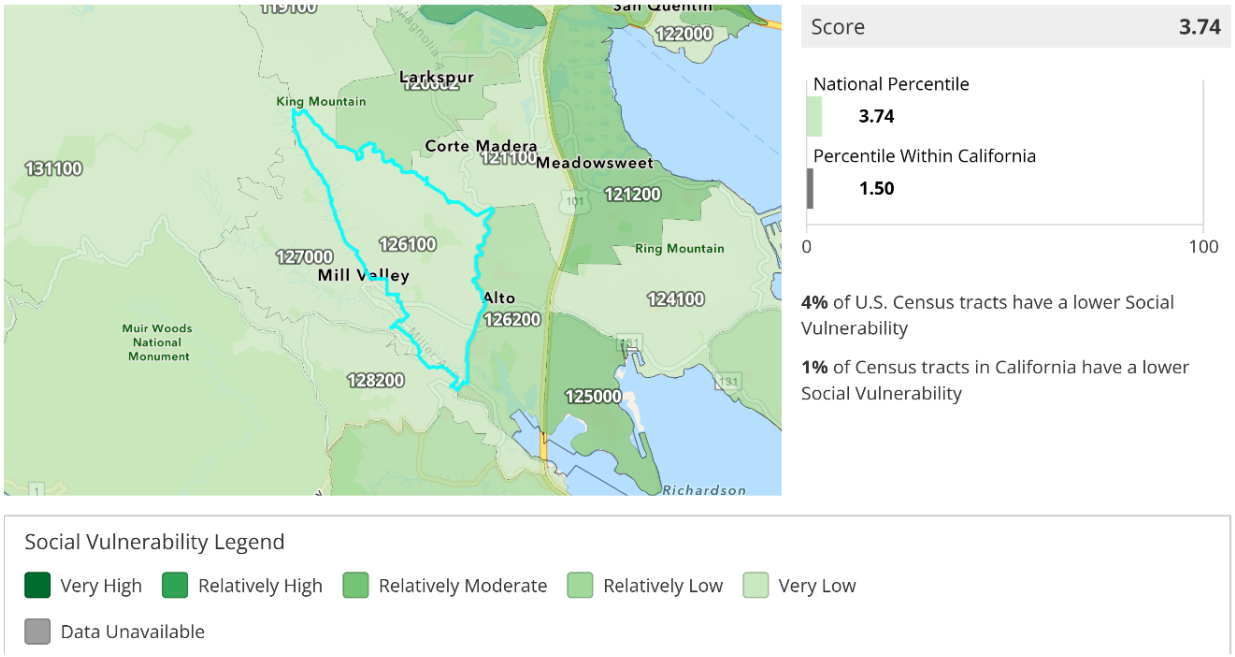


Figure 658: City of Mill Valley Social Vulnerability Map Census Tract 1261.00
Source: FEMA National Risk Index 2023

Table 6: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,077,596	Relatively Low	Very High	0.94	$1,009,900	91.3
Riverine Flooding	$779,681	Relatively Low	Very High	0.94	$730,701	97.7
Coastal Flooding	$23,958	Relatively Low	Very High	0.94	$22,453	92.4
Heat Wave	$7,024	Relatively Low	Very High	0.94	$6,582	44.3
Tornado	$3,739	Relatively Low	Very High	0.94	$3,504	8.1
Landslide	$2,757	Relatively Low	Very High	0.94	$2,584	80.4
Tsunami	$1,144	Relatively Low	Very High	0.94	$1,072	96.5
Wildfire	$575	Relatively Low	Very High	0.94	$538	56

Table 347: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00
Source: FEMA National Risk Index 2023

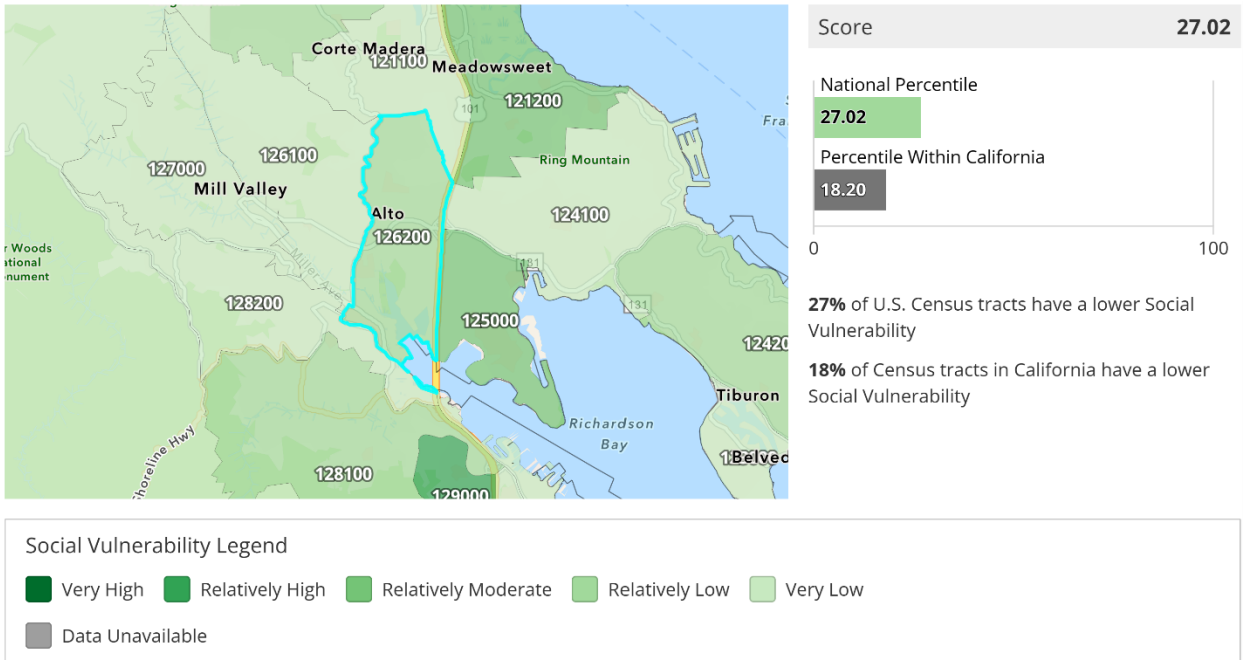


Figure 659: City of Mill Valley Social Vulnerability Map Census Tract 1262.00
Source: FEMA National Risk Index 2023

Table 7: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,217,445	Very Low	Very High	0.72	$880,410	90.3
Riverine Flooding	$176,890	Very Low	Very High	0.72	$127,920	87.5
Wildfire	$40,457	Very Low	Very High	0.72	$29,257	88.9
Heat Wave	$5,300	Very Low	Very High	0.72	$3,832	35.9
Tornado	$4,570	Very Low	Very High	0.72	$3,305	7.6
Landslide	$1,624	Very Low	Very High	0.72	$1,175	67.2
Strong Wind	$256	Very Low	Very High	0.72	$185	7
Coastal Flooding	$0	Very Low	Very High	0.72	$0	0
Drought	$0	Very Low	Very High	0.72	$0	0
Tsunami	$0	Very Low	Very High	0.72	$0	0

Table 348: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00
Source: FEMA National Risk Index 2023

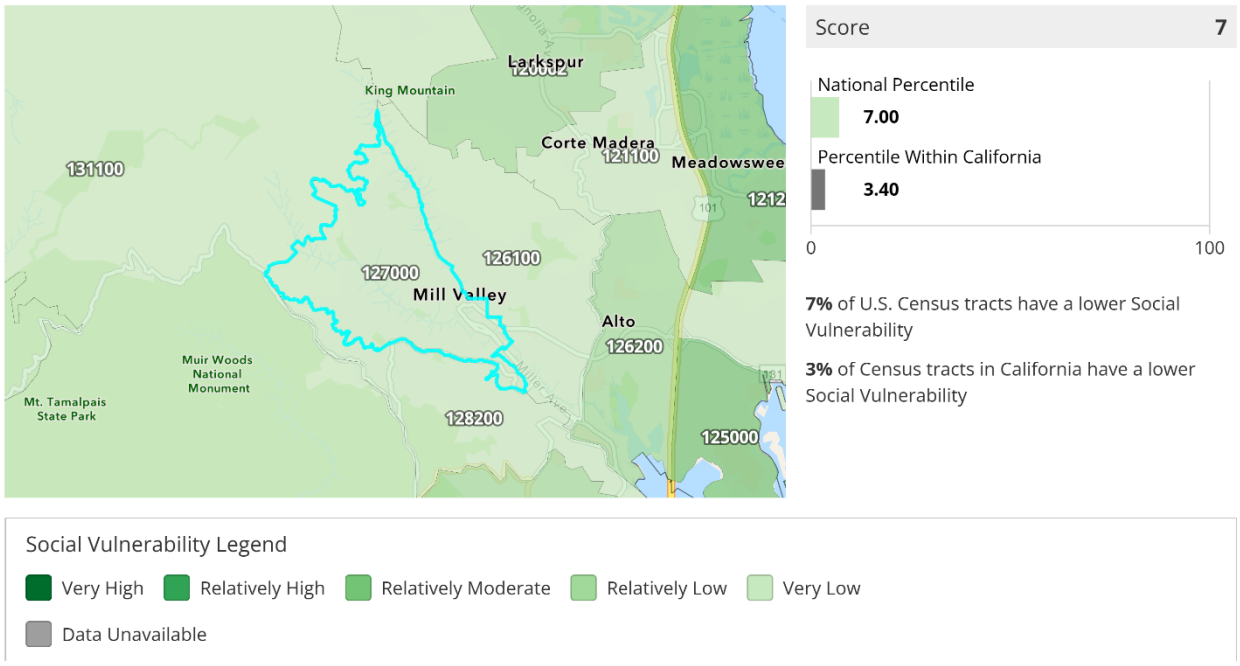


Figure 660: City of Mill Valley Social Vulnerability Map Census Tract 1270.00
Source: FEMA National Risk Index 2023

Table 8: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$704,009	Very Low	Very High	0.79	$553,971	87.3
Riverine Flooding	$48,101	Very Low	Very High	0.79	$37,850	72.8
Coastal Flooding	$5,117	Very Low	Very High	0.79	$4,026	86.2
Landslide	$3,202	Very Low	Very High	0.79	$2,519	80
Tornado	$3,181	Very Low	Very High	0.79	$2,503	5.8
Heat Wave	$359	Very Low	Very High	0.79	$282	17.1
Strong Wind	$188	Very Low	Very High	0.79	$148	6
Tsunami	$1	Very Low	Very High	0.79	$1	88.4
Drought	$0	Very Low	Very High	0.79	$0	0
Wildfire	$0	Very Low	Very High	0.79	$0	0

Table 349: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01
Source: FEMA National Risk Index 2023

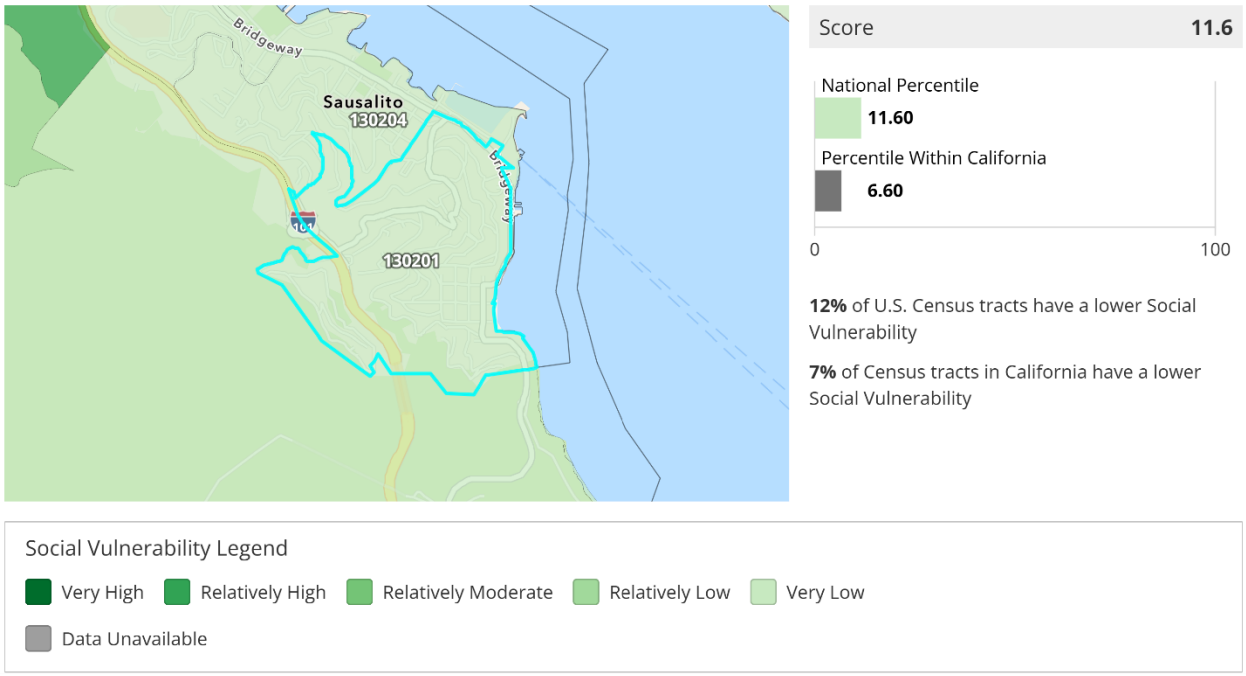


Figure 661: City of Sausalito Social Vulnerability Map Census Tract 1302.01
Source: FEMA National Risk Index 2023

Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$277,560	Very Low	Very High	0.81	$224,222	82.3
Landslide	$7,589	Very Low	Very High	0.81	$6,131	92.2
Tornado	$1,283	Very Low	Very High	0.81	$1,037	2.9
Tsunami	$1,239	Very Low	Very High	0.81	$1,001	96.4
Wildfire	$200	Very Low	Very High	0.81	$162	40.9
Heat Wave	$176	Very Low	Very High	0.81	$142	16.4
Strong Wind	$86	Very Low	Very High	0.81	$70	3.6
Coastal Flooding	$10	Very Low	Very High	0.81	$8	71.8
Drought	$0	Very Low	Very High	0.81	$0	0
Riverine Flooding	$0	Very Low	Very High	0.81	$0	0

Table 350: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03
Source: FEMA National Risk Index 2023

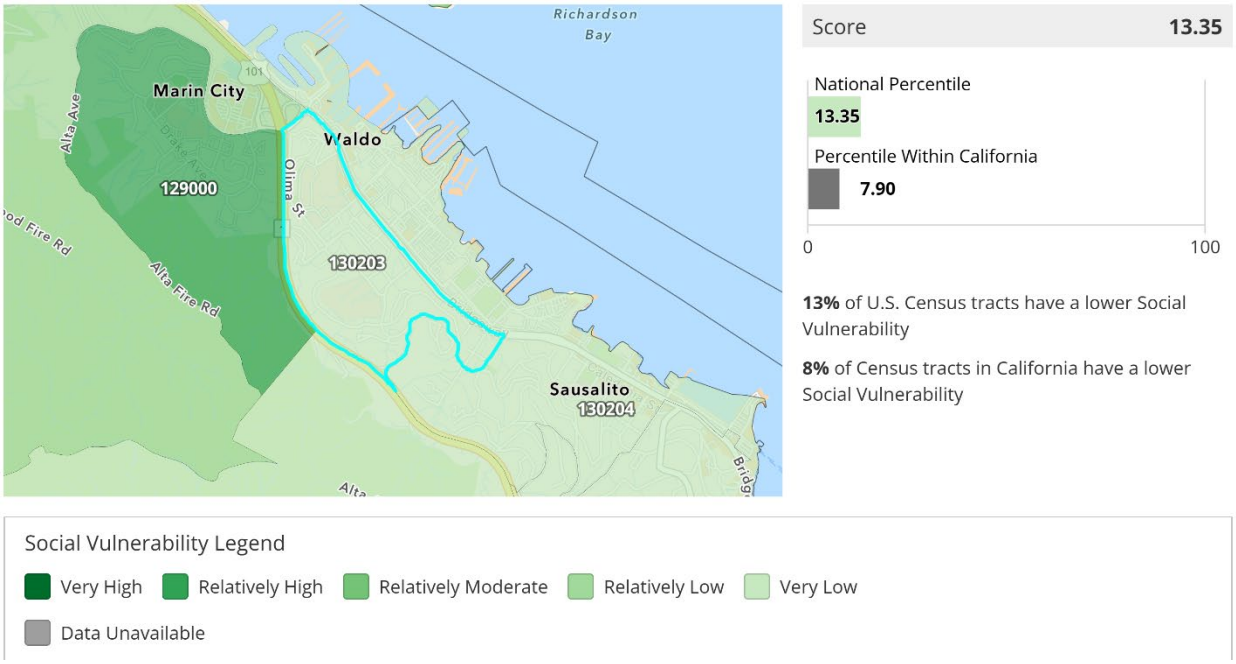


Figure 662: City of Sausalito Social Vulnerability Map Census Tract 1302.03
Source: FEMA National Risk Index 2023

Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,169,125	Very Low	Very High	0.58	$683,563	88.5
Riverine Flooding	$778,574	Very Low	Very High	0.58	$455,216	96.1
Coastal Flooding	$124,477	Very Low	Very High	0.58	$72,779	95.6
Tsunami	$14,622	Very Low	Very High	0.58	$8,549	99.1
Tornado	$3,340	Very Low	Very High	0.58	$1,953	4.6
Landslide	$2,262	Very Low	Very High	0.58	$1,322	69.1
Heat Wave	$852	Very Low	Very High	0.58	$498	18.3
Strong Wind	$166	Very Low	Very High	0.58	$97	4.5
Wildfire	$15	Very Low	Very High	0.58	$9	26.5
Drought	$0	Very Low	Very High	0.58	$0	0

Table 351: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04
Source: FEMA National Risk Index 2023

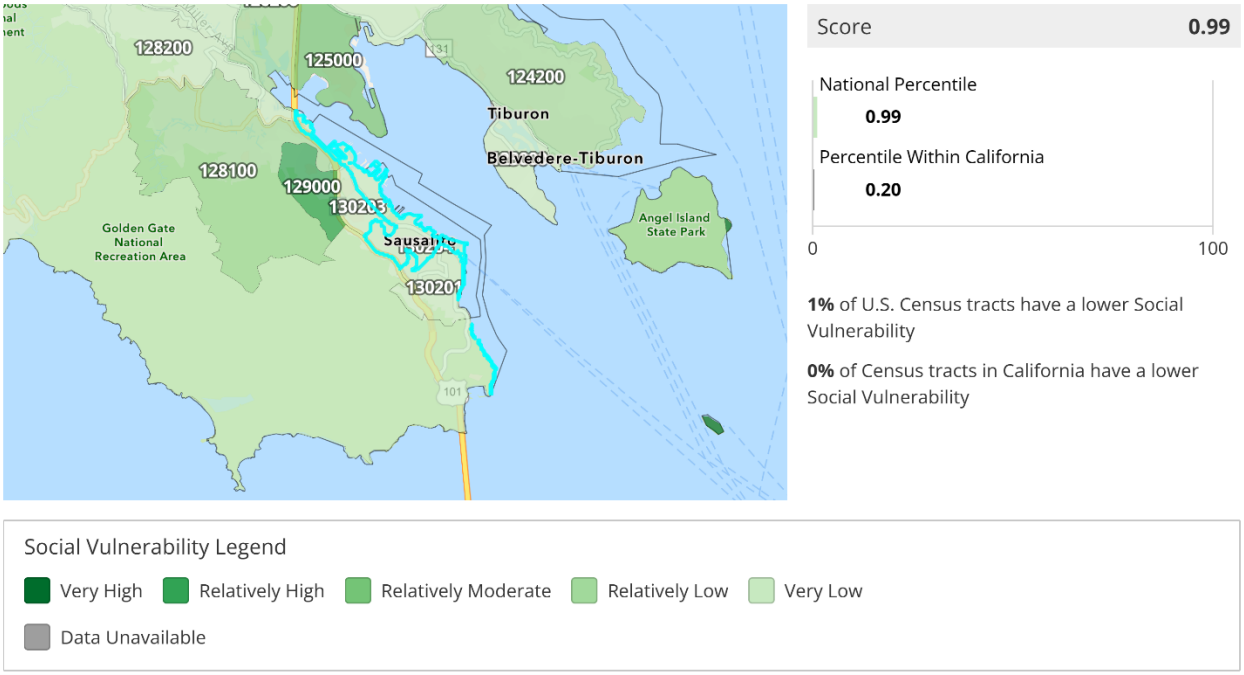


Figure 663: City of Sausalito Social Vulnerability Map Census Tract 1302.04
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1281.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,282,203	Relatively Low	Very High	0.97	$1,242,403	92.8
Riverine Flooding	$359,276	Relatively Low	Very High	0.97	$348,124	94.9
Coastal Flooding	$49,671	Relatively Low	Very High	0.97	$48,129	94.5
Landslide	$40,069	Relatively Low	Very High	0.97	$38,825	99.1
Wildfire	$29,347	Relatively Low	Very High	0.97	$28,436	88.8
Tornado	$5,603	Relatively Low	Very High	0.97	$5,429	13.1
Heat Wave	$726	Relatively Low	Very High	0.97	$703	19.7
Strong Wind	$363	Relatively Low	Very High	0.97	$351	11.4
Tsunami	$261	Relatively Low	Very High	0.97	$253	93.8
Drought	$0	Relatively Low	Very High	0.97	$0	0

Table 352: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1281.00
Source: FEMA National Risk Index 2023

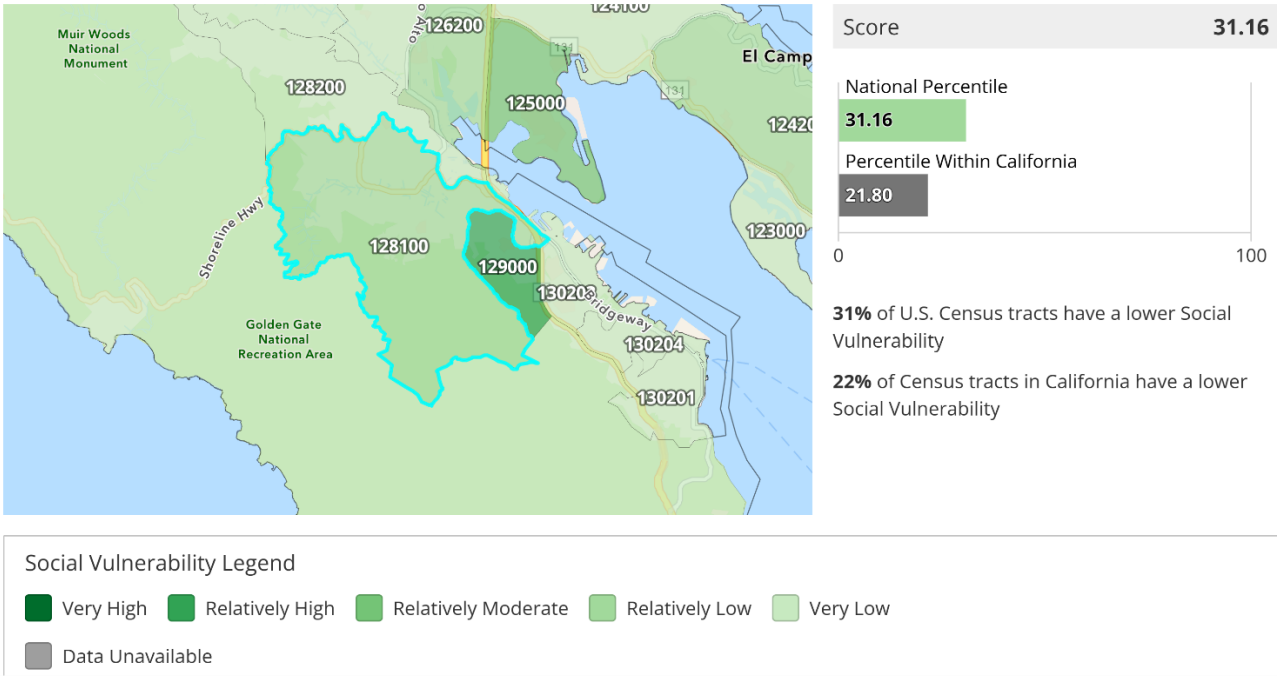


Figure 664: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1281.00
Source: FEMA National Risk Index 2023

Table 12: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1282.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$911,472	Very Low	Very High	0.75	$685,000	88.5
Riverine Flooding	$124,366	Very Low	Very High	0.75	$93,465	84.3
Wildfire	$34,470	Very Low	Very High	0.75	$25,905	88.3
Coastal Flooding	$15,955	Very Low	Very High	0.75	$11,991	90.2
Tornado	$3,999	Very Low	Very High	0.75	$3,006	6.9
Heat Wave	$1,320	Very Low	Very High	0.75	$992	21.8
Landslide	$1,134	Very Low	Very High	0.75	$852	62.2
Strong Wind	$255	Very Low	Very High	0.75	$192	7.2
Tsunami	$188	Very Low	Very High	0.75	$141	92.7
Drought	$0	Very Low	Very High	0.75	$0	0

Table 353: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1282.00
Source: FEMA National Risk Index 2023

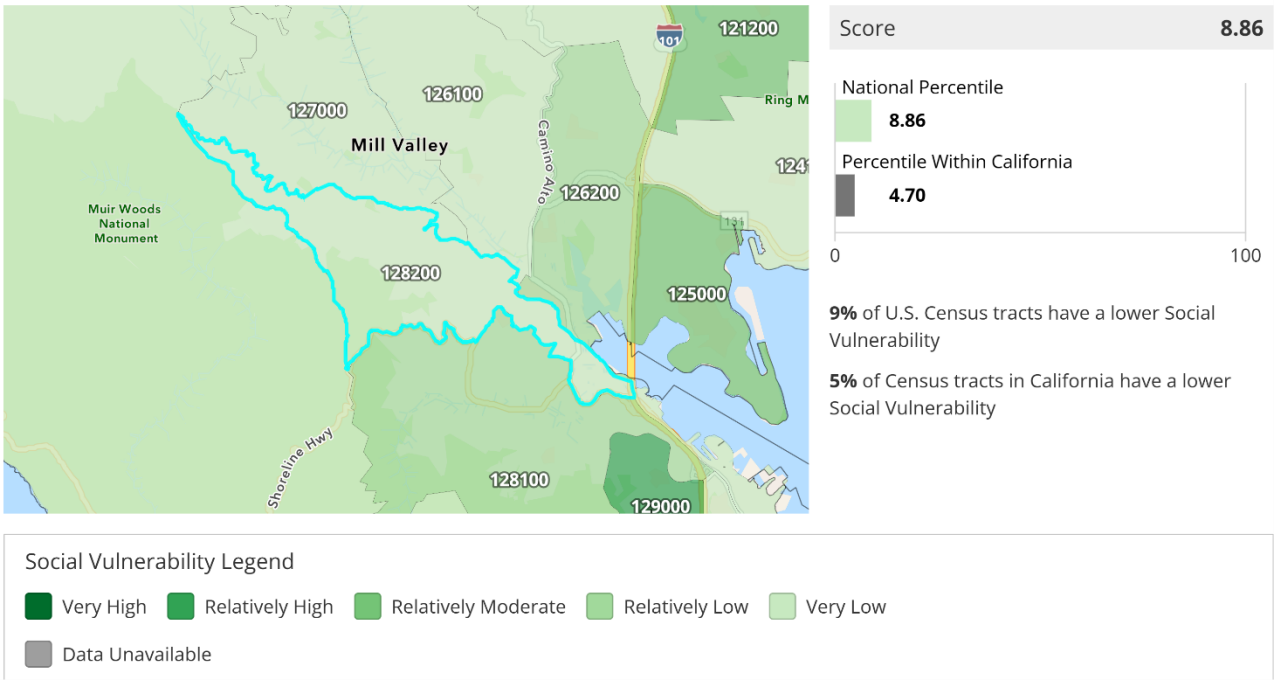


Figure 665: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1282.00
Source: FEMA National Risk Index 2023

Social Vulnerability in Marin County and the Southern Marin Fire Protection District

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia.

The median income for a household in the City was $179,529 and the per capita income for the City was $110,356. Approximately 2.4 percent of families and 4.5 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low or Relatively Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

The median income for a household in the City of Sausalito was $140,410 and the per capita income for the City was $111,167. Approximately 0 percent of families and 7.3 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

Customers within the Southern Marin Fire Protection District reside within census tracts that have a Social Vulnerability Index of "Relatively Low" to "Very Low", the Southern Marin Fire Protection District's ability to serve this community is limited to the Fire and Emergency Medical Services they provide.

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Southern Marin Fire Protection District to fulfill the requirements of its mission during an emergency:

Table 13: Southern Marin Fire Protection District Critical Facilities

Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	VH	X
Fire	City of Mill Valley SMFD (SOM) & City Hall Building/ Fire Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	H	X/AE
Fire	Southern Marin Fire Protection District (SOM)/ Station 4	309 Poplar Street Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM)/ Station 9	308 Reed Blvd Mill Valley, CA 94941	U	X
Fire	Southern Marin Fire Protection District Main Office (SOM) / EOC	28 Liberty Ship Way, Suite 2800, Sausalito, CA 94965	U	VE
Fire	City of Mill Valley SMFD (SOM) & Public Safety Building /Fire St. 7	1 Hamilton Dr, Mill Valley, CA 94941	U	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	VH	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	H	X

Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	VH	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	H	X
School Lycee Francais	Private School, K-6	100 Ebbtide, Sausalito, CA	H	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	H	X
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	H	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	VH	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	U	X
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	U	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	H	AE
Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	M	X
Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	VH	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	M	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	H	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941	VH	X

		(Unincorporated Marin Co but serves Mill Valley)		
High Potential Loss Facilities				
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	H	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	M	X
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	H	X
Critical Infrastructure				
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	VH	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	M	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	U	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	H	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	H	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	VH	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	VH	X
Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	VH, H, M	X, VE, AE
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	VH	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941 37.906425, -122.531301	H	X
Water Supply Facilities	H-Line Fire Road	H-Line Fire Road 37.927032, -122.556641	VH	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	VH	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	VH	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	VH	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	VH	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	VH	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	H	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	VH	X

Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	H	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	X	X
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	H	X
Communications	MERA Radio Antena Site - GGNRA Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	H	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	M, L	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	H	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	M	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	VH	X
Transportation	32 miles of City Roadways	Sausalito CA	VH, H, M	X, AE
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	H	D
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	H	X, AE
Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	M, H	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	VH	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	VH, H	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 3- Homestead	Montford Ave Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 16 - Sausalito	Hecht Ave Sausalito, CA 94965 **Lat:** 37.846963° N **Lon:** 122.483571° W	H	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 2 - Sausalito	300 Spencer Ave., Sausalito, CA 94965	H	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 1 - Sausalito	Rodeo Ave., Sausalito, CA 94965 **Lat:** 37.861804° N **Lon:** 122.498587° W	M	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 6 - Mill Valley	Edgewood Ave Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 5– Tam Valley	Eastwood Park Mill Valley, CA 94941	VH	X
Local Government	City of Mill Valley / LRAD Site 12 - Cascade	Cascade Ave Mill Valley, CA 94941	VH	X
Local Government	City of Mill Valley / LRAD Site 13 – Golf Course	City Golf Course, Mill Valley, CA 94941 **Lat:** 37.912321° N **Lon:** 122.532580° W	H	X

Local Government	City of Mill Valley / LRAD Site 14 – Vasco Ct	Vasco Ct, Mill Valley, CA 94941 **Lat:** 37.909892° N **Lon:** 122.524649° W	H	X
Local Government	City of Mill Valley / LRAD Site 15 – Ralston White	Ralston White Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM) – Bel Aire School RUSD / LRAD Site 8- Tiburon	277 Karen Way Mill Valley, CA 94941 **Lat:** 37.902517° N **Lon:** 122.495679° W	U	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 17- Marin City	850 Drake Ave, Marin City Mill Valley, CA 94941	VH	X
Fire/Local Government	Publicly Maintained Hydrants	1,929 individual site locations within the District.	VH, H, M	X, VE, AE
Fire/Local Government	Public Emergency Fire Roads	9.59 miles of non-paved emergency access fire roads	VH, H, M	X, VE, AE

Table 354: Southern Marin Fire Protection District Critical Facilities
Source: Southern Marin Fire Protection District

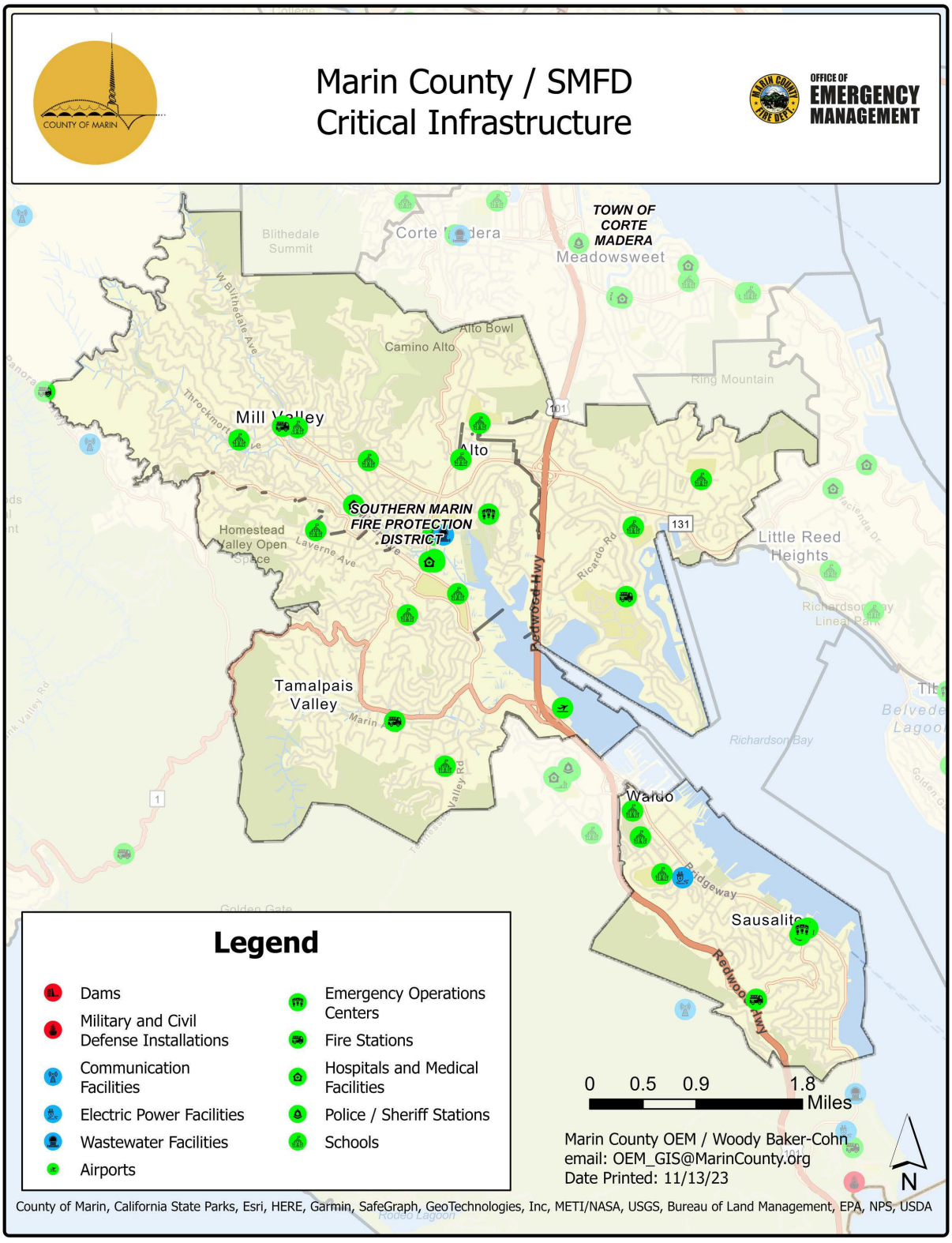


Figure 666: Map of the Southern Marin Fire Protection District and Critical Facilities and Infrastructure within the District
Source: Marin County OEM

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Southern Marin Fire Protection District identified hazards that affect the District and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 17 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

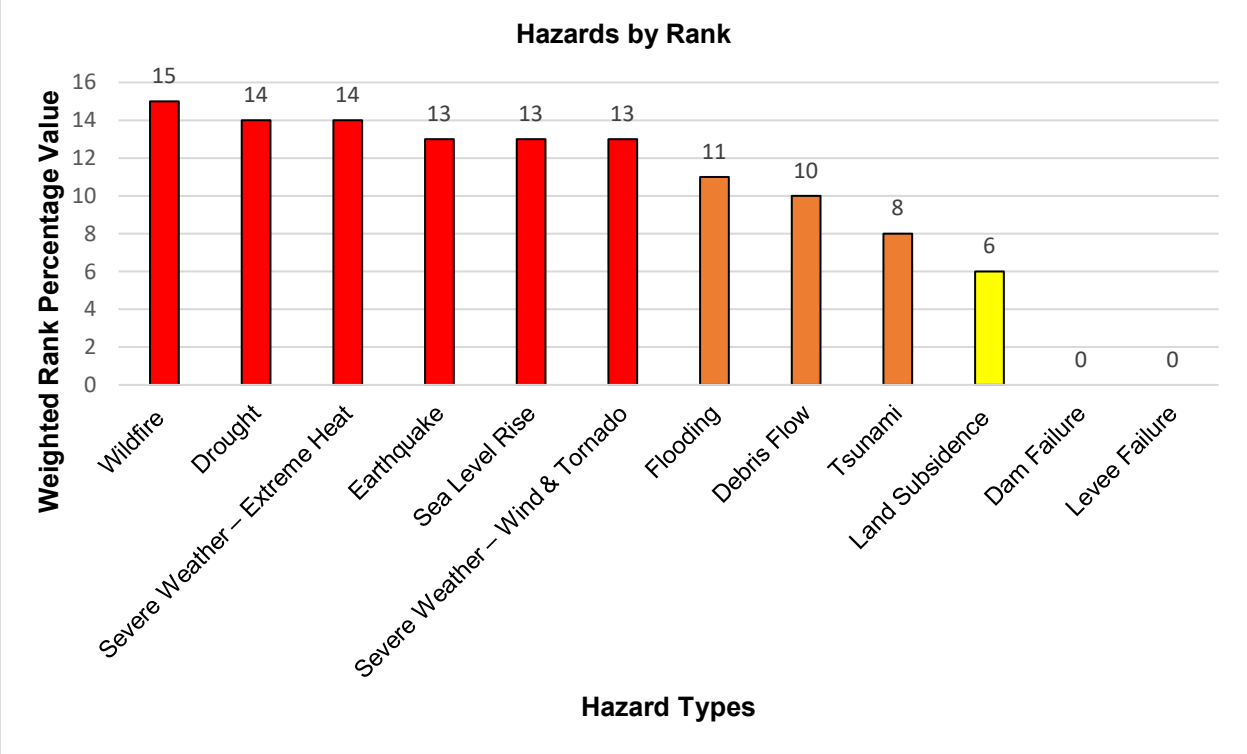


Figure 667: SMFD Risk Assessment – Planning Team Top Hazards

Figure 18: Risk Rank Categorization	
Risk Level	Risk Numerical Score
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 668: Hazard Risk Categorization

Each Marin County OA MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and organization then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed

the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 14: Select Hazards Magnitude and Severity Scale

Hazard	Scale/Index	Weak	Moderate	Severe	Extreme
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 355: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

ATMOSPHERIC METHANE CONCENTRATIONS SINCE 1984

Data source: Data from NOAA, measured from a global network of air sampling sites

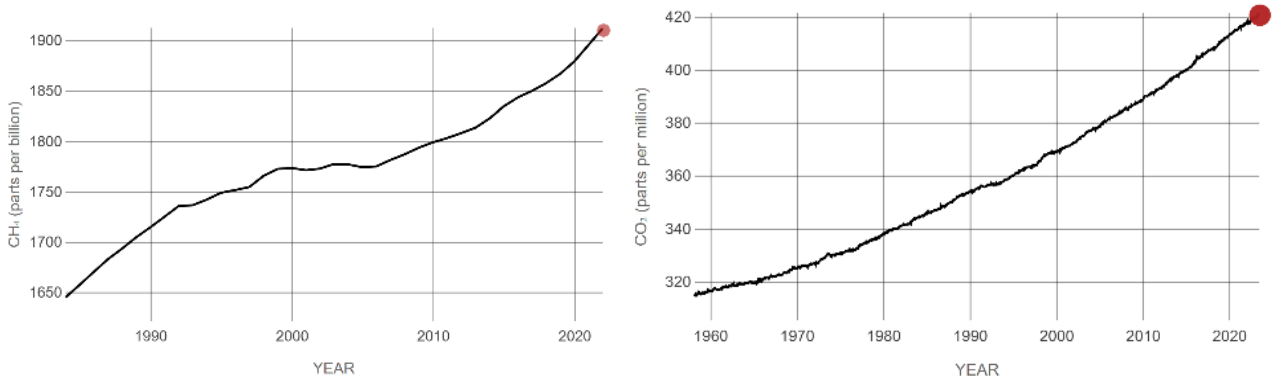


Figure 669: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

TIME SERIES: 1884 TO 2022

Data source: NASA/GISS
Credit: NASA's Scientific Visualization Studio

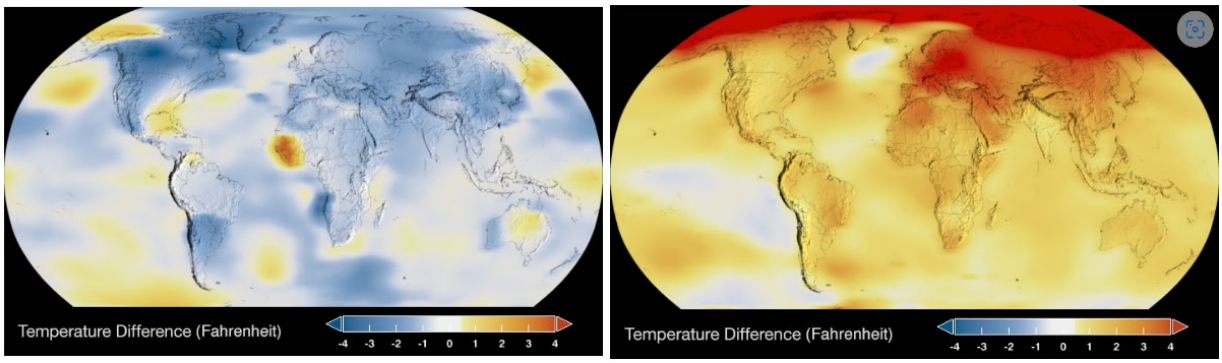


Figure 670: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.
- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.

- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

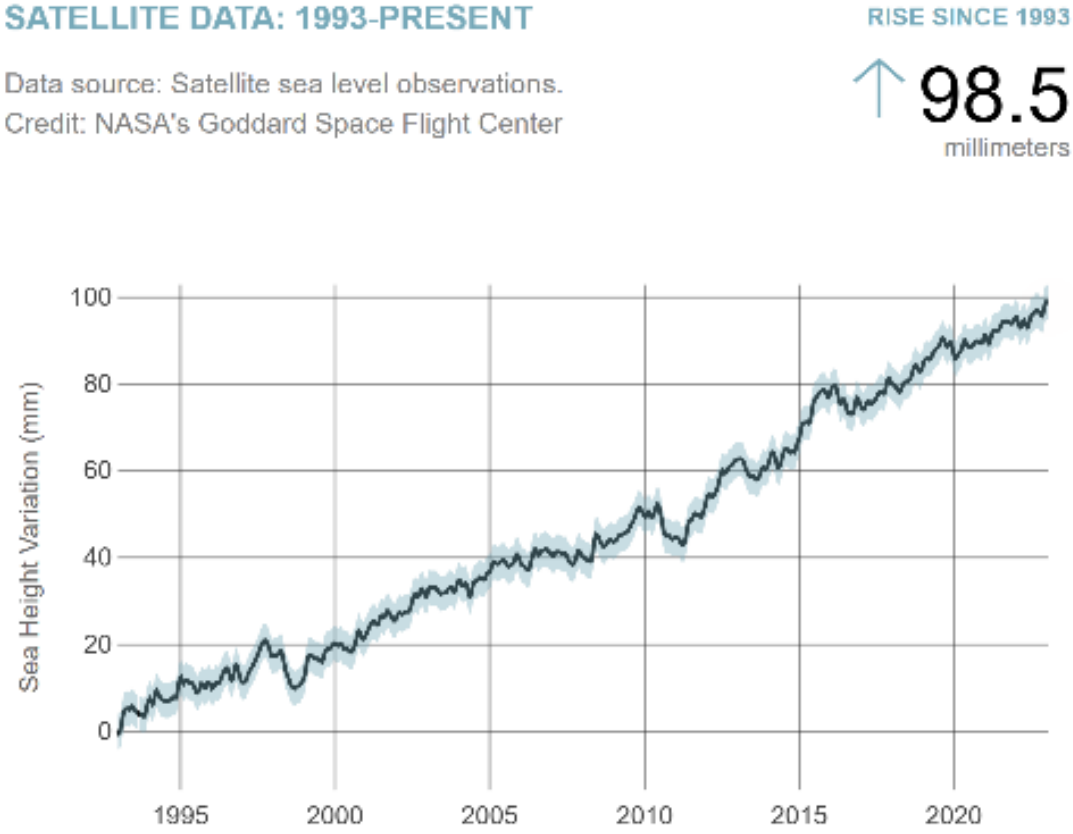


Figure 671: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.

- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County Hazard Mitigation Plan as a standalone hazard while addressing each of the other natural hazards. Marin County is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California

Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.
- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.

- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

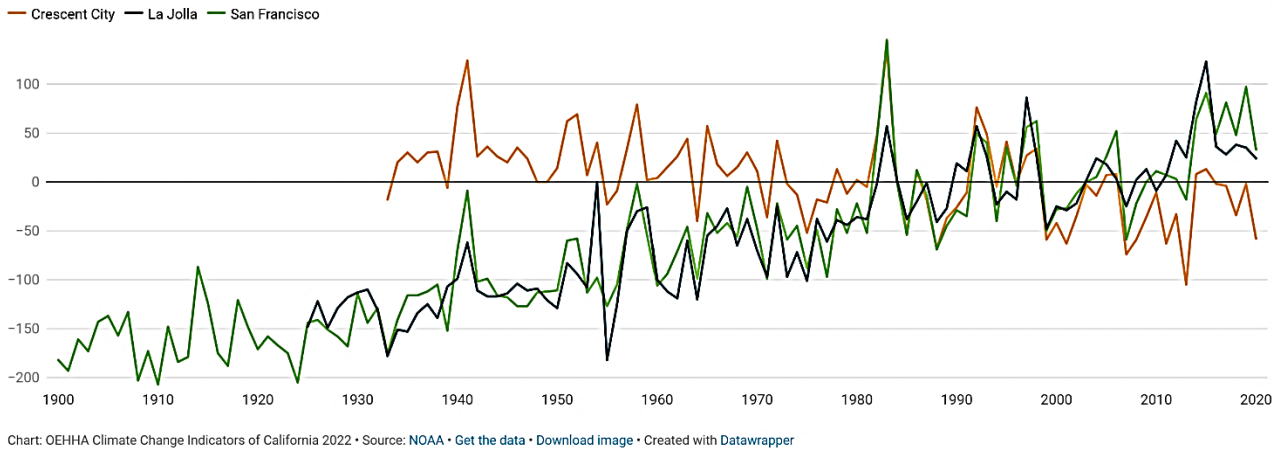


Figure 672: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable. Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise, storm surge, and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.

Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In October 2022, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2020. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the Southern Marin Fire Protection District as per the planning team.

Table 15: SMFD Hazard Risk Assessment

Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 356: SMFD Hazard Risk Assessment
Source: Southern Marin Fire Protection District

Omitted Hazards

Dam Failure: There are no dams within the district that a failure of which would impact the Southern Marin Fire Protection District service area. The district service area is not in any dam inundation zone.

Table 16: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 357: County of Marin Hazard Risk Assessment
Source: Marin County

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of

the two for complex movements. Rock refers to hard or firm bedrock that was intact and in place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits, but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 23 shows landslide susceptibility classes.

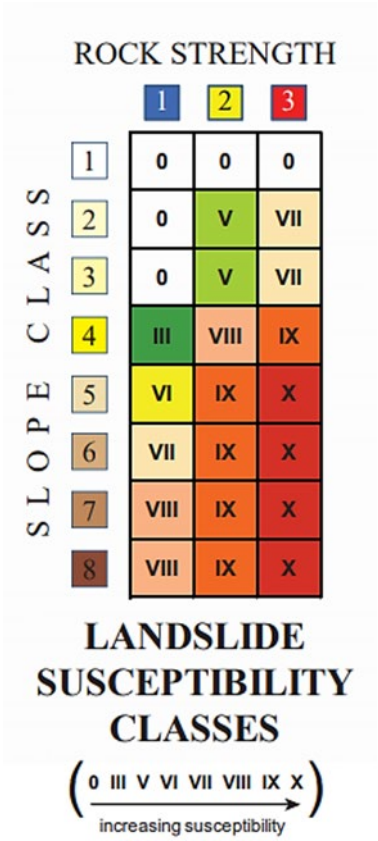


Figure 673: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour". Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 24 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

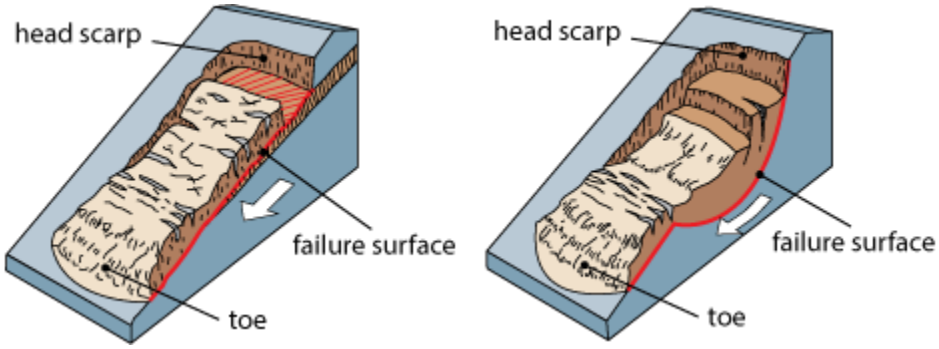


Figure 674: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in the SMFD would most likely occur in any of the areas throughout the District where the terrain is steeper and is more susceptible to movement of hill slope materials.

A landslide having major impacts on any of the critical facilities in the District could affect the provision of District services. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open spaces in the District could contribute to debris flows throughout the District.

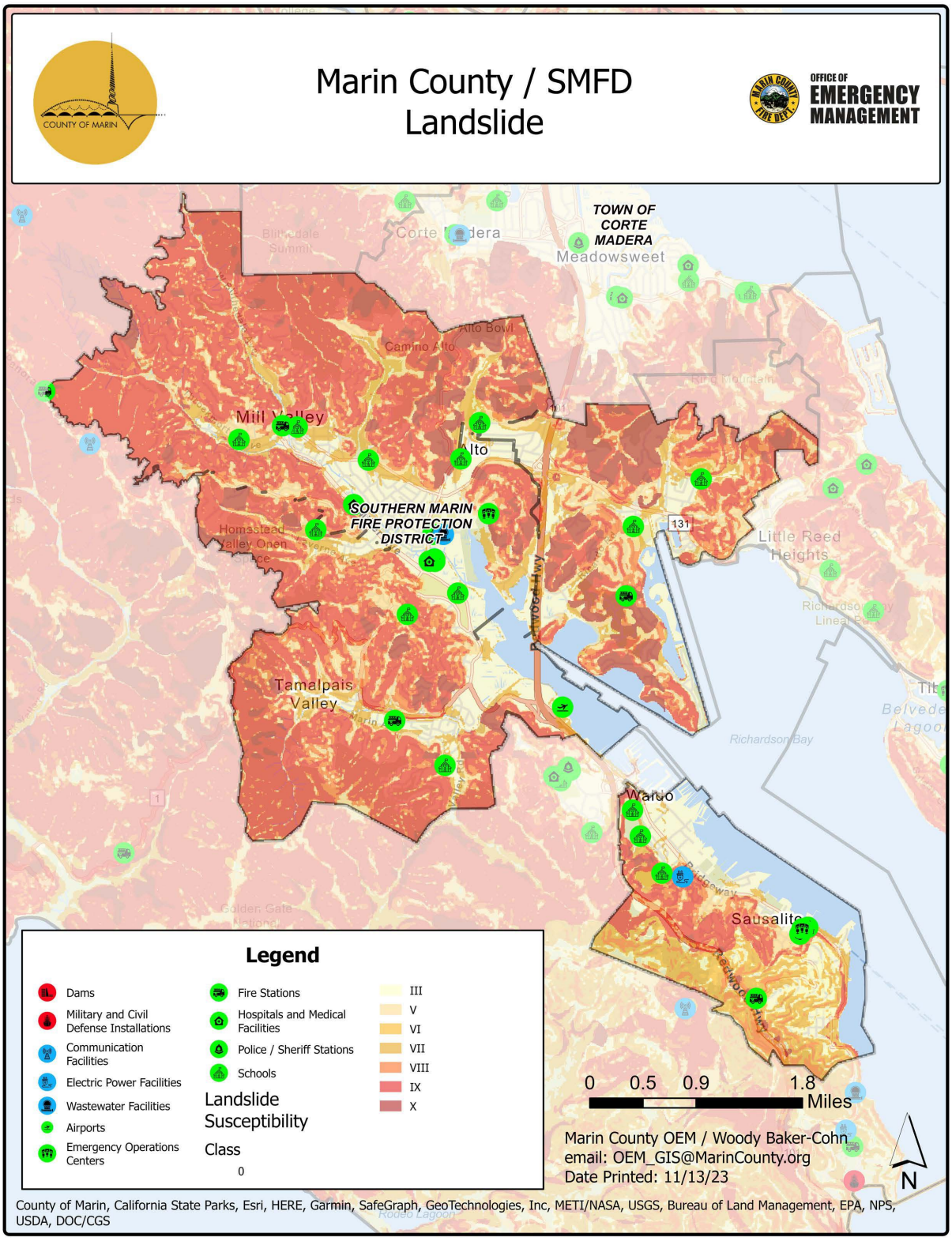


Figure 675: SMFD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

Unincorporated County of Marin
Much of Tamalpais Valley and the outskirts of Marin City lie in an area of high landslide susceptibility. There are hundreds of residences along with several schools, community centers and emergency facilities that lie in this area. While Alto has low landslide susceptibility, most of Strawberry down to Harbor Point lies in an area of moderate to high landslide susceptibility. There are hundreds of residences and several schools and community centers in these areas, as well as the SMFD Station #9. A landslide having major impacts on any of the roads in these areas could affect the ability of residents' ingress and egress to their property. Earthquakes also have the potential to cause soil instabilities throughout these areas. A major wildfire and/or rain soaking event in these areas could threaten communities with a debris flow.

Sausalito
The western side of Sausalito is in an area of high landslide susceptibility and is primarily residential with some businesses along sections of the Bridgeway. It consists of numerous winding streets and hillside homes that may sustain damage from soil movement in the area. All of Sausalito's critical facilities lie in areas of low landslide susceptibility but are adjacent to areas of high landslide susceptibility. Transportation challenges may be of particular concern with a landslide in the Sausalito. Major roads that traverse Sausalito, including all of Highway 101 and sections of the Bridgeway along with roads that connect Bridgeway with Highway 101 including Spencer Avenue/San Carlos Avenue and Rodeo Avenue/Nevada Street are located on steep hillsides which may be susceptible to landslides. Ingress and egress into part of Sausalito may be impacted by a landslide.

A landslide having major impacts on any of the roads in this area could affect the ability of residents' ingress and egress to their property. Earthquakes also have a potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Sausalito may contribute to soil instabilities and pose a risk to properties and infrastructure in Sausalito's jurisdiction. several small watersheds originate above Sausalito in the Golden Gate National Park's jurisdiction and flow towards San Francisco Bay through Sausalito's jurisdiction. Erosion from these small watersheds can add to soil instability.

During the storms of 1982 severe storm caused numerous mudslides across the city and within the County of Marin. One such slide impacted a private home by moving the structure off its foundation and sending it into and adjacent structure which resulted in a fatality. The same storm event impacted Highway 101, above Sausalito, by developing a slide that closed Highway 101 which closed the main County of Marin highway. Further weakening of saturated soils threatened to destabilize a 250,000-gallon water tank. Other soils instabilities occurred during this event including the north slope of the Waldo Grade area, weakening Highway 101 and threatening collapse of the Robin Williams (then Waldo) Tunnel which is located above the city. On 2/14/2019 a storm caused 50 homes to be evacuated after a mudslide occurred on National Park Property in the Hurricane Gulch neighborhood, sending at least one home sliding 75 yards down a hill. Sausalito Boulevard and Crescent Avenue were inundated with mud during the event. The landslide caused hundreds of thousands of dollars in damage. The City as well as the state and federal government declared the event a disaster.

Figure 676: Mudslide in Sausalito – 2019
Source: San Jose Mercury News

12/12/2022 – A landslide closed all southbound lanes of Highway 101, affecting traffic.

The City of Sausalito formed a Landslide Task Force following the events of 2019. The task force developed recommendations for the city to consider including but not limited to the development of a Geologic Hazard Study of Sausalito. That study has been initiated and is expected to be completed in early 2024. Other recommendations from the Landslide Task force may be considered such as establishing geologic hazard areas or possible code changes to address known instabilities.

Mill Valley

Most of Mill Valley is extremely susceptible to landslides due to the steepness of the terrain around the city. A landslide in Mill Valley could occur anywhere in the city where the terrain may be susceptible to soil movement. These areas primarily consist of numerous winding and dead end streets and hillside homes that may sustain damage from soil movement. Development in these areas was mostly done in the 1920s and 1930s before landslides were factored into design and construction regulations. Most of the downtown and commercial area of Mill Valley between Miller Avenue and E. Blithedale Avenue from Thockmorton Avenue to Camino Alto lies on relatively flat land with low to no landslide susceptibility. Approximately half of Mill Valley's critical facilities lie in areas of no landslide susceptibility but are adjacent to areas of moderate to high landslide susceptibility. The Old Mill Elementary School, The Mill Valley Fire Station #6, the Greenwood School, Park Elementary School, the Helix School, and Edna Maguire Elementary School all lie in areas of the city that have some landslide susceptibility. The Mill Valley Police Department and SMFD Fire Station #7 lie directly adjacent to an area of very high landslide susceptibility.

Transportation challenges may be of particular concern with a landslide in the city, particularly in the hilly and mountainous residential areas around the city. Ingress and egress into these areas may be impacted by a landslide.

Earthquakes also have the potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Mill Valley may contribute to soil instabilities and pose a risk to properties and infrastructure in Mill Valley. Several small watersheds originate above Mill Valley in the Muir Woods National Monument and Mount Tamalpais State Park and flow towards Richardson Bay through Mill Valley. Erosion from these small watersheds can add to soil instability and could contribute to debris flows. Homes along Old Mill Creek, Arroyo Corte Madera del Presido and Warner

Creek are particularly susceptible to a debris flow, which could destroy bridges and other road infrastructure.

On 10/24/2021, a severe storm caused a mudslide that damaged the Guidepost Montessori School.

On 4/12/2006, a mud flow coursed down the steep slope behind a home at 70 Bolsa Avenue, uprooting oak trees before crashing into the master bedroom. The debris flow was about 50 feet wide and 12- to 14-feet deep and it killed a resident who was found under 12 feet of mud.

Tiburon
Most of the District area of Tiburon has steeper terrain, with the area around the Ring Mountain Open Space Preserve on the north side of the town being most susceptible. These areas are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. The Bel Aire School lies in this area. A landslide having major impacts on any of the roads on the northern Tiburon Peninsula could affect the ability of residents to reach their homes and could affect the provision of emergency and essential services. An earthquake has the potential to cause landslides in the areas of Tiburon with landslide susceptibility. A wildfire and subsequent rain event in the Ring Mountain Open Space Preserve could potentially contribute to debris flows and mudslides in Tiburon.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[44], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Southern Marin Fire Protection District service area could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It

[44] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Drought can occur in all areas of the SMFD, though its effects would be most felt in the mountainous areas around the Tamalpais Valley, Mill Valley, Sausalito and Tiburon where the risk of wildfire would increase. Dry trees throughout the district may become a safety hazard to the public due to falling trees or its limbs.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including in the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA, including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of

Tiburon. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Sausalito, increasing the chances of brush fires there. Future development in this area, in the mountainous areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 27).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 677: Modified Mercalli Intensity Scale
Source: USGS

Figure 28 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 678: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 29). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 679: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around the SMFD due to the number of active faults within and near Marin County.

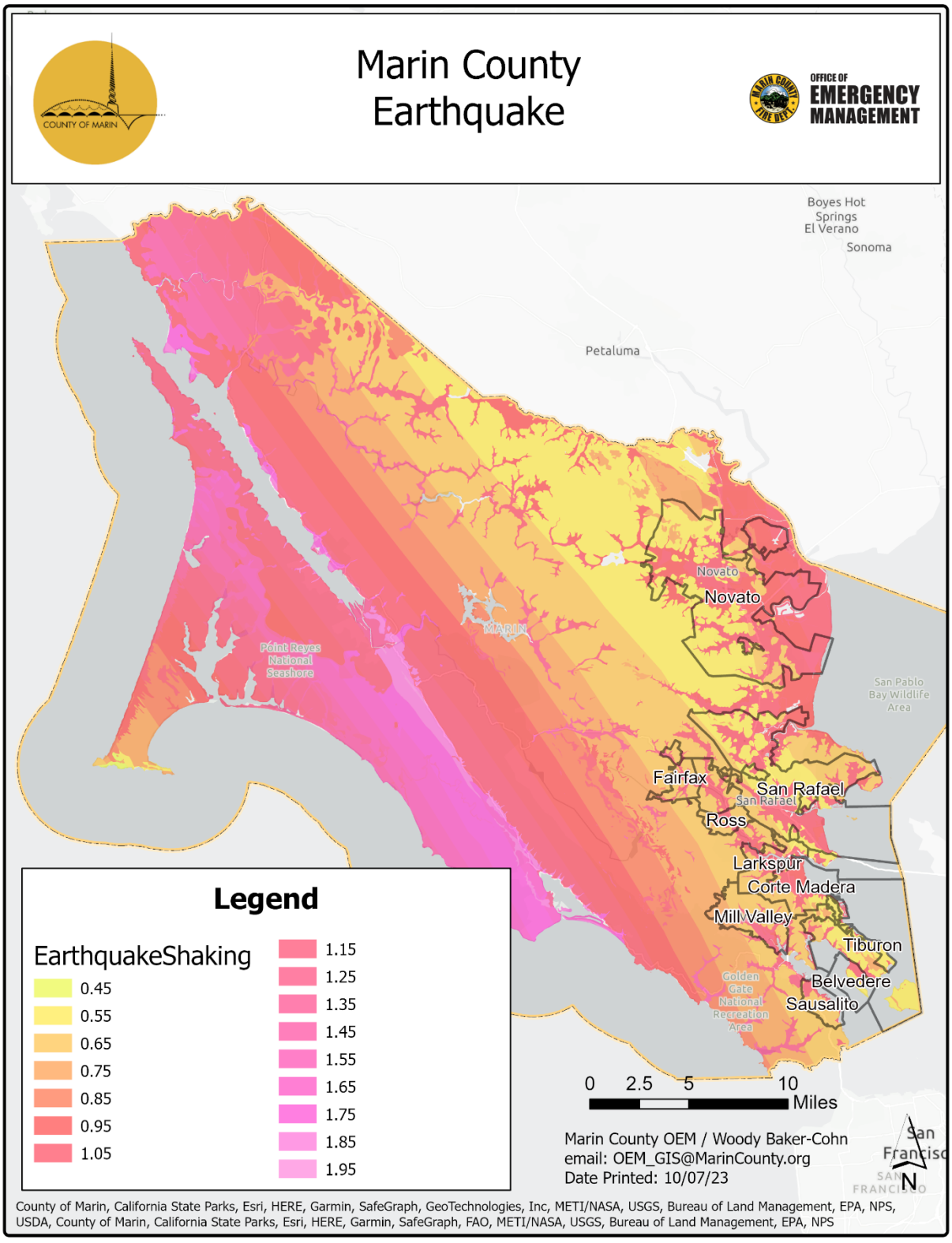


Figure 680: Marin County Earthquake Impact
Source: Marin County OEM

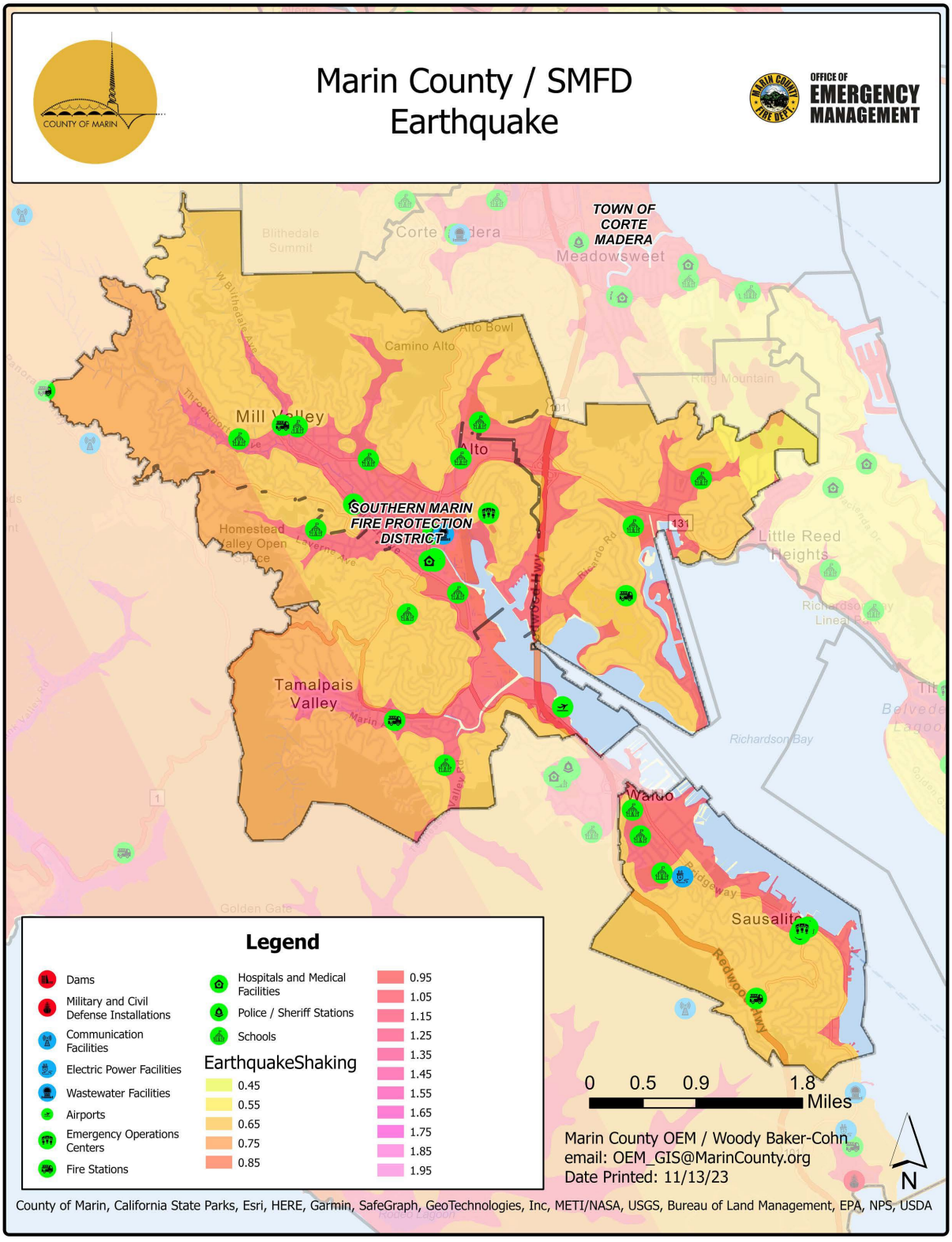


Figure 681: SMFD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

The District is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the District.

Unincorporated County of Marin
There is increased risk of shaking and liquefaction in the District's unincorporated area along creeks and on bay mud and current and former marshlands. This includes the area of Tamalpais Valley along Coyote Creek where hundreds of homes and the SMFD Fire Station #4 are located, Alto and along the shoreline of Strawberry where dozens of homes are located. Landslides in the unincorporated County as a result of an earthquake may cause damage to homes and roads as a result of shifting soils.

Sausalito
There is increased risk of shaking and liquefaction in Sausalito from an earthquake, particularly in the lowland areas north and east of Bridgeway where superficial deposits and fill are more prevalent. This includes residences and the primary commercial areas the Bridgeway corridor where there are numerous businesses, marinas and other docking facilities. A residential neighborhood that includes the Lycee Francais de San Francisco and the Dr. Martin Luther King Jr. Academy also lies in this area, along with the part of the Southern Marin Fire Protection District Station #1 and the City's Police Station. The highest risk areas due to liquefaction are in the Marinship area, which was filled in for the building of the wartime Marinship shipyards in 1942. Other areas along Bridgeway in the downtown area were also filled to create new space for housing and businesses in the late 1800's. There may also be increased risk of landslides in Sausalito due to an earthquake based on the steepness of the terrain throughout the city. This includes most of the residential area of Sausalito west of Bridgeway and central part of the City between Highway 101 and the Bridgeway. Vulnerable structures include a bridge and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the city may also be impacted by an earthquake.

Landslides in Sausalito as a result of an earthquake may cause damage to homes and roads as a result of shifting soils.

Mill Valley
In the upland areas of the City, most modern single-family buildings with foundations to bedrock should perform well to shaking. Modern multi-story buildings with foundations to bedrock should not be subject to collapse, although some serious damage may occur. There is increased risk of earthquake shaking and liquefaction in certain parts of Mill Valley, particularly in the area of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 where superficial deposits and fill are more prevalent. This area has greater development density and includes residences and the primary downtown and commercial areas of the City. Residential areas of the city along the lower reaches of Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creek also have an increased risk of earthquake shaking. All of the City's critical facilities lie areas of moderate earthquake shaking susceptibility. Unreinforced masonry buildings in the downtown area could suffer moderate to severe damage from an earthquake. Falling debris could endanger those in the vicinity of these older buildings. "Pancaking" of these older structures during business hours may entrap many people. The City's densely settled alluvial lowlands have a potential for heavy damage. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base.

Landslides in Mill Valley as a result of an earthquake may cause damage to homes and roads as a result of shifting soils, effecting ingress and egress in the hilly and mountainous residential areas of the city where there are numerous windy and dead-end roads. Many hillsides in Mill Valley are unstable in their natural state, and even minor changes in the shape of the land surface could create major landslide problems.

Mill Valley hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Mill Valley On 12/31/2020, a 3.6 magnitude earthquake originating from the San Andreas Fault struck near Mill Valley. There were no reports of damages or injuries.

In 2023, the Mill Valley City Council approved an ordinance that requires retrofitting for some apartment buildings built before 1978. The ordinance applies to "soft-story" apartment buildings or those with a wood-frame target story design and three or more residences. Approximately 50 to 90 buildings could meet the criteria according to the city.

Tiburon

All buildings located in Tiburon are vulnerable to earthquake damage, but depending upon construction, some buildings are expected to perform better than others. There is increased risk of shaking and liquefaction in lowland areas of Tiburon in the District from an earthquake, particularly in the area north of the Cove Shopping Center. where superficial deposits and fill are more prevalent. Dozens of residences and the Bel Aire School lie in this area. Earthquakes could also cause landslides in open space areas around Tiburon in the District with steeper terrain, including around the Ring Mount Open Space Preserve, causing damage to homes and roads as a result of shifting soils.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[45], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including in the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes areas along creeks in Tamalpais Valley, along the shoreline of Strawberry, and in the lowlands of Mill Valley, Sausalito and Tiburon, where the risk of subsidence and subsequent earthquake shaking are higher. Future

[45] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

The SMFD has not experienced a major earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in the District.

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its “bank-full” capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the “Atmospheric River” contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the “Pineapple Express” because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 32.

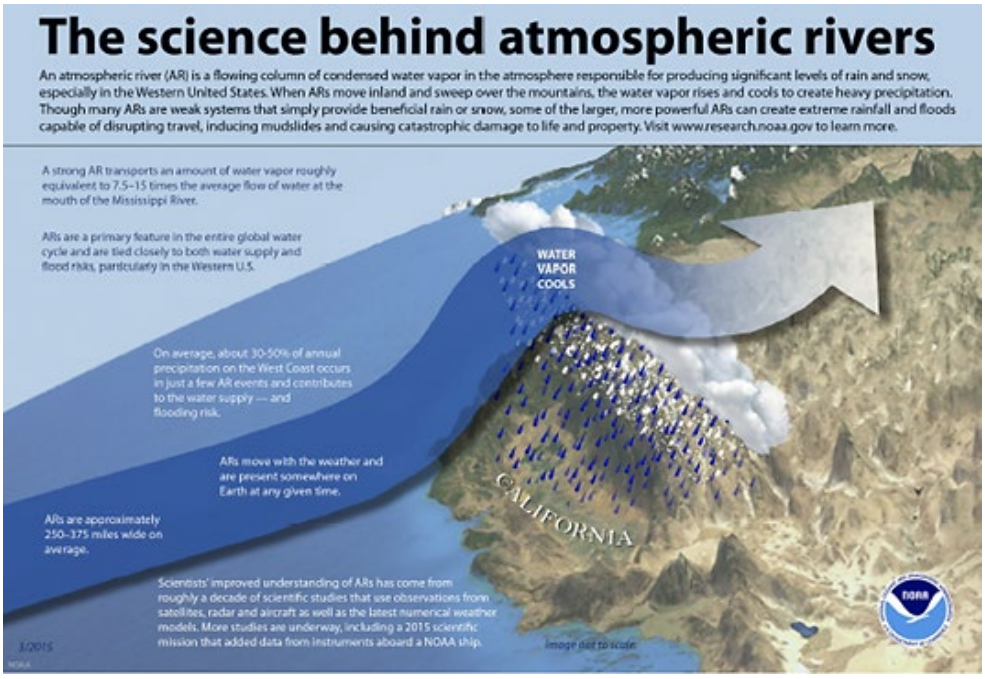


Figure 682: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging. Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line.

Flooding in the SMFD generally results from creek flooding and tidal flooding in low-lying areas. Approximately half of the lowland areas in the District are in the 100-year floodplain, with the other half in the 500-year floodplain.

Unincorporated County of Marin
Major county watersheds where significant numbers of structures are at risk from riverine flooding include Coyote Creek in the Tamalpais Valley area of the District. Most of the Tamalpais Junction area of Tamalpais Valley along Coyote Creek and the creek along Tennessee Valley Road lies in the 100-year floodplain, with a smaller section lying in the 500-year floodplain. Numerous residences lie in the 500-year floodplain and could be susceptible to either creek flooding or flooding from Richardson Bay. Hundreds of residences, a church, the Tamalpais Valley Community Center, part of the Tamalpais Valley Elementary School, a large shopping center with numerous businesses, the CalTrans Manzanita Station, sections of Highway 1, a section of Highway 101 and the Commodore Center Heliport all lie in the 100-year floodplain and could be susceptible to flooding. Most of the Strawberry and Alto areas lie outside the 100 and 500-year floodplain, though dozens of residences, several apartment complexes, numerous commercial buildings and part of the Strawberry Point Middle School lie in the 100-year floodplain and could be susceptible to flooding.

Mill Valley
Many developed and undeveloped Mill Valley lands are subject to flooding due to a combination of factors, including periodic heavy winter rainfalls, tidal fluctuations, and potential for tsunami due to seismic activity. Mill Valley has numerous drainage basins which lead to small riparian streams and creeks which drain to Richardson Bay. Flooding in Mill Valley generally results from a combination of creek flooding along Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creeks as well as from high tides and storm runoff in low-lying areas along Richardson Bay. Mill Valley drains into Richardson Bay mainly by way of the Arroyo Corte Madera del Presidio. The creek drains an area of about six square miles from the upper reaches of Mount Tamalpais. Creek bank gradients are, therefore, exceptionally steep in the upper elevations, and flatten markedly as the creek continues over alluvial plains and enters the tidal marshlands along the periphery of Richardson Bay. Consequently, the creek often overflows its banks in the lower reaches during periods of heavy rainfall. Sunny-day king tide flooding has become a common occurrence along the bay in Mill Valley. Several lowland areas in Mill Valley, particularly the alluvial fan where its creeks converge, are in the 100-year floodplain, with several pockets in in the 500-year floodplain. Significant encroachment by urban development and vegetative growth has occurred along Arroyo Corte Madera del Presidio. Both factors have imposed extreme limitations on channel flow capacities along substantial portions of the creek, resulting in flood problems. During heavy rainfall conditions, floodwaters cascade down the steep upper reaches of the main tributary streams and flow through central Mill Valley, where they overflow the flatter, generally constricted and inadequate channels. Damaging floods have periodically occurred over this area as a result. Part of the downtown area, the commercial areas along Miller Avenue, E. Blithedale Avenue east of Lomita Drive and along Redwood Highway adjacent to Highway 101, and numerous residences lie in the 100-year floodplain and could be susceptible to flooding. Part of the Mill Valley City Hall and Fire Station #6, the Marin Terrace and Redwoods medical facilities, Tamalpais High School and part of the Mill Valley Treatment Plant lie in the 100-year floodplain. Part of the Mill Valley Middle School, the Redwoods medical facility, the Mill Valley Treatment Plant and dozens of homes and businesses lie in the 500-year floodplain and could be susceptible to flooding.

Tide elevations within Richardson Bay have the potential to significantly impact the Mill Valley storm drain system. Mill Valley already sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. Mill Valley areas subject to frequent flooding in the past are predominantly former marshlands (Bay Mud areas) that have previously been filled for urban expansion purposes. Consequently, the flood problem in Mill Valley has increased with time.

Mill Valley has experienced the impacts of flooding from winter storms, most notably in 1982, 1997, 1998, 2005 and 2006.

On 01/10/2023, roads and schools closed in Mill Valley as storms doused the region. Saturated soil caused fallen trees and landslides to impact roads. Power outages impacted thousands. Flooding in Mill Valley prompted closures at Sycamore Avenue and Locust Avenue and Miller Avenue at Evergreen Avenue, according to Southern Marin Fire Protection District.

On 12/23/2022, king tides in Mill Valley peaked preceding a storm. Water pooled on roads in some places, including the ramps on and off Highway 101 outside city limits, and along the San Francisco Bay Trail and on Miller Avenue and E Blithedale Avenue and at the SASM WWTP within city limits. The City worked to ensure that drains and debris were clear.

On 10/21/2021, a storm caused flooding in Mill Valley, particularly in the Sycamore Triangle neighborhood. Residents were told to move their vehicles to higher ground at the Mill Valley Community Center. Miller Avenue was closed at three spots due to localized flooding including Montford Avenue, at Camino Alto, and between Camino Alto and Almonte Boulevard. Residents living along the Arroyo Corte Madera del Presidio were advised to monitor their properties closely for flooding.

On 1/3/2018, a king tide caused flooding in Mill Valley, inundating the shoreline in several places.

On 2/7/2017, a storm caused flooding across Mill Valley. Miller Avenue was closed at Almonte Street and along parts of Camino Alto, police said. Golden Gate Transit suspended bus service at the Manzanita Park and Ride lot because of flooding.

On 12/3/2014, storms caused such significant flooding across roads in Mill Valley that the city advised all residents to stay home due to heavy traffic congestion and so emergency crews could work.

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Sausalito

Sausalito has a total of five primary drainage basins which lead to small riparian streams which drain to San Francisco Bay. Flooding in Sausalito generally results from a combination of high tides and storm runoff in low-lying areas along Richardson Bay. Sunny-day king tide flooding has become a common occurrence in Sausalito. Several lowland areas in Sausalito are in the 100-year floodplain, with several areas in the 500-year floodplain. The central commercial area of Sausalito and a southern area along both sides of the Bridgeway lies in the 500-year floodplain. A large commercial area, known as the Marinship, in the northern part of the City between the Bridgeway and Richardson Bay lies in the 100-year floodplain. There are numerous commercial buildings and businesses in this area, along with some residences that could be susceptible to flooding. Most of Sausalito's critical facilities lie outside of the floodplain, but part of the Southern Marin Fire Protection District Station #1 lies in the 500-year floodplain and could be susceptible to flooding.

Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay have the potential to significantly impact the Sausalito storm drain system. Sausalito already sees flooding from king

tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. There is frequent flooding of Gate 5 Road and Swede's Beach.

On 12/21/2022, king tides in Sausalito caused flooding along the San Francisco Bay Trail. The City worked to ensure that drains and debris were clear.

On 1/3/2018, a king tide caused flooding in Sausalito, inundating the shoreline in several places.

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Tiburon

Flooding in the District area of Tiburon generally results from a combination of high tides from Richardson Bay and from storm runoff in low-lying areas. The lowland area in the District in Tiburon includes the area around Cove Shopping Center, which is in the 500-year floodplain and includes numerous residences and commercial buildings. Tiburon sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[46] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon will likely experience more rain inundation events that lead to flooding and increase the potential threat of dam and levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Future development in these areas will expose more people and infrastructure to the effects of flooding.

[46] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

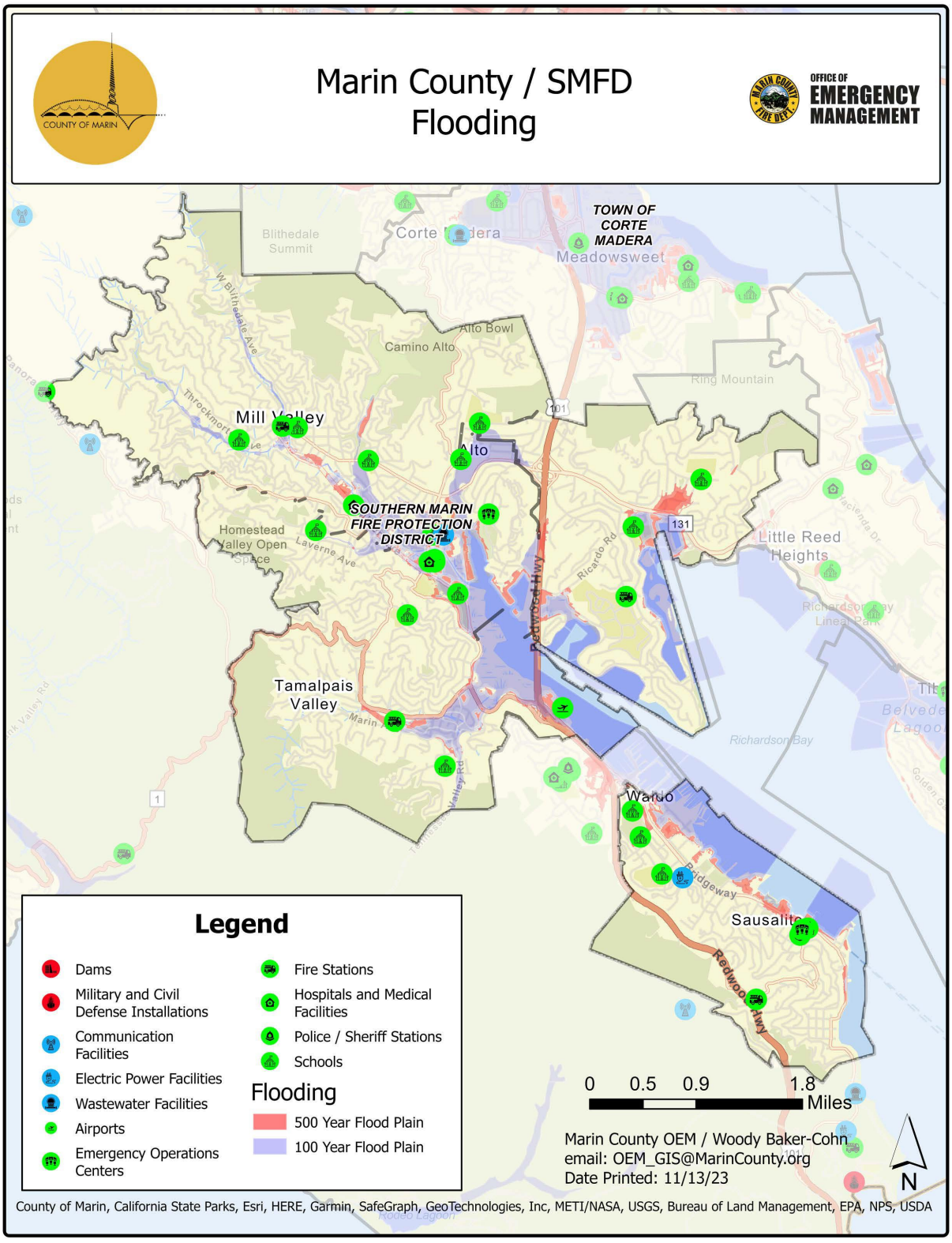


Figure 683: SMFD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 17 shows the number of Southern Marin Fire Protection District critical facilities by flood zone.

Table 17: Southern Marin Fire Protection District Critical Facilities

Category	Name	Address	Flood Zone
Critical Facilities			
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	X
Fire	City of Mill Valley SMFD (SOM) & City Hall Building/ Fire Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	X/AE
Fire	Southern Marin Fire Protection District (SOM)/ Station 4	309 Poplar Street Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM)/ Station 9	308 Reed Blvd Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District Main Office (SOM) / EOC	28 Liberty Ship Way, Suite 2800, Sausalito, CA 94965	VE
Fire	City of Mill Valley SMFD (SOM) & Public Safety Building /Fire St. 7	1 Hamilton Dr, Mill Valley, CA 94941	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	X
Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	X
School	Lycee Francais, Private School, K-6	100 Ebbtide, Sausalito, CA	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	X
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	X
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	AE

Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	X
Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	X
High Potential Loss Facilities			
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	X
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	X
Critical Infrastructure			
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	X
Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	X, VE, AE
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941	X

		37.906425, -122.531301	
Water Supply Facilities	H-Line Fire Road	H-Line Fire Road 37.927032, -122.556641	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	X
Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	X
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	X
Communications	MERA Radio Antena Site - GGNRA Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	X
Transportation	32 miles of City Roadways	Sausalito CA	X, AE
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	D
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	X, AE
Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 3- Homestead	Montford Ave Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 16 - Sausalito	Hecht Ave Sausalito, CA 94965 **Lat:** 37.846963° N **Lon:** 122.483571° W	X

Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 2 - Sausalito	300 Spencer Ave., Sausalito, CA 94965	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 1 - Sausalito	Rodeo Ave., Sausalito, CA 94965 **Lat:** 37.861804° N **Lon:** 122.498587° W	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 6 - Mill Valley	Edgewood Ave Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 5– Tam Valley	Eastwood Park Mill Valley, CA 94941	X
Local Government	City of Mill Valley / LRAD Site 12 - Cascade	Cascade Ave Mill Valley, CA 94941	X
Local Government	City of Mill Valley / LRAD Site 13 – Golf Course	City Golf Course, Mill Valley, CA 94941 **Lat:** 37.912321° N **Lon:** 122.532580° W	X
Local Government	City of Mill Valley / LRAD Site 14 – Vasco Ct	Vasco Ct, Mill Valley, CA 94941 **Lat:** 37.909892° N **Lon:** 122.524649° W	X
Local Government	City of Mill Valley / LRAD Site 15 – Ralston White	Ralston White Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM) – Bel Aire School RUSD / LRAD Site 8- Tiburon	277 Karen Way Mill Valley, CA 94941 **Lat:** 37.902517° N **Lon:** 122.495679° W	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 17- Marin City	850 Drake Ave, Marin City Mill Valley, CA 94941	X
Fire/Local Government	Publicly Maintained Hydrants	1,929 individual site locations within the District.	X, VE, AE
Fire/Local Government	Public Emergency Fire Roads	9.59 miles of non-paved emergency access fire roads	X, VE, AE

Table 358: Southern Marin Fire Protection District Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

2.2.5 LAND SUBSIDENCE/SINKHOLES

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

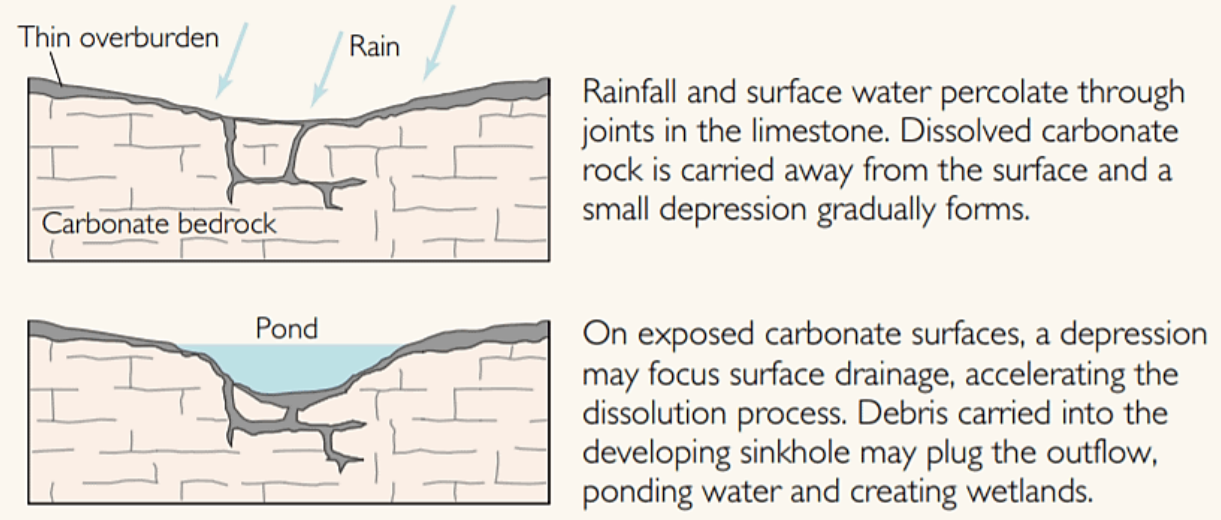


Figure 684: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 35 for a picture and description of how cover-subsidence sinkholes form.

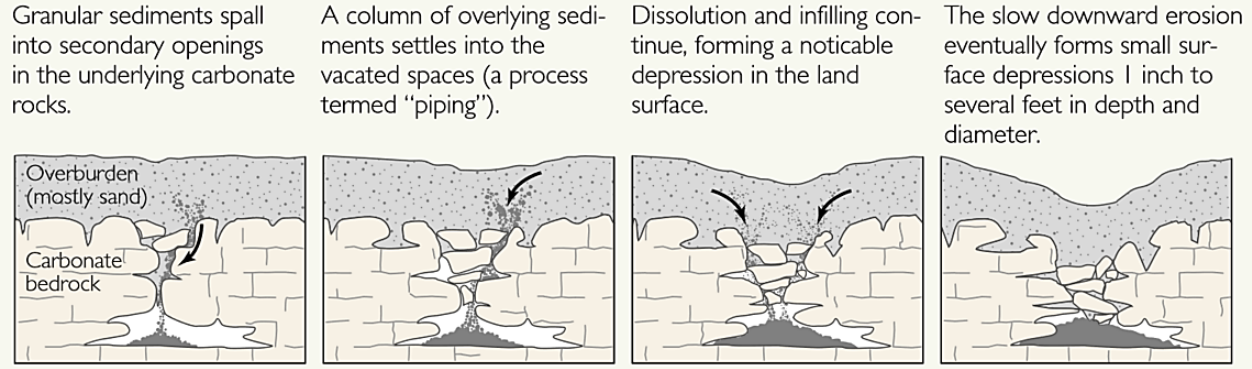


Figure 685: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 36 for a picture and description of how cover-collapse sinkholes form.

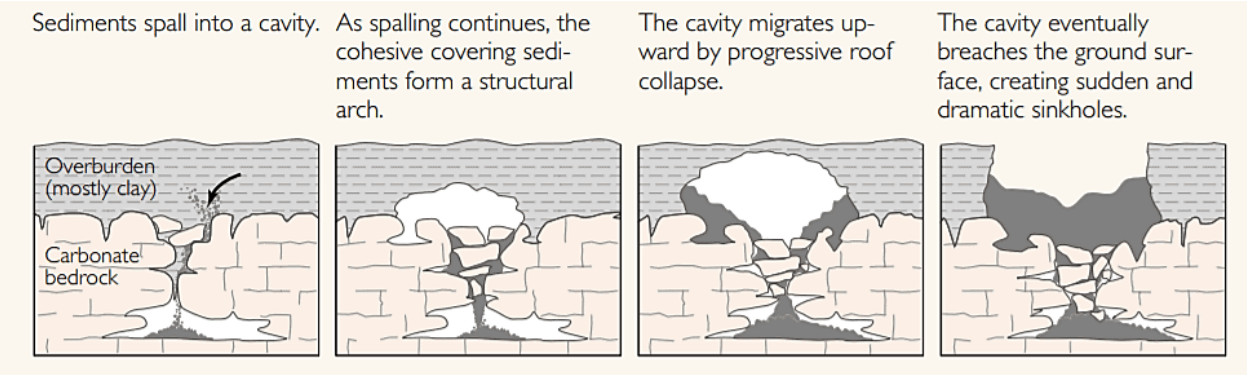


Figure 686: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Land subsidence and sinkholes would most likely occur in the lowland areas of the SMFD where superficial deposits and fill are more prevalent. These areas could anticipate increased

rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for the District, including the settling of District facilities as well as the shifting of District infrastructure.

Unincorporated County of Marin
The areas of the Marin County OA most vulnerable to land subsidence are those underlain with the younger Holocene unconsolidated alluvial and colluvial sediments, and even more so the younger bay muds. In general, Marin County unincorporated community shoreline properties, especially those in Southern Marin on fill in the low-lying areas east of US Highway 101, including Strawberry and Alto, are the most exposed and vulnerable to subsidence. This impacts buildings, roads, and utility infrastructure. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below.

Land subsidence is an ongoing issue in the low-lying exposed areas of nearly every unincorporated Bayshore community, and sea level rise associated with climate change would only exacerbate existing subsidence impacts.

Mill Valley
Large areas of former bay mud marshlands in Mill Valley have been artificially filled over the years. Land subsidence and sinkholes would most likely occur in these lowland areas of Mill Valley along Richardson Bay where superficial deposits and fill are more prevalent. This includes the area around Bothin Marsh, Bayfront Park and the SASM WWTP. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base. There are several schools, medical facilities, and commercial buildings in area of increased land subsidence susceptibility. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. The Redwoods medical facility, Mill Valley Middle School, the Mill Valley Community Center, the Mill Valley Fire Station #7 and the Mill Valley Police Station are all located within very high liquefaction risk areas. Land subsidence could have numerous impacts for Mill Valley, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

There have been no major sinkholes recorded in Mill Valley, however, there have been several smaller sink holes around the city caused by a variety of factors.

Sausalito
Land subsidence and sinkholes would most likely occur in the lowland areas of Sausalito along Richardson Bay where superficial deposits and fill are more prevalent. This includes the primary commercial area of City along the Bridgeway where Marinship was located. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for Sausalito, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

On 8/24/2020, a small sinkhole formed at the corner of Spring Street and the Bridgeway. It was caused by a leaky corrugated storm drainpipe under the Bridgeway.

Tiburon
Areas of Tiburon within the District designated with very high potential for land subsidence are generally located in the Cove Shopping Center area. Thia areas consist of numerous residences and commercial buildings. Land subsidence could have numerous impacts for

Tiburon, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the town. The lowland areas of Tiburon could anticipate increased rates of subsidence as bay waters saturate the soil from below.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities in the District could increase with future development in the lowland populated areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon where land subsidence is more likely to occur.

2.2.6 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

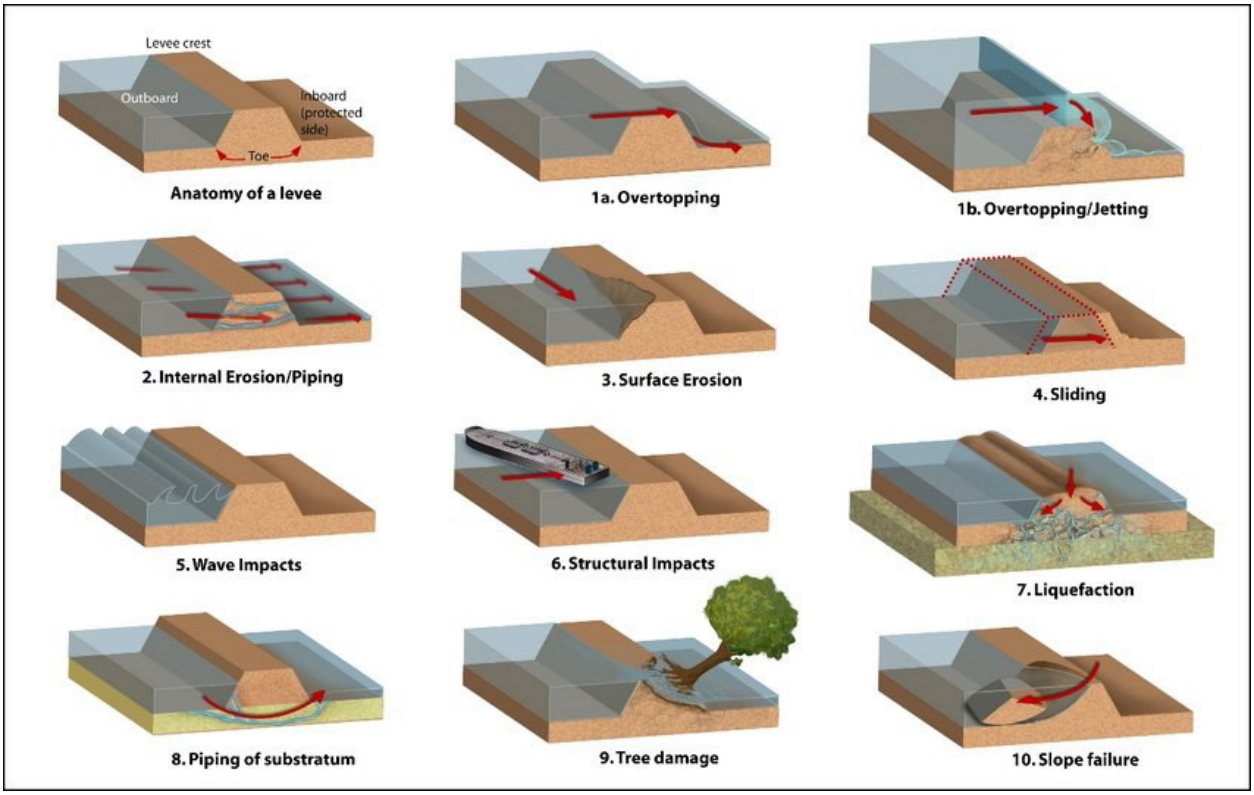


Figure 687: Levee Failure Mechanisms
Source: University of California

Several Marin County OA communities in the District including Tamalpais Valley, parts of Strawberry and Mill Valley are protected by levees. The City of Sausalito and the area of the District in the Town of Tiburon have no levees and are not at risk of levee failure.

A small area of Tamalpais Valley in the District is protected from the Coyote Creek Levees (COYL) and could be susceptible to a levee failure. The Coyote Creek Left Bank Levee System (COYL) is a federally authorized and non-federally operated and maintained project and is located in the County of Marin on the west shore of Richardson Bay, an arm on the western side of San Francisco Bay where the Coyote Creek drains approximately 2,200 acres of the eastern slopes of the Marin Peninsula. The COYL is 0.96 miles long with a maximum height of four feet. The COYL is one of the two flood protection systems of the Coyote Creek flood control project and is situated along the left bank of the creek when looking downstream. The other system is along the right bank of Coyote Creek. There is only one segment within the COYL. The subject levee system is located along the left bank of Coyote Creek and is approximately 1.5 miles long. The purpose of the levee is to provide flood protection to the community of Tamalpais Valley, California. The channel improvement project for Coyote Creek, located in the County of Marin, California, was authorized by the Chief of Engineers on January 15, 1963, under the provisions of Section 205 of the Flood Control Act of 1948, as amended by the Flood Control Act of 1962. The COYL was completed in February 1965. Improvements to the project to address the local subsidence were completed in 1977. The public sponsor of the COYL is the Marin County Department of Public Works. The other Coyote Creek Levee system is an additional smaller levee that was constructed on the right bank in 1965. It is 0.22 miles long with a maximum height of four feet. The levee from the Highway 1 bridge to the downstream end is no longer

maintained. This area of Tamalpais Valley protected by the Coyote Creek levees includes dozens of homes along with several commercial buildings and a section of Highway 1. Approximately 206 people and 105 buildings are at risk from a failure of the COYL levee, with a property value risk of around $59.4 million. Approximately 557 people and 265 buildings are at risk from the levee on the southern bank of Coyote Creek, with a property value risk of around $156 million. The risk is considered to be low LSAC 4 (Levee Safety Action Classification) for both levees prior to overtopping and overtopping breach scenarios. The levee has an overtopping recurrence of 1/100 USACE with low life safety risk. Seepage has not been documented since the construction of a seepage barrier in 2005 (the levee was loaded 75% in 2008). Some uncertainty exists in the condition of culvert penetrations. Areas of oversteepened slope and erosion at the waterside levee toe are also moderate concerns. No loss of life is anticipated, and economic damages are anticipated to be low.

Two small areas of Strawberry in the District are protected by levees and could be susceptible to levee failure. The Seminary Marsh Levee on the west side of Strawberry is 0.19 miles long with an undocumented height. The Strawberry Levee on the east side of Strawberry is 0.26 miles long with an undocumented height. The area protected by the Seminary Marsh Levee consists of several businesses adjacent to Highway 101. Approximately 325 people and 13 buildings are at risk from a failure of the Seminary Marsh Levee, with a property value risk of $20.9 million. The area protected by the Strawberry Marsh Levee consists of several homes and Strawberry Elementary School. Approximately 488 people and 36 buildings are at risk from a failure of the Strawberry Marsh Levee, with a property value risk of around $17.2 million.

The City of Mill Valley has one existing levee in the District. Marin County Levee 57 is 0.32 miles long with an undocumented height and surrounds the SASM WWTP on three sides. It is maintained by the SASM and according to the Mill Valley Department of Public Works, the levee at the SASM is above the high tide water mark and is not technically a levee but rather a berm to hold extra water storage at the side. It is not acting as a flood wall. Twenty-six people and four buildings with a property value of $4.48 million are at risk from a failure of the Marin County 57 levee.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in the unincorporated County and the City of Mill Valley, increasing the potential for a levee failure.

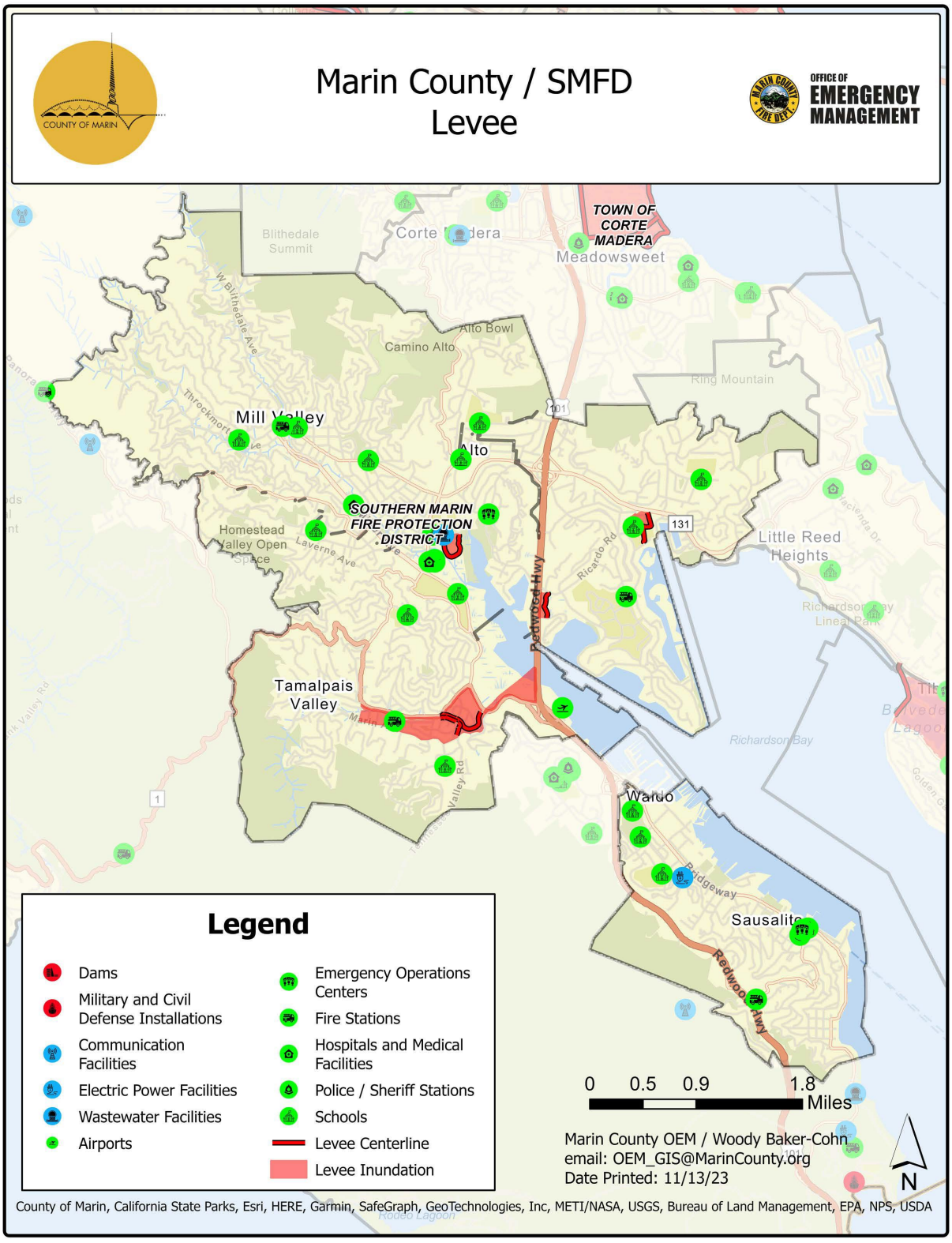


Figure 688: SMFD Levee Inundation Map
Source: Marin County OEM

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Unincorporated County of Marin

All residents in the unincorporated County, including in the Tamalpais Valley and Strawberry areas of the District, are susceptible to sea level rise. In the medium-term, portions of Tamalpais Valley homes, and Strawberry Circle, Strawberry Village Shopping Center and homes along Seminary Drive in Strawberry could face impacts from sea level rise. Smaller public and private marinas and boat launches along the bay in Strawberry could be flooded out and unusable. Storm surges can be powerful enough to damage and sink boats, including those belonging to the SMFD. Most concerning, however, is the potential inability of emergency professionals and vehicles to access people in or through flooded areas. Storm surge flooding could be 10 inches with a 100-year storm surge and extend further inland beyond the marshy areas of Strawberry.

Mill Valley

While only a small area of the Mill Valley could flood tidally from Richardson Bay, several key access routes and public facilities used by entire communities are in the exposed low-lying areas surrounding the Bay. The lowland areas of Mill Valley close to the Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are vulnerable to sea level rise and may experience between one and six feet of inundation based latest predictions of sea level rise in this area in the next 100 years.

Numerous commercial areas, dozens of residences, the Mill Valley Sewerage Agency of Southern Marin (SASM) Wastewater Treatment Plant (WWTP), Tamalpais High School, and the Redwoods medical facility lie in areas of Mill Valley susceptible to sea level rise. Several main thoroughfares including Miller Avenue and Camino Alto also lie in this area and already experience tidal flooding. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates Mill Valley could anticipate impacts to over 13,000 people and over 1,000 living units with $550 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, 44 acres of the City could be exposed to sea level rise. In the long-term, 190 acres of the City could be exposed to sea level rise; and 273 acres could be exposed with an additional 100-year storm surge. Ten percent of Mill Valley's land area could be exposed to five feet of sea level rise and a 100-year storm surge. Miller Avenue could be flooded in the near-term. This area already experiences seasonal flooding that extends to Tamalpais High School fields. Homes and businesses along and near Shelter Cove, Hamilton Drive, and the Frontage Road could expect near-term flooding impacts. The Redwoods, a retirement community, is vulnerable in the medium-term. The SASM WWTP, serving six sanitary districts and 30,000 people, including Mill Valley residents, could expect flooding impacts in the medium and long-term. The Mill Valley-Sausalito Bike Path could flood a majority of the year during average high tides in the medium-term. This Path currently floods regularly during major storms. Mill Valley Middle School could expect sea level rise impacts to the grounds and could expect flood waters reach the buildings with the 100-year storm

coincidence. Bothin Marsh habitat could transition to mudflats without adequate sediment supply because the marsh does not have options for inland migration. Loss of marshland vegetation would remove natural buffers to stormwater inundation from Richardson Bay. The Mill Valley Recreation Center fields could be vulnerable to sea level rise in the long-term. A 100-year storm surge could impact nearly the whole site. Camino Alto, between Miller and Blithedale Avenues, and the neighborhood north of it, could expect flooding in the long-term.

Relative to other East Marin communities, Mill Valley has a low number of buildings vulnerable to sea level rise and a 100-year storm surge. However, several areas already vulnerable to stormwater backups could expect these conditions to worsen with added saltwater. Most of Mill Valley's buildings are wood-framed. While it is unclear how many buildings are older than 30 years, many in the low-lying areas are. Newer buildings typically have drilled piles 20-30 feet deep with reinforced steel cages and concrete to connect the homes to the foundation. This feature can help buildings withstand lateral forces from wind and water. However, even if buildings remain structurally intact, utility-related equipment could be vulnerable. Moreover, material and content damage from water and salt could occur.

Sausalito

Numerous businesses and residences and part of the Southern Marin Fire Protection District Station #1 lie in areas of Sausalito susceptible to sea level rise. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates t that Sausalito could anticipate impacts to over 7,000 people and over 265 living units with $400 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, twenty-six acres of the city could be exposed to sea level rise. In the long-term, 84 acres of the city could be exposed to sea level rise; and 150 acres could be exposed with an additional 100-year storm surge. Several shoreline restaurants, hotels, and business could be vulnerable to flooding in the near-term. Numerous assets in the low-lying areas primarily east of Bridgeway may be vulnerable to storm surges and sea level rise. Northerly access to Sausalito could be blocked in the Waldo Point community near Gate 6 Road. Shoreline homes in Old Town could be impacted by erosion, storm surges, and high tides. Bridgeway leading to Old Town is also vulnerable in the long-term. The main wastewater force main leading to Sausalito Marin City Sanitary District treatment plant is in places under Bridgeway Blvd. Swede's and Tiffany beaches, and all other shoreline parks, could be vulnerable in the near term. Inflow and infiltration of tide waters into underground pipes could increasingly burden the wastewater treatment facilities. Several small shoreline parks and festival areas at Schoonmaker Point are susceptible to flooding, degrading public facilities and impeding public use. Several residents live in boats in marinas and unauthorized boats out in Richardson's Bay that are especially vulnerable during storms and could be vulnerable to damage at the marinas that host them. Sea level rise is projected to inundate parts of Sausalito's Downtown Historic District in the near term, with storms expanding the vulnerable area and exacerbating impacts. Both water and land routes to Sausalito's Downtown Historic District could be vulnerable in the near-term. The Sausalito Ferry terminal could experience inundation in the near-term. In the long-term, parts of Bridgeway could be tidally flooded, and impacts will worsen with storms. In other parts of Sausalito, a handful of private properties on the city's Historic Resources Inventory could also be vulnerable to sea level rise. Sausalito's Ark Row District includes seven noteworthy properties vulnerable to more than six feet of water in the near-term and more than six feet of water in the long-term. An additional ten other properties could be vulnerable in the long-term, including the original

firehouse. Two of Sausalito's landmark buildings, Castle by the Sea and the Ice House, could be vulnerable to a 100-year storm surge in the long-term. Marinship was built on bay fill on top of bay mud, and some areas, such as Heath Way, have experienced approximately five feet of subsidence since 1943 based on photographic records and are more susceptible to sea level rise. This is a primary employment area in the city.

Tiburon

Parts of Tiburon in the District are at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in Tiburon in the District, including the area around the Cove Shopping Center, are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these residences continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017). The Cove Shopping Center is vulnerable in the long-term to sea level rise, though could suffer sooner from combinations of higher tides and stormwater. A batch of homes could suffer tidal impacts just east of the Cove Shopping Center in the long-term. Vehicular access along Tiburon Boulevard could be compromised at the Cove Shopping Center in the long-term.

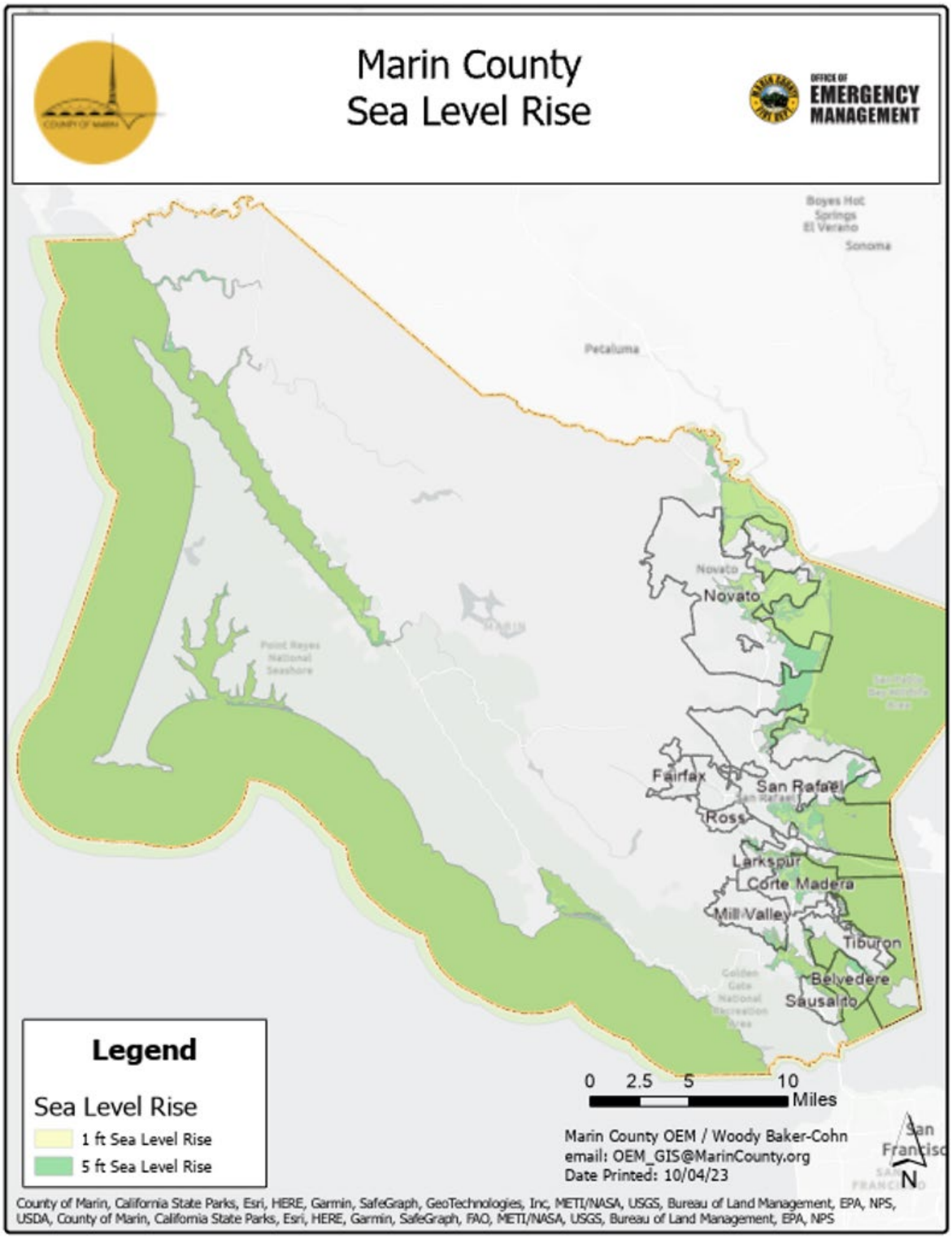


Figure 689: Marin County Sea Level Rise Impact
Source: Marin County OEM

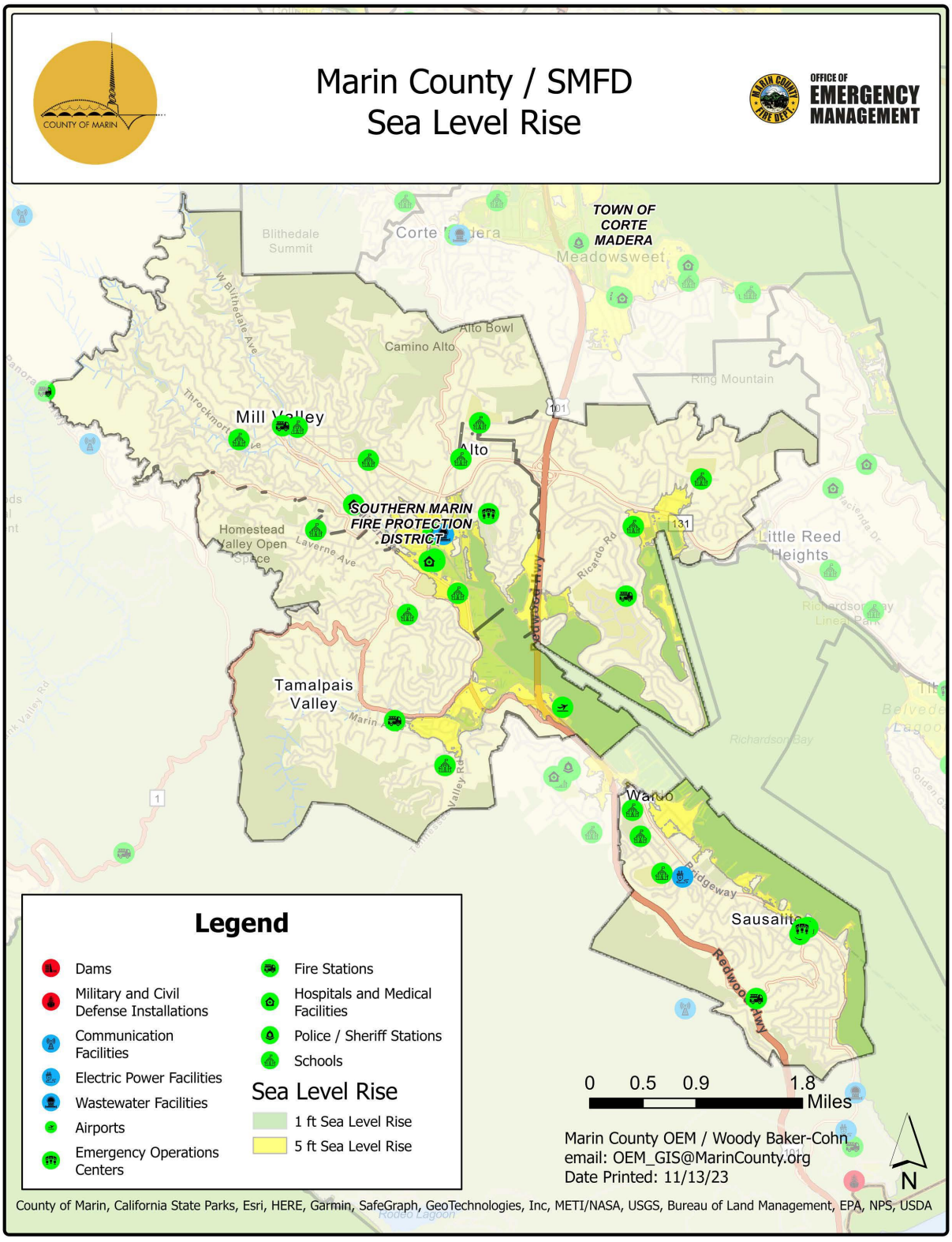


Figure 690: SMFD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

Critical facilities throughout the District can become damaged extensively with their foundations compromised over time. Of particular concern are those facilities that have not been elevated to projected sea level rise heights over the next century. Sea level rise in the District has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into areas were critical facilities lie. Sea level rise can also cause increased subsidence in the District, which may damage underground water and wastewater pipelines and disrupt services.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

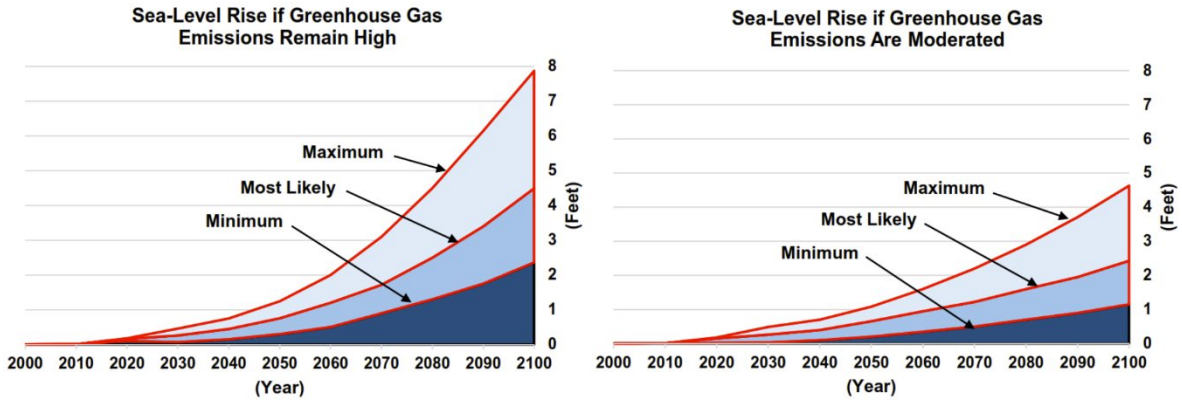


Figure 691: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon will put more people and property at risk from flooding as a result of sea level rise. Roads and utility infrastructure across the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon will continue to become inundated.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 42):

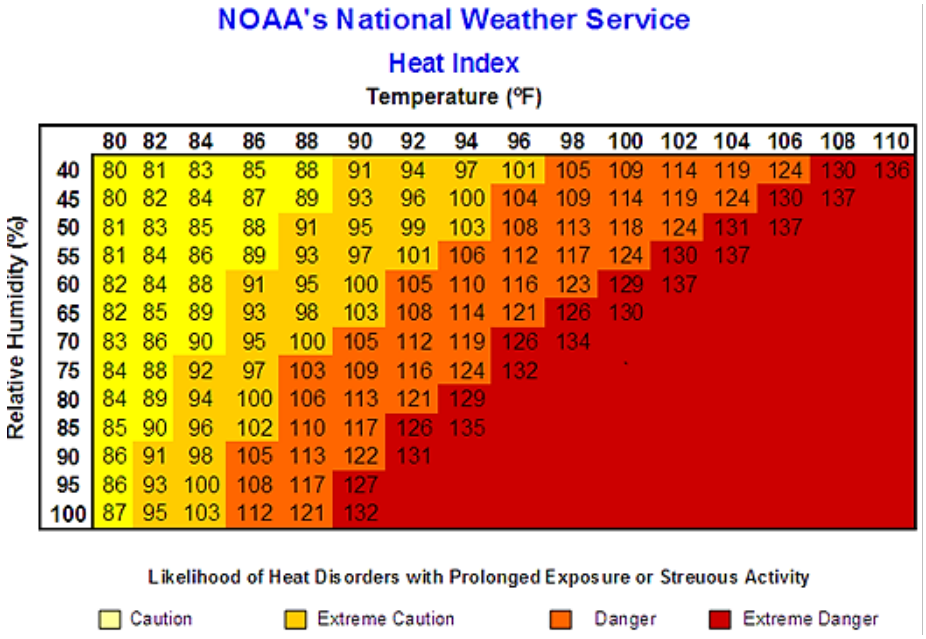


Figure 692: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes the lowland areas of Tamalpais Valley and Alto in the unincorporated County; and most of the downtown and commercial area of Mill Valley between Miller Avenue and E. Blithedale Avenue. There are dozens of residences in these areas. The lowland areas of the District in Strawberry, Sausalito and Tiburon lie along Richardson Bay where cool bay breezes would help mitigate the effects of high temperatures. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate,

annual average temperatures in the Marin County OA region and Bay Area will likely increase by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

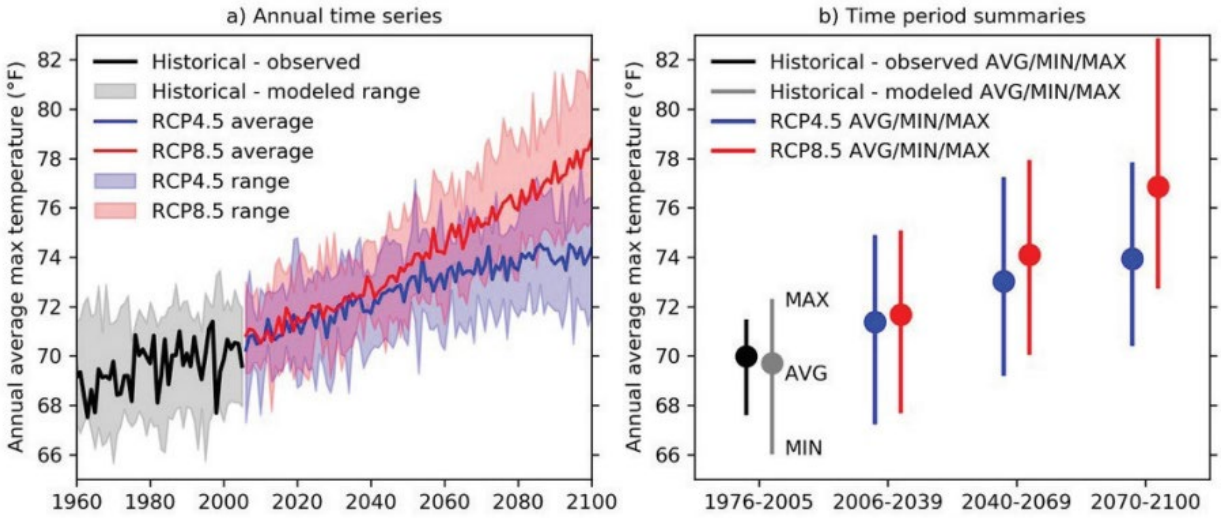


Figure 693: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of the Tamalpais Valley and Mill Valley where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including in the Tamalpais Valley and Mill Valley could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including the unincorporated County and Mill Valley as conditions become hotter and drier. These effects will primarily be felt in the mountainous and marshlands areas in the Tamalpais Valley and Mill Valley where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around the Tamalpais Valley and Mill Valley could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 44).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 694: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

All of the SMFD is susceptible to storms and damage from wind and tornadoes, though the hilly and mountainous areas throughout the District have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage critical facilities and infrastructure. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the delivery of services and access to critical facilities.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 45) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 695: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 696: Waterspout Formation
Source: MarineInsights

All of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon are susceptible to storms and damage from wind, though the hilly and mountainous areas of the Tamalpais Valley, Mill Valley and Sausalito have increased susceptibility due to a higher presence of trees. There are numerous windy and dead end roads in these areas where a downed tree could hinder access. Tamalpais Valley, Mill Valley, Sausalito and Tiburon are unlikely to experience a tornado due to the terrain but it could experience a waterspout originating from Richardson Bay. Drought coupled with high winds which frequently occur may increase the susceptibility of trees toppling and falling branch damages to property. Fallen trees may damage homes and other facilities. Power lines may be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

Mill Valley
On 1/17/2023, a tree fell and destroyed a garage at 56 Monte Vista.

On 1/13/2023, a storm caused a large tree to fall, closing Marion Avenue.

On 1/16/2019 a man was struck and killed by a car as he was trying to avoid a falling tree at the intersection of Laverne Avenue and North Ferndale Avenue during a storm. A huge downed tree fell across the street from the Horizon School during the storm, crushing the rear of a car and narrowly missing the people inside. Nobody was hurt. A 125-foot-tall redwood tree fell off Molino Avenue splitting a power pole in two. It cut power to about 60 homes.

On 2/17/2017, a storm with high winds caused 2,100 people in Mill Valley to lose power.

Sausalito

On 3/21/2023, a torrent of powerful winds caused several trees to topple throughout the City with only minor damage. Damage occurred at Harrison Street and along Bridgeway Blvd. Wind gusts reached 68 mph on Wolfback Ridge in the City with slightly less wind throughout the City of Sausalito. Sausalito reported that 1,778 meters lost power in the City and in Fort Baker and the Marin Headlands in the unincorporated County of Marin.

On 1/19/2021, winds reached 61 mph in Sausalito, causing numerous boats to come adrift in Richardson Bay. One boat came to shore on Schoonmaker Beach, another behind the Pelican Yacht Harbor and a third near the Sausalito Cruising Club. Over 7,200 meters in the City lost power.

On 2/14/2019, a severe storm with high winds caused significant power outages and numerous tree to topple across the City.

On 12/16/2017, strong winds and high waves caused a boat in Richardson Marina in Sausalito to flip over. Multiple people were rescued. A nearby buoy recorded winds peaking at 31 mph.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Sausalito as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Mill Valley and Sausalito's mountainous residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by the SMFD would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the District. Much of the lowland areas of the Tamalpais Valley, Strawberry, the cities of Mill Valley and Sausalito and the Town of Tiburon lie in a tsunami inundation zone.

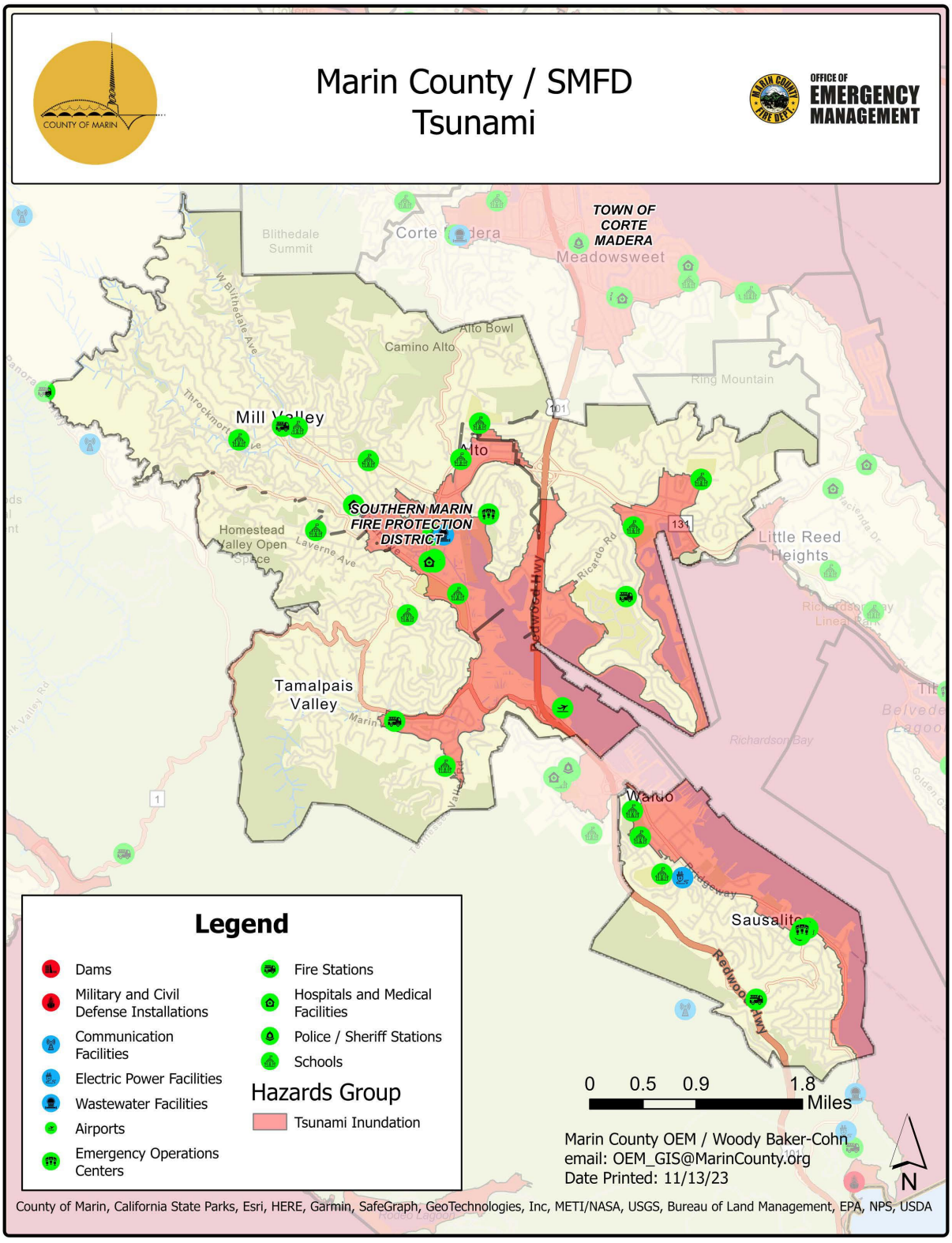


Figure 697: SMFD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Unincorporated County of Marin
A large section of Tamalpais Valley, including smaller sections to the north adjacent to and including the City of Mill Valley, lie in a tsunami inundation zone and could be susceptible to a tsunami pushing water up Coyote Creek. There are hundreds of homes, commercial buildings, the Southern Marin Fire Protection District Station #4 and part of Tamalpais Valley Elementary School that lie in this area. Most of the commercial core of Marin City, including the Gateway Shopping Center, the Martin Luther King Jr. Academy, the Marin City Fire Station, and numerous residences lie in a tsunami inundation zone and could be susceptible to a tsunami. The Waldo Point community consisting of dozens of floating homes in Richardson Bay could be susceptible to a tsunami. The area around the intersection of Highways 1 and 101 including the highways themselves, the Commodore Heliport and several businesses lie in a tsunami inundation zone and could be susceptible to a tsunami.

Both sides of the Strawberry Peninsula lie in a tsunami inundation zone and could be susceptible to a tsunami. There are dozens of homes in this area along with numerous commercial buildings, the Strawberry Point elementary school and a large section of Highway 101 that could be susceptible to a tsunami. There are also several homes in the northwest corner of Strawberry near Alto that lie in a tsunami inundation zone and could be susceptible to a tsunami.

Mill Valley
The entire shoreline of Mill Valley along Richardson Bay is in a lowland area and lies in a tsunami hazard area. The lowland areas of Mill Valley close to Richardson Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, the Mill Valley Treatment Plant, along Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are in a tsunami hazard area and may be susceptible to a tsunami. Tamalpais High School, Mill Valley Middle School and the Redwood medical facility lie in this area.

Sausalito
The entire shoreline of Sausalito is in a lowland area and lies in a tsunami hazard area. This includes the entire commercial area of the City along both sides of the Bridgeway and the main commercial area on both sides of Caledonia Street. There are numerous residences, businesses, marinas and other docking facilities in this area that could be susceptible to a tsunami. The Southern Marin Fire Protection District, the Sausalito Police Department and the Headlands Preparatory School also lie in this area and could be susceptible to a tsunami.

Tiburon
Areas of Tiburon in the District in the 500-year floodplain are at a lower elevation and lie in a tsunami hazard area, including most of the Cove Shopping Center where there are numerous residences and commercial buildings.

Mill Valley and Sausalito have experienced minor tsunamis in the past. Similar of other San Francisco Bay fronting communities, major tsunami wave energy is dissipated by the fact that these waves would have to propagate through the water way under the Golden Gate Bridge. Nevertheless, major tsunamis may impact District areas along Richardson Bay in Tamalpais Valley, Strawberry, the cities of Mill Valley and Sausalito. Flooding from a tsunami may be

similar to king tide flooding already experienced by Marin County OA with the exception that a tsunami occurs in a shorter time frame and may impact the City's vibrant harbor systems. Roadways and infrastructure may become inundated with salt water, causing transportation issues and utility disruptions.

On 1/15/2022, an undersea volcano erupted in the Pacific Ocean near Tonga causing a minor surge in Sausalito from Richardson Bay. Rough waters were reported with no significant damage. A dock pulled away from an apartment in Tiburon

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. This is particularly true around the marshland areas of Mill Valley and Sausalito where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Mill Valley and Sausalito would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem and climate change. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with Marin County Fire Department (MCFD). Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA.. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

The Southern Marin Fire Protection District (SMFD) provides wildland fire protection and fire prevention activities for the City of Mill Valley as LRA. As a JPA of the Marin County OA, SMFD has response areas within the County for both LRA and SRA.

Figure 48 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

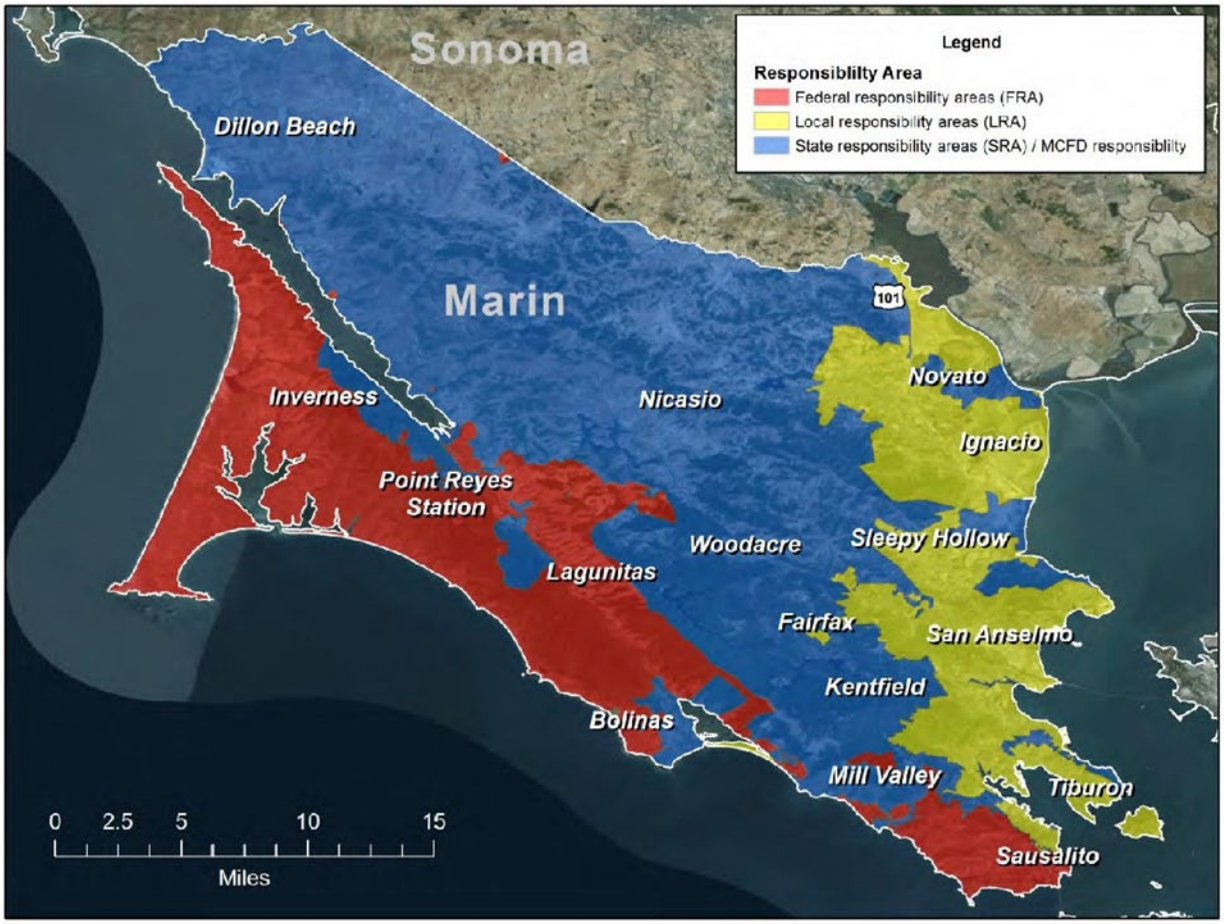


Figure 698: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are

located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Sausalito and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the CWPP, an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

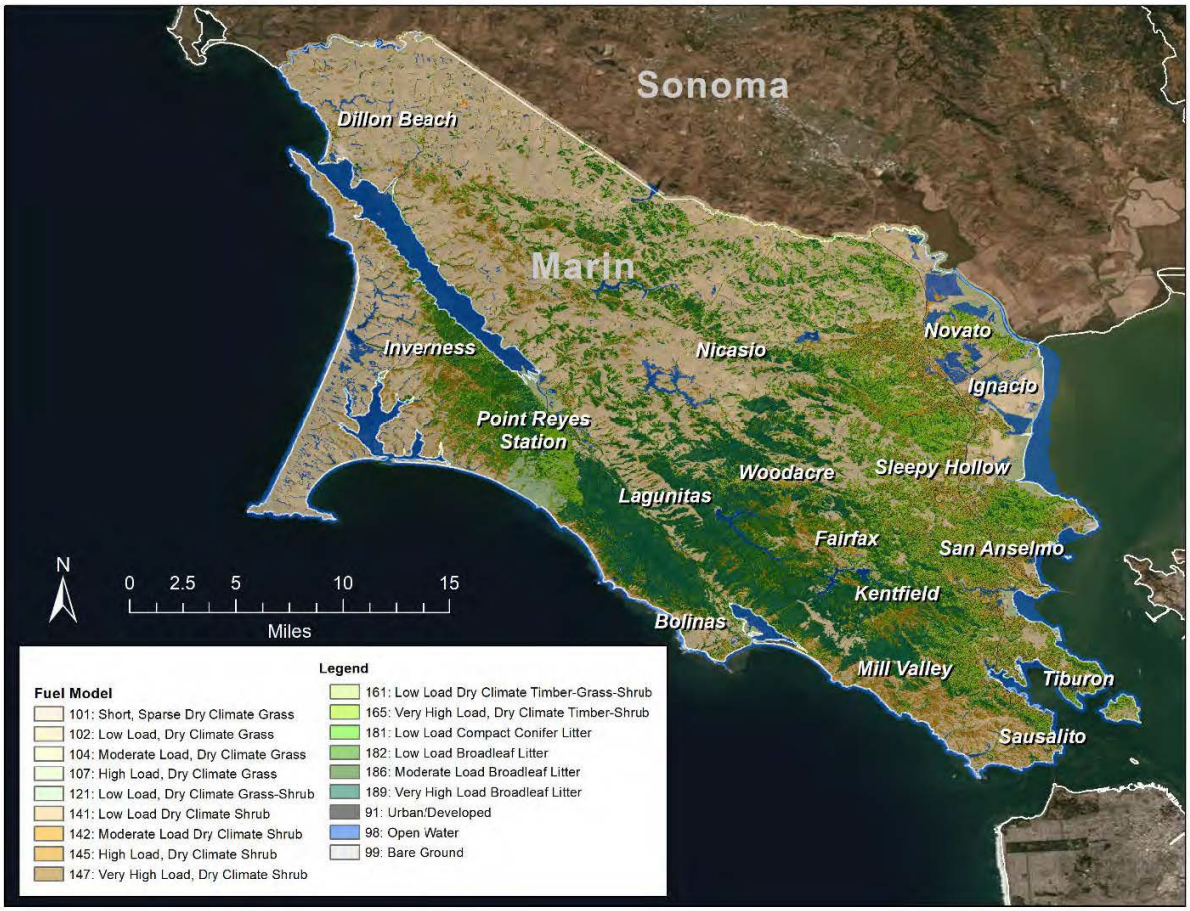


Figure 699: Fuel Model Map for the Marin County OA
Source: Unknown

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in the Marin County OA. Sudden oak death has no known cure and is a concern since this specific disease can impact vegetation through Marin including the WUI; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular, appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease

largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher, and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Sausalito's upper areas are generally Golden Gate National Park and are heavily vegetated with various fuel types. In addition, a significant number of properties and structures are located on existing steep hillsides which are also heavily vegetated. Sausalito experiences strong winds throughout the summer months and into the fall with the marine layer crossing over the hill from the Pacific Ocean.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E's overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of

Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

PSPS events have occurred in the Marin County OA, including the District, in years past. While PG&E continues to address safety issues with their systems by installing equipment that can segregate their system in order to continue to provide power to their customers wildfires from overhead electrical systems. While wildfires can start anywhere, the high winds and high abundance of fuels within and upslope of Tamalpais Valley, the Cities of Mill Valley and Sausalito and the Town of Tiburon may be the most likely location for a wildfire to occur. Areas which are also heavily vegetated and are primarily residential and consist of numerous winding streets and hillside homes may be damaged or destroyed by a wildfire.

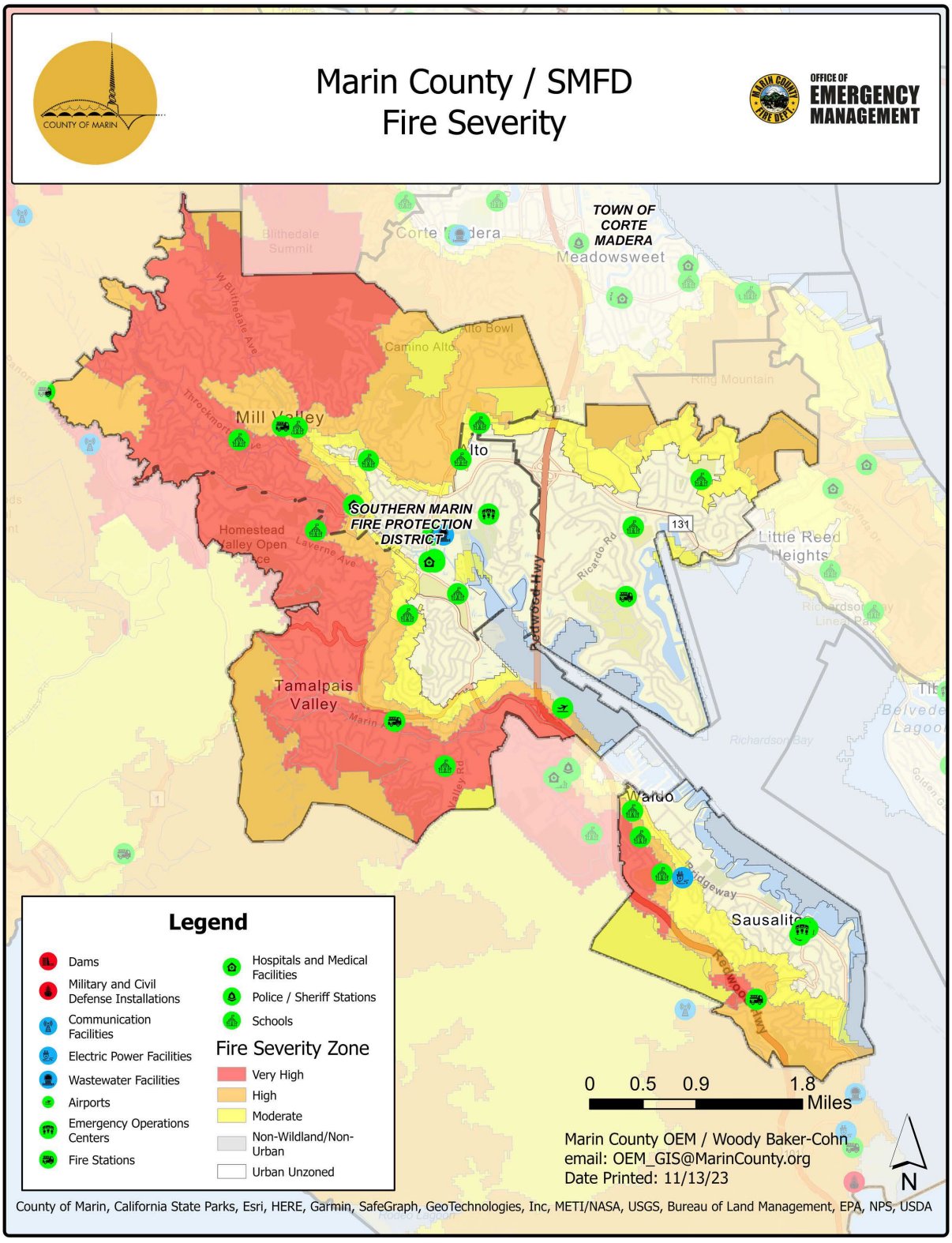


Figure 700: SMFD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

A wildfire in the SMFD would most likely occur in the areas of the District where there is more forested terrain. District critical facilities, including the SMFD Station #4 are located in Very High FHSZ and could be impacted by a wildfire originating around the slopes of Mount Tamalpais. As wildland areas around the District become drier due to climate change and drought, the risk of a wildfire or brush fire occurring and impacting the District will continue to increase as open spaces experience drier conditions.

Specific communities in the Tamalpais Valley, Mill Valley and Sausalito are in a Very High FHSZ and are at a higher risk of wildfire. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access.

Unincorporated County of Marin
Most of Tamalpais Valley lie in a Very High FHSZ. There are thousands of homes and buildings in this area of Tamalpais Valley, along with a MERA antenna site, the Marin Horizon School, the SMFD Station #4 and the Tamalpais Valley Elementary School that could have a very high susceptibility to wildfire. Populations in this area are particularly susceptible to wildfire due to the presence of numerous cul de sacs and windy secondary roads that could impede an evacuation. The Very High FHSZ in Tamalpais Valley is bordered to the east by a High FHSZ. Hundreds of homes and numerous businesses along with the Commodore Center Heliport lie in the High FHSZ and could have higher susceptibility to wildfire. The Mount Tamalpais School lies in the Moderate FHSZ and could be susceptible to wildfire.

A small area in the north of Strawberry lies in a High FHSZ with a larger area that lies in a moderate FHSZ. There are several homes in this area that could have higher susceptibility to wildfire.

Mill Valley
Specific communities in Mill Valley around the northern side of the city are in a Very High FHSZ and are at a higher risk of wildfire. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access. The Old Mills Elementary school lies in this area. Hundreds of homes and parts of the downtown and commercial area along Miller Avenue in Mill Valley lie in a High FHSZ and could be susceptible to wildfire. The Mill Valley Fire Station #6, the Greenwood School and the Marin Terrace medical facility lie in this area. Dozens of residences and parts of the commercial areas along Miller Avenue and E. Blithedale Avenue east of Lomita Drive lie in a Moderate FHSZ and have some susceptibility to wildfire. The Helix School and Edna Maguire Middle School lie in this area. Marshland around Bayfront Park is also in a moderate FHSZ and could be susceptible to a brush fire when vegetation is dry. All of Mill Valley could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Mill Valley, including in Muir Woods National Monument, Mount Tamalpais State Park and the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City may continue to increase. Brush fires in the City may increase over time as parks, and other open spaces experience drier conditions.

On 9/27/2022, a brush fire broke out on a populated hillside adjacent to the Camino Alto Open Space Preserve near Kite Hill Lane and Camino Alto in Mill Valley. The fire burned a half-acre.

In 1929, the base of Mt. Tamalpais in Mill Valley experienced a significant fire known as the Great Mill Valley Fire. That fire's footprint is now developed with more than 1,100 homes

(valued at over $1 billion) which have significantly altered the natural vegetation through urban and suburban development.

Sausalito

Specific communities in Sausalito are in a Very High FHSZ and are at a higher risk of wildfire. This area includes the Wolfback Ridge neighborhood and the residential area along Lincoln Drive between Highway 101 and Nevada Street. Part of the Lycee Francais de San Francisco lies in this area. Hundreds of homes in Sausalito lie in a High FHSZ and could be susceptible to a wildfire. Most of the commercial area of Sausalito, including most of the Citys critical facilities lie outside a FHSZ though there are some commercial buildings along the Bridgeway in the northern part of the City that like in a Moderate FHSZ and could be susceptible to a wildfire. All of Sausalito could be impacted by a Power Safety Shutoff (PSP) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Sausalito, including in the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City will continue to increase. Brush fires in the City may increase over time as parks, and other open spaces experience drier conditions.

On 7/18/2022, a brush fire broke out near Sausalito closing northbound Highway 101, Golden gate National Park area south of Marin City. Residents in the Anchorage Apartments in Sausalito, off Lincoln Drive, were advised to shelter in place. The fire emitted a large plume of smoke.

On 2/10/2022, an arson fire and explosion at a homeless encampment in Marinship Park caused the City to declare a local emergency. One tent fully was engulfed in flames that spread to another tent causing minimal damage. No injuries were reported.

On 9/12/2021, a fire broke out in the Golden Gate National Recreation Area near Sausalito. Between five to ten acres were burned with no damage to structures.

On 10/17/2017, two small vegetation fires broke out in Sausalito along Rodeo Avenue near Highway 101, causing southbound lane closures on the highway. The flames spread into eucalyptus trees and headed uphill toward the Wolfback Ridge neighborhood. People living near the fires were asked to evacuate. No residential damage or major injuries were reported. Air quality readings were classified as either unhealthy or unhealthy for sensitive groups from this event.

Sausalito's largest fire in its history occurred on September 19, 1919. A raging fire originating from an outdoor burn pile caused the loss of twelve homes and five stores. Fires on the roofs of multiple homes and businesses were extinguished before any significant damage. The Holy Family Hall on Third Street was totally destroyed. The South End Grocery Store was saved with slight fire damage. Many grass fires and roof fires were also promptly extinguished. A spark landed on and set fire to the canvas covering on a power boat cruiser moored five hundred feet offshore.

Tiburon

A wildfire in the District area of Tiburon would most likely originate from the Ring Mountain Open Space Preserve in the unincorporated County on the north side of the town, This area of Tiburon is in a high FHSZ, is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by wildfire. The hillside neighborhoods in this area have extremely limited ingress and egress for residents and emergency services.

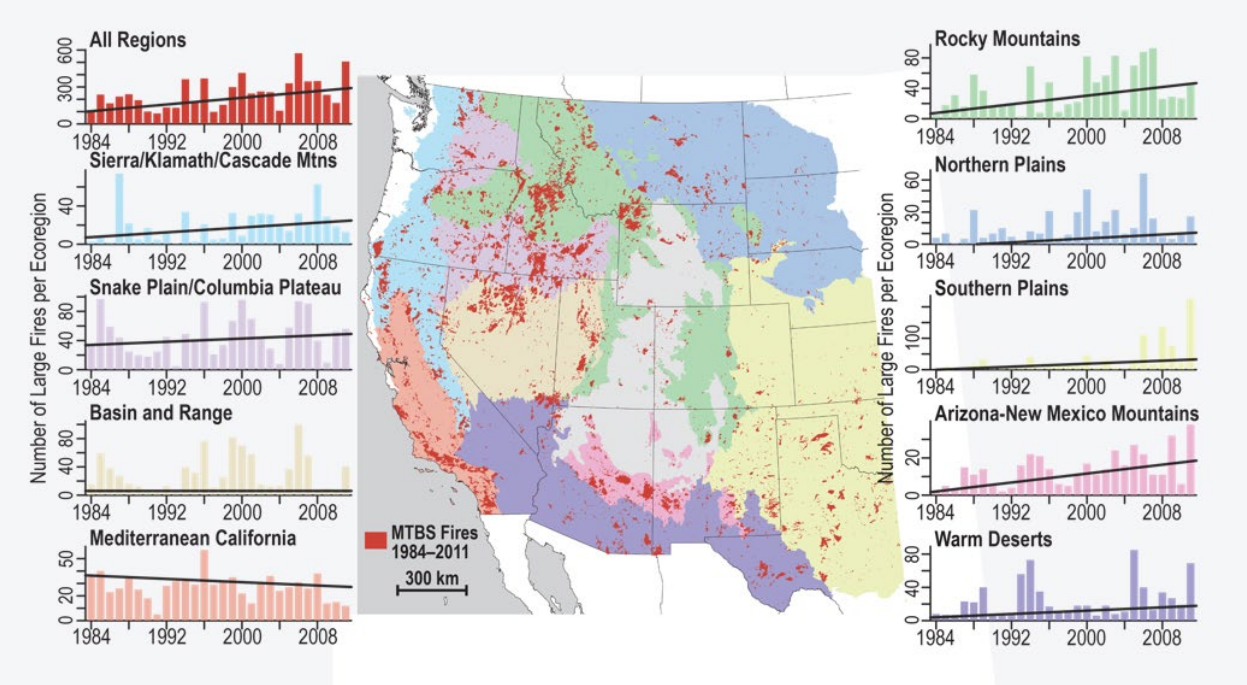
Tiburon has historically experienced several huge fires before the formation of the Tiburon Fire Protection District, but none in the last century. On 11/13/1890, Tiburon was destroyed by an urban conflagration. There have been no major wildfires or brush fires in Tiburon since the last plan update.

On 6/15/2012, a three-acre brush fire was reported near Reed Ranch Road. Nearby homes and structures were not threatened by the blaze.

The entire District could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Tamalpais Valley, Mill Valley, Sausalito and Tiburon, including in Muir Woods National Monument, Mount Tamalpais State Park and the Marin Headlands, and the Ring Mountain Open Space become drier due to climate change, the risk of a wildfire occurring and impacting the District may continue to increase. Brush fires in the District may increase over time as parks and other open spaces experience drier conditions.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.



Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail,

sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Mill Valley and Sausalito. Future development in the WUI throughout Tamalpais Valley, Mill Valley, Sausalito and Tiburon will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Tamalpais Valley, Mill Valley, Sausalito and Tiburon WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Mill Valley and Sausalito marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character. Future large development in the County is not expected within the next 5 years, however, some managed development has been identified, approved, or submitted.

There has been a significant amount of development within the Southern Marin Fire Protection District since 2018. However, the development has been to existing facilities or within the facility footprint of the SMFD. There has not been any increased risk to the District as a result of new development since the last plan update in 2018.

Future land use and growth management strategies in the Southern Marin Fire Protection District are consistent with priorities detailed in the 2018 Marin County MJHMP and aim to concentrate future development into and toward existing areas away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. No further development is planned for the next five years.

Marin County and the Cities of Mill Valley and Sausalito have planning and community development departments, SMFD only is involved in providing fire services in new development approved by the County and Cities of Mill Valley and Sausalito.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Cities of Mill Valley and Sausalito. has occurred and will continue to occur throughout the city in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

3.2 CAPABILITY ASSESSMENT

The Southern Marin Fire Protection District did not participate in the 2018 Marin County MJHMP. However, the strategies which support the overall District priorities are reflected in the sections below.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms and hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

The legal and regulatory capabilities include existing ordinances and codes that affect the District's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the Southern Marin Fire Protection District an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Local Emergency Operations Plan and Continuity of Operations Plan**: The Cities of Mill Valley and Sausalito would benefit from the development of our own emergency operations Plan and Continuity of Operations Plan. These Plans are currently being updated and will allow the Cities to develop response and contingency plans for the risk and vulnerability of the City to the hazards identified in the Hazard Mitigation Plan.
- **Community Wildfire Protection Plan:** The cities of Mill Valley and Sausalito plan to take an active role in mitigation actions to enhance wildfire protection.
- **StormReady certification and Firewise Communities certification:** The cities of Mill Valley and Sausalito will consider participation in these programs.

Table 18: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive /Master Plan	No	N/A
Strategic Plan	Yes 2016	Guiding document determining vision including vision to implement the Hazard Mitigation Action table. Does not address hazards. Can be used to identify goals but not to implement mitigation actions.
Capital Improvements Plan	No	N/A
Economic Development Plan	Yes 2021 Annually	The SMFD has an Annual Comprehensive Financial Report that ensures funds are addressing identified hazard mitigation and public safety programs. The plan helps to implement the hazard mitigation strategy and programs.
Local Emergency Operations Plan (EOP)	Yes	The EOP is being updated and developed to include a collaborative EOC between Sausalito, Mill Valley, and SMFD. Details of the plan may be able to be implemented as a mitigation strategy once completed.
Continuity of Operations Plan	Yes	In 2022, SMFD adopted a Continuity of Operations Plan for Infectious Respiratory Pandemics. This could benefit from additional support with the LHMP. Yes, the plan can be used to implement mitigation actions.

Flood Mitigation Plan (FMP)	Yes	Sausalito is part of the community rating system initiated through FEMA
Engineering Studies for Streams	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Open Space Management Plan	No	N/A
Regional Transportation Plan (RTP)	No	N/A
Stormwater Management Plan/Program	No	N/A
Community Wildfire Protection Plan	Yes	Mill Valley and Sausalito are represented through SMFD with the County of Marin CWPP. This plan provides a science-based assessment of wildfire hazards and threats to homes in the WUI of Marin County. The purpose of the plan is to provide fire agencies, land managers and other stakeholders in Marin County with guidance and strategies to reduce fire risk in the WUI while promoting protection and enhancement of economic assets and ecological resources. Implementation of this plan serves to mitigate fire risk. Multiple hazard mitigation projects are identified in the plan. Directly tied to mitigation efforts.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	No	N/A
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Fire department ISO rating:	Yes	The Southern Marin Fire District has an ISO rating of 2.
Site plan review requirements	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
District Code	Yes	District Code allows for collection of sewer service fees and capacity fees to fund mitigation projects. Program is adequately administered. No enforcement.
Zoning ordinance	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Subdivision ordinance	No	

Floodplain ordinance	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Flood insurance rate maps	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Elevation Certificates	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.
Acquisition of land for open space and public recreation uses	No	
Erosion or sediment control program	Yes	Yes, District participates with service jurisdictions or Marin County on plan reviews.

Table 359: Southern Marin Fire Protection District Legal and Regulatory Capabilities
Source: Southern Marin Fire Protection District

Southern Marin Fire Protection District Comprehensive Plan or Master Plan

Southern Marin Fire Protection District boundaries overlap unincorporated areas of Marin County and the Cities of Mill Valley and Sausolito, both of which are required to have a General Plan or Master Plan per California Government Code 65300. Please see their respective General Plan or Master Plan for details.

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the District personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 19: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	Administrative staff works with the Fire Chiefs to handle finance and purchasing, budgeting, risk management, information technology, and billing for the District. The admin staff may be responsible for implementing mitigation actions related to the District's activation of an EOC/DOC.
Hazard Mitigation Planning	Y	The Prevention Division commissioned a Hazard & Risk assessment in 2020 that is the guiding document for much of the vegetation work in the District.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Partner agency in the Marin Wildfire Protection Authority (MWPA). Provides fuel reduction and evacuation route clearing as a primary focus. Additional funds are allocated to provide similar services across the District.

Mutual aid agreements	Yes	Expanded response area into Marin City with a JPA with all Marin County fire services.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Yes	Yes, Utilizes the emergency warning systems through the County EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911. Utilizes an outdoor notification network of sirens as a redundant communication for evacuations for wildfires. The Southern Marin Emergency Notification system currently utilizes 15 L.R.A.D. outdoor sirens to warn of wildfires and ongoing efforts to sound map the response from testing is conducted through the District's "Did You Hear It" program.
Hazard data and information	Yes	Yes, Marin County and the Southern Marin Fire Protection District have maintained hazard mitigation data in the form of WUI Hazard Assessments of the District and the Marin County Community WUI Protection Plan.
Grant writing	Yes	Yes, The District has been awarded multiple past grants for wildfire fuels reductions.
GIS Mapping	Yes	Yes, GIS mapping tools and data collection systems have been implemented by SMFD to track progress and establish on going status changes for areas of mitigation efforts. Examples; tracking wildfire fuels reductions programs, fire hydrant infrastructure, water supply
Staff/Personnel Resources	Yes/No Full Time/ Part Time	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Fire Chiefs	Yes/FT	Fire Chiefs are in place to designate representatives to enforce regulations. Hazard mitigation training is provided to establish functional implementation standards for staff. The Fire Chiefs facilitate a role between multiple agency representatives.
Division Chief – Fire Marshal	Yes/FT	Oversees the operations of the Prevention Division as the designated authority by the Fire Chief. Supports staff and acts as a PIO and Investigator with the County fire investigation team.
Deputy Fire Marshal	Yes/FT	Oversees the daily operations of Fire Inspectors and Investigators. Supports staff and acts as a PIO and Investigator with the County fire investigation team.
Communications Coordinator	Yes/FT	Maintains the social media presents and analytics of the District while supporting the messaging from the District for emergency preparedness and hazard mitigation. Serves a role as a PIO.

Safety - Fire Prevention Staff **Inspectors/Investigators/ Code Enforcement**	Y/FT	Develops and maintains amendments to the adopted Fire Code and Standards. Implements building and fire code standards for the District. Serves as Fire Prevention Specialist in public outreach and education. Supports the County fire prevention officers and the fire investigation team.
Admin – Fire Prevention Staff Inspectors/Code Enforcement	Y/FT	Develops and executes fuel and hazard mitigation projects for the District and land owners within the service area of the District. Provides community outreach and education on
NRG Coordinator	Y/PT	Provides community outreach for CERT and NRGs while facilitating community meetings and training. Plans evacuation drills and coordinates community drills between NRGs and CERT members.
Fire Department Front Line Staff	Y/FT	Southern Marin Fire Protection District protects the District from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire.

Table 360: Southern Marin Fire Protection District Administrative and Technical Capabilities
Source: **Southern Marin Fire Protection District**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 20: Southern Marin Fire Protection District Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Fire water supply improvement programs, wildfire fuels reductions, roadway access for emergency vehicles, flood water rescue training and equipment. Allocated funds could be used to improve on past efforts for future mitigation actions.
Authority to levy taxes for specific purposes	Y	The Fire District has been approved with past tax measures to enhance wildfire mitigation efforts through staffing and community programs. These initiatives will continue to be augmented through local taxes.
Fees for water, sewer, gas, or electric services	Y	The Fire District has an established Fee Schedule for services rendered by the Fire Prevention Division. These fees provide cost recovery for staff and can be used to enhance staffing capabilities for an EOC/DOC and other

		mitigation actions.
Impact fees for new development	N	The Fire District could impose new development fees on projects in the Wildland Urban Interface to fund future mitigation actions for water supply upgrades and access roads for emergency vehicles.
Storm water utility fee	N	Not at this time. The Fire District has not used this funding source in the past
Incur debt through general obligation bonds and/or special tax bonds	N	The District will review applicable funding sources depending on projects and timelines.
Incur debt through private activities	N	The Fire District has not used this funding source in the past.
Community Development Block Grant	N	The Fire District has not used this grant source in the past.
Other federal funding programs	Y	Federal funding has been used in the past to mitigate roadside fuels reduction for evacuations and wide shaded fuel breaks. Federal funding could be used in the future to fund various mitigation projects including flood control, wildfire risk reduction, infrastructure upgrades, emergency response, and climate adaption.
State funding programs	Y	State funding has been used in the past to mitigate roadside fuels reduction for evacuations and wide shaded fuel breaks. Federal funding could be used in the future to fund various mitigation projects including flood control, wildfire risk reduction, infrastructure upgrades, emergency

Table 361: Southern Marin Fire Protection District Fiscal Capabilities
Source: **Southern Marin Fire Protection District**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Southern Marin Fire Protection District and the Southern Marin Fire Protection District partnerships utilized to promote those programs.

Table 21: Southern Marin Fire Protection District Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The District has several volunteer groups that can help hazard mitigation efforts including the local Emergency Preparedness Committees, Neighborhood Response Groups, and the CERT program. These groups are both personnel resources and can make recommendations to the District Board, the governing body, which can update local codes. Volunteer resources for events, education, and data collection.
Ongoing public education or information program	Y	Educating Volunteer resources for events, education, and data collection.

(e.g., responsible water use, fire safety, household preparedness, environmental education)		
Natural disaster or safety related school programs	Y	Annually, SMFD visits schools during Fire Prevention week to educate K- Second graders. Building a school ambassador program that could be supported by LHMP. Yes, this program could enhance and benefit future efforts for mitigation efforts. Fourth grade ambassador program at local schools. Seventh grade emergency prep training.
StormReady certification	N	Marin County is a National Weather Service StormReady and TsunamiReady site. The Fire District could use this program with Marin County and other local municipalities to improve storm resiliency and fund future mitigation actions.
Firewise Communities certification	Y	The Southern Marin Fire Protection District has 19 established Firewise USA sites. Yes, the Firewise USA plan identifies local hazards to the site. Yes, the plan can be mitigated by larger projects and requests the community to implement mitigation identified in the plan.
Community Rating System	N	Marin County is a CRS participating community as of 5/1/2016. The Fire District has not participated in this program.
Public-private partnership initiatives addressing disaster-related issues	Y	ReadyMarin is a comprehensive source of emergency preparedness information for Marin County, and coordinates public agency resources and neighborhood response groups.

Table 362: Southern Marin Fire Protection District Community Outreach
Source: **Southern Marin Fire Protection District**

3.2.5 Participation in the National Flood Insurance Program

As a Special District the Southern Marin Fire Protection District does not participate in the national flood insurance program (NFIP). However, the City of Sausalito, City of Mill Valley, the Town of Tiburon, and the County of Marin do participate in the NFIP and have profiled their flood risk in the Flood Profile in this Annex, the Marin County OA MJHMP, and the City of Sausalito, City of Mill Valley, the Town of Tiburon, Annex. Repetitive loss and severe repetitive loss structures are also addressed in the NFIP portion of the Marin County OA MJHMP, and the City of Sausalito, City of Mill Valley, the Town of Tiburon, Annex. The SMFD does have any facilities within a flood plain and that vulnerability is addressed in the Flooding profile. The SMFD does not have any repetitive loss and severe repetitive loss structures are defined as a structures covered under an NFIP flood insurance policy (44 CFR § 77.2(i)).

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

The Southern Marin Fire Protection District did not participate in the 2018 Marin County MJHMP and therefore, did not have any previous mitigation actions.

3.5 Hazard Mitigation Actions

The 2023 Marin County MJHMP was revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Southern Marin Fire Protection District based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires District Board of Directors regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions

with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 22 lists the Current Hazard Mitigation Actions for the Southern Marin Fire Protection District.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SMFD-1	Create Local Funding Mechanisms for Hazard Mitigation (MU-9)	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $12,000 year/ General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years/ Medium	Partner with local stakeholders and public schools to establish hazard mitigation projects that require additional funding sources. Prioritize and support efforts to implement local programs with hazard mitigation funding sources.
SMFD-2	**Fire Code**. Review and adopt current California Fire codes. Amend Fire Code to reduce damage to structures from hazard risk specific to Southern Marin Fire Protection District. (MU-8)	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	Existing	Cost: TBD General Fund, fees based	1 – 3 years/ High	Fire code was most recently updated December 2022. Southern Marin Fire Protection District continues to review and adopt current California Fire codes with updates specific to the District as necessary.
SMFD-3	Develop emergency supply cache storages for providing disaster relief and logistic aid to local municipalities and public volunteers.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, Tam Valley Community Service District, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-3 years/ High	Work with local municipalities to identify strategic storage locations across the Fire District. These locations would be used to house emergency supplies and receive palletized shipments.
SMFD-4	Develop a multilingual and culturally appropriate business outreach program, in concert with existing business organizations and planning partners, to educate businesses on risk and risk reduction and to identify policies and programs to help businesses become more resilient.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years/ Medium	Partner with local businesses to establish hazard mitigation projects that require additional funding sources. Prioritize and support efforts to implement local programs with hazard mitigation funding sources.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SMFD-5	Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD	1-5 years/ Medium	Develop a Safety Element in the general plan for the district that ties in an updated version of the SMFD WUI Hazard Mitigation Plan and the MJLHMP.
SMFD-6	Develop model policy templates to assist with coordinated development and implementation of resiliency policies, such as the Safety Elements.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years/ Medium	This is designed to provide a model for the public and private sectors of the District to implement for resiliency and mitigation of hazards.
SMFD-7	Develop a list of vulnerable populations that could benefit from an emerging emergency notification technology or system.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years Medium	Collect beneficial data from the public for determining what emerging emergency notification systems could provide the District with advanced warning.
SMFD-8	Integrate emerging emergency notification technologies or systems to serve vulnerable populations.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years Medium	Identify the best use of emerging technologies to serve the communities of the District that are vulnerable to advancing natural disasters.
SMFD-9	Map Community Risk	Debris Flow/ 1,2,4,5	SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-5 years/ Medium	Develop a standardized GIS dataset for modeling hazards and impacts for regional and jurisdictional assessment purposes. Implement a program to digitally map historical hazard events and future hazard events and impacts (for example, new fire

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
							hazard severity mapping and social vulnerability data produced by federal, state, or local sources that would apply to the entire planning area).
SMFD-10	Educate the public and local nurseries on drought tolerant plants. Develop an educational program to allow for fire safety planting and drought safe landscapes to occur.	Drought/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $20,000/year General Fund, HMPG, BRIC, CDAA Grant funded	1-5 years/ Medium	Develop a local educational program around best practices in drought conditions to conserve water based on plant types, while also integrating in fire safe landscaping techniques. Provide resources for the public to ensure that this training can be implemented.
SMFD-11	Expand public emergency outreach/education including, but not limited to, emergency preparedness, CERT, evacuation planning and earthquake threat. (EQ-4, EQ-7, EQ-9)	Earthquake/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $20,000/year General Fund, HMPG, BRIC, CDAA Grant funded	1-5 years/ Medium	Reach out to schools and private sector groups to establish preparedness and evacuation education opportunities. Host live training and drills to prepare staff with the training and knowledge needed to assist in a disaster.
SMFD-12	Develop a program for local officials to receive building inspection training and establish lists of trained inspectors. (EQ-8)	Earthquake/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $10,000/year General Fund, HMPG, BRIC, CDAA Grants	1-5 years/ Medium	Work with local municipalities to provide detailed training between building officials and inspectors to be able to safely and effectively assist with post-earthquake structure assessment. Develop a training and certification process to allow for local officials to be training and

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
							establish a list of certified individuals.
SMFD-13	Subsidence Study. Analyze and monitor subsidence in low elevation areas of Sausalito [FEMA Project SU-4]	Subsidence/ 1, 2, 4, 5	Sausalito Public Works Dept, SMFD	New (2024)	Cost: TBD General Fund	5 years	Evaluate subsidence over time in Sausalito's bay side areas.
SMFD-14	Tsunami Analysis and Improvements: Develop an analysis, recommendations and improvements to address Tsunami impacts and Sea Level Rise along Sausalito's Shoreline [FEMA Project TSU-5, F-19]	Tsunami, Flooding, Sea Level Rise/ 1,2,3, 4	Sausalito Public Works Dept, SMFD	New (2024)	Cost TBD General Fund, HMPG, BRIC, FMA, CDAA Grants	1-3 years /High	Example Projects: Installation of a Sea Wall on the east side of Bridgeway between Princess and Richardson.Installation of protective measures on Humboldt and along the entire Sausalito waterfront.
SMFD-15	Severe Storms. Reduce Sausalito's vulnerability to severe storms and associated hazards. [FEMA Project SW-4 Protect Power Lines and Infrastructure]	Severe Weather- Wind, Tornado & Wildfire 1, 2, 4, 5	Sausalito Public Works Dept, SMFD	Existing	Cost TBD General Fund, HMPG, BRIC, CDAA grants as needed	1-5 years/ Medium	Work with PG&E to underground power lines that are vulnerable to high winds or Tornadoes that can break the lines causing loss of power or potential fire.
SMFD-16	Develop localized flood risk mapping for use in preparing the community with educational tactics and additional flood barrier resources. (SLR-1,SRL-4)	Sea Level Rise/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA Grant funded	3-5 years low	Utilize available mapping and data to develop localized programs and strategies to educate the public on hazard mitigation approaches. Provide additional resources for the public to prepare for flooding and king tides.
SMFD-17	Establish local procedures to educate the public on health risks associated with severe weather and provide community resource programs to ensure the public is	Severe Weather- Heat/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of	New (2023)	Cost: $25,000 General Fund, HMPG, BRIC, FMA, CDAA Grant funded	3-5 years/ low	Based on the extreme weather event, provide the public with educational information to better prepare against adverse health risks associated with the weather

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
	prepared based on the event. (ET-2,ET-3,ET-4)		Sausalito, SMFD				event. Develop programs and plans to implement community support and outreach, example: cooling centers, clear air shelter.
SMFD-18	**Fire Engine Access Improvements.** Hillside neighborhoods adaptation projects to protect against wildfire risk including widening narrow roads and adding road pullouts, increasing number of emergency egress roads from neighborhoods, continue vegetation management in highest risk areas, and other projects listed in the assessment.	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, Tam Valley Community Services District, Homestead Sanitary District, SMFD	New (2023)	Cost: $100,000/year General Fund, Municipal Service Tax, HMPG, BRIC, CDAA grants, Fire Safe Marin	1-2 years/ High	Analysis of the roadway systems that feed in and out of the District's vulnerable hillside communities would be utilized to determine where additional widening efforts could prove beneficial. Enhancing evacuation times and emergency response during large scale evacuation efforts.
SMFD-19	Community All Hazards Safety Evacuation Route Mitigation	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, CDAA grants, Fire Safe Marin	1-3 years Medium	Enhancing evacuation routes in the hillside communities by developing steps, lanes, and paths to allow for both downhill and uphill evacuation options.
SMFD-20	Expand and upgrade the resiliency of the water supply system by adding additional fire hydrant and infrastructure. (D-7)	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD, MMWD	New (2023)	Cost: $50,000/year General Fund, HMPG, BRIC, CDAA grants, Fire Safe Marin Grant funded, Special Tax	1-2 years/ High	Identifying fire hydrants that require increased water flow and access for wildfire efforts in the hillside communities is essential. Determining what fire hydrants are becoming subject to extreme weather conditions that indicate need for early replacement to avoid massive water leaks during

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
							droughts and/or failure during wildfires.
SMFD-21	**Steps, Lanes and Paths**. Maintain and improve SLP pedestrian evacuation network through the SLP Annual Maintenance Program and SLP Design and Construction Program.	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD, MMWD	New (2023)	Upgrades/Maintenance: Cost: $20,000/year General Fund	1-3 years/ Medium	Replace damage stair systems utilized as evacuation routes as funding is available.
SMFD-22	Develop a community outreach program for education around early warning systems and notification. (TSU-1, TSU2)	Tsunami/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA grants	1-3 years/ Medium	Outdoor early warning sirens are installed and require additional public education for general awareness and education.
SMFD-23	Develop a community outreach program for vulnerable communities that focuses on reducing the risk of wildfire around all residential structures and vessels. (TSU-3)	Tsunami/ 1, 2, 3, 4, 5	County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA Grant funded	1-2 years/ High	Provide residents in the community most at risk from the impacts of tsunamis and associated wildfires that could occur. Add additional signage in marinas and educate the public on quick and effective wildfire mitigation tactics.

Table 363: Southern Marin Fire Protection District Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Southern Marin Fire Protection District. The planning team for the Southern Marin Fire Protection District identified and prioritized the mitigation actions as detailed in Table 22, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this Southern Marin Fire Protection District Profile by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as master planning, strategic planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where the 2023 MJHMP will be used for further integration.

The planning team for the Southern Marin Fire Protection District will maintain this plan and will serve as a lead staff for grant project applications on District projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Southern Marin Fire Protection District will use existing plans and/or programs to implement hazard mitigation actions both directly within the District and through the coordinated efforts with the Cities they serve.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Southern Marin Fire Protection District and the Cities they serve already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

District Master & Strategic Plans - Integrates hazard mitigation through the consideration of hazards most likely to impact the district.

District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Cities planned response to hazards most likely to impact the district.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

31. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA.
32. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs.
33. Using the risk assessment information to update the hazards section in the County and City Emergency Operations Plans.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 Future Development Trends

Marin County and the Cities of Mill Valley and Sausalito have planning and community development departments, SMFD only is involved in providing fire services in new development approved by the County and Cities of Mill Valley and Sausalito.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Cities of Mill Valley and Sausalito. has occurred and will continue to occur throughout the city in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

No other development projects are being considered by the Southern Marin Fire Protection District.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Southern Marin Fire Protection District.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Southern Marin Fire Protection District Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Southern Marin Fire Protection District plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Southern Marin Fire Protection District is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Southern Marin Fire Protection District Fire Marshall will monitor and update the Southern Marin Fire Protection District Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase

engagement and enhance collaboration on the plan and projects. The summit will also have the goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 PLAN EVALUATION

Upon approval and adoption by the Southern Marin Fire Protection District, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Southern Marin Fire Protection District, to evaluate the plan after each update meeting.

4.4 Plan Update

The Southern Marin Fire Protection District Fire Marshall will monitor and update the Southern Marin Fire Protection District Annex to the Marin County OA MJHMP. During the five-year update cycle, the Southern Marin Fire Protection District and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

List of Figures

Figure 1: Marin County OEM MJHMP Website 14-20
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 14-21
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 14-22
Figure 4: Hazard Mitigation Plan Survey 14-24
Figure 5: Map of the Southern Marin Fire Protection District 14-27
Figure 6: Map of the Southern Marin Fire Protection District and Other Fire Districts 14-28
Figure 7: The Southern Marin Fire Protection District Precipitation and Monthly Temperatures 14-30
Figure 8: City of Mill Valley Social Vulnerability Map Census Tract 1261.00 14-32
Figure 9: City of Mill Valley Social Vulnerability Map Census Tract 1262.00 14-33
Figure 10: City of Mill Valley Social Vulnerability Map Census Tract 1270.00 14-34
Figure 11: City of Sausalito Social Vulnerability Map Census Tract 1302.01 14-35
Figure 12: City of Sausalito Social Vulnerability Map Census Tract 1302.03 14-36
Figure 13: City of Sausalito Social Vulnerability Map Census Tract 1302.04 14-37
Figure 14: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1281.00 14-38
Figure 15: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1282.00 14-39
Figure 16: Map of the Southern Marin Fire Protection District and Critical Facilities and Infrastructure within the District 14-45
Figure 17: SMFD Risk Assessment – Planning Team Top Hazards 14-46
Figure 18: Hazard Risk Categorization 14-46
Figure 19: NASA Global Temperature Change CO2 Gas 14-50
Figure 20: NASA Global Temperature Change 1884 to 2022 14-50
Figure 21: NASA Global Temperature Change Sea Level 14-51
Figure 22: Annual Mean Sea Level Trends 14-53
Figure 23: Landslide Susceptibility Classes 14-58
Figure 24: Mud Flow Areas 14-59
Figure 25: SMFD Debris Flow Critical Facilities and Infrastructure 14-60
Figure 26: Mudslide in Sausalito – 2019 14-62
Figure 27: Modified Mercalli Intensity Scale 14-66
Figure 28: Mercalli Scale vs. Magnitude 14-66
Figure 29: Soil Types 14-67
Figure 30: Marin County Earthquake Impact 14-68
Figure 31: SMFD Earthquake Critical Facilities and Infrastructure 14-69
Figure 32: Diagram of an Atmospheric River Event 14-74
Figure 33: SMFD Flooding Critical Facilities and Infrastructure 14-78
Figure 34: Dissolution Sinkhole Formation 14-83
Figure 35: Cover-Subsidence Sinkhole Formation 14-84
Figure 36: Cover-Collapse Sinkhole Formation 14-84
Figure 37: Levee Failure Mechanisms 14-87
Figure 38: SMFD Levee Inundation Map 14-89
Figure 39: Marin County Sea Level Rise Impact 14-94

Figure 40: SMFD Sea Level Rise Impact on Critical Facilities 14-95
Figure 41: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 14-96
Figure 42: Heat Index 14-97
Figure 43: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 14-98
Figure 44: Beaufort Wind Scale 14-99
Figure 45: Enhanced Fujita Scale 14-100
Figure 46: Waterspout Formation 14-101
Figure 47: SMFD Tsunami Critical Facilities and Infrastructure 14-103
Figure 48: Federal, State and Local Responsibility Areas in the Marin County OA 14-107
Figure 49: Fuel Model Map for the Marin County OA 14-111
Figure 50: SMFD Wildfire Critical Facilities and Infrastructure 14-115

List of Tables

Table 1: SMFD Local Hazard Mitigation Planning Team Members 14-8
Table 2: 2023 MJHMP Planning Team Members 14-13
Table 3: SMFD & Marin County MJHMP Planning Meetings 14-16
Table 4: NRI Hazards and Marin County MJHMP Hazards 14-31
Table 5: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00 14-32
Table 6: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00 14-33
Table 7: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00 14-34
Table 8: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01 14-35
Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03 14-36
Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04 14-37
Table 11: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1281.00 14-38
Table 12: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1282.00 14-39
Table 13: Southern Marin Fire Protection District Critical Facilities 14-44
Table 14: Select Hazards Magnitude/ Severity Scale or Index 14-47
Table 15: SMFD Hazard Risk Assessment 14-55
Table 16: County of Marin Hazard Risk Assessment 14-56
Table 17: Southern Marin Fire Protection District Critical Facilities in the Flood Zones 14-82
Table 18: Southern Marin Fire Protection District Legal and Regulatory Capabilities 14-123
Table 19: Southern Marin Fire Protection District Administrative and Technical Capabilities 14-125
Table 20: Southern Marin Fire Protection District Fiscal Capabilities 14-126
Table 21: Southern Marin Fire Protection District Community Outreach 14-127
Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions 14-137

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire Protection District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting

15. Town of Tiburon Community Profile

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Town of Tiburon and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

The official Marin County hazard mitigation Steering Committee provided the oversight and dedication to this project that was required, and without their commitment, this project would not be possible.

As with any working plan, this document represents planning strategies and guidance as understood as of the date of this plan's release. This plan identifies natural hazards and risks and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of the Town of Tiburon more disaster resistant and sustainable.

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TABLE OF CONTENTS

15. TOWN OF TIBURON COMMUNITY PROFILE 15-1
ACKNOWLEDGEMENTS 15-3
TABLE OF CONTENTS 15-5
SECTION 1.0: INTRODUCTION 15-7
1.1 Introduction 15-7
1.2 Planning Process 15-7
1.2.1 Steering Committee Members (Jurisdictional Representatives) 15-8
1.2.2 Steering Committee Planning Process 15-9
1.2.3 Coordination with Stakeholders and Agencies 15-9
1.2.4 Public Engagement 15-16
1.3 Overview and History 15-23
1.4 Government 15-26
1.5 Weather and Climate 15-26
1.6 Demographics 15-27
1.7 Social Vulnerability and Risk 15-31
1.8 Economy and Tax Base 15-35
1.9 Critical Facilities 15-37
1.10 Historical Properties 15-39
SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT 15-40
2.1 Climate Change 15-42
2.2 Hazards 15-49
2.2.1 Debris Flows 15-50
2.2.2 Drought 15-56
2.2.3 Earthquake 15-57
2.2.4 Flooding 15-64
2.2.5 Land Subsidence 15-71
2.2.6 Levee Failure 15-74
2.2.7 Sea Level Rise 15-77
2.2.8 Severe Weather – Extreme Heat 15-82
2.2.9 Severe Weather – High Wind & Tornado 15-83
2.2.10 Tsunami 15-86
2.2.11 Wildfire 15-89

SECTION 3.0: MITIGATION STRATEGY 15-101
3.1 Changes in Development 15-101
3.2 Capability Assessment 15-103
3.2.1 Regulatory Capabilities 15-103
3.2.2 Administrative and Technical Capabilities 15-109
3.2.3 Fiscal Capabilities 15-111
3.2.4 Community Outreach 15-112
3.2.5 Participation in the National Flood Insurance Program 15-113
3.3 Mitigation Goals 15-116
3.4 Status of Previous Mitigation Actions 15-118
3.5 Hazard Mitigation Actions 15-119
3.6 Progress in Local Mitigation Efforts 15-124
3.7 Plan Integration 15-124
3.8 Future Development Trends 15-125
SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION 15-127
4.1 Plan Adoption 15-127
4.2 Plan Monitoring 15-127
4.3 Plan Evaluation 15-128
4.4 Plan Update 15-128
FIGURES AND TABLES 15-130
ACRONYMS/ABBREVIATIONS 15-132

SECTION 1.0: INTRODUCTION

1.1 INTRODUCTION

The Town of Tiburon, Community Profile has been prepared in conjunction with the Marin County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), establishing an inter-jurisdictional process for the development and implementation of effective hazard mitigation strategies in association with identified hazards that pose real or potential threats to the Town of Tiburon.

1.2 PLANNING PROCESS

The majority of Marin County is unincorporated sparsely populated rural and protected lands. Most of the 262,000 county population is consolidated into the Eastern portion of the county. The Marin County MJHMP Steering Committee and broader Planning Team approached the development of the Marin County MJHMP and the associated jurisdictional and district profiles from a coordinated and collaborative planning and public engagement unity of effort.

The Marin County and Town of Tiburon Steering Committee felt a unified effort, led by the County Office of Emergency Management (OEM), would be the most effective approach for this planning process. This approach allowed the small participating jurisdictions and districts with limited staffing and resources to take advantage of the combined efforts of the County, the Town of Tiburon and the other participating planning areas to reach a broader segment of each of their own populations and do so in a way to ensure greater equity and inclusion of the public in this planning process. Extensive and coordinated public outreach was done involving the Town of Tiburon and all participating jurisdictions and districts with an eye towards equity, inclusion, openness, accessibility, and ensuring they meet the population where they live, work, or recreate to provide the public convenience of access and ease of participation in this planning process.

Marin County is very different from most California Counties in that the populated portion of the County where the participating jurisdictions and district's planning areas are located has the same climate, similar topography, and are exposed to many of the same hazards. Only three jurisdictions, Larkspur, Ross, and San Anselmo, are not coastal jurisdictions and are not impacted by Tsunami or Sea Level Rise.

This unity of effort approach allowed the Marin County and Town of Tiburon Steering Committee to establish a more robust Planning Team representing local Tiburon, countywide, regional, state, and federal stakeholders servicing the Marin County and Town of Tiburon planning area. These stakeholders were in a unique position to provide informed and specific information and recommendations on hazard mitigation goals and actions, as well as population needs and social vulnerability for each of the jurisdictional and district planning areas. This united effort allowed the planning team to attend fewer meetings than they would have been required to attend if they were required to attend separate meetings for each participating jurisdiction and district. The reduced number of meetings allowed the planning team the opportunity and time to provide more detailed and thoughtful contributions to the planning effort.

In addition to providing representation on the coordinated Marin County and Town of Tiburon Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the Town of Tiburon involved additional internal planning team members to support the broader planning process. The Town of Tiburon jurisdictional representatives for the coordinated Marin County Multi-Jurisdictional

Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (Jurisdictional Representatives)

Primary Point of Contact
Sam Bonifacio, Associate Planner
Telephone: 415-435-7392
E-mail: sbonifacio@townoftiburon.org

Alternate Point of Contact
Laurie Nilsen, Emergency Svs, Coord.
Telephone: 415-789-2805
E-mail: lnilsen@tiburonpd.org

This annex was developed by the primary point of contact with assistance from the members of the local mitigation planning team listed in Table 1 and Table 2.

Table 1: Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
Tiburon	Sam Bonifacio	Associate Planner	415-435-7392	sbonifacio@townoftiburon.org
Tiburon	Dina Tasini	Director of Community Development	415-435-7393	dtasini@townoftiburon.org
Tiburon	Laurie Nilsen	Emergency Svs, Coord.	415-789-2805	lnilsen@tiburonpd.org
Tiburon	Patrick Kerslake	Public Works Operations Manager	415-435-7399	pkerslake@townoftiburon.org
Tiburon	David Eshoo	Public Works Engineering Manager	415-435-7388	deshoo@townoftiburon.org

Table 364: Local Hazard Mitigation Planning Team Members

This 2023 Marin County Operational Area (OA) MJHMP is a comprehensive update of the 2018 Marin County OA MJHMP. The planning area and participating jurisdictions and organizations were defined to consist of unincorporated Marin County, five special districts, and the eleven incorporated jurisdictions to include the Town of Tiburon. All participating jurisdictions are within the geographical boundary of Marin County and have jurisdictional authority within this planning area.

The Marin County and Town of Tiburon Steering Committee led the planning process based on the contribution and input from the whole community stakeholders who identified the community's concerns, values, and priorities. The Steering Committee met and reviewed the mitigation recommendations and strategies identified within this plan. Each participating local jurisdiction established a mechanism for the development and implementation of jurisdictional mitigation projects, as identified within this plan and associated locally specific supporting documents. As deemed necessary and appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

The Marin County and Town of Tiburon Steering Committee assisted with the planning process in the following ways:

- Attending and participating in the Steering Committee meetings.
- Identification of potential mitigation actions.

- Updating the status of mitigation actions from the 2018 Marin County OA MJHMP.
- Collecting and providing other requested data (as available).
- Making decisions on plan process and content.
- Reviewing and providing comments on plan drafts; including annexes.
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to be involved and provide comment.
- Coordinating, and participating in the public input process.
- Coordinating the formal adoption of the plan by the governing boards.

1.2.2 Steering Committee Planning Process

The Marin County and Town of Tiburon Steering Committee met monthly to develop the plan. Email notifications were sent out to each Steering Committee member to solicit their participation in the Steering Committee meetings. The meetings were conducted using a Zoom platform videoconferencing. Meeting attendees signed in using the chat feature to record their attendance.

The Marin County and Town of Tiburon Steering Committee agreed to make and pass plan-based general policy recommendations by a vote of a simple majority of those members present. The Steering Committee will also seek input on future hazard mitigation programs and strategies from the mitigation planning team by focusing on the following:

- Identify new hazard mitigation strategies to be pursued on a state and regional basis, and review the progress and implementation of those programs already identified.
- Review the progress of the Hazard Mitigation program and bring forth community input on new strategies.
- Coordinate with and support the efforts of the Marin County OEM to promote and identify resources and grant money for implementation of recommended hazard mitigation Strategies within local jurisdictions and participating public agencies.

During the planning process, the Marin County and Town of Tiburon Steering Committee communicated through videoconferencing, face-to-face meetings, email, telephone conversations, and through the County and Town websites. The County and Town website included information for all stakeholders on the MJHMP update process. Hannah Tarling of the Marin County Office of Emergency Management and Preparative Consulting established a Microsoft 365 SharePoint folder which allowed the Steering Committee members and Marin OEM and Preparative Consulting to share planning documents and provide a format for the planning partners to submit completed documents and access other planning related documents and forms. Draft documents were also posted on this platform and the Marin County OES website so that the Steering Committee members and the public could easily access and review them.

1.2.3 Coordination with Stakeholders and Agencies

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (44 CFR, Section 201.6(b)(2)).

Early in the planning process, the Marin County and Town of Tiburon Steering Committee

reached out to the following Local and Regional Agencies involved in hazard mitigation activities to invite them to participate in this planning process as a member of the Planning Team. These individuals work with Marin County and the Town of Tiburon communities and could provide subject matter expertise and relevant information to the planning process regarding the community history, hazard risk, vulnerability, and impact, mitigations efforts, community needs, demographics, and social vulnerability, economic concerns, ecology, and other community services and needs.

The Marin County and Town of Tiburon Steering also determined that data collection, risk assessment analyses, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, the Town of Tiburon and/or their interest as a neighboring jurisdiction, representatives from the following groups were invited to participate on the Planning Team:

Eighty-five planning partners participated in this update, as listed in Table 2.

Table 2: 2023 MJHMP Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager
19	Marin County	Steven Torrence	OEM Director
20	Marin County	Hannah Tarling	Emergency Management Coordinator
21	Marin County	Chris Reilly	OEM Project Manager
22	Marin County	Woody Baker-Cohn	Senior Emergency Management Coordinator
23	Marin County	Leslie Lacko	Community Development Agency
24	Marin County	Hannah Lee	Senior Civil Engineer
25	Marin County	Felix Meneau	Project Mgr./ FCWCD
26	Marin County	Julia Elkin	Department of Public Works
27	Marin County	Beb Skye	Department of Public Works

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
28	Marin County	Scott Alber	Battalion Chief, Marin County Fire Dept.
29	Marin County	Lisa Santora	Deputy Public Health Officer, Marin Health & Human Services
30	Marin County	Koblick, Kathleen	Marin Health & Human Services
31	Marin County	Amber Davis	Public Health Preparedness
32	Mill Valley	Patrick Kelly	Department of Public Works
33	Mill Valley	Ahmed A Aly	Project Manager
34	Mill Valley	Jared Barrilleaux	Deputy Director of Engineering
35	Mill Valley	Daisy Allen	Senior Planner
36	Southern Marin Fire District	Tom Welch	Deputy Chief/South Marin Fire Dist.
37	Southern Marin Fire District	Marshall Nau	Fire Marshall/South Marin Fire Dist.
38	North Marin Water District	Eric Miller	Asst. General Manager
39	North Marin Water District	Tim Fuette	Senior Engineer
40	Novato	David Dammuller	Engineering Services Mgr.
41	Novato	Dave Jeffries	Consultant/JPSC
42	Ross	Richard Simonitch	Public Works Director
43	San Anselmo	Sean Condry	Public Works & Building Director
44	San Anselmo	Erica Freeman	Building Official
45	San Anselmo	Scott Schneider	Asst. PW Director
46	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
47	San Rafael	Cory Bytof	Sustainability
48	San Rafael	Joanna Kwok	Senior Civil Engineer
49	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
50	Sausalito	Andrew Davidson	Senior Engineer/ DPW
51	Sausalito	Kevin McGowan	Director of Public Works
52	Sausalito	Brandon Phipps	Planning Director
53	Tiburon	Sam Bonifacio	Associate Planner
54	Tiburon	Dina Tasini	Director of Community Development
55	Tiburon	Laurie Nilsen	Emergency Svs, Coord.
Special Districts & Partner Agencies			
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Svcs	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects

Table 2: 2023 MJHMP Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
State Partners			
74	Cal OES - ESC	Sarah Finnigan	Cal OES Emergency Services Coordinator
75	Cal OES, Division of Safety of Dams	Danielle Jessup	Coordinator/ Dam Safety Planning Division
76	California Department of Public Health	Svetlana Smorodinsky	Disaster Epidemiologist/ Environmental & Occupational Emergency Preparedness Team
77	California Department of Public Health	Patrice Chamberlain	Health Program Specialist II
78	California Department of Water Resources	Julia Ekstrom, PhD	Supervisor, Urban Unit Water Use Efficiency Branch
79	Caltrans	Trang Hoang	Senior Transportation Engr/ Office of Advance Planning
80	Caltrans	Markus Lansdowne	Caltrans D4 Emergency Coordinator
Federal Partners			
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 365: 2023 MJHMP Planning Team Members

Several opportunities were provided for the groups listed above to participate in the Town of Tiburon's planning process. At the beginning of the planning process, invitations were extended to these groups to actively participate on the Planning Team. Participants from these groups assisted in the process by attending several videoconferencing meetings where hazard vulnerability and risk were discussed along with hazard mitigation strategies and actions. Planning Team members provided data and other applicable information directly as requested in meetings, emails, telephone calls, videoconferencing, worksheets, or through data contained

on their websites or as maintained by their offices. This information was used to develop hazard vulnerability and risk profiles along with mitigation actions.

These key agencies, organizations, and advisory groups received meeting announcements, agendas, and minutes by e-mail throughout the plan update process. They supported the effort by attending meetings or providing feedback on issues. All the agencies were provided with an opportunity to comment on this plan update and were provided with a copy of the plan to review and offer edits and revisions. They were also provided access to the Marin County OEM hazard mitigation plan website to review all planning documents and hazard mapping tools.

Each was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region IX for a pre-adoption review to ensure program compliance.

In addition, through the public meetings conducted at the beginning of the planning process, members of the planning team, the public, and other key stakeholders were invited to participate in the planning process through public outreach activities.

Further as part of the public outreach process, all planning areas engaged in public outreach and education by providing information on their Town of Tiburon website or though press releases directing the public to the main Marin County OEM website that provided coordinated and detailed public information of the planning process and how the public could participate. All planning areas were invited to attend the public meetings and to review and comment on the plan prior to submittal to Cal OES and FEMA. Additional public outreach action is detailed in the 1.2.4 PUBLIC ENGAGEMENT section of this annex.

The following planning meetings were held with the planning team:

Table 3: Town of Tiburon & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview

Table 3: Town of Tiburon & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives • Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects

Table 3: Town of Tiburon & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps • Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan	• Individual phone or conference calls with planning jurisdictions and

Table 3: Town of Tiburon & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
			Development Sessions	districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 366: Town of Tiburon & Marin County MJHMP Planning Meetings

1.2.4 PUBLIC ENGAGEMENT

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM and the Town of Tiburon, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release from Marin County and the Town of Tiburon informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

Public involvement activities for this plan update were conducted by Marin County, the Town of Tiburon, and all participating jurisdictions and districts and included press releases; website postings; a community survey; stakeholder and public meetings; and the collection of public and stakeholder comments on the draft plan which was posted on the Marin County and Town of Tiburon website. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2018 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

Equity and Whole Community Approach

The Marin County OEM and the Marin County and Town of Tiburon Steering Committee prioritized equity and engagement of the whole community in the development of the Marin County OA MJHMP by establishing a framework with key actions for each step of the planning process. Elements of the equity approach included:

Engaging hard-to-reach populations

This effort was to ensure the greatest equity and access to the public to enable participation in the process. The Marin County OEM outreach strategy is to “meet people where they are.” The Town Hall meetings were conducted at different familiar locations within the county where people could easily access them and were conducted on both a weekday and weekend, and in the evening and during the daytime. The meetings were offered in-person with a virtual

broadcast using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. After the meeting, Marin County OEM uploaded the recorded meeting to their website to allow the public on demand access to the meeting.

Translation and Interpretation Services

The survey and outreach materials were provided in both English and Spanish to improve accessibility among populations with limited English proficiency. The website uses Google Translate for accessibility in multiple languages. Interpretation services were offered for both town hall meetings. Each town hall meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

Three stakeholder and public meetings were held, two at the beginning of the plan development process and one prior to finalizing the updated plan. Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan, including the sections that address mitigation goals and strategies. Specifically, public comments were obtained during the plan development process and prior to plan finalization.

All press releases and website postings are on file with the Marin County OEM. Public meetings were advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large. Advertisement mechanisms for these meetings and for involvement in the overall MJHMP development process include:

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations
- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

The public outreach activities were conducted with participation from and on behalf of all jurisdictions participating in this plan.

The Marin County and Town of Tiburon Steering Committee has made the commitment to periodically bring this plan before the public through public meetings and community posting so that citizens may make input as strategies and implementation actions change. Public meetings will continue to be held twice a year after the first and third MJHMP meetings. Public meetings will continue to be stand-alone meetings but may also follow a council meeting or other official government meeting. The public will continue to be invited to public meetings via social media messaging, newspaper invitations, and through the website for each jurisdiction participating in the plan. Each jurisdiction is responsible for assuring that their citizenry is informed when deemed appropriate by the Steering Committee.

WEBSITE

At the beginning of the plan update process, Marin County OEM established a hazard mitigation website https://emergency.marincounty.org/pages/lhmp on behalf of all the planning areas to ensure consistent messaging and information, to keep the public posted on plan development milestones, and to solicit relevant input. The website also provided information on signing up for Alert Marin, provided detailed information about the hazard mitigation process and plan

development, provided a URL and QR code link to the survey in both English and Spanish, and provided information about upcoming town hall meetings. (See Figure 1)

The site's address was publicized in all press releases, surveys and public town hall meetings. Each planning partner also established a link on their own agency website. Information on the plan development process, the Steering Committee, a link to the Hazard Mitigation survey, and drafts of the plan were made available to the public on the site. Marin County intends to keep a website active after the plan's completion to keep the public informed about successful mitigation projects and future plan updates.

Figure 701: Marin County OEM MJHMP Website

PUBLIC MEETINGS

Two separate Marin County MJHMP Public Town Hall Meeting were conducted at different locations within the County, on different days of the week and during different times of the day. This effort was to ensure the greatest equity and access by the public to enable participation in the process. The Marin County OEM outreach strategy is to "meet people where they are." Each Town Hall Meeting included live Spanish translation and subtitles, Live American Sign Language (ASL/CDI) interpretation, the ability for the Zoom videoconferencing attendee to activate subtitles in 29 different languages, and vision accessible PowerPoint slide.

The first Town Hall Meeting was conducted on Thursday, April 13, 2023, from 6:00 pm to 7:30 pm, at the Marin County Board of Supervisors Chambers, Marin County Civic Center, 3501 Civic Center Drive, Room #330 San Rafael, CA 94903. The in-person meeting was also broadcast virtually using Zoom videoconferencing and streamed live on Marin County OEM Facebook account. Each of the jurisdictions participating in the MJHMP released a Press Release on their respective websites announcing the Public Town Hall Meeting and providing the date, time, and URL link to the Zoom Meeting for the public to log in and attend the Zoom Meeting. Marin County OEM also posted a notice for the Public Town Hall Meeting

on their Facebook account. At the conclusion of the presentation, a question and answer session was held to answer questions from the attendees.

The second Town Hall Meeting was conducted on Saturday, April 29, 2023, from 10:00 am to 11:30 am, at the Marin County Health and Wellness Center, 3240 Kerner Ave. Rooms #109 and #110 San Rafael, CA. 94903. The meeting followed the same format as the first and hosted the same access level of equity and accessibility.

The Marin County MJHMP Public Town Hall Meeting was recorded and downloaded from Zoom and made available to all of the jurisdictions and districts to place on their websites and local Access TV for the public to view.

Meeting participants were also invited to complete the Hazard Mitigation Survey and were provide the URL link to the Survey Monkey website to complete the survey.

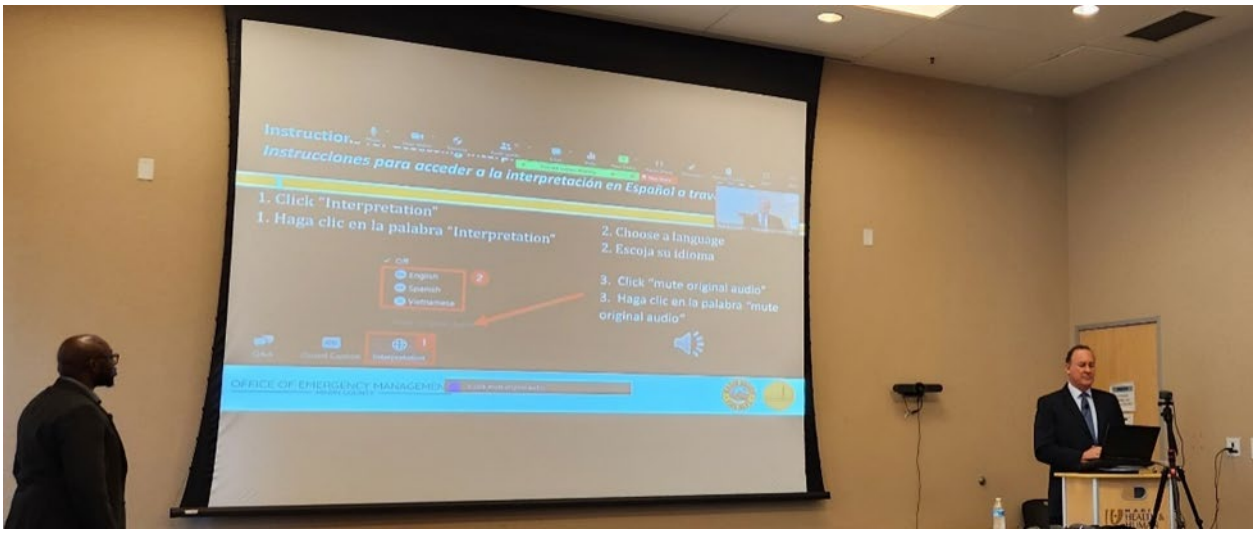


Figure 702: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

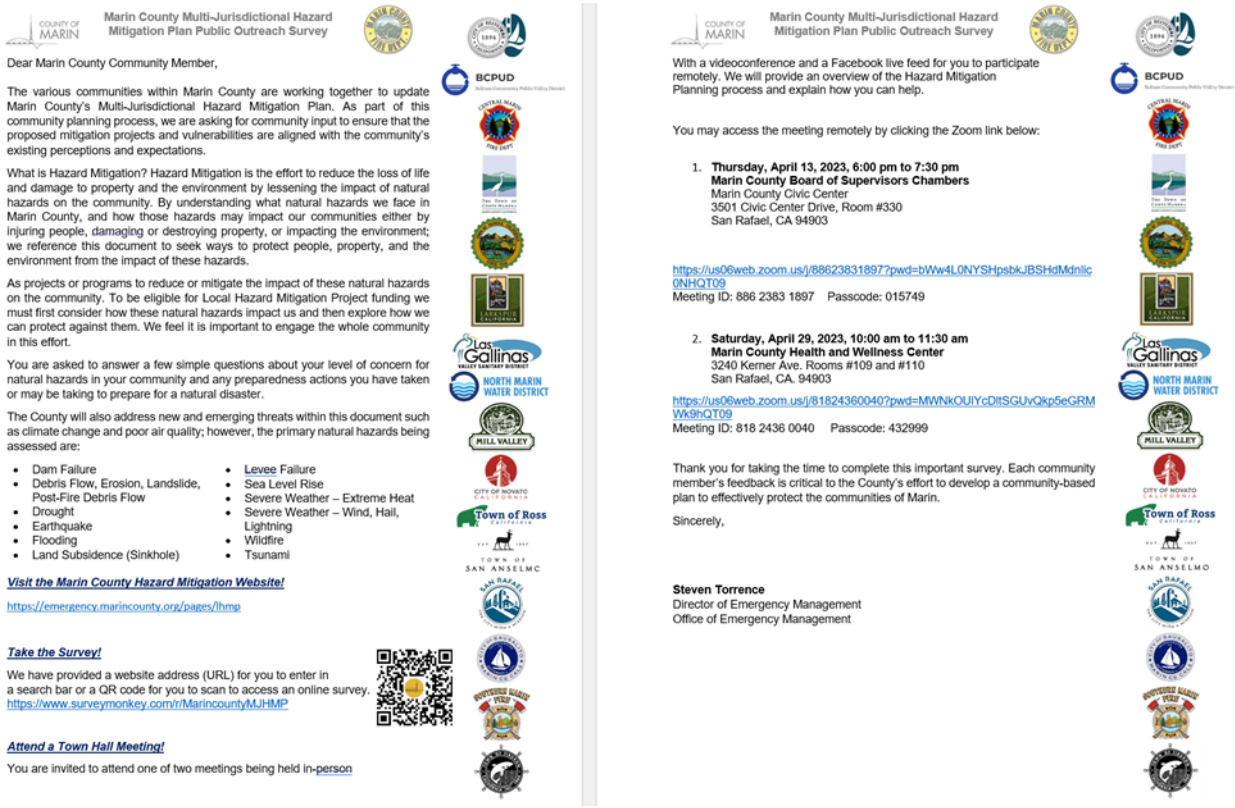
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete the Hazard Mitigation Plan survey which was accessible via an attached URL or QR Code and provide feedback on potential hazard mitigation projects or programs.

The results of the survey were provided to each of the planning partners and used to support the jurisdictional annex process. Each planning partner was able to use the survey results to help identify actions as follows:

- Gauge the public's perception of risk and identify what citizens are concerned about.
- Identify the best ways to communicate with the public.
- Determine the level of public support for different mitigation strategies.
- Understand the public's willingness to invest in hazard mitigation.

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County MJHMP Public Town Hall Meeting. All press releases were made available to the community in both English and Spanish.



Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

Dear Marin County Community Member,

The various communities within Marin County are working together to update Marin County's Multi-Jurisdictional Hazard Mitigation Plan. As part of this community planning process, we are asking for community input to ensure that the proposed mitigation projects and vulnerabilities are aligned with the community's existing perceptions and expectations.

What is Hazard Mitigation? Hazard Mitigation is the effort to reduce the loss of life and damage to property and the environment by lessening the impact of natural hazards on the community. By understanding what natural hazards we face in Marin County, and how those hazards may impact our communities either by injuring people, damaging or destroying property, or impacting the environment; we reference this document to seek ways to protect people, property, and the environment from the impact of these hazards.

As projects or programs to reduce or mitigate the impact of these natural hazards on the community. To be eligible for Local Hazard Mitigation Project funding we must first consider how these natural hazards impact us and then explore how we can protect against them. We feel it is important to engage the whole community in this effort.

You are asked to answer a few simple questions about your level of concern for natural hazards in your community and any preparedness actions you have taken or may be taking to prepare for a natural disaster.

The County will also address new and emerging threats within this document such as climate change and poor air quality; however, the primary natural hazards being assessed are:

- Dam Failure
- Debris Flow, Erosion, Landslide, Post-Fire Debris Flow
- Drought
- Earthquake
- Flooding
- Land Subsidence (Sinkhole)
- Levee Failure
- Sea Level Rise
- Severe Weather – Extreme Heat
- Severe Weather – Wind, Hail, Lightning
- Wildfire
- Tsunami

Visit the Marin County Hazard Mitigation Website!

https://emergency.marincounty.org/pages/lhmp

Take the Survey!

We have provided a website address (URL) for you to enter in a search bar or a QR code for you to scan to access an online survey. https://www.surveymonkey.com/r/MarincountyMJHMP

Attend a Town Hall Meeting!

You are invited to attend one of two meetings being held in-person

Marin County Multi-Jurisdictional Hazard Mitigation Plan Public Outreach Survey

With a videoconference and a Facebook live feed for you to participate remotely. We will provide an overview of the Hazard Mitigation Planning process and explain how you can help.

You may access the meeting remotely by clicking the Zoom link below:

1. **Thursday, April 13, 2023, 6:00 pm to 7:30 pm**
   Marin County Board of Supervisors Chambers
   Marin County Civic Center
   3501 Civic Center Drive, Room #330
   San Rafael, CA 94903

https://us06web.zoom.us/j/88623831897?pwd=bWw4L0NYSHpsbkJBSHdMdnlic0NHQT09
Meeting ID: 886 2383 1897 Passcode: 015749

2. **Saturday, April 29, 2023, 10:00 am to 11:30 am**
   Marin County Health and Wellness Center
   3240 Kerner Ave. Rooms #109 and #110
   San Rafael, CA. 94903

https://us06web.zoom.us/j/81824360040?pwd=MWNkOUlYcDltSGUvQkp5eGRMWk9hQT09
Meeting ID: 818 2436 0040 Passcode: 432999

Thank you for taking the time to complete this important survey. Each community member's feedback is critical to the County's effort to develop a community-based plan to effectively protect the communities of Marin.

Sincerely,

Steven Torrence
Director of Emergency Management
Office of Emergency Management

Figure 703: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

A hazard mitigation plan survey (see Figure 4) was developed by the Steering Committee and made available to the public in both English and Spanish. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to its ten questions helped guide the Steering Committee in defining our hazards, and selecting goals, objectives, and mitigation strategies. The survey was available on the hazard mitigation plan website, advertised in press releases, and at town hall meetings. Finally, the survey and the process of public input was advertised throughout the course of the planning process. The survey was available to the public on March 13, 2023, and closed on June 12, 2023. At the conclusion of the planning process 293 surveys were completed by the public.

Public Comments Considered by the Planning Team

The Planning Team used the following information gathered from the Public Outreach Survey to inform decisions regarding hazard mitigation strategies, actions, and priorities.

- Climate Change, Wildfire, and Drought were the top hazards of concern for the public.

- Text messages, mail, and the County website were the preferred methods for receiving hazard mitigation information.
- 48% of respondents expressed that they were “Very Much” concerned and 31% were “Moderately” concerned that a natural disaster could impact their home or place of residence.
- 85% of respondents own their own home.
- 99% of respondents have access to the internet.

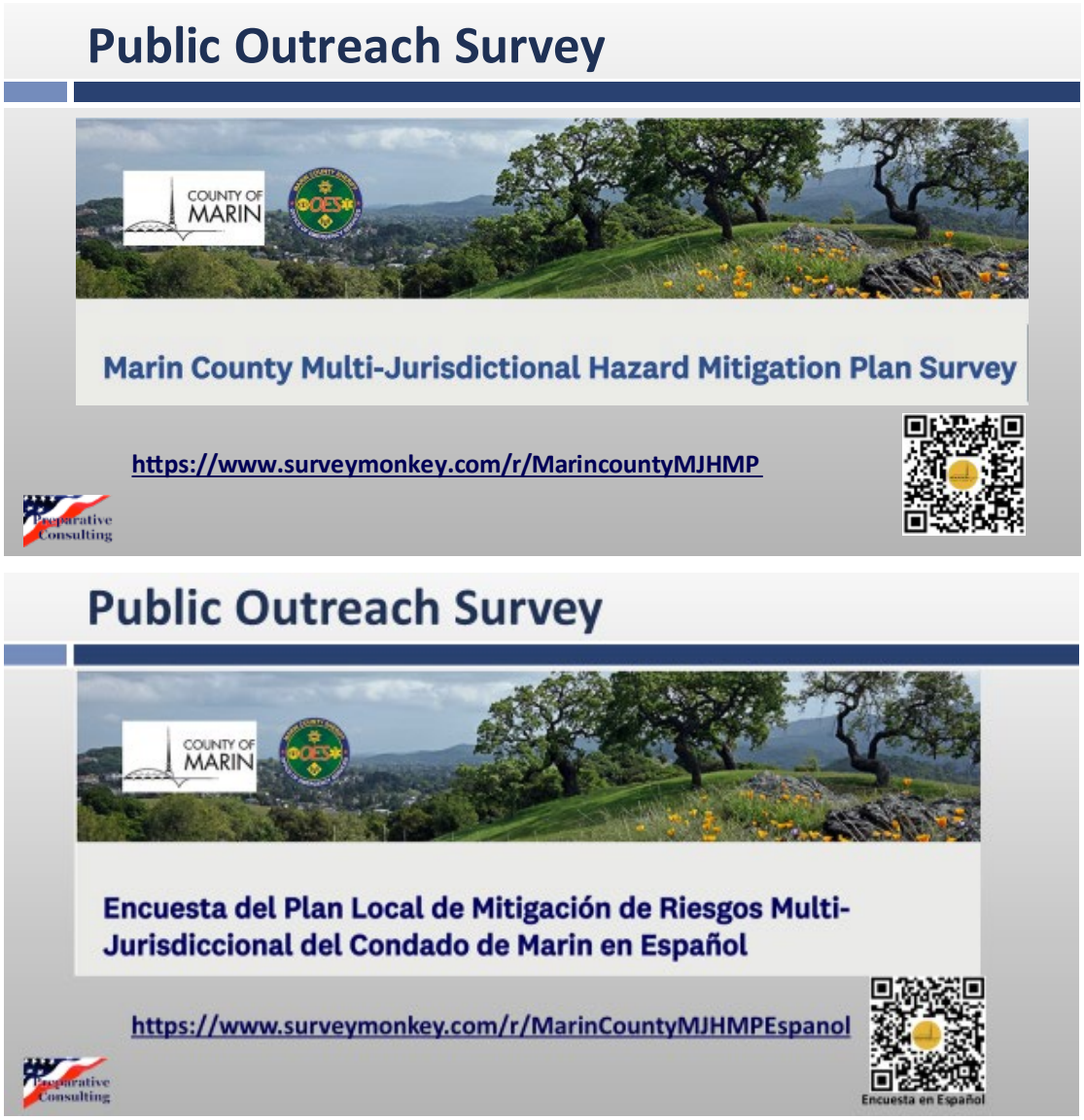


Figure 704: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

To solicit public feedback on the draft plan, Marin OEM engaged in a multi-faceted approach intended to reach as many Marin residents as possible, including members of the community who are under-served and under-represented. All members of the community had the opportunity to provide initial comments on the plan during a two-week period from

Wednesday, December 4, 2023, to Wednesday, December 18, 2023. Although the initial comment period was listed as two weeks, the public could submit comments indefinitely via the County's website to support the County's continuous improvement efforts. The base plan, as well as city, town and special district annexes, were available for download on emergency.marincounty.org (include photos). The website additionally asked for feedback in a survey in English and Spanish (include photos), the survey was designed to establish where that person lives or works, their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

The website and survey were shared through traditional and social media (photos) The Marin Independent Journal (Marin IJ) used the press release to write an article (hopefully; include photos). Social media accounts were updated four times with an initial ask, two reminders, and a closing announcement. The Marin OEM Public Information Officer coordinated with the Marin County Public Information Officers (MAPIO) working group to distribute information to partner jurisdictions (city, town, and special districts) to share this information on their social media sites and with the communities in the area.

To reach those who may not be engaged digitally, the planning team worked with Marin County Community Response Teams, (CRTs are a collaboration of non-profit organizations supporting underrepresented communities in four zones) to conduct outreach with half-sheet flyers in English and Spanish to share in the 4 CRT zones (southern Marin, north Marin, west Marin, San Rafael). These half sheets were also shared county-wide at libraries, including in areas not covered by CRTs, like at the Fairfax library. CRTs are designed to reach Marin's traditionally underserved and underrepresented communities, so by conducting outreach through this method, we were able to inform residents who may not have been engaged otherwise, including residents in Marin City, West Marin, and the Canal District of San Rafael.

After December 18, 2023, the various participating jurisdiction and district profiles remained on the Marin County OEM website for public comments. The Town of Tiburon had an additional 14-day comment period for the Town of Tiburon Community Profile where their profile was posted on the Town website for final public comment from January 29 – February 5, 2024.

The 14-day public comment period gave the public an opportunity to comment on the draft plan update prior to the plan's submittal to Cal OES. Comments received on the draft plan are available upon request. All comments were reviewed by the planning team and incorporated into the draft plan as appropriate.

Public Comments Considered by the Planning Team

The Marin County OEM posted the draft Hazard Mitigation Plan and hazard mitigation actions on their website and solicited public comments on the content. The Town of Tiburon distributed press releases directing the community to the Marin County OEM website to review the draft plans. The Planning Team gathered public comments and information on the Marin County OEM website regarding proposed and current Hazard Mitigation Actions. The Planning Team used the comments and suggestions to inform decisions regarding hazard mitigation strategies, actions, and priorities. Most comments included ideas for hazard mitigation projects and comments on the effectiveness of current mitigation projects. These

comments were used to revise the proposed hazard mitigation actions which resulted in the final list of hazard mitigation actions listed in 3.5 Hazard Mitigation Actions.

1.3 Overview and History

Tiburon is an incorporated town in Marin County, California. It was incorporated on June 23, 1964, and is located on the Tiburon Peninsula, which reaches south into the San Francisco Bay. It shares a ZIP code (94920) with the smaller incorporated city of Belvedere (formerly a separate island), which occupies the southwest part of the peninsula and is contiguous with Tiburon. Tiburon is bordered by Corte Madera to the north and Mill Valley to the west but is otherwise mostly surrounded by the bay. Besides Belvedere and Tiburon, much of the peninsula is unincorporated, including portions of the north side and the communities of Strawberry and Paradise Cay.

Elevations on the Tiburon Peninsula range from sea level to about 650 feet, and it is drained by multiple small watersheds on the north and south sides. Vegetation occurring within the planning area primarily consists of agricultural, ruderal, riparian, and landscaping vegetation. The Town of Tiburon comprises approximately 4.5 square miles of land area and 8.75 square miles of submerged land.

The town's name derives from the Spanish word tiburón, which means "shark". The name was first given to the peninsula on which the town is situated, and probably inspired by the prevalence of locally native leopard sharks in the surrounding waters. Tiburon was formerly the southern terminus of the San Francisco and North Pacific Railroad (subsequently the Northwestern Pacific Railroad), which transported freight for transfer to barges for shipping to cities around San Francisco Bay. It is now a commuter and tourist town, linked by fast ferry services to San Francisco and with a concentration of restaurants and clothes shops. It is the nearest mainland point to Angel Island and a regular ferry service connects to the island.

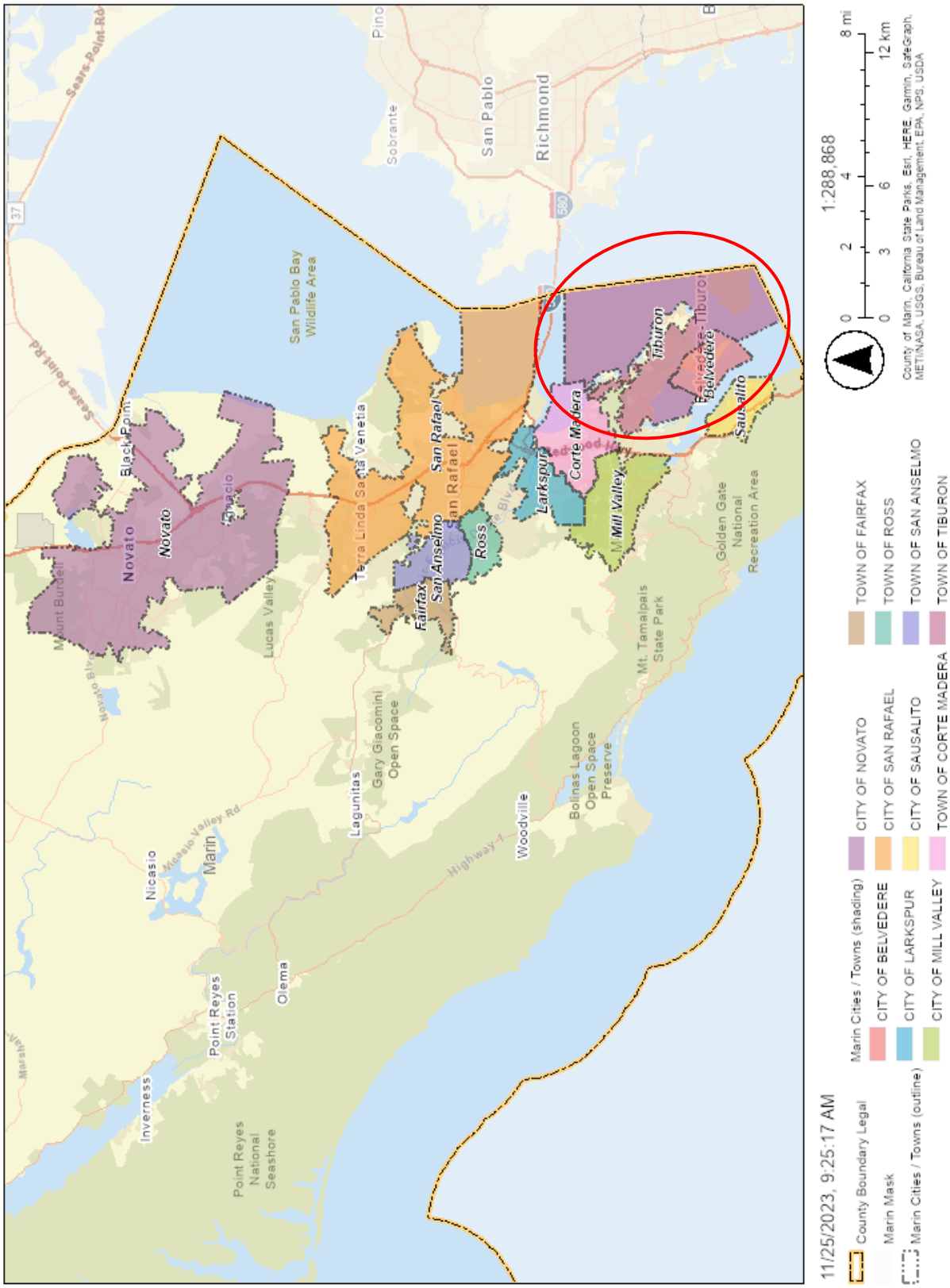


Figure 705: Map of Town of Tiburon in Marin County
Source: Marin County OEM

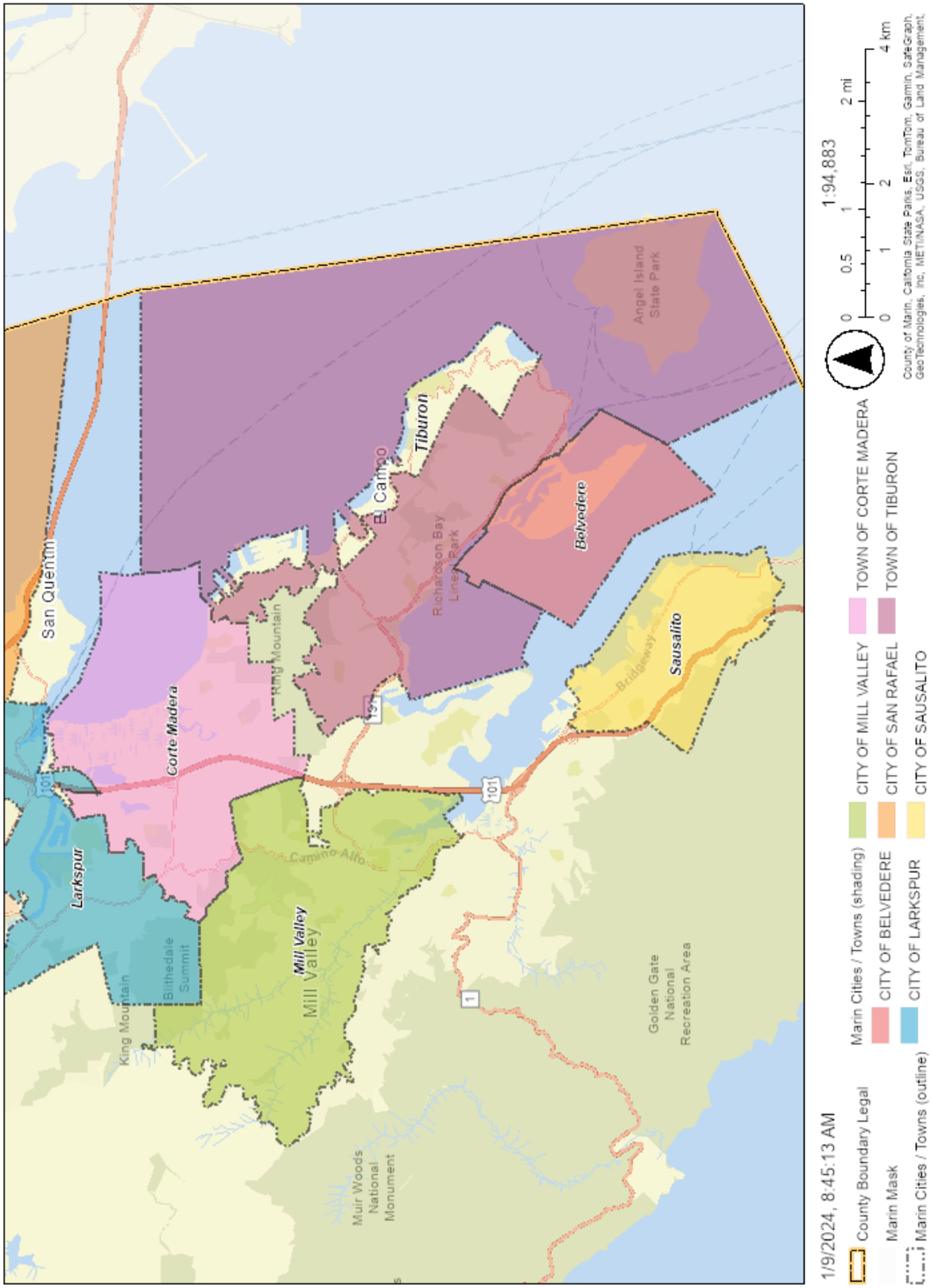


Figure 706: Map of the Town of Tiburon
Source: Marin County OEM

1.4 GOVERNMENT

The Town of Tiburon is governed by a five-person Town Council. The Town Council elects one of its members to serve as Mayor, the executive head of the town; and appoints a Town Manager, the administrative head of the town. The town consists of 5 departments: Administration and Finance, Community Development, Police, Public Works, and Town Clerk.

The Town Council assumes responsibility for the adoption of this plan; and the Town Manager will oversee its implementation.

Tiburon Fire Protection District is a combination department with 21 career safety employees, one clerical and one finance officer, 13 volunteer firefighters, and 6 trainee firefighters. Protecting the town of Tiburon and the city of Belvedere, California and the surrounding area, the Fire District's boundaries represent a diverse community with responsibility for commercial, residential, wildland/urban interface, and parts of the San Francisco Bay to Angel Island State Park. The Tiburon Fire Protection District was established in April 1941 and remained an all-volunteer fire department until December 1959. In 1981 the Tiburon Fire District contracted with the City of Belvedere, providing emergency medical and fire related services to the City.

The Tiburon Police Department was established in 1972 following the Town's incorporation by eight years. In addition to normal police activities, the Police Station also houses the Emergency Operations Center, which is equipped to manage disaster response for Tiburon and Belvedere. The Police Department and Emergency Operations Center are also responsible for developing and maintaining the Emergency Operations Plan for the entire Tiburon Peninsula.

1.5 WEATHER AND CLIMATE

The Town of Tiburon lies approximately 100 feet above sea level. In Tiburon, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, and partly cloudy. Over the course of the year, the temperature typically varies from 48°F to 73.1°F and is rarely below 43°F or above 62.3°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is 42 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	113 (4)	118 (4)	83 (3)	40 (1)	21 (0)	6 (0)	2 (0)	2 (0)	3 (0)	25 (0)	57 (2)	111 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	2	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.9	6.5	7.8	9.1	9.1	9.3	7.4	6.8	7.6	7.3	6.8	5.8

Figure 707: The Town of Tiburon Precipitation and Monthly Temperatures
Source: en.Climate-Data.org

1.6 DEMOGRAPHICS

The California Department of Finance shows an overall estimated decrease in the population of Marin County and the Town of Tiburon since the last plan update in 2018. Of the total estimated 257,135 residents of Marin County in 2022 based on the 2020 U.S. Census Survey, 190,148 residents live in the incorporated county and 66,987 residents live in the unincorporated county.

The Town of Tiburon had an estimated population of 9,542 in the 2018 plan. 2020 U.S. Census Survey estimated the Town's population at 9,146. However, revised estimates for 2022 estimated the population to decrease to 8,956 population.

Table 4: Town of Tiburon Estimated Jurisdictional Population

Jurisdiction	Population 2022 (Estimate)	Population 2020	Population 2018 (Estimate)	Percent Change 2018-2022
Marin County	257,135	262,321	262,179	-1.92%
Town of Tiburon	8,956	9,146	9,542	-6.14%

Table 367: Town of Tiburon Estimated Jurisdictional Population
Source: California Department of Finance

Table 5: Population Change of The Town of Tiburon

Jurisdiction	Total Population		Change, 2010-2020	
	April 1, 2010	April 1, 2020	Number	Percent
California	37,253,956	39,538,223	2,284,267	6.1%
Marin County	252,409	262,321	9,912	3.9%
Tiburon, town	9,542	9,146	396	-6.14%

Table 368: Population Change of The Town of Tiburon
Source: Town of Tiburon Housing Element, US Census Bureau, California Department of Finance

Table 6 lists the various languages spoken in the Town of Tiburon.

Table 6: Languages Spoken in Tiburon	
Primary Language Spoken	% of Population
English only	75.7%
Spanish	3.4%
Other Indo-European languages	16.1%
Asian and Pacific Islander languages	4.5%
Other languages	0.2%

Table 369: Languages Spoken in Tiburon
Source: US Census Bureau (2020)

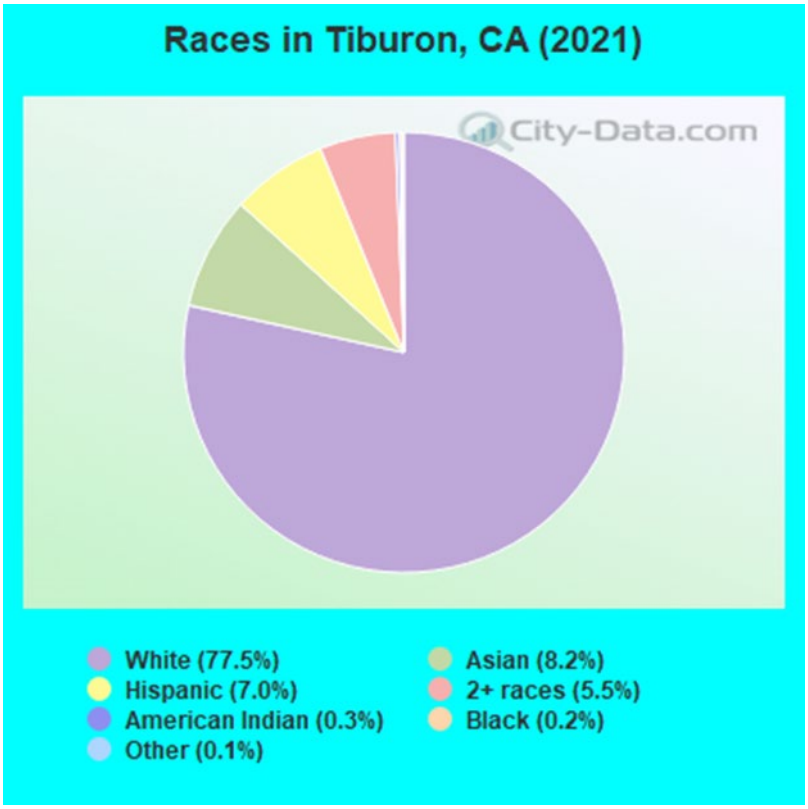


Figure 708: Races in Tiburon
Source: City-Data.com

Table 7: Marin County Jurisdictional Housing Stock							
2022 and 2018							
Year		Total Units	Single Family		Multi-Family		Mobile Homes
			Detached	Attached	2 to 4	5 plus	
California							
2022	Number	14,583,998	8,341,577	1,010,851	1,168,669	3,500,674	562,223
	Percent	100.0%	57.2%	6.9%	8.0%	24.0%	3.9%
2018	Number	14,157,502	8,160,864	985,926	1,129,761	3,318,946	562,005
	Percent	100.0%	57.6%	7.0%	8.0%	23.4%	4.0%
Marin County							
2022	Number	111,879	68,004	11,314	8,524	22,013	1,984
	Percent	100.0%	60.8%	10.1%	7.6%	19.7%	1.8%
2018	Number	112,294	68,697	11,318	8,307	21,986	1,986
	Percent	100.0%	61.2%	10.1%	7.4%	19.6%	1.8%
Town of Tiburon							
2022	Number	4,051	2,645	386	383	624	14
	Percent	100.00%	65.29%	9.53%	9.45%	15.40%	0.35
2018	Number	4,036	2,644	384	370	624	14
	Percent	100.00%	65.51%	9.51%	9.17%	15.46%	0.35%

Table 370: Marin County Jurisdictional Housing Stock
Source: California Department of Finance

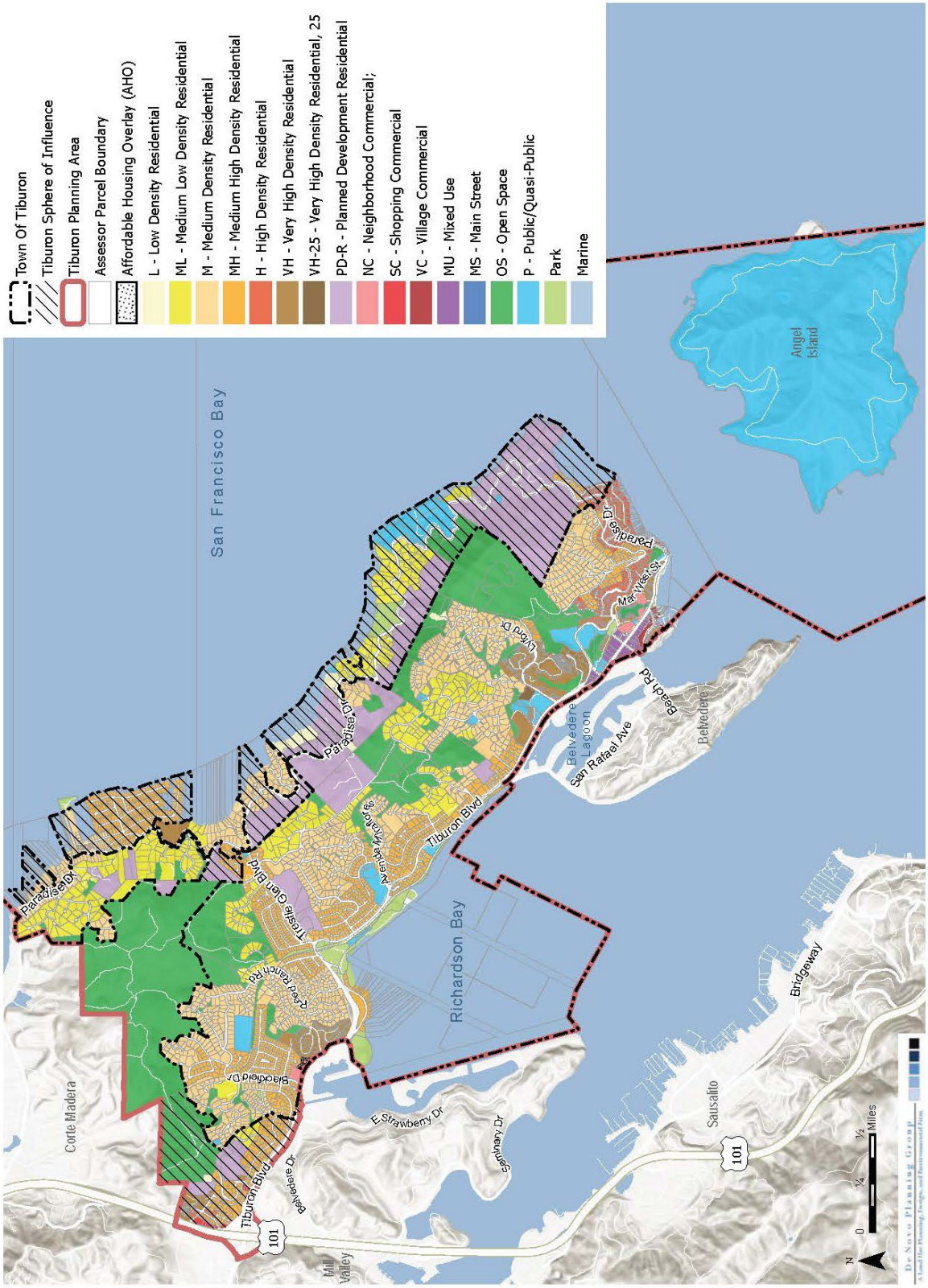


Figure 709: Town of Tiburon Land Use Map
Source: Town of Tiburon 2040 General Plan

1.7 Social Vulnerability and Risk

The California Governor's Office of Emergency Services (Cal OES) has initiated the "Prepare California" grant program focused on building community resilience amongst vulnerable individuals living in the areas of the state most susceptible to natural disasters. The Prepare California Initiative is aimed at reducing long-term risks from natural disasters by investing in local capacity building and mitigation projects designed to protect communities.

Prepare California leverages funds approved in Governor Gavin Newsom's 2021-22 State Budget and is designed to unlock federal matching funds for community mitigation projects that vulnerable communities would otherwise be unable to access. This program is intended for communities that are the most socially vulnerable and at the highest risk for future natural hazard events. The state identified communities by prioritizing California census tracts according to their estimated hazard exposures and social vulnerability.

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

For purposes of this plan the following National Risk Index (NRI) hazards are profiled in support of eight of the twelve Marin County OA MJHMP Hazards. NRI data was not available for Dam Failure, Land Subsidence, Levee Failure, or Sea Level Rise.

Table 8: NRI Hazards and Marin County MJHMP Hazards

NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 371: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value. Table 9 illustrates the NRI Hazard Type Risk Index for Tiburon Census Tract 1212.00.

Table 9: NRI Hazard Type Risk Index for Tiburon Census Tract 1212.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,424,606	Relatively Low	Very High	1.02	$1,445,994	94
Riverine Flooding	$286,988	Relatively Low	Very High	1.02	$291,297	93.9
Landslide	$108,329	Relatively Low	Very High	1.02	$109,955	99.6
Coastal Flooding	$27,845	Relatively Low	Very High	1.02	$28,263	93.1
Heat Wave	$8,479	Relatively Low	Very High	1.02	$8,606	48.8
Tornado	$6,286	Relatively Low	Very High	1.02	$6,381	15.4
Wildfire	$2,710	Relatively Low	Very High	1.02	$2,751	77
Tsunami	$636	Relatively Low	Very High	1.02	$646	95.6
Strong Wind	$338	Relatively Low	Very High	1.02	$343	11.2
Drought	$0	Relatively Low	Very High	1.02	$0	0

Table 372: NRI Hazard Type Risk Index for Tiburon Census Tract 1212.00
Source: FEMA National Risk Index 2023

Figure 10 illustrates the Social Vulnerability Map for Tiburon Census Tract 1212.00.

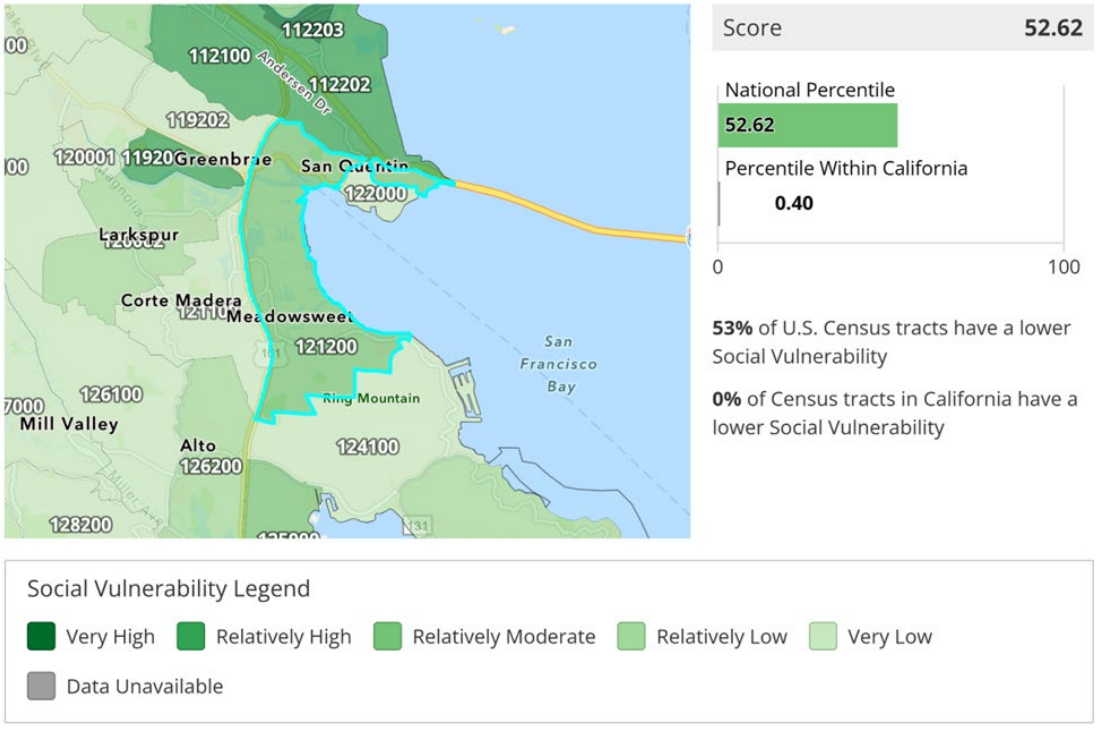


Figure 710: Town of Tiburon Social Vulnerability Map Census Tract 1212.00
Source: FEMA National Risk Index 2023

Table 10 illustrates the NRI Hazard Type Risk Index for Tiburon Census Tract 1241.00.

Table 10: NRI Hazard Type Risk Index for Tiburon Census Tract 1241.00

Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,168,268	Very Low	Very High	0.65	$764,278	89.3
Riverine Flooding	$253,225	Very Low	Very High	0.65	$165,659	89.8
Coastal Flooding	$29,091	Very Low	Very High	0.65	$19,032	91.9
Landslide	$17,468	Very Low	Very High	0.65	$11,427	96.6
Heat Wave	$8,723	Very Low	Very High	0.65	$5,707	42
Tornado	$5,174	Very Low	Very High	0.65	$3,385	7.8
Wildfire	$4,175	Very Low	Very High	0.65	$2,731	77
Tsunami	$1,113	Very Low	Very High	0.65	$728	95.7
Strong Wind	$305	Very Low	Very High	0.65	$199	7.4
Drought	$0	Very Low	Very High	0.65	$0	0

Table 373: NRI Hazard Type Risk Index for Tiburon Census Tract 1241.00
Source: FEMA National Risk Index 2023

Figure 11 illustrates the Social Vulnerability Map for Tiburon Census Tract 1241.00.

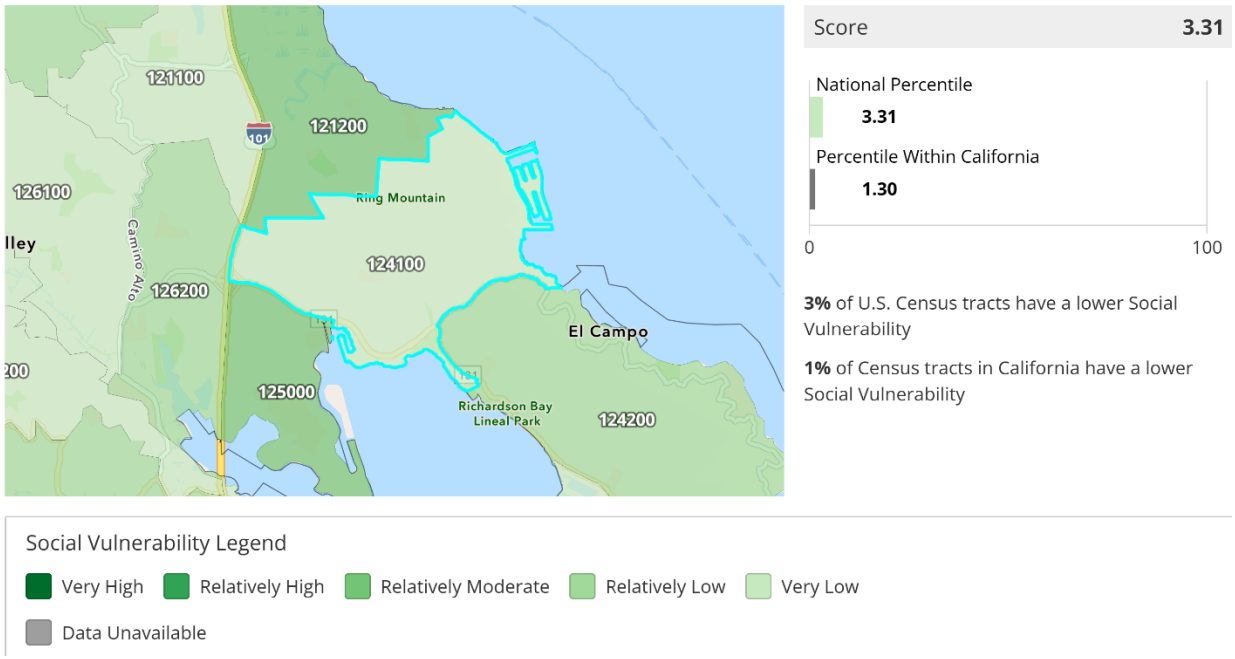


Figure 711: Town of Tiburon Social Vulnerability Map Census Tract 1241.00
Source: FEMA National Risk Index 2023

Most socially vulnerable residents in Marin County reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia. This aligns with what the County knows about Marin residents. However, discrepancy lies in the western, more rural area of the county. West Marin is comprised of seven villages, and other populated areas, that are distanced from the centralized resources in the eastern part of the county. At three local elementary school in West Marin (2022-2023 school year), students eligible for free and reduced lunch program are, 62%, 41%, and 52%, a reflection of the financial capacity of local families. West Marin is home to many farms that may employ and house underrecognized workers that may not have taken part in a census survey, what the SVI is calculated from. In the fourth quarter of FY 2021/22 the bus routes traveling to West Marin (Rural Routes) were the only service category to have increased in ridership since pre-COVID (increase 0.1%; Marin Transit, 2022) showing the reliance of West Marin residents on public transportation; however, this data continues to adjust based upon the increase in alternate methods of mass transportation. Considering this, the County of Marin acknowledges that unique social factors in West Marin require different approaches than other parts of the County.

Looking to the community resilience index (CRI) results, the data is only calculated at the county-level and compared across the nation. As a whole, Marin County is considered to have a “very high” ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S. Unfortunately, this metric does not give us the distinct experiences of the diverse communities across Marin.

When the Estimated Annual Loss Index, Social Vulnerability Index, and Community Resilience Index are aggregated as one, final results of the National Risk Index show Marin County as a whole to have "Relatively High" risk, this is due to the financial implications a disaster may have on the county. When broken out by census tract, five tracts are in the highest category ("Very High Risk"), this matches generally with the same tracts that are ranked in as higher social vulnerability; parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and unincorporated areas of Santa Venetia.

The median income for a household in the Town of Tiburon was $192,292 and the per capita income for the Town was $119,477. Approximately 0 percent of families and 1.3 percent of the population were below the poverty line (2010 data, U.S. Census Bureau).This poverty line is lower than other communities within Marin County. The two census tracts reflect both a Relatively Low and Very Low Social Vulnerability Index in the Town.

1.8 Economy and Tax Base

Table 11 shows income by household in The Town of Tiburon as of 2021.

Table 11: Household Income for The Town of Tiburon as of 2021

Household Income	Number	Percent
Total Households	3,515	-
Less than $10,000	56	1.6
$10,000 to $14,999	0	0.0
$15,000 to $24,999	77	2.2
$25,000 to $34,999	102	2.9
$35,000 to $49,999	141	4.0
$50,000 to $74,999	91	2.6
$75,000 to $99,999	264	7.5
$100,000 to $149,999	734	20.9
$150,000 to $199,999	380	10.8
$200,000 or more	1670	47.5
Median household income (dollars)	$192,292	
Mean household income (dollars)	$304,909	

Table 374: Household Income for The Town of Tiburon as of 2021
Source: US Census Bureau American Community Survey 2021 Estimates

Table 12 shows the percentage of people in The Town of Tiburon over the age of 16 employed by industry.

Table 12: Town of Tiburon Civilian Employed Population 16 years+ by Industry		
Industry	Estimated Employed	Percent
Civilian employed population 16 years and over	3,982	-
Agriculture, forestry, fishing and hunting, and mining	14	0.35%
Construction	228	5.73%
Manufacturing	83	2.08%
Wholesale trade	81	2.03%
Retail trade	261	6.55%
Transportation and warehousing, and utilities	161	4.04%
Information	147	3.69%
Finance and insurance, and real estate and rental and leasing	888	22.30%
Professional, scientific, and management, and administrative and waste management services	1304	32.75%
Educational services, and health care and social assistance	544	13.66%
Arts, entertainment, and recreation, and accommodation and food services	160	4.02%
Other services, except public administration	61	1.53%
Public administration	50	1.26%

Table 375: Town of Tiburon Civilian Employed Population 16 years+ by Industry
Source: US Census Bureau American Community Survey 2019 Estimates

1.9 CRITICAL FACILITIES

The following list of facilities has been determined to be critical to the ability of the Town of Tiburon to fulfill the requirements of its mission during an emergency:

Table 13: Town of Tiburon Critical Facilities					
	Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities					
66.	Fire	Tiburon Fire Department	1679 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
67.	Fire	Tiburon Fire Department	4301 Paradise Drive Tiburon, CA 94920	High	X
68.	Law	Tiburon Police Department	1155 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
69.	EOC	Bel-Tib Joint EOC	1155 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
70.	Local Government	Tiburon Town Hall	1505 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
71.	Local Government	Tiburon Library	1501 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
72.	Local Government	Tiburon Corporation Yard	101 Kleinert Way Tiburon, CA 94920	Moderate	AE
73.	School	Reed School	1199 Tiburon Blvd Tiburon, CA 94920	Moderate	AE
74.	School	Bel Aire School	277 Karen Way Tiburon, CA 94920	Moderate	X
75.	School	St Hilary School church	765 Hilary Drive Tiburon, CA 94920	Moderate	X
76.	School	Del Mar School	105 Avenida Miraflores Tiburon, CA 94920	Moderate	X
77.	Evacuation Shelter	Kol Shofar	215 Blackfield Tiburon, CA 94920	Moderate	X
78.	Evacuation Shelter	Tiburon Baptist Church	445 Greenwood Beach Rd Tiburon, CA 94920	Unzoned	X
79.	Evacuation Shelter	Community Congregation Church	145 Rock Hill Tiburon, CA 94920	High	X
80.	Health/ Medical	Marin Convalescent Hospital	30 Hacienda Drive Tiburon, CA 94920	High	X
Critical Infrastructure					
81.	Transportation	Tiburon Ferry Docks	1 & 21 Main Street Tiburon, CA 94920	Moderate	VE
82.	Wastewater	Sanitary District 5	2001 Paradise Drive Tiburon, CA 94920	Moderate	X
83.	Wastewater	Richardson Bay Sanitary District	500 Tiburon Blvd Tiburon, CA 94920	Moderate	X

Table 376: Town of Tiburon Critical Facilities
Source: Town of Tiburon

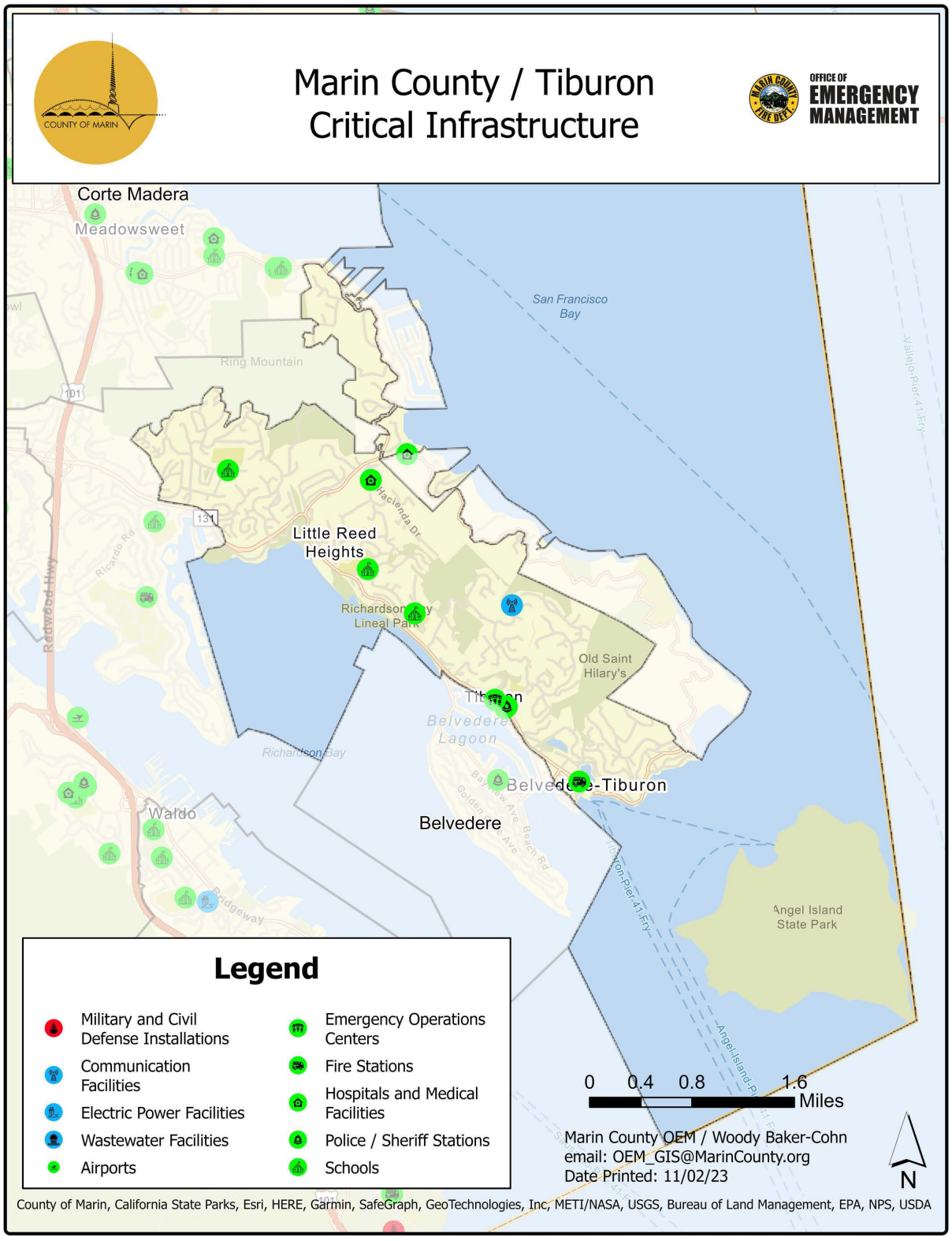


Figure 712: Town of Tiburon Critical Facilities
Source: Marin County OEM

1.10 HISTORICAL PROPERTIES

The Town of Tiburon has four registered historically significant homes, public buildings, or landmarks. To inventory these resources, the Marin County OA MJHMP Planning Team collected information from a number of sources:

- California Department of Parks and Recreation Office of Historic Preservation (OHP) OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs.
- Town of Tiburon Chamber of Commerce.
- Town of Tiburon website.

As defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a potential historic resource and is potentially eligible for the National or California Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation. Similar regulations exist for buildings under the California Environmental Quality Act (CEQA)

Table 14: Historic Sites in Tiburon

Name/Landmark State Plaque Number	National Register (NR)	State Landmark	California Register	Date Listed (NR)	Jurisdiction
Angel Island, U.S. Immigration Station (529)	X	X	X	10/14/1971	Tiburon
Lyford's Stone Tower	X			12/2/1976	Tiburon
Benjamin and Hilarita Lyford House	X			11/10/2000	Tiburon
St. Hilary's Mission Church	X			2/3/2020	Tiburon
San Francisco and North Pacific Railroad Station House-Depot	X			8/4/1995	Tiburon

Table 377: Historic Sites in Tiburon
Source: California Office of Historic Preservation and the National Register of Historic Places

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Town of Tiburon identified hazards that affect the town and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 13 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

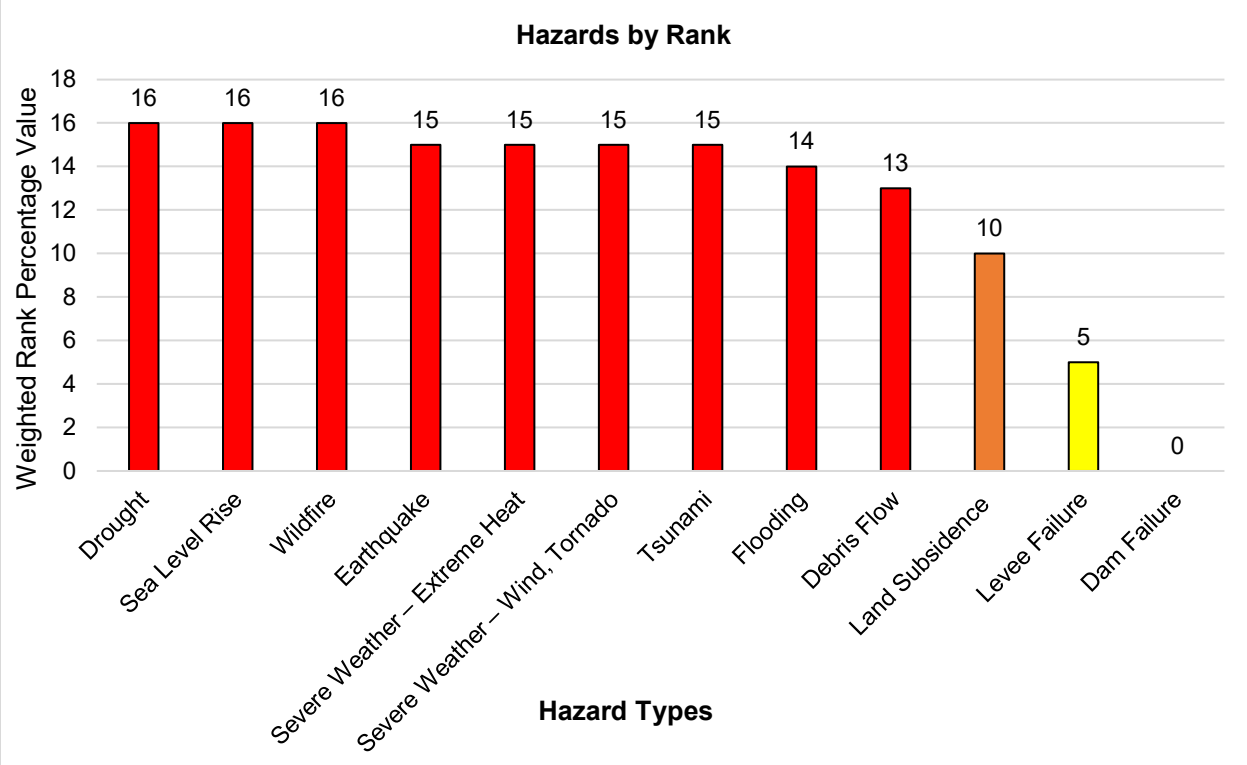


Figure 713: Town of Tiburon Risk Assessment – Planning Team Top Hazards

Figure 14: Risk Rank Categorization	
Risk Level	**Risk Numerical Score**
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 714: Hazard Risk Categorization

Each Marin County MJHMP participating jurisdiction and organization reviewed and approved the Top Hazards identified by the Planning Team. Each participating jurisdiction and district then completed a more complex assessment tool to further develop their hazard assessment and prioritization.

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed the participating jurisdiction or organization to assess their own level of vulnerability and

mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

- Probability/ Likelihood of Future Events
- Geographic Extent
- Magnitude/ Severity
- Climate Change Influence
- Significance

Probability/ Likelihood of Future Events

- **Unlikely:** Occurs in intervals greater than 100 years - Less than 1% probability of occurrence in the next year or a recurrence interval greater than 100 years.
- **Occasional:** Occurring every 11 to 100 years - 1-10% probability of occurrence in the next year or a recurrence interval of 11 to 100 years.
- **Likely:** Occurring every 1 to 10 years - 10-90% probability of occurrence in the next year or recurrence interval of 1 to 10 years.
- **Highly Likely:** Occurring almost every year - 90-100% probability of occurrence in the next year or a recurrence interval of less than 1 year.

Geographic Extent

- **Negligible:** Less than 10% of the planning area
- **Limited:** 10-25% of the planning area
- **Significant:** 25-75% of planning area
- **Extensive:** 75-100% of planning area

Magnitude/ Severity

- **Weak:** Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage.
- **Moderate:** Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days.
- **Severe:** Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months.
- **Extreme:** Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions.

Table 15: Select Hazards Magnitude and Severity Scale					
Hazard	**Scale/Index**	**Weak**	**Moderate**	**Severe**	**Extreme**
Drought	Palmer Drought Severity Index	+1.99 to -1.99	-2.00 to -2.99	-3.00 to -3.99	-4.00 and below
Earthquake	Modified Mercalli	I to IV	V to VII	VIII	IX to XII
	Richter Magnitude	2,3	4,5	6	7,8
Tornado	Fujita Tornado Damage Scale	FO	F1, F2	F3	F4, F5

Table 378: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

- **Low:** Minimal potential impact
- **Medium:** Moderate potential impact
- **High:** Widespread potential impact

Significance

- **Low:** Minimal potential impact - Two or more criteria fall in lower classifications, or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** Moderate potential impact - The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating.
- **High:** Widespread potential impact - The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with.

2.1 CLIMATE CHANGE

The County of Marin and associated jurisdictions profiled jointly recognize that the earth's climate is forcibly being augmented due to humans' reliance on fossil fuels and non-natural resources which pose negative impacts on the earth's climate. Reliance on fossil fuels and non-natural products results in the climate shifting to include unseasonable temperatures, more frequent and intense storms, prolonged heat and cold events, and a greater reliance on technological advancements to maintain the wellbeing of community members and balance of the environment. The forced adaptation to climatic shifts is necessary for the County and jurisdictions to understand and include with these assessments.

Locally to Marin, drought and rain events have already had devastating impacts to critical infrastructure, agriculture, and water resources; and globally, unseasonable temperatures have been identified as the cause for enhanced wildfires, severe droughts, ice sheets and glaciers disappearing, and persons emigrating from their countries due to a lack of sustainable, local resources. Melting land ice contributes additional water to the oceans and as ocean temperatures rise the water expands, both of which contribute to increase rates of sea level rise. Marin is bordered on the west by the Pacific Ocean and on the east by San Francisco Bay, making it particularly vulnerable to flooding and erosion caused by sea level rise.

The cause of current climate change is largely human activity, burning fossil fuels, natural gas, oil, and coal. Burning these materials releases greenhouse gases into Earth's atmosphere. Greenhouse gases trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature was formerly called, "global warming", but climate change has shown to include both intense heat and cold shifts. The warming of the planet impacts local and regional climates. Throughout Earth's history, climate has continually changed; however, when occurring naturally, this is a slower process that has taken place over hundreds and thousands of years. The human influenced climate change that is happening now is occurring at an abnormally faster rate with devastating results.

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

- Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability.
- Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
- Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems.
- The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming.
- Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.

FUTURE TRENDS/ IMPACTS

Source: Study Confirms Climate Models are Getting Future Warming Projections Right – Climate Change: Vital Signs of the Planet (nasa.gov)

Global Warming

- If global warming transiently exceeds 1.5°C in the coming decades or later, then many human and natural systems will face additional severe risks.
- An estimated 60% of today's methane emissions are the result of human activities. The largest sources of methane are agriculture, fossil fuels, and decomposition of landfill waste.
- The concentration of methane in the atmosphere has more than doubled over the past 200 years. Scientists estimate that this increase is responsible for 20 to 30% of climate warming since the Industrial Revolution (which began in 1750).
- According to the most recent National Climate Assessment, droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.
- The last eight years have been the hottest years on record for the globe.

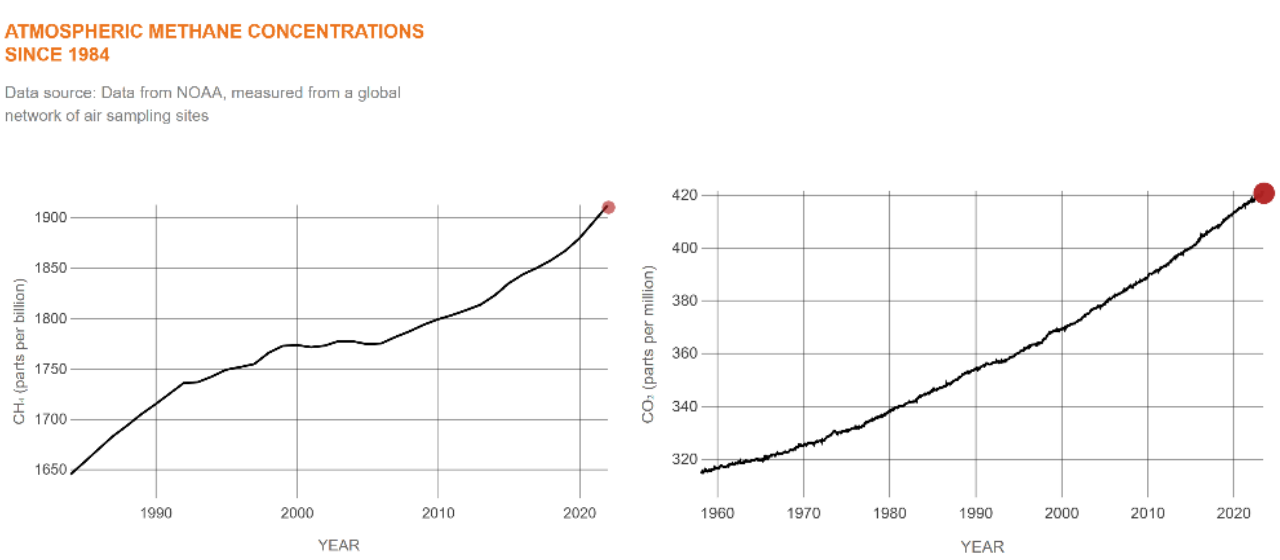


Figure 715: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

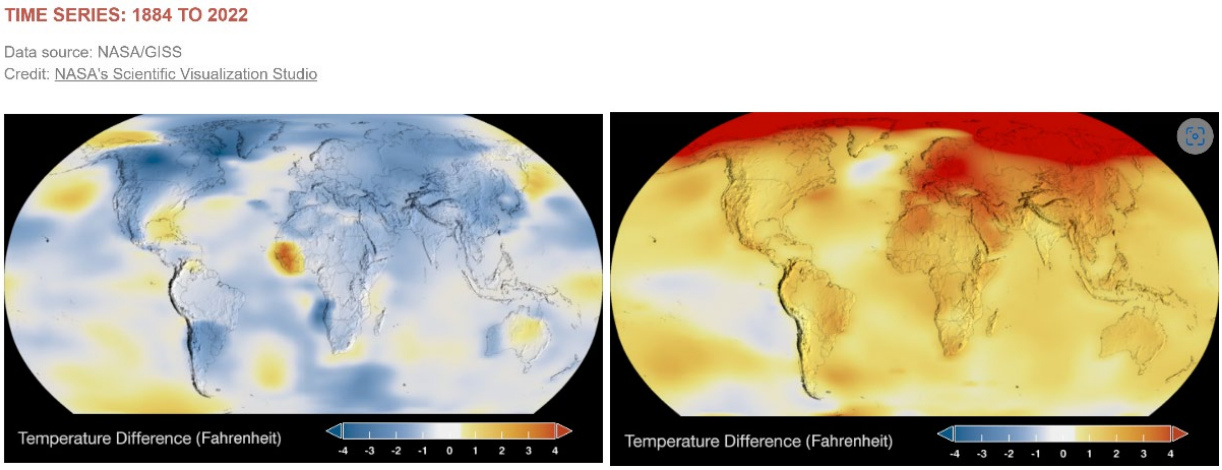


Figure 716: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

Drought

- A NASA-led study in 2022 concluded that the 22-year-long megadrought in southwestern US was the driest the territory had experienced in at least 1,200 years and was expected to persist through at least 2022.

Sea Level Rise

- Global sea levels are rising as a result of human-caused global warming, with recent rates being unprecedented over the past 2,500-plus years.

- U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100.
- Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario.
- Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.
- An indicator of changes in the Arctic sea ice minimum over time. Arctic sea ice extent both affects and is affected by global climate change.

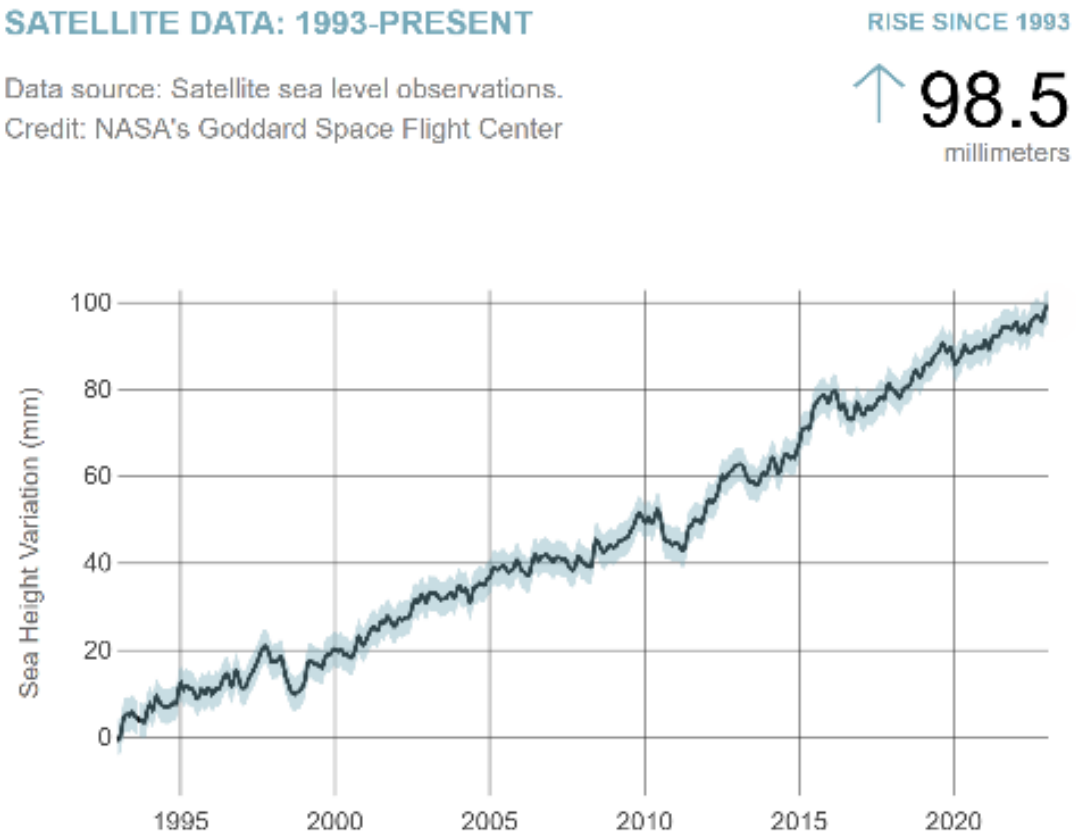


Figure 717: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

Wildfire

- Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires.
- Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times.
- Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Flooding (Precipitation)

- Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought.
- On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Projections of future climate over the U.S. suggest that the recent trend toward increased heavy precipitation events will continue. This means that while it may rain less frequently in some regions (such as the Southwest), when it does rain, heavy downpours will be more common.

Extreme Cold

- The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States.

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack, altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services. Climate change is being profiled in the 2023 Marin County OA MJHMP as a standalone hazard while addressing each of the other natural hazards. The Marin County OA is considering climate change issues when identifying future mitigation actions.

California is experiencing a climate crisis that is increasingly taking a toll on the health and well-being of its people and on its unique and diverse ecosystems. Every Californian has suffered from the effects of record high temperatures, dry winters, prolonged drought, and proliferating wildfires in recent years. California's biodiversity is threatened as alterations to habitat conditions brought about by a changing climate are occurring at a pace that could overwhelm the ability of plant and animal species to adapt.

Indicators of Climate Change in California
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

- Since 1895, annual average air temperatures in California have increased by about 2.5 degrees Fahrenheit (°F). Warming occurred at a faster rate beginning in the 1980s.
- Recent years have been especially warm: Eight of the ten warmest years on record occurred between 2012 and 2022; 2014 was the warmest year on record.
- Of all the Western states, California endured the hottest temperatures for the longest time, driving the average statewide temperature to the second warmest over the past 128 years.

- Extreme heat ranks among the deadliest of all climate-driven hazards in California, with physical, social, political, and economic factors effecting the capacity of individuals, workers, and communities to adapt, and with the most severe impacts often on communities who experience the greatest social and health inequities.
- Glaciers have essentially disappeared from the Trinity Alps in Northern California
- In 2020, wildfire smoke plumes were present in each county for at least 46 days.
- The 2022 fire season saw more fires than the previous fire season along with continued extreme drought and heat conditions.
- The drought, begun in 2019, was the third statewide drought declared in California since 2000.
- This drought has been marked by extreme swings; the state received record-breaking amounts of precipitation in October and December 2021 that were offset by the driest January, February, and March 2022 dating back more than 100 years. The year 2023 opened with California simultaneously managing both drought and flood emergencies.
- A series of storms in late December 2022 and early January 2023 broke rural levees, disrupted power, flooded roads, downed trees, and eroded coastal land.
- Sea level rise accelerates coastal erosion, worsens coastal flooding during large storms and peak tidal events, and impacts important infrastructure positioned along our state's 1,100-mile coast.
- The western drought which impacted all of California and the western United States was nearly lifted due to unseasonably heavy rains in late 2022 and early 2023.

The graph below shows the relative change, in millimeters, in sea levels at Crescent City (1933-2020), San Francisco (1900-2020), and La Jolla (1925-2020).

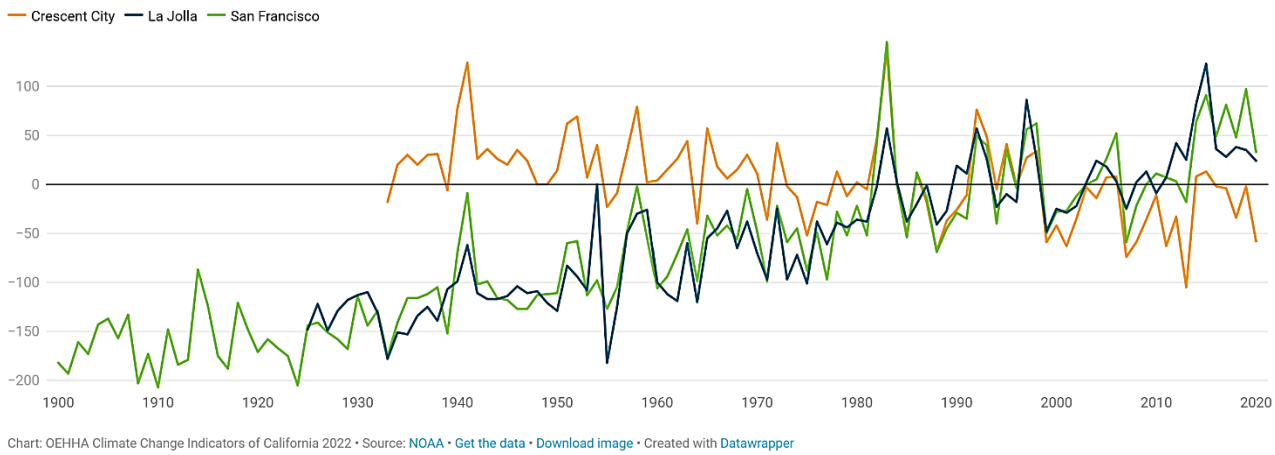


Figure 718: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

Climate change is already having significant impacts across California. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable.

Climate change will continue to alter Marin County OA ecosystems as a result of rising temperatures, changes in precipitation, and sea level rise, which will increase the severity and occurrence of natural hazards across the Marin County OA well into the future. Coastal cooling processes that keep temperatures down, such as fog, will continue to decrease. Rising temperatures will exacerbate drought conditions and raise the potential for significant wildfires and associated smoke as vegetation becomes drier and tree mortality increases. Forested woodlands that play a major role in carbon reduction will gradually transition into chaparral and shrublands. There will be more extreme storms and weather events, including expanded heat waves and increased rain events with changes in precipitation. Significant rain events will lead to an increase in flooding and the potential for severe landslides. Shoreline communities will become inundated with sea level rise and high tide events. Marshlands and wetlands that act as natural storm barriers will disappear as they transition into open water.
Notable impacts from climate change that are already evident in the Marin County OA and surrounding region as identified in a 2020 Marin County Civil Grand Jury Report include:

- From 1895-2018, the average temperature in Marin County increased by 2.3 degrees Fahrenheit.
- Over the past century, sea level rise in the San Francisco Bay Area rose by eight inches and has accelerated rapidly since 2011.
- The threat of wildfires in 2019 was so severe that Pacific Gas and Electric shut off electric power to the County for multiple days.

Climate change will continue to affect homes, businesses, infrastructure, utilities, transportation systems and agriculture across the Marin County OA. The risk to socially vulnerable populations will increase as they feel the immediate impacts of climate change more significantly and are less able to adapt to climate change and recover from its impacts.

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In June 2023, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2021. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives include Marin Clean Energy, Electrify Marin, the Marin Solar Project, the Marin Energy Watch Partnership, Resilient Neighborhoods, and Drawdown: Marin.

2.2 HAZARDS

Of the hazards profiled in the Marin County MJHMP, those noted in the table are specific for the Town of Tiburon as per the planning team.

Table 16: Town of Tiburon Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence (Sinkhole)	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	None	None	High	**5.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 379: Town of Tiburon Hazard Risk Assessment
Source: Town of Tiburon

Omitted Hazards

Dam Failure: The Town of Tiburon does not have any exposure to flood water inundation resulting from a dam failure.

Table 17: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Dam Failure	Unlikely	Negligible	Extreme	Low	Medium	**9.00**
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	None	High	**7.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – High Wind/Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 380: Hazard Risk Assessment
Source: Marin County

2.2.1 Debris Flows

For the purposes of the Marin County OA MJHMP, debris flows are classified as landslides (including rockslides) and mud flows.

A landside is the breaking away and gravity-driven downward movement of hill slope materials, which can travel at speeds ranging from fractions of an inch per year to tens of miles per hour depending on the slope steepness and water content of the rock/soil mass. Landslides range from the size of an automobile to a mile or more in length and width and, due to their sheer weight and speed, can cause serious damage and loss of life. The rate of a landslide is affected by the type and extent of vegetation, slope angle, degree of water saturation, strength of the rocks, and the mass and thickness of the deposit. Some of the natural causes of this instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. In addition, certain human activities tend to make the earth materials less stable and increase the chance of ground failure. These activities include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation and over-steepening of slopes by undercutting them or overloading them with artificial fill. These activities can cause slope failure, which normally produce landslides.

Landslide material types are often broadly categorized as either rock or soil, or a combination of the two for complex movements. Rock refers to hard or firm bedrock that was intact and in

place prior to slope movement. Soil, either residual or transported material, means unconsolidated particles. The distinction between rock and soil is most often based on interpretation of geomorphic characteristics within landslide deposits but can also be inferred from geologic characteristics of the parent material described on maps or in the field. Landslide movements are also based on the geomorphic expression of the landslide deposit and source area, and are categorized as falls, topples, spreads, slides, or flows. Falls are masses of soil or rock that dislodge from steep slopes and free fall. Topples move by the forward pivoting of a mass around an axis below the displaced mass. Lateral spreads move by horizontal extension and shear or tensile fractures. Slides displace masses of material along one or more discrete planes and can either be rotational or transitional. Flows mobilize as a deforming, viscous mass without a discrete failure plane.

Natural conditions that contribute to landslide include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances
- Road building, excavation and grading
- Earthquake

In addition, many human activities tend to make the earth materials less stable and, thus, increase the chance of ground movement. Human activities contribute to soil instability through grading of steep slopes or overloading them with artificial fill, by extensive irrigation, construction of impermeable surfaces, excessive groundwater withdrawal, and removal of stabilizing vegetation.

Another hazard related to landslide and erosion is the fall of a detached mass of rock from a cliff or down a very steep slope (rockfall). Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Other causes include ice wedging, root growth, or ground shaking (earthquake). Destructive landslides and rockfalls usually occur very suddenly with little or no warning time and are short in duration.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 19 shows landslide susceptibility classes.

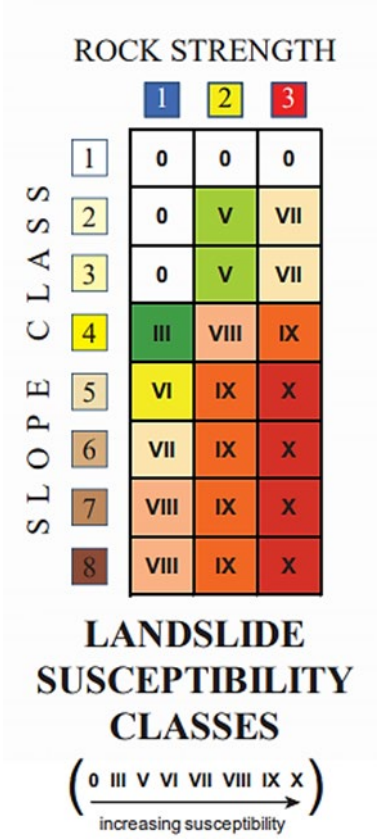


Figure 719: Landslide Susceptibility Classes
Source: USGS

A mud flow is a general term for a mass-movement landform and process characterized by a flowing mass of fine-grained earth material with a high degree of fluidity. Heavy rainfall, snowmelt, or high levels of groundwater flowing through cracked bedrock may trigger a movement of soil or sediments. Floods and debris flows may also occur when strong rains on hill or mountain slopes cause extensive erosion and/or what is known as "channel scour." Some broad mud flows are rather viscous and therefore slow; others begin very quickly and continue like an avalanche. Mud flows are composed of at least 50% silt and clay-sized materials and up to 30% water.

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 20 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

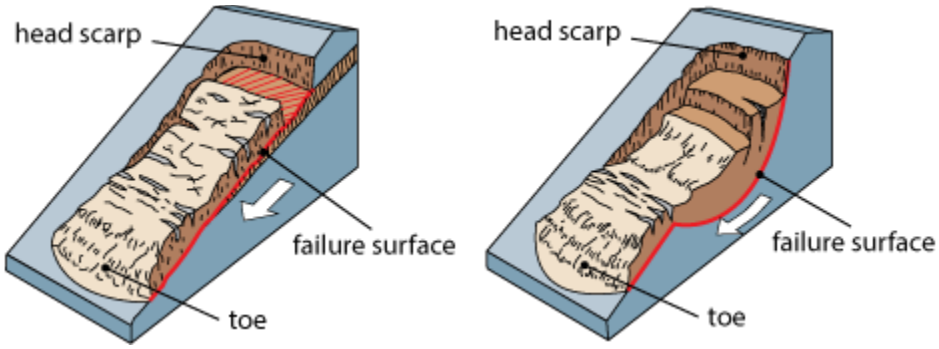


Figure 720: Mud Flow Areas
Source: Washington Department of Natural Resources

If large enough, mud flows can devastate villages and country-sides. Mud flows are common in mountain areas prone to wildfire, where they have destroyed many homes built on hillsides without sufficient support after fires destroy vegetation holding the land. The area most generally recognized as being at risk of a dangerous mud flow are:

- Areas where wildfires or human modification of the land have destroyed vegetation
- Areas where landslides have occurred before
- Steep slopes and areas at the bottom of slopes or canyons
- Slopes that have been altered for construction of buildings and roads
- Channels along streams and rivers
- Areas where surface runoff is directed

A landslide in Tiburon would most likely occur in areas where the terrain is steeper and is more susceptible to movement of hill slope materials. Most of Tiburon has areas of steeper terrain, with the area around the Ring Mountain Open space preserve on the north side of the town, the area around the numerous open spaces in the middle of the town, and the area around the Tiburon Uplands Nature Preserve and the Old St. Hilary Open Space Preserve on the south side of the town being most susceptible. These areas are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. Both Tiburon Boulevard and Paradise Drive, the only two primary access points to the Tiburon Peninsula, both have sections with high landslide susceptible. The Bel Aire School, the Del Mar School, the St. Hilary School, several health care facilities and a Marin Emergency Radio Authority antenna site lie in or directly adjacent to areas of high landslide susceptibility. Most of the downtown commercial core of Tiburon has little to no landslide susceptibility.

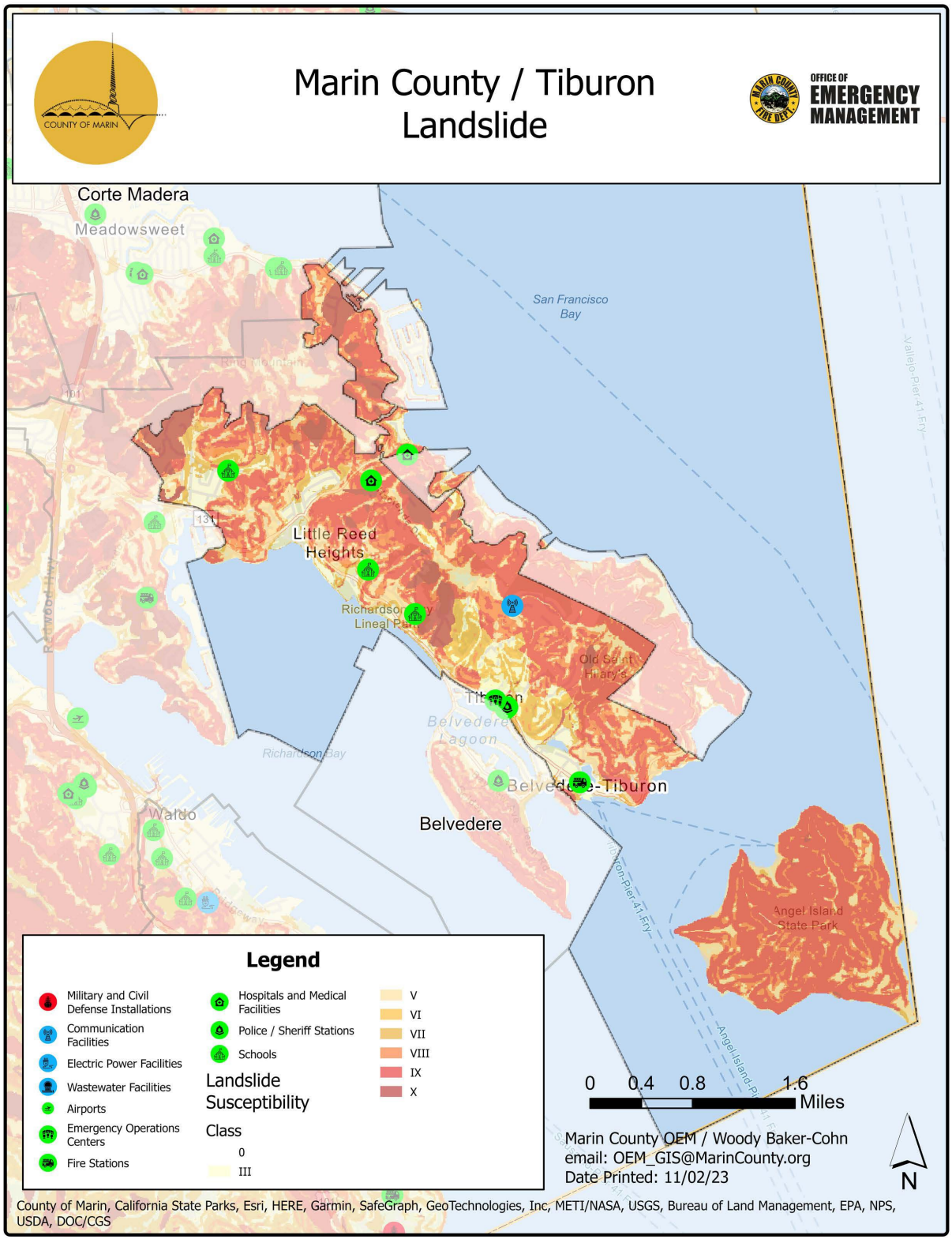


Figure 721: Town of Tiburon Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

A landslide having major impacts on any of the roads on the Tiburon Peninsula could affect the ability of residents to reach their homes and could affect the provision of emergency and essential services. An earthquake has the potential to cause landslides in the areas of Tiburon with landslide susceptibility. A wildfire and subsequent rain event in the Ring Mountain Open Space Preserve, any of the open spaces in the center of the town, or in the Tiburon Uplands Nature Preserve and Old St. Hilary Open Space Preserve could potentially contribute to debris flows and mudslides in Tiburon. There are no creeks that flow directly into Tiburon that could contribute to debris flows, though the area around Blackie's Pasture along Richardson Bay serves as a natural alluvial fan for drainage from parts of the Ring Mountain Open Space Preserve through Belveron Mini-Park. There are also numerous small canyons in the Tiburon Open Space Preserve and the Old St. Hillary Open Space Preserve that could channel debris flows into Tiburon after a wildfire and subsequent rain event.

In February 2019, winter storms caused a section of Vistazo West halfway between the Lyford Drive turnoff and the Old St. Hilary Open Space Preserve trailhead to wash out after runoff overwhelmed the storm-drain system and undermined the roadbed, and a landslide occurred on Paradise Drive.

Figure 722: Landslide in Vistazio West (Tiburon) - February 2019
Source: The Ark

On 12/16/2014, a December storm caused a mudslide behind a home on Venado Drive and a resident had to be evacuated. The storm also overwhelmed a marsh on Tiburon Boulevard, sending muddy water into the Town Hall and local businesses.

From 1/3–1/5/1982, a severe storm caused a mudslide that collapsed several homes, resulting in fatalities.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022

study by the American Geophysical Union (AGU)[47], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of Tiburon that have a higher landslide susceptibility, including the numerous open spaces around town, will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents throughout Tiburon could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris after a major rain event, particularly down streets and driveways in areas where there are no natural water channels. Adequate space adjacent to open spaces should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

2.2.2 DROUGHT

A drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can thus vary significantly from one region to another. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities.

There are several types of drought which can often be defined regionally based on its effects:

- Meteorological drought is usually defined by a period of below average water supply, based on the degree of dryness (in comparison to normal or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock. Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation.
- Hydrological drought is defined as deficiencies in surface and subsurface water supplies. It is generally measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. Hydrological drought usually occurs following periods of extended precipitation shortfalls.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

[47] Landslide Sensitivity and Response to Precipitation Changes in Wet and Dry Climates. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GL099499

Drought can occur in all areas of Tiburon, though it's effects would be most felt in the hilly areas where the risk of wildfire would increase. An increase in brush fires as a result of drought could impact local businesses and residences in the area. Dry trees in public spaces and in the tree-lined hillside neighborhoods of Tiburon can become a safety hazard to the public due to falling limbs or the toppling of the tree itself.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including Tiburon may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA and Tiburon, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around Tiburon. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous and hilly areas of the Marin County OA including Tiburon where wildfires are more likely to occur. Future development in the hilly areas of Tiburon around its open spaces could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including Tiburon can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, town plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

Earthquakes are sudden rolling or shaking events caused by movement under the earth's surface. Earthquakes happen along cracks in the earth's surface, called fault lines, and can be felt over large areas, although they usually last less than one minute.

The amount of energy released during an earthquake is usually expressed as a magnitude and is currently measured by seismologists on the Moment Magnitude (Mw Scale). The Mw Scale was developed to succeed the previously used Richter Scale and is measured on a scale of zero to ten with increasing values reflecting increasing intensity.

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 23).

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 723: Modified Mercalli Intensity Scale
Source: USGS

Figure 24 gives intensities (measured on the MMI scale) that are typically observed at locations near the epicenter or earthquakes of different magnitudes.

Richter Magnitude Scale	Typical Maximum Modified Mercalli Intensity Scale
1.0 – 2.9	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 or higher	VIII or higher

Figure 724: Mercalli Scale vs. Magnitude
Source: USGS

The extent of ground shaking also depends in large part on how soft the underlying soil is. Soft soils amplify ground shaking (see Figure 25). This was observed during the 1989 Loma Prieta Earthquake when the most significant damages experienced in San Francisco were in the Marina District, which was built on fill.

Soil type A	Vs > 1500 m/sec	Includes unweathered intrusive igneous rock. Occurs infrequently in the bay area. We consider it with type B (both A and B are represented by the color blue on the map). Soil types A and B do not contribute greatly to shaking amplification.
Soil type B	1500 m/sec > Vs > 750 m/sec	Includes volcanics, most Mesozoic bedrock, and some Franciscan bedrock. (Mesozoic rocks are between 245 and 64 million years old. The Franciscan Complex is a Mesozoic unit that is common in the Bay Area.)
Soil Type C	750 m/sec > Vs > 350 m/sec	Includes some Quaternary (less than 1.8 million years old) sands, sandstones and mudstones, some Upper Tertiary (1.8 to 24 million years old) sandstones, mudstones and limestone, some Lower Tertiary (24 to 64 million years old) mudstones and sandstones, and Franciscan melange and serpentinite.
Soil Type D	350 m/sec > Vs > 200 m/sec	Includes some Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.
Soil Type E	200 m/sec > Vs	Includes water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type.

Figure 725: Soil Types
Source: USGS

An earthquake fault is defined as “a fracture or fracture zone in the earth’s crust along which there has been displacement of the sides relative to one another.” For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

An earthquake could occur anywhere in and around Tiburon due to the number of active faults within and near Marin County.

Earthquake Shake Intensity
The colors on Figures 32 and 33 represent the level of ground shaking intensity of a potential future earthquake. The result is expressed as the level of ground shaking (**expressed as a percentage of gravity**) that on average occurs every 500 years.

This map shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2500 year average repeat time. The relatively long-period (1.0 second) earthquake shaking is shown here. Long period-shaking affects tall, relatively flexible buildings, but also correlates well with overall earthquake damage.

Earthquake Shaking Potential Maps for California depict expected intermediate period (1s or 1hz) ground motions with 2% exceedance probability in 50 years.

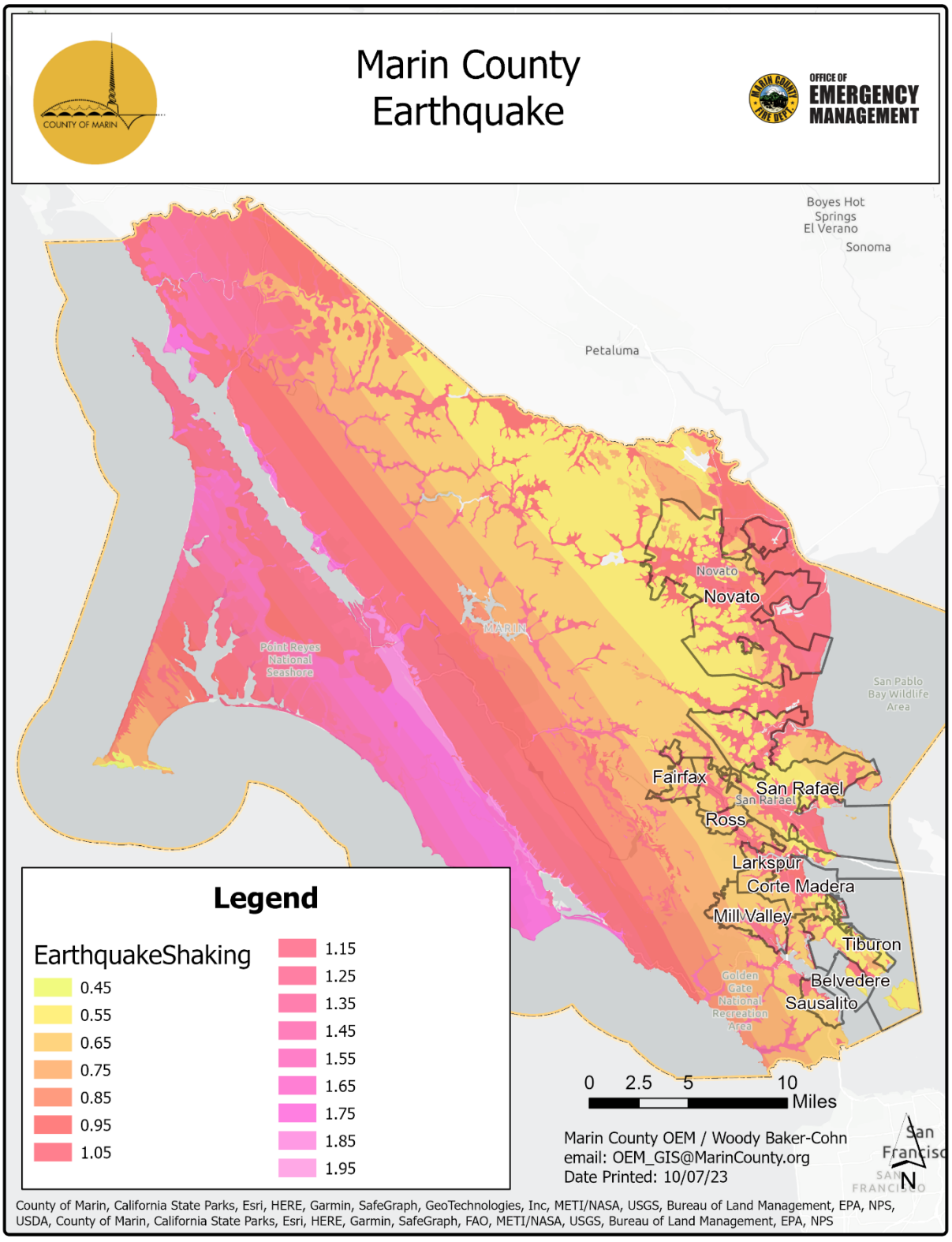


Figure 726: Marin County Earthquake Impact and Fault Lines
Source: Marin County OEM

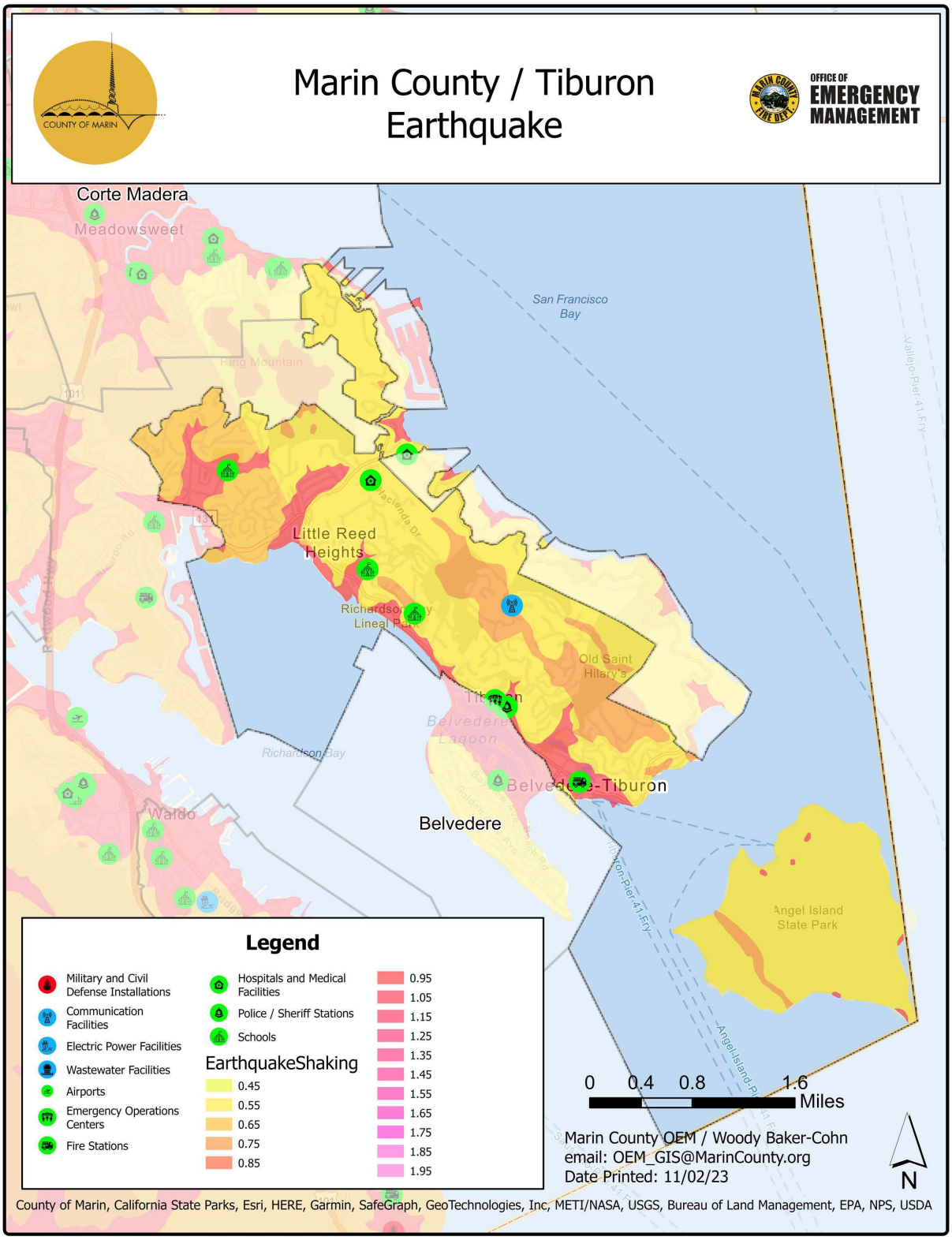


Figure 727: Town of Tiburon Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

Tiburon is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the town. All buildings located in Tiburon are vulnerable to earthquake damage, but depending upon construction, some buildings are expected to perform better than others. There is increased risk of shaking and liquefaction in lowland areas of Tiburon from an earthquake, particularly in the downtown commercial area, the areas north of Blackie's Pasture and the Cove Shopping Center, and on Tiburon Boulevard along Richardson Bay where superficial deposits and fill are more prevalent. There are hundreds of residences, numerous commercial buildings, and several critical facilities including the Bel Aire School the Reed School, the Tiburon Police Department and Town Hall (including the Emergency Operation Center for both Tiburon and Belvedere) and the Tiburon Fire Protection District Station #11 that like in areas of the town with higher earthquake shaking vulnerability. Vulnerable structures include bridges and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the town could be impacted by an earthquake.

Earthquakes could also cause landslides in open space areas around Tiburon with steeper terrain, causing damage to homes and roads as a result of shifting soils.

Tiburon hasn't yet experienced a significant earthquake. Marin County was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across Marin County as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Tiburon.

Climate Change and Future Development Considerations

There is no direct link between climate change and seismic activity that could impact the Marin County OA including Tiburon, so climate change is not expected to cause any changes to the frequency or intensity of seismic shaking. According to a 2018 study by the Institute of Physics (IOP)[48], climate change could result in "isostatic rebounds," or a sudden upward movement of the crust because of reduced downward weight caused by glaciers. As glaciers are known to melt when overall global temperatures increase, climate change could indirectly lead to an increase in seismicity in the Marin County OA including Tiburon. Climate change could also impact earthquakes felt in the Marin County OA as droughts can further deteriorate existing fault lines and pumping groundwater can put further pressure on the earth's crust. Future development in the populated areas of Marin County OA where seismic shaking and subsidence are more prevalent could exacerbate the impacts of an earthquake. This includes the lowlands of Tiburon, where the risk of subsidence and subsequent earthquake shaking are higher. Future development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

[48] An Enhanced Seismic Activity Observed Due to Climate Change: Preliminary Results from Alaska. https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018

2.2.4 FLOODING

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The area adjacent to a channel is the floodplain. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is one that has 0.5% chance of being equaled or exceeded each year. The 500-year flood is a flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity such as construction of bridges or channels. In areas where flow contains high sediment load, such as Easkoot Creek in Stinson Beach (due to an active landslide upstream), the flow carrying capacity of the channel may be reduced dramatically during a single flood event. Coastal floodplains may also change over time as waves and currents alter the coastline (especially wetlands) and sea levels rise.

Flooding can occur in several ways:

Riverine flooding – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with snowmelt and/or already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days and is often characterized by high peak flows combined with a large volume of runoff. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Marin County OA, riverine flooding can occur anytime from November through April and is largely caused by heavy and continued rains, sometimes combined with snowmelt, increased outflows from upstream dams, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The warning time associated with slow rise riverine floods assists in life and property protection.

Flash flooding – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.

Localized/Stormwater flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Tidal flooding – Tidal flooding develops when high tides exceed either the top of bank elevation of tidal sloughs and channels, or the crest of bay levees. An especially high tide event that occurs during alignment of the gravitational pull between the sun and the moon, causing tidal water levels to rise to higher-than normal levels. King tides are normal, predictable events that occur semi-annually during winter months. Typically storms in which high tides coincide with peak stormwater flow may be damaging to municipal infrastructure and private property.

The area is also at risk to flooding resulting from levee failures and dam failures. Dam failure flooding is discussed separately in the Dam Failure Section of this document; levee failure flooding is discussed separately in the Levee Failure Section of this document. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

A weather pattern called the "Atmospheric River" contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the "Pineapple Express" because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 28.

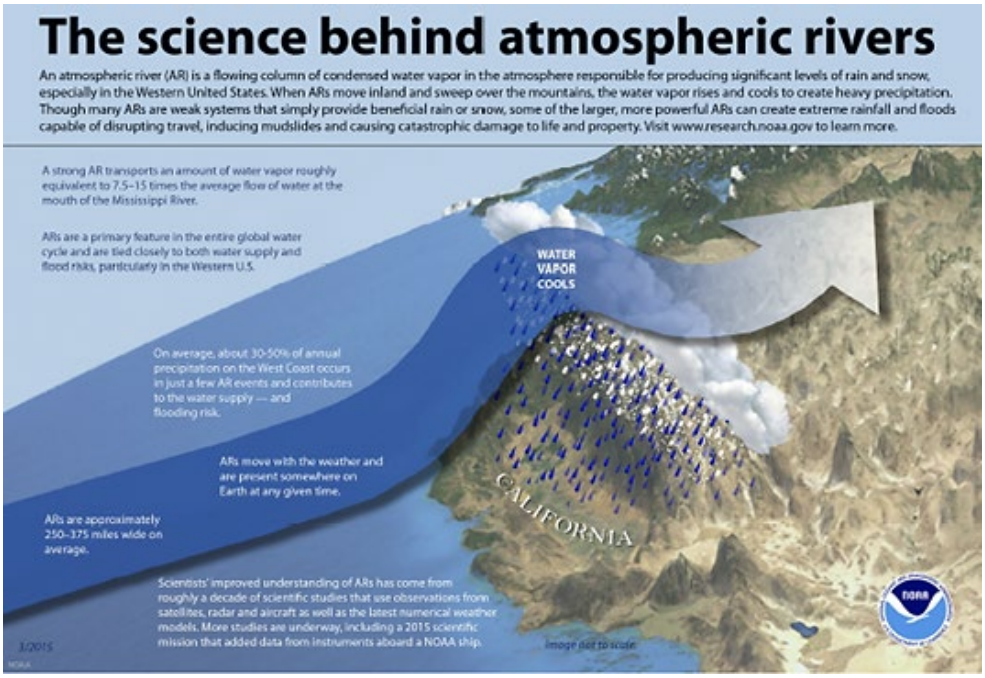


Figure 728: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground pipes to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead to are already full, water backs up onto the streets. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging.

Flooding in Tiburon generally results from a combination of high tides from Richardson Bay and San Francisco Bay and from storm runoff in low-lying areas. Most of the lowland areas in Tiburon, including the commercial downtown area, are in the 100-year floodplain, with several areas in the 500-year floodplain including the areas around Blackie's Pasture and the Cove Shopping Center, and along Tiburon Boulevard. Dozens of residences north of the Cove Shopping Center lie in the 500-year floodplain, along with part of the Reed Elementary School. The Tiburon Fire Protection District Station #11 lies in the 100-year floodplain.

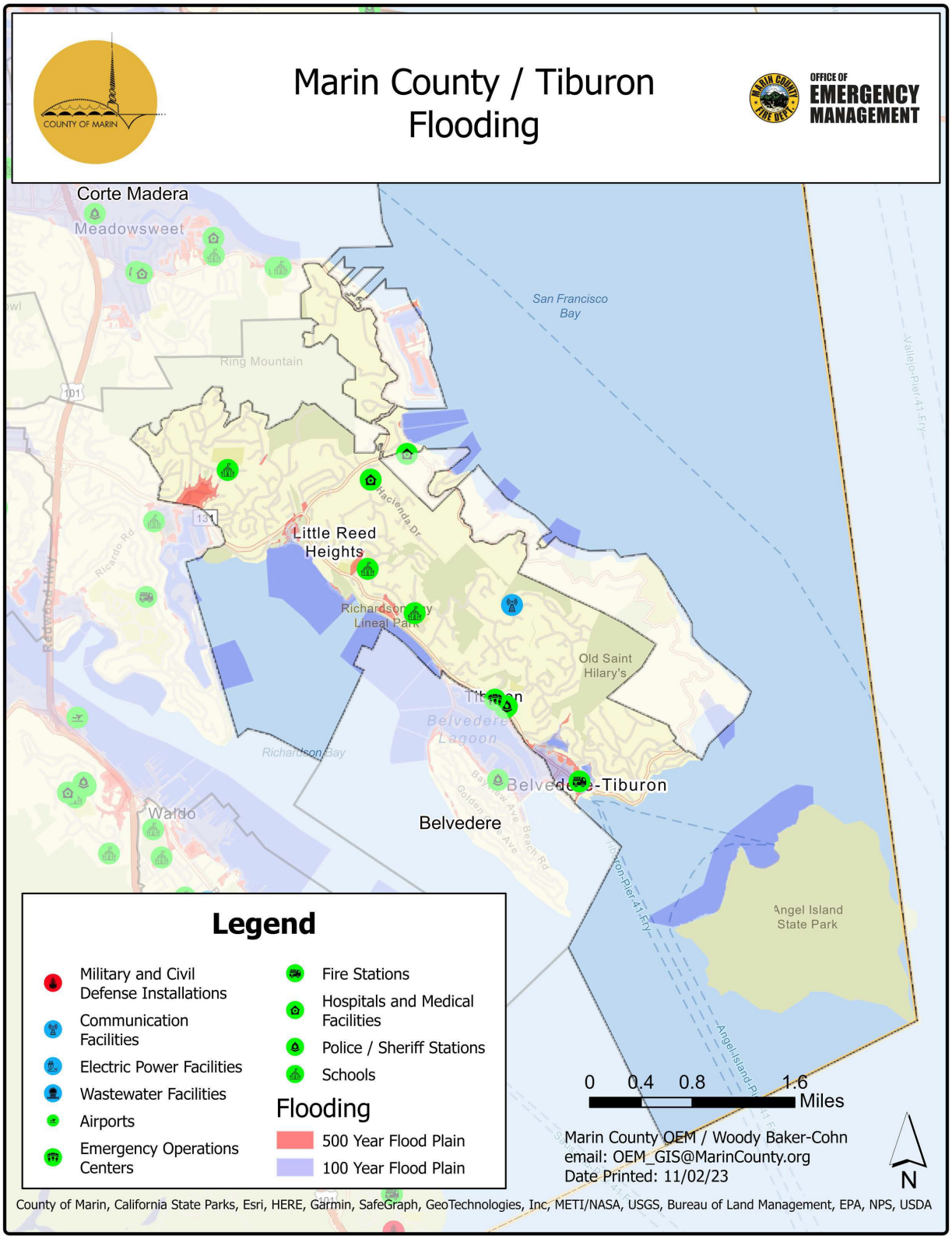


Figure 729: Town of Tiburon Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 18 shows the number of residential structures by flood zone in the Town of Tiburon.

Table 18: Residential Structures in The Town of Tiburon by Flood Zone		
Flood Zone	FEMA Flood Zone Designations	Improved Residential Parcels
High Risk Areas		
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.	
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.	**1245**
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).	
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.	
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.	
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.	
High Risk - Coastal Areas		
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.	
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	**17**

Moderate to Low-Risk Areas		
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile	**2390**
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.	
Undetermined Risk Areas		
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.	
Total		**3,652**

Table 381: Residential Structures in The Town of Tiburon by Flood Zone
Source: FEMA

Table 19 shows the number of Town of Tiburon critical facilities by flood zone.

Table 19: Town of Tiburon Critical Facilities			
Category	Name	Address	Flood Zone
Critical Facilities			
Fire	Tiburon Fire Department	1679 Tiburon Blvd Tiburon, CA 94920	AE
Fire	Tiburon Fire Department	4301 Paradise Drive Tiburon, CA 94920	X
Law	Tiburon Police Department	1155 Tiburon Blvd Tiburon, CA 94920	AE
EOC	Bel-Tib Joint EOC	1155 Tiburon Blvd Tiburon, CA 94920	AE
Local Government	Tiburon Town Hall	1505 Tiburon Blvd Tiburon, CA 94920	AE
Local Government	Tiburon Library	1501 Tiburon Blvd Tiburon, CA 94920	AE
Local Government	Tiburon Corporation Yard	101 Kleinert Way Tiburon, CA 94920	AE
School	Reed School	1199 Tiburon Blvd Tiburon, CA 94920	AE
School	Bel Aire School	277 Karen Way Tiburon, CA 94920	X
School	St Hilary School church	765 Hilary Drive Tiburon, CA 94920	X
School	Del Mar School	105 Avenida Miraflores Tiburon, CA 94920	X
Evacuation Shelter	Kol Shofar	215 Blackfield Tiburon, CA 94920	X
Evacuation Shelter	Tiburon Baptist Church	445 Greenwood Beach Rd Tiburon, CA 94920	X
Evacuation Shelter	Community Congregation Church	145 Rock Hill Tiburon, CA 94920	X
Health/ Medical	Marin Convalescent Hospital	30 Hacienda Drive Tiburon, CA 94920	X

Critical Infrastructure			
Transportation	Tiburon Ferry Docks	1 & 21 Main Street Tiburon, CA 94920	VE
Wastewater	Sanitary District 5	2001 Paradise Drive Tiburon, CA 94920	X
Wastewater	Richardson Bay Sanitary District	500 Tiburon Blvd Tiburon, CA 94920	X

Table 382: Town of Tiburon Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

Although the Town of Tiburon has not experienced recent catastrophic flooding, floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay and San Francisco Bay have the potential to significantly impact the Tiburon storm drain system. Tiburon sees flooding from king tides in Richardson Bay and San Francisco Bay and this is only expected to increase with sea level rise and climate change. During heavy rainfall conditions, and especially when combined with high tides, certain areas are known to flood, including Beach Road at Tiburon Boulevard, Tiburon Boulevard at Ned's Way, and Tiburon Boulevard near Greenwood Beach Road by the gas station.

The Tiburon Peninsula saw nearly 40 inches of rain between October 2022 and March 2023, including nearly 24 inches between 12/29/2022 and 1/15/ 2023 that wreaked havoc, with storms frequently downing trees and power lines and flooding roads, including the intersection at Tiburon Boulevard and Beach Road.

Figure 730: Town of Tiburon Flooding – January 5, 2023
Source: The ARK

Between 2/12 and 2/14/2019, the Town of Tiburon declared a local state of emergency in the wake of back-to-back storms that dumped nearly six inches of rain in the area and triggered minor flooding.

On 12/16/2014, heavy rains caused significant flooding downtown. Six inches of water inundated one business on Tiburon Boulevard. Over a foot of water had to be pumped out of Tiburon Town Hall. Tiburon Lagoon was pumped in anticipation of more rain.

Climate Change and Future Development Considerations

Climate change is expected to affect California's precipitation patterns, which are likely to influence future flood events. A 2017 study[49] found that the number of very intense precipitation days in California is projected to more than double by the end of the century, increasing 117 percent, making it likely that flood events will become more frequent in the Marin County OA including Tiburon. Climate change is expected to alter rainfall patterns in Northern California, including the Marin County OA. As the climate warms, rain events are predicted to become more intense. The Marin County OA including Tiburon will likely experience more rain inundation events that lead to flooding and increase the potential threat of levee failure, tree mortality, and other potential hazards. Sea level rise as a result of climate change will exacerbate the impacts of tidal flooding in the lowland areas of the Marin County OA including the shoreline areas of Tiburon. Future development in these areas, particularly in the downtown commercial area of Tiburon, will expose more people and infrastructure to the effects of tidal flooding and storm surge as a result of climate change.

2.2.5 Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The principal causes are aquifer-system compaction, drainage of organic soils through groundwater pumping, underground mining, hydro-compaction, natural compaction, sinkholes, and thawing permafrost. More than 80 percent of the identified subsidence in the United States is a consequence of underground water exploitation. The increasing development of land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 31 for a picture and description of how dissolution sinkholes form.

[49] Precipitation in a Warming World: Assessing Projected Hydro-Climate Changes in California and other Mediterranean Regaions. https://www.nature.com/articles/s41598-017-11285-y

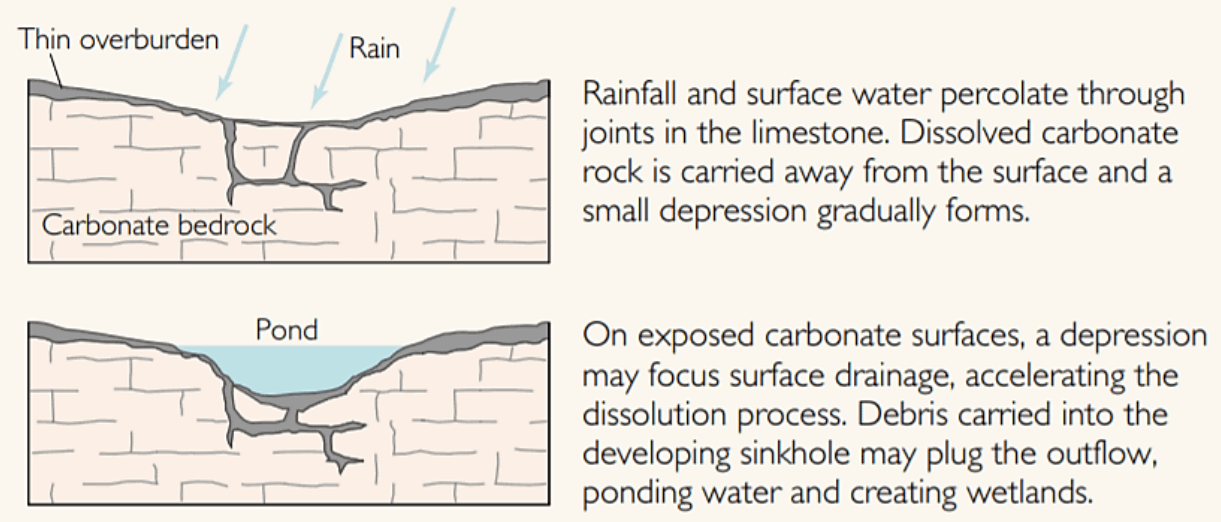


Figure 731: Dissolution Sinkhole Formation
Source: USGS

Cover-subsidence sinkholes tend to develop gradually where the covering sediments are permeable and contain sand. In areas where cover material is thicker, or sediments contain more clay, cover-subsidence sinkholes are relatively uncommon, are smaller, and may go undetected for long periods. See Figure 32 for a picture and description of how cover-subsidence sinkholes form.

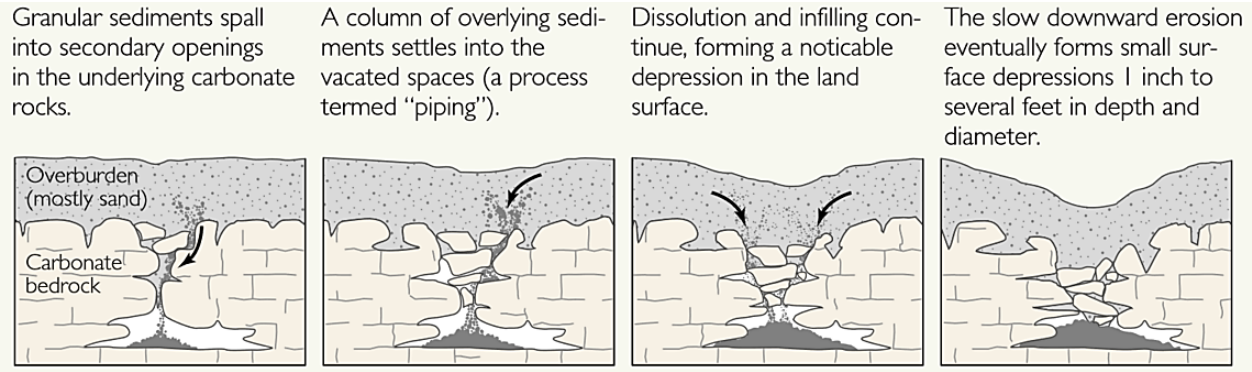


Figure 732: Cover-Subsidence Sinkhole Formation
Source: USGS

Cover-collapse sinkholes may develop abruptly over a period of hours and cause catastrophic damages. They occur where the covering sediments contain a significant amount of clay. Over time, surface drainage, erosion, and deposition of sediment transform the steep-walled sinkhole into a shallower bowl-shaped depression. See Figure 33 for a picture and description of how cover-collapse sinkholes form.

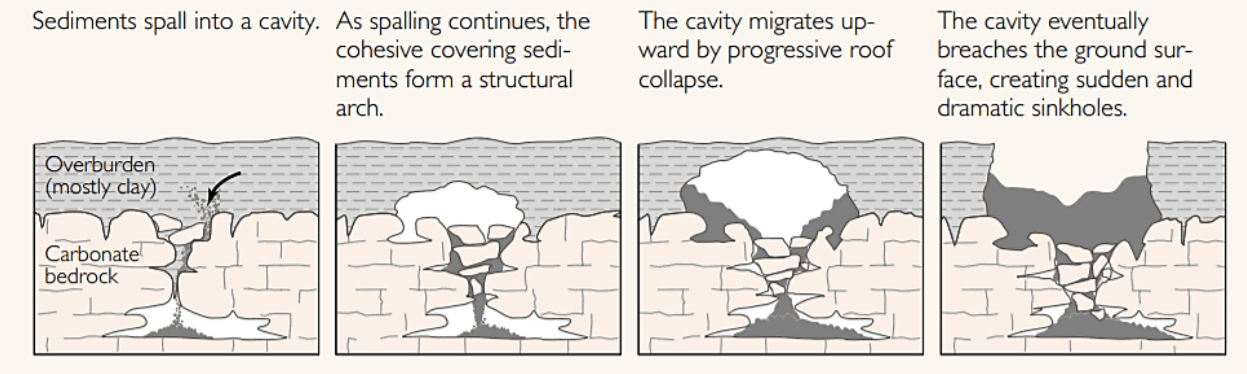


Figure 733: Cover-Collapse Sinkhole Formation
Source: USGS

New sinkholes have been correlated to land-use practices, especially from groundwater pumping and from construction and development practices that cause land subsidence. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. Some sinkholes form when the land surface is changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, thus causing a sinkhole.

The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by groundwater fluid pressure. The water below ground helps to keep the surface soil in place. Groundwater pumping for urban water supply and for irrigation can produce new sinkholes in sinkhole-prone areas. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Areas in Tiburon designated with very high potential for land subsidence are generally located in the downtown commercial from San Francisco Bay to Mar West Street, including the Tiburon Town Hall and the Tiburon Fire Protection District Station #11; the Blackie's Pasture area and Tiburon Ridge and Belveron neighborhoods; and the Cove Shopping Center and Bel Aire neighborhood. These areas consist of numerous residences and commercial buildings. Land subsidence could have numerous impacts for Tiburon, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the town. The lowland areas of Tiburon could anticipate increased rates of subsidence as bay waters saturate the soil from below.

On 01/25/24, a large sinkhole formed near Tiburon Boulevard and Stewart Drive in Tiburon, along a portion of Highway 131. The sinkhole formed just days after heavy rainfall swept through the Bay Area.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including Tiburon, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of Tiburon as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities, in Tiburon could increase with future

development in the lowland populated areas of town, particularly the downtown commercial area, where land subsidence is more likely to occur.

2.2.6 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 34 shows a levee and the multiple ways it can fail.

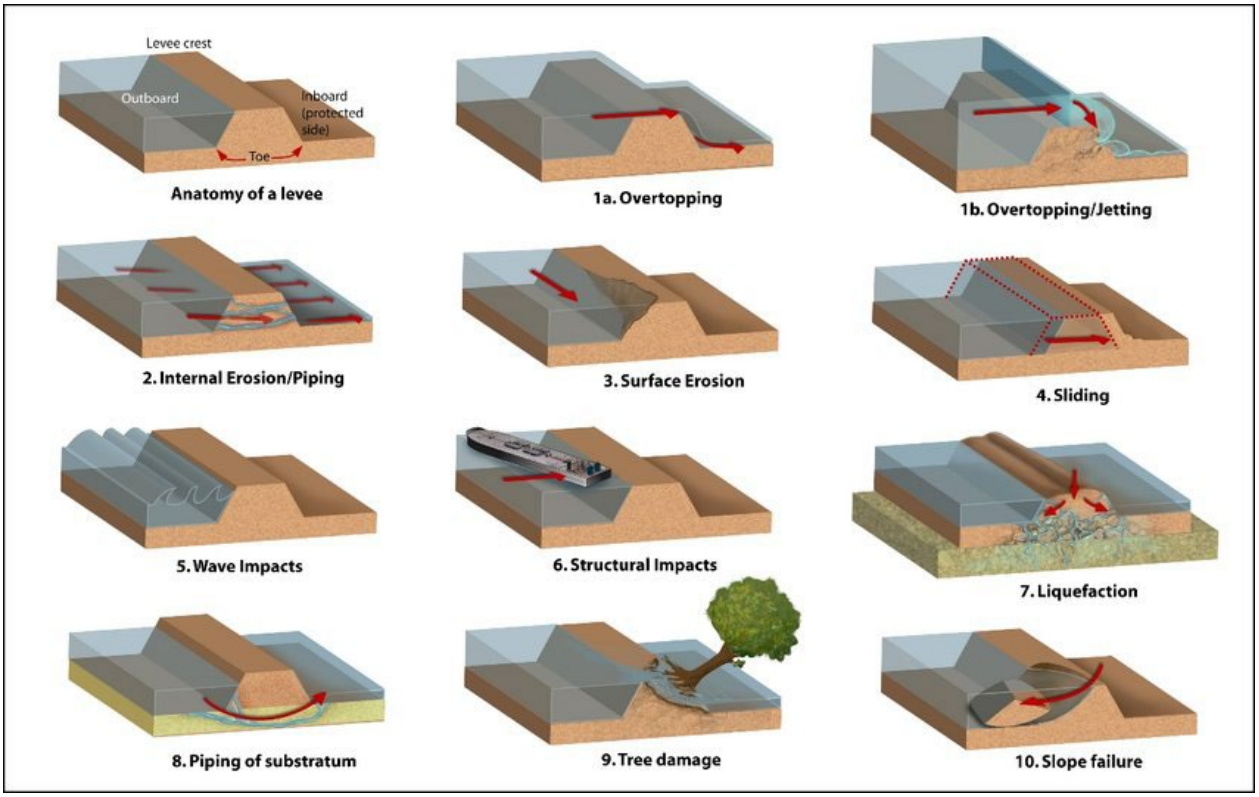


Figure 734: Levee Failure Mechanisms
Source: University of California

Tiburon is protected by one levee, the San Rafael Avenue sea wall, in the City of Belvedere along Richardson Bay. The seawall is 0.4 miles long with an undocumented height. Approximately 1,266 people and 349 buildings with a property value of $347 million in both Tiburon and Belvedere combined are at risk of a failure of the sea wall, including most of commercial downtown Tiburon and the Tiburon Fire Protection District Station #11 in the 100-year floodplain. Fortunately, few residences in Tiburon at risk of failure of the sea wall. A failure

of the seawall during a high rain event could cause flooding across Tiburon Boulevard, impacting ingress and egress into the southern area of town.

On 10/10/2018, Belvedere declared a state of emergency due to increased shifting of the San Rafael Avenue sea wall that provides protection for the Town of Tiburon and the City of Belvedere. An inspection of the sea wall in 2017 revealed that portions of the concrete had crumbled and cracked and that a portion of the sea wall was sagging toward the water. The most problematic section directly across from Peninsula Road was at a high risk for failure. The levee had to be shored up.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in Tiburon, increasing the potential for a levee failure. Rising seas will lead to increased stress on the levees around the Marin County OA shoreline including in Belvedere adjoining Tiburon, particularly during a major tidal event and potential tsunami. As development increases in the populated areas of Tiburon, particularly the downtown commercial area, the potential for significant impacts to businesses and infrastructure will only increase.

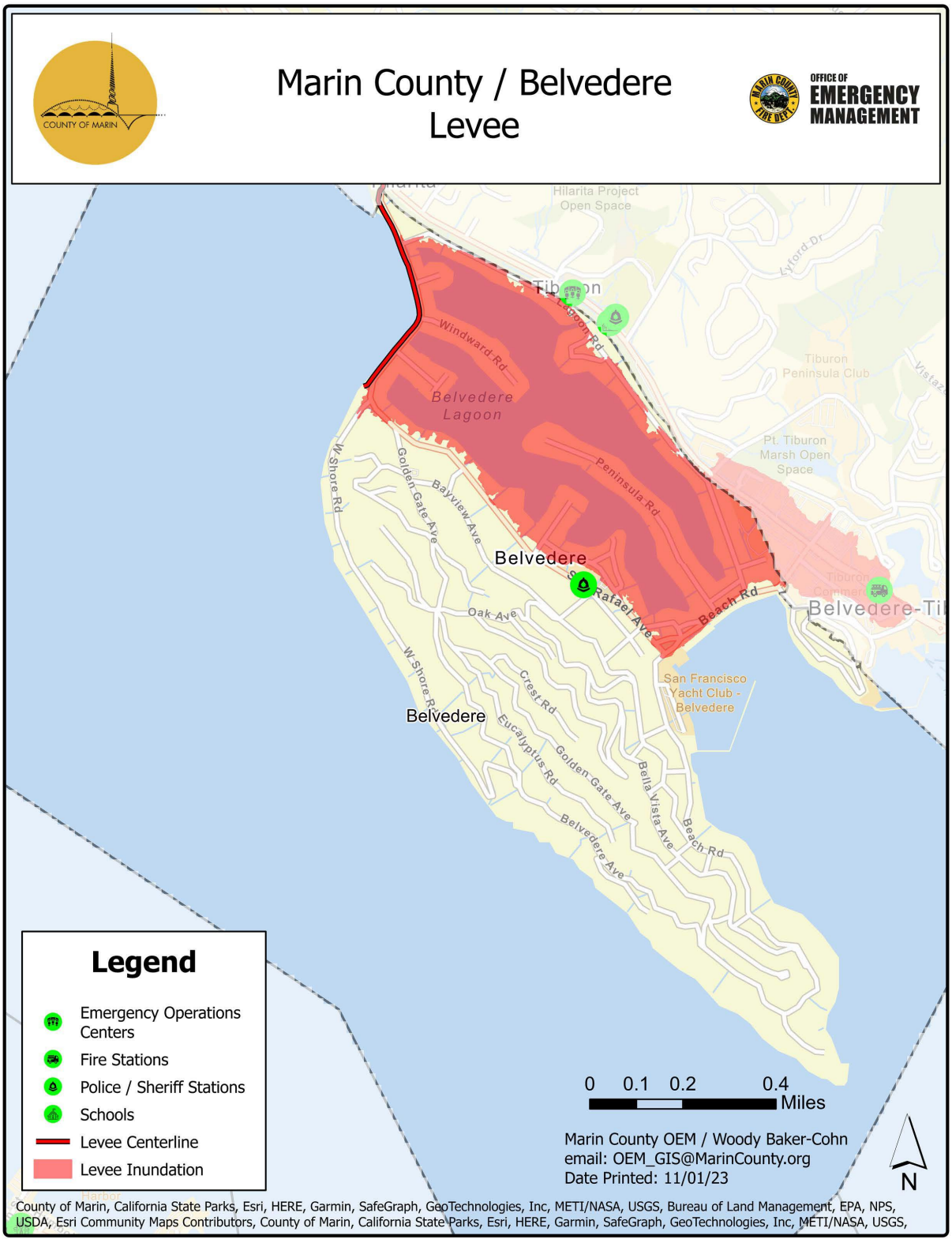


Figure 735: Town of Tiburon Levee Failure Critical Facilities and Infrastructure
Source: Marin County OEM

2.2.7 Sea Level Rise

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate until recently.

The Marin County OA MJHMP is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2013 State of California Multi- Hazard Mitigation Plan stated that climate change is already affecting California. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

Rising sea levels are considered a secondary effect of climate change due to warming ocean temperatures and melting glacial ice sheets into the ocean. The California coast has already seen a rise in sea level of four to eight inches over the 20th century due to climate change. Sea level rise impacts can be exacerbated during coastal storms, which often bring increased tidal elevations called "storm surge." The large waves associated with such storm surges can cause flooding in low-lying areas, erosion of coastal wetlands, saltwater contamination of drinking water, disruption of septic system operations, impacts on roads and bridges, and increased stress on levees. In addition, rising sea levels results in coastal erosion as shoreline sediment is re-deposited back into the ocean. Evidence shows that winter storms have increased in frequency and intensity since 1948 in the North Pacific, increasing regional wave heights and water levels during storm events.

According to the 2017 "Rising Seas in California, An Update on Sea-Level Rise Science" report Marin County may experience impacts from Sea Level Rise over defined periods of time, to include long-term changes (second half of this century and beyond), and short- to mid-term projections (within the next two or three decades).

Parts of Tiburon are at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in Tiburon, including the commercial downtown area and the areas around Blackie's Pasture and the Cove Shopping Center are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these neighborhoods continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017). Numerous businesses, residential neighborhoods, schools, medical facilities roads, and other critical facilities lie in areas of Tiburon susceptible to sea level rise.

The following are key issues related to Tiburon sea level rise and a 100-year storm surge:

- Highly valued Main Street shoreline shops and restaurants could be vulnerable in the near-term.
- Homes along the interface of the bluffs and shoreline could be vulnerable to increased erosion and bluff collapse during storms.
- The Tiburon and Angel Island ferries may face complications with loading during extreme high tides and may experience compromised American Disabilities Act (ADA) access.
- Vehicular access along Tiburon Boulevard could be compromised at the Cove Shopping Center and in the downtown area in the long-term.
- The Tiburon Fire Protection District Station #11, library, post office, and municipal facilities may be vulnerable to tidal flooding in the long-term.
- The Bay Trail and hotels downtown are compromised in the near-term.
- Corinthian Yacht Club facilities could be vulnerable to storm damage and flooding in the medium- to long-terms.
- The Cove Shopping Center is vulnerable in the long-term to sea level rise, though could suffer sooner from combinations of higher tides and stormwater. A batch of homes could suffer tidal impacts just east to the Cove Shopping Center in the long-term.
- If US 101 is compromised, so is service and goods delivery to Tiburon businesses.
- Access to Tiburon from the City of Corte Madera could also flood in the medium-term.
- Homes high in the hills could become isolated and cut off from necessities and the ability to leave the community, as alternative access routes are not available at this time.
- Several historic sites downtown and the old shipping terminal could flood with saltwater as early as the near-term.

Tiburon's most vulnerable assets are concentrated on the face of the peninsula, downtown, and around the Cove. These areas feature housing and a number of business, civic, recreation, historic and visitor serving uses. These areas tend to draw millions of visitors a year and provide a significant amount of economic and cultural value to the community and Marin County. Approximately 65 percent of commercial properties could be vulnerable to long-term levels of sea level rise in Tiburon. Tidal flooding could extend down Tiburon Boulevard. Additional stormwater from the hillsides would only exacerbate his flooding during storms. Reductions in service or loss due to building or inventory damage could have significant economic and

employment repercussions for Tiburon. Compared to other communities in the Marin County OA, Tiburon has fewer buildings that could be vulnerable to sea level rise due to the bluff side development pattern. Nevertheless, these buildings provide much of Tiburon's historic and charming character. Tiburon Boulevard could expect 100-year storm surge impacts at Main Street, Paradise Drive, and the Cove. Paradise Drive faces its own flooding issues in Corte Madera. With both Tiburon Boulevard and Paradise Drive being the main access roads to Tiburon, public transportation could be cut off more with sea level rise. People who travel through or to the area for work could be cut off and people with mobility or health constraints could be affected. The smaller of two treatment plants in Sanitary District No. 5, the Paradise Cove Plant, could be impacted at 5 feet of sea level rise, plus 100-year storm surge. The primary treatment facility off Tiburon Boulevard could anticipate some flooding during storm surges in the parking lot. This flooding may also create access issues for employees.

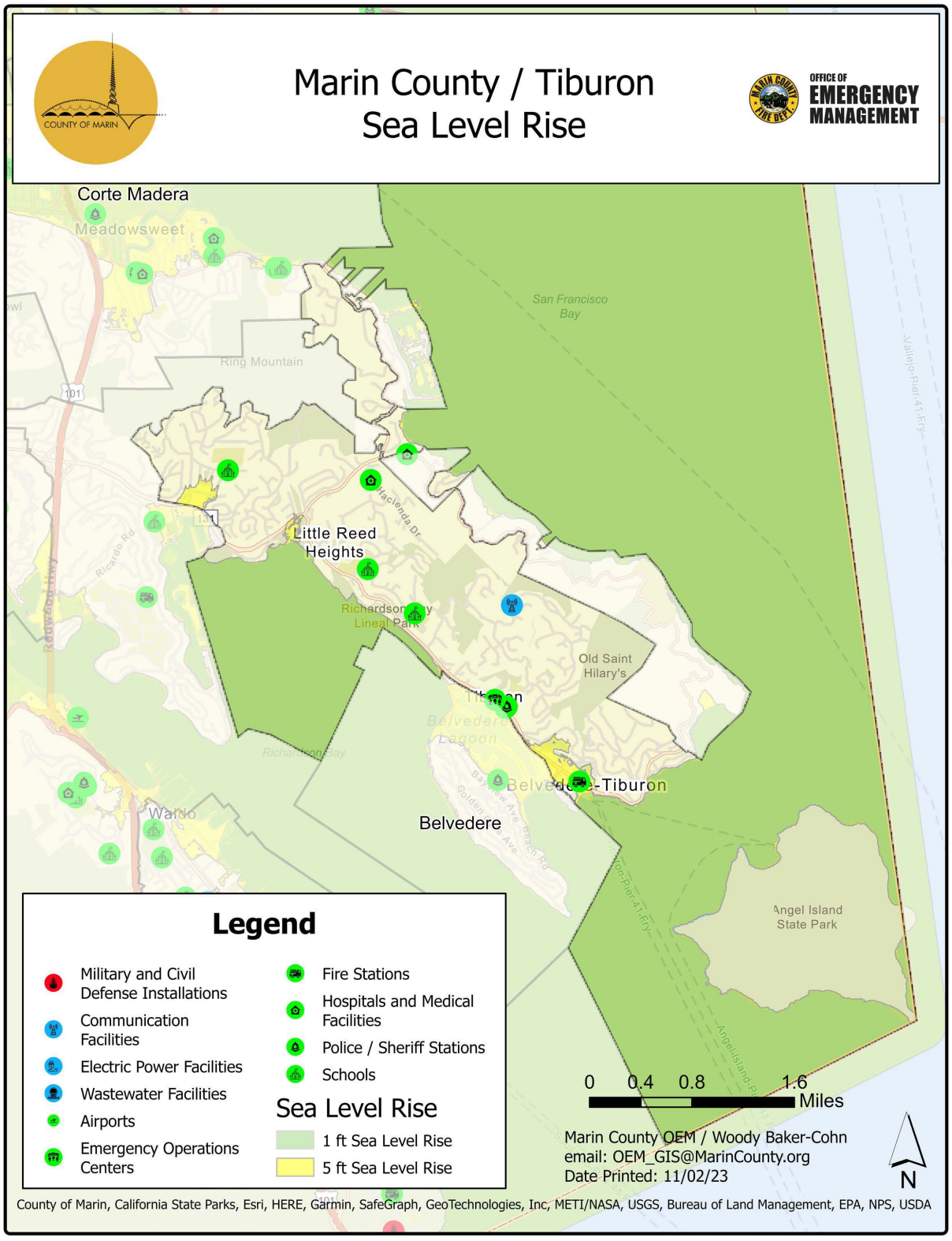


Figure 736: Town of Tiburon Sea Level Rise
Source: Marin County OEM

The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates that Tiburon could anticipate impacts to over 8,500 people and 341 living units with over $400 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. Structures throughout the town can become damaged extensively with their foundations compromised over time. Of particular concern are those structures and infrastructure that have not been elevated to projected sea level rise heights over the next century. Sea level rise in Tiburon has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from the bays over their banks and into adjacent neighborhoods. Sea level rise can also cause increased subsidence along Tiburon's shoreline, which may damage underground water and wastewater pipelines and disrupt services. Tiburon would begin to experience seasonal, king tide, and storm surge flooding more frequently in the future.

Climate Change and Future Development Considerations

The two major causes of global sea level rise are thermal expansion of warming oceans and the melting of land-based glaciers and polar ice caps. Climate change is affecting natural and built systems around the world, including the California coast. In the past century, average global temperature has increased about 1.4°F, and average global sea level has increased 7 to 8 inches. Sea level rise in the San Francisco Bay Area is projected to increase by eight inches MHW in 2050 and could reach 4.5 to eight feet by 2021 if greenhouse gas emissions aren't reduced.

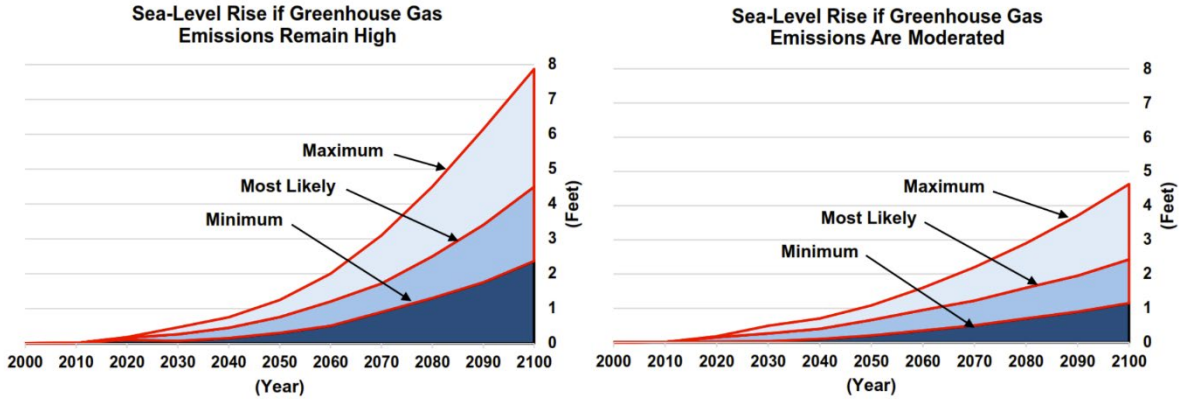


Figure 737: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

While the Marin County OA shoreline including around Tiburon already experiences regular erosion, flooding, and significant storm events, sea level rise will exacerbate these natural processes, leading to significant social, environmental, and economic impacts. The third National Climate Assessment cites strong evidence that the cost of doing nothing exceeds the costs associated with adapting to sea level rise by 4 to 10 times. Sea level rise will continue to affect the Marin County OA including Tiburon with increased tidal flooding and storm surge during severe weather events, and future development along the Marin County OA shoreline including around Tiburon will only amplify these impacts. Sea level can also lead to increased land subsidence and the potential of levee failure. The impacts of a tsunami would also be magnified with rising seas. Future development in the coastal and lowland areas of Tiburon, including the commercial downtown area, will put more people and property at risk from flooding

as a result of sea level rise. Roads and utility infrastructure across Tiburon will continue to become inundated, impacting ingress and egress across the Tiburon peninsula.

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 38):

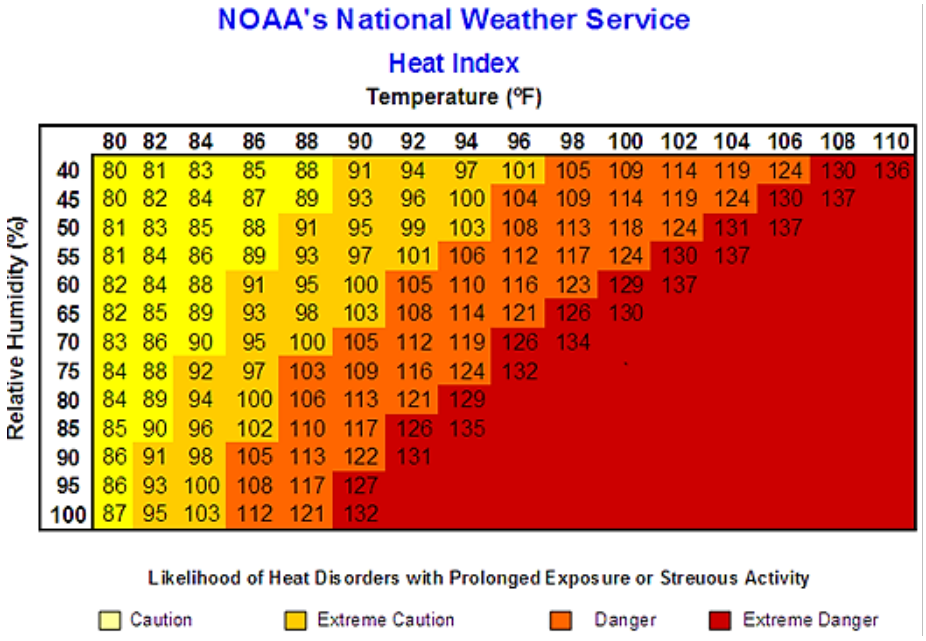


Figure 738: Heat Index
Source: NOAA

Heat kills by taxing the human body beyond its abilities. In a normal year, about 1,300 Americans succumb to the demands of summer heat. Heat is the leading weather-related cause of mortalities in the US. In 2006, California reported a high of 204 heat related deaths, with 98 reported in 2017 and 93 deaths reported in 2018.

Extreme heat has the potential to impact all areas of Tiburon and would be felt more at lower elevations in the central and eastern areas of the town. Temperatures can feel warmer in this area due to the widespread presence of concrete and asphalt, which stores heat longer. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

In September 2022 the Marin County OA experienced an Extreme Heat Event with temperatures exceeding 103 degrees.

Climate Change and Future Development Considerations

The primary effect of climate change is warmer average temperatures. The annual average daily high temperatures in California are expected to rise by 2.7°F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. At the current rate, annual average temperatures in the Marin County OA region and Bay Area will likely increase

by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

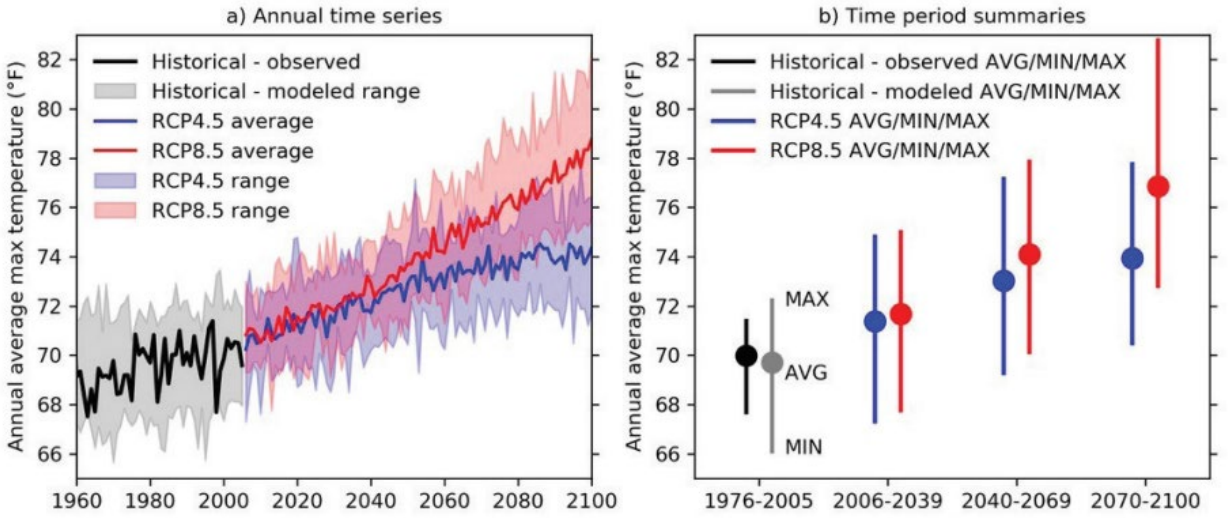


Figure 739: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

As climate change accelerates in the 21st century, it is anticipated that extreme heat events will become more frequent and intense across the Marin County OA including in Tiburon. There will be increased residential and business needs for cooling and addressing heat-related issues. These effects would primarily be felt in the lowland areas of Tiburon where heat builds in developed areas. Heat waves also tax the energy grid. Future development in the Marin County OA including Tiburon could exacerbate the impacts from heat related events, particularly in electricity provision and water delivery. Increased temperatures will also lead to an increase in the occurrence and severity of wildfires across the Marin County OA including Tiburon as conditions become hotter and drier. These effects will primarily be felt in the open space areas of Tiburon where hotter and drier conditions are more apt to lead to wildfires. Future development near the many open spaces around Tiburon could expose more people and infrastructure to the threat of a major wildfire as a result of increasing temperatures.

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 40).

Beaufort number	Description	Wind speed		Land conditions
		kts	km/h	
0	Calm	< 1	< 1	Calm. Smoke rises vertically.
1	Light air	1 – 2	1 – 5	Wind motion visible in smoke.
2	Light breeze	3 – 6	6 – 11	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	7 – 10	12 – 19	Leaves and smaller twigs in constant motion.
4	Moderate breeze	11 – 15	20 – 28	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	16 – 20	29 – 38	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	21 – 26	39 – 49	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	27 – 33	50 – 61	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	34 – 40	62 – 74	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	41 – 47	75 – 88	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	48 – 55	89 – 102	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	56 – 63	103 – 117	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 64	≥ 118	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Figure 740: Beaufort Wind Scale
Source: NOAA

Windstorms in the Marin County OA are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 41) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

Enhanced Fujita Scale	
EF-0	65-85 mph winds
EF-1	86-110 mph winds
EF-2	111-135 mph winds
EF-3	136-165 mph winds
EF-4	166-200 mph winds
EF-5	>200 mph winds

Figure 741: Enhanced Fujita Scale
Source: NOAA

Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Figure 742: Waterspout Formation
Source: MarineInsights

All of Tiburon is susceptible to storms and damage from wind and tornadoes particularly those areas throughout town that have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees

could damage homes and other facilities. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

On 3/21/2023, a torrent of powerful winds caused trees and power lines to fall all over Tiburon. Wind gusts of 48 mph were reported in Tiburon.

On 1/11/2023, pair of 40-foot cypress trees in Tiburon snapped off during the high winds, just missing a house below.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the Marin County OA and Tiburon. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Tiburon as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the areas of high tree cover throughout Tiburon including in residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

Tsunamis consist of waves generated by large disturbances of the sea floor, which are caused by volcanic eruptions, landslides or earthquakes. Shallow earthquakes along dip slip faults are more likely to be sources of tsunami than those along strike slip faults. The West Coast/Alaska Tsunami Warning Center (WC/ATWC) is responsible for tsunami warnings. Tsunamis are often incorrectly referred to as tidal waves. They are actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour with unusual wave heights. Tsunamis can reach the beach before warnings are issued.

A tsunami experienced by Tiburon would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the town. Areas of Tiburon in the 100 and 500-year floodplain are at a lower elevation and lie in a tsunami hazard area, including most of commercial downtown area with Tiburon Town Hall and the Tiburon Fire Protection District Station #11; Blackie's Pasture; the Cove Shopping Center; and waterfront properties along Paradise Drive and Tiburon Boulevard. Additionally, many recreational areas such as beaches, the shoreline park, Paradise Park, and the Old Rail Trail are at risk from tsunamis. Dozens of residences in these areas are vulnerable to a tsunami.

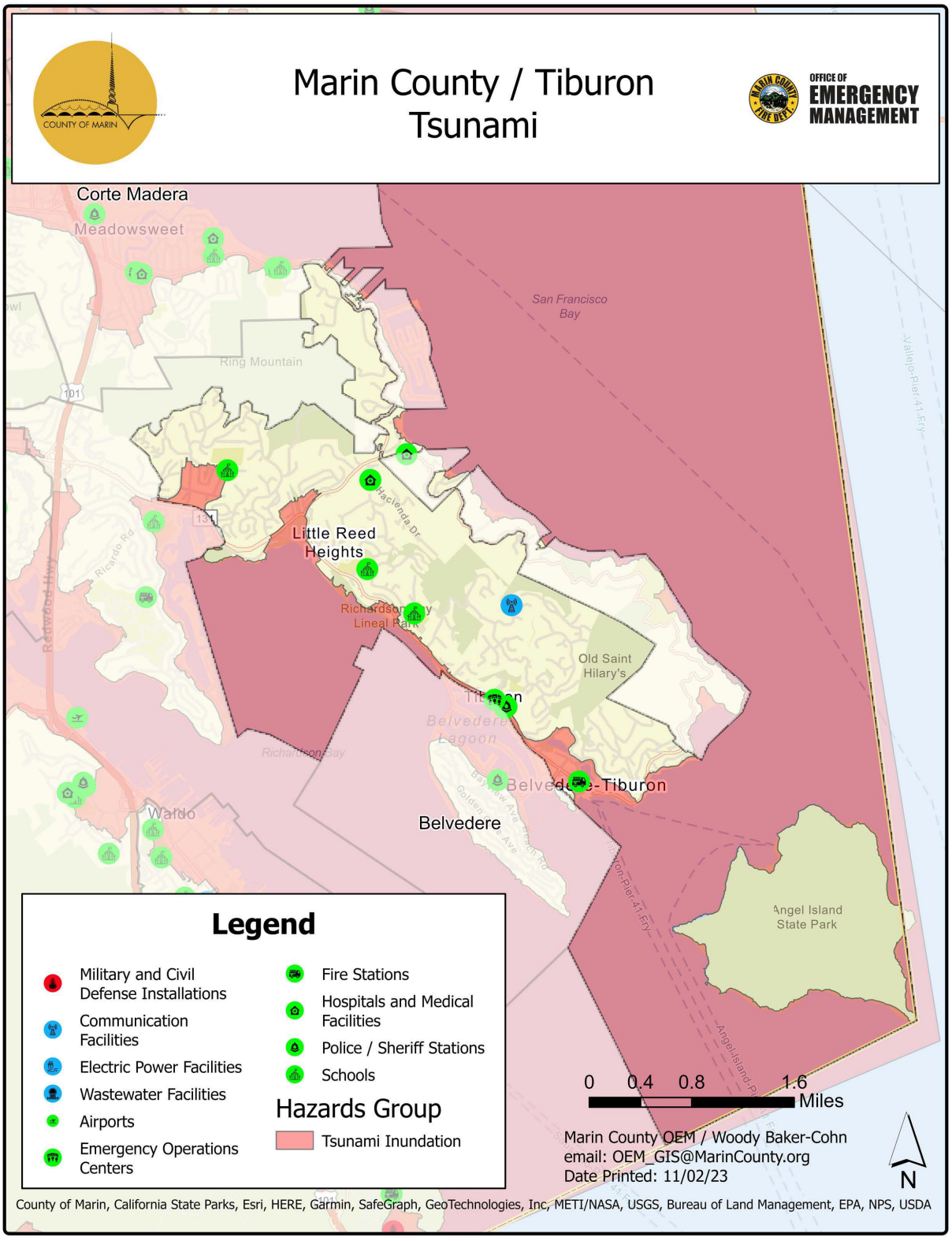


Figure 743: Town of Tiburon Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Tiburon has never experienced a tsunami, however, given its proximity to Richardson Bay and San Francisco Bay, it potentially experience the impacts of one. On 1/16/2022 a tsunami resulting from a massive volcanic eruption near Tonga caused powerful waves around Tiburon. A dock pulled away from an apartment.

Figure 744: Town of Tiburon Tsunami Impacts – January 16, 2022
Source: Marin County OEM

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including Tiburon, where a large segment of the downtown commercial area lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including Tiburon. This is particularly true in the downtown commercial area, the Blackie's Cove area and the Cove Shopping Center area where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Flooding could be exacerbated in areas where levees could fail in Belvedere as a result of high wave heights associated with a more significant tsunami.

2.2.11 WILDFIRE

A wildfire is a fire that occurs in an area of combustible vegetation. The three conditions necessary for a wildfire to burn are fuel, heat, and oxygen. Fuel is any flammable material that can burn, including vegetation, structures, and cars. The more fuel that exists and the drier that fuel is, the more intense the fire can be. Wildfires can be started naturally through lightning or combustion or can be set by humans. There are many sources of human-caused wildfires including arson, power lines, a burning campfire, an idling vehicle, trains, and escaped controlled burns. On average, four out of five wildfires are started by humans. Uncontrolled wildfires fueled by wind and weather can burn acres of land and everything in their path in mere minutes and can reach speeds up to 15 miles per hour or faster depending upon wind speed and ember distribution. On average, more than 100,000 wildfires burn 4 to 5 million acres of land in the United States every year. Although wildfires can occur in any state, they are most common in the Western states including California where heat, drought, and thunderstorms create perfect wildfire conditions.

Wildfires are of primary concern when they occur in the Wildland Urban Interface (WUI), which is defined as areas where homes are built near or among lands prone to wildfire. Even relatively small acreage fires may result in disastrous damages. Most structures in the WUI are not destroyed from direct flame impingement, but from embers carried by wind. The damages can be widely varying, but are primarily reported as damage to infrastructure, built environment, and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern may now burn these newly developed areas. WUI fires can occur where there is a distinct boundary between the built and natural areas or where development or infrastructure has encroached or is intermixed in the natural area. WUI fires may include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets.

Consequently, wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Warning times are usually adequate to ensure public safety, provided that evacuation recommendations and orders are heeded in a timely manner. While in most cases wildfires are contained within a week or two of outbreak, in certain cases, they have been known to burn for months, or until they are completely extinguished by fall rains.

Wildfire poses the greatest risk to human life and property in the Marin County OA's densely populated WUI, which holds an estimated 69,000 living units. The Marin County OA is home to 23 communities listed on CAL FIRE's Communities at Risk list, with approximately 80% of the total land area in the county designated as having moderate to very high fire hazard severity ratings. The county has a long fire history with many large fires over the past decades, several of which have occurred in the WUI. To compound the issue, national fire suppression policies and practices have contributed to the continuous growth (and overgrowth) of vegetation

resulting in dangerously high fuel loads. The Community Wildfire Protection Plan (CWPP) provides a scientifically based assessment of wildfire threat in the WUI of the Marin County OA.

Fire protection in California is the responsibility of either the federal, state, or local government depending upon the location of the incident. On federally owned land, or federal responsibility areas (FRA), fire protection is provided by the federal government, and or in partnership with local agreements. In state responsibility areas (SRA), CAL FIRE typically provides fire protection. However, in some counties CAL FIRE contracts with county fire departments to provide protection of the SRA – this is the case in the Marin County OA, where CAL FIRE contracts with MCFD. Local responsibility areas (LRA) include incorporated cities and cultivated agriculture lands, and fire protection is typically provided by city fire departments, fire protection districts, counties, and by CAL FIRE under contract to local government.

CAL FIRE contracts with MCFD to provide wildland fire protection and associated fire prevention activities for lands designated by the State Board of Forestry as SRA.. The MCFD is responsible for the protection of approximately 200,000 acres of SRA within the county and is the primary agency that handles wildland fires. MCFD also provides similar protection services to approximately 100,000 acres of FRA in the Golden Gate National Recreation Area (GGNRA), the Muir Woods National Monument, and the Point Reyes National Seashore.

Figure 45 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

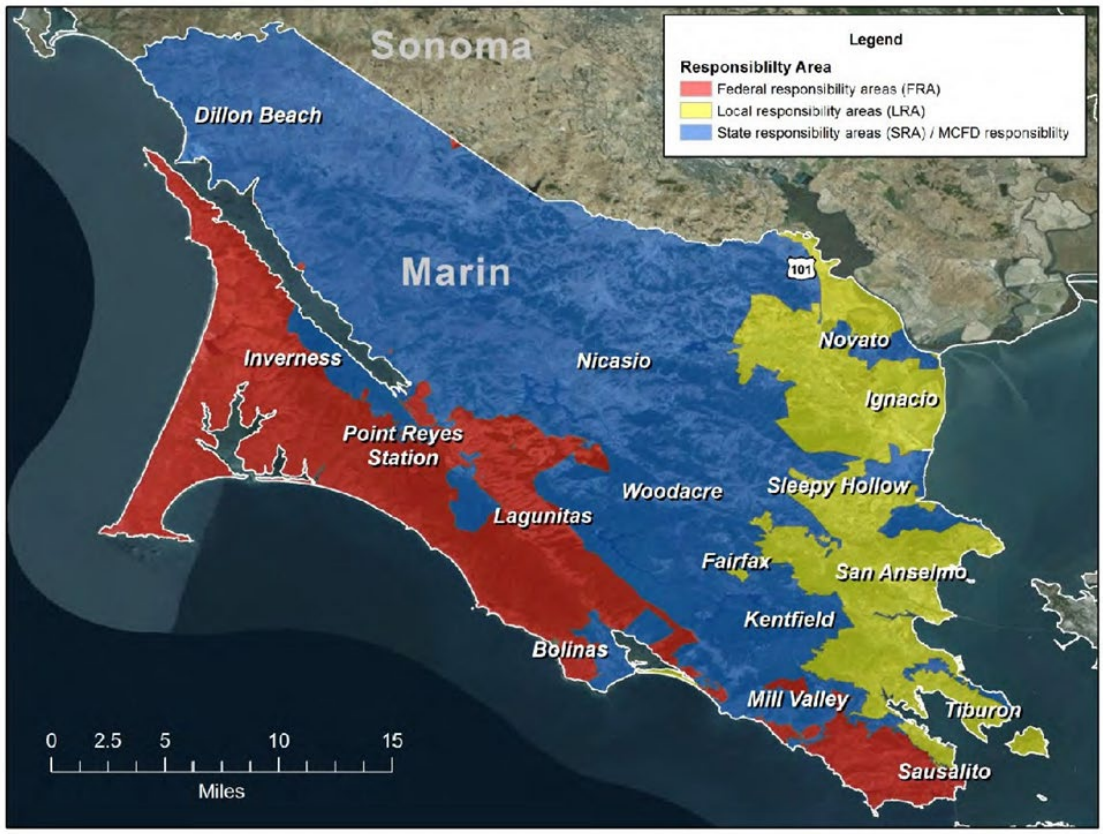


Figure 745: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan, 11/27/23

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre ECC currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

The Marin County OA is bounded by the cool waters of the Pacific Ocean to the west, the San Francisco and Richardson Bays to the southeast, the San Pablo Bay to the east, and Sonoma County agricultural lands to the north. The combination of these large bodies of water, location in the mid-latitudes, and the persistent high pressure over the eastern Pacific Ocean results in several micro-climates. Weather in the OA consists of warm, dry summers and cool, wet winters. The climate in early fall and late spring is generally similar to the summer, and late fall is similar to winter. Spring is generally cool, but not as wet as the winter. While these general weather conditions are fairly representative of the typical Marin County OA weather, complex topography, annual variability of weather patterns, and less frequent and transient weather patterns are important to fire conditions.

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

The Pacific High that persists from late spring through early fall over the eastern Pacific, combined with a thermal low pressure over the Central Valley of California, results in an almost continuous sea breeze. These winds usher in cool and moist air and can be strong at times (15 to 25 mph), especially over the ridge tops and through northwest to southeast lying valleys, including San Geronimo/Ross, Hicks, Lucas Valleys, and Mill Valley and the Marin Headlands. These westerly winds are usually highest in the afternoon, decrease in the evening, and are light overnight before increasing again in the late morning/early afternoon.

Occasionally in the summer and more often in the fall, the Pacific High moves inland and centers over Oregon and Idaho, while low pressure moves from the Central Valley of California to southern California and Arizona. The resulting north-to-south pressure gradient can be strong enough to retard the typical sea breeze and can even result in winds blowing from the land to the ocean (offshore winds). As the offshore winds move air from the Central Valley to the coastal areas of California, the air descends and compresses, which greatly warms and dries the air. Under these “Diablo” wind conditions, temperatures in the Marin County OA can reach 100°F in the inland areas and even 80°F at the coast, and relative humidity can be very low. In addition, wind speeds can be high (20 to 40 mph), gusty and are often much faster over the mountains and ridge tops such as Mt. Tamalpais, Loma Alta, Marin Headlands and Mt. Burdell compared to low-lying areas. Wind speeds can be high over the ridges and mountains at all times of day under this “offshore” wind pattern and are often much slower or even calm at night in low-lying areas because nighttime cooling decouples the aloft winds from the surface winds. It is during these Diablo wind events that there is a high potential for large, wind-driven fires

should there be an ignition. Historically, the largest and most destructive fires have occurred during these offshore (also known as Foehn) wind events including the Angel Island and the Vision fires which were located in West Marin.

A few times per year in the summer and early fall, monsoonal flow from Mexico may bring in moist and unstable air over central and northern California, which can result in thunderstorms with or without precipitation. With the otherwise dry summer conditions, lightning from this type of weather pattern can ignite fires. These monsoonal flow patterns are usually only one to two-day events.

Beginning in late November and lasting through the end of March, the Pacific High moves south and weakens, allowing storms that originate in the Gulf of Alaska to move over California.

These storms bring precipitation and, at times, strong winds out of the south. Each storm usually results in one fourth inch to several inches of rain over a day or so. Near Mt. Tamalpais, rainfall amounts are enhanced by orographic lifting, resulting in higher rain amounts in the Kentfield and Fairfax areas compared to the rest of the county. Typically, after the first rain in November, the cool weather and occasional storm keeps the ground wet through late Spring. However, in some years, significant rain does not occur until later in the year (e.g., early-to-late December) and there can be several weeks without any storms and rain. During storms, temperatures are usually mild.

When there are no storms over California, a land-breeze typically forms (i.e., winds blowing from the Central Valley to the Pacific Ocean). These winds can reach 30 mph, and travel through the southeast to northwest lying valleys, over low-lying ridges such as the Marin Headlands, and through the Golden Gate. These winds are usually highest in the mid-morning hours and decrease in the afternoon as the Central Valley warms during the day. The winds are associated with cold and modestly moist air.

In late February/early March through late April, the Pacific High strengthens and moves north, and storms impacting the county become less frequent. During this time of year there is often a low-pressure area over the desert in southwest California. The combination of the Pacific High to the north and low-pressure to the southwest results in strong winds blowing from the northwest to the southeast. Like the sea breeze, these winds bring in cool, moist air and are usually highest in the afternoon hours. Because of winter and spring rains, the land is wet and there is little danger of wildland fire despite the strong winds and only occasional precipitation. There is often little coastal fog this time of year.

Vegetation, which is also known as fuel, plays a major role in fire behavior and potential fire hazards. A fuel's composition, including moisture level, chemical make-up, and density, determines its degree of flammability. Of these, fuel moisture level is the most important consideration. Generally, live trees contain a great deal of moisture while dead logs contain very little. The moisture content and distribution of fuels define how quickly a fire can spread and how intense or hot it may become. High moisture content will slow the burning process since heat from the fire must first eliminate moisture.

In addition to moisture, a fuel's chemical makeup determines how readily it will burn. Some plants, shrubs, and trees such as chamise and eucalyptus (both present in the Marin County

OA) contain oils or resins that promote combustion, causing them to burn more easily, quickly, and intensely.

Finally, the density of a fuel influences its flammability; when fuels are close together but not too dense, they will ignite each other, causing the fuel to spread readily. However, if fuels are so close that air cannot circulate easily, the fuel will not burn freely.

The Marin County OA has extensive topographic diversity that supports a variety of vegetation types. Marin County's OA has significant changes in topography with steep vegetated slopes which can also add to the ability of the fuel to further expand a wildfire.

Environmental factors, such as temperature, precipitation, soil type, aspect, slope, and land use history, all help determine the existing vegetation at any given location. In the central and eastern parts of the county, north facing slopes are usually densely wooded from lower elevations to ridge peaks with a mixture of mostly hardwood tree species such as coast live oak, California bay, Pacific madrone, and other oak species. Marshlands are also present throughout the county; once ignited marsh fires can be difficult to contain and extinguish.

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

In the west portion of the county closer to the coast, where precipitation is higher and marine influence is greater, most areas are densely forested with conifer species (i.e., Bishop pine, Douglas-fir, and coast redwood) and associated hardwood species. Chaparral vegetation also occurs in parts of the county, especially on steeper south and west facing slopes. This mix of densely forested areas mixed with chaparral results in higher fuel loads and potentially higher fire intensity. Expansion of the residential community into areas of heavier vegetation has resulted in homes existing in close proximity to dense natural foliage; these homes are often completely surrounded by highly combustible or tall vegetation, increasing the potential that wildland fires could impact them.

As part of the development of the Marin Community Wildfire Protection Plan (CWPP), an updated vegetation map layer was created using the most recent vegetation information available from a variety of state and local data sources.

Vegetation distribution in the Marin County OA is characterized by approximately 20 different types of vegetation which have been classified into 15 fire behavior fuel models.

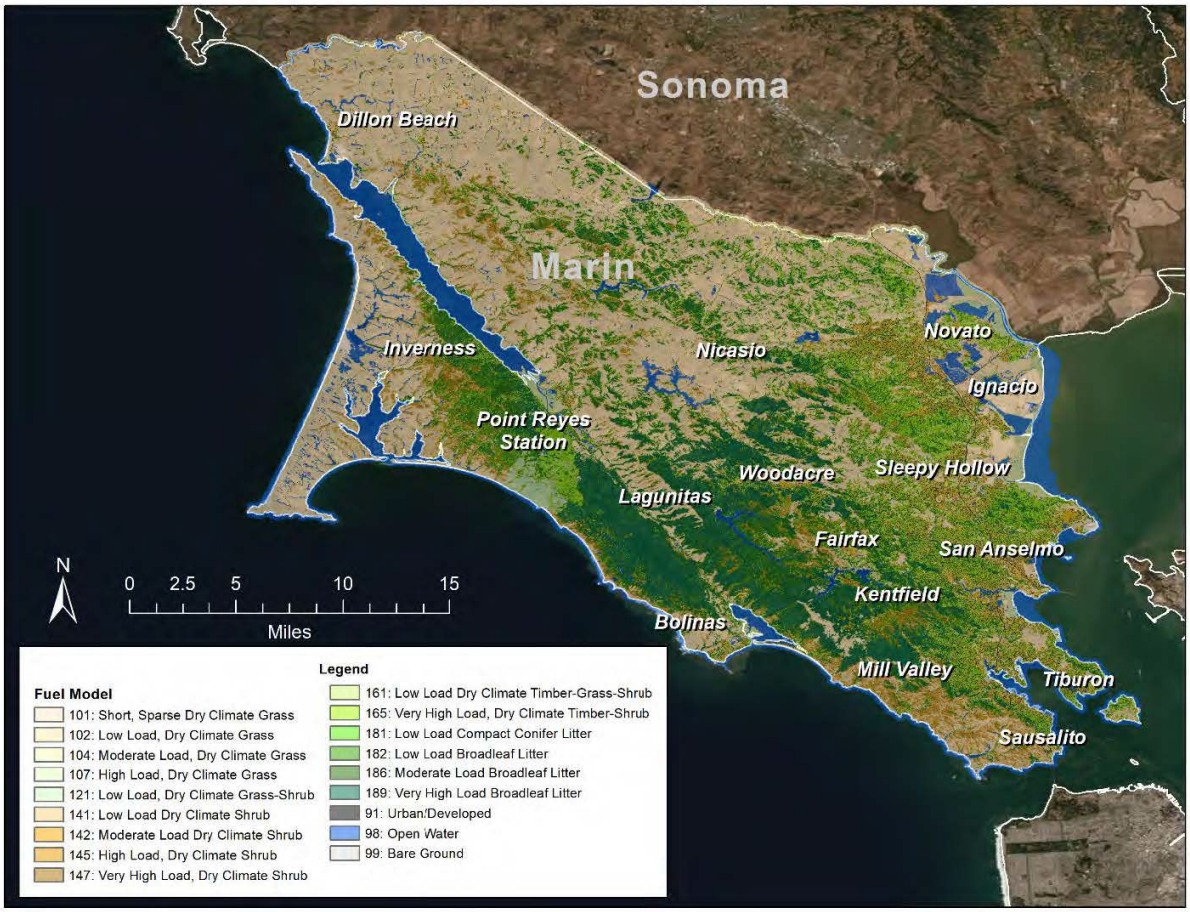


Figure 746: Fuel Model Map for the Marin County OA
Source: Marin CWPP, 11/27/23

Insect infestations and plant diseases, such as California oak mortality syndrome (sudden oak death), are increasing and threaten to change the structure and overall health of native plant communities in Marin County. Sudden oak death has no known cure and is the biggest concern; this syndrome is caused by the fungus-like Phytophthora ramorum, which has led to widespread mortality of several tree species in California since the mid-1990s; the tanoak (Lithocarpus densiflorus) in particular appears to have little or no resistance to the disease. Sudden oak death has resulted in stands of essentially dead trees with very low fuel moistures.

Studies examining the impacts of sudden oak death on fire behavior indicate that while predicted surface fire behavior in sudden oak death stands seems to conform to a common fuel model already in use for hardwood stands, the very low moisture content of dead tanoak leaves may lead to crown ignitions more often during fires of “normal” intensity.

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species) and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a

particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

These dead and dying trees have created large swaths of land with dense and dry fuel loads. Madrone twig dieback is caused by the native fungus Botryosphaeria dothidea and appears to be getting worse throughout the county due to drought effects on Pacific madrones. Three additional threats to trees common to the Marin County OA include:

- Bark and ambrosia beetles (Monarthrum dentiger and monarthrum scutellare), which target oak and tanoak trees. Sudden oak death may be exacerbating the effects of beetle infestations which prey on trees already weakened by this disease.
- Root rot, caused by oak root fungus (Armillaria mellea), is primarily associated with oaks and other hardwoods but also attacks conifers. These fungal infestations cause canopy thinning and branch dieback and can kill mature trees. As with the beetle infestations, sudden oak death may be exacerbating the effects of root rot fungus in the county forests.
- Velvet-top fungus (Phaeolus schweinitzii) is a root rot fungus affecting Douglas-fir and other conifers, with the infection typically occurring through a wound.

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to 70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

In the WUI where natural fuels and structure fuels are intermixed, fire behavior is complex and difficult to predict. Research based on modeling, observations, and case studies in the WUI indicates that structure ignitability during wildland fires depends largely on the characteristics and building materials of the home and its immediate surroundings.

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

Wildfire can further ignite structures through direct flame contact and/or radiant heat. For this reason, it is important that structures and property in the WUI are less prone to ignition by ember dispersion, direct flame contact, and radiant heat.

Public Safety Power Shutoff (PSPS) Events

As a result of the 2017 Northern California Wildfires, the 2018 Camp Fire in Butte County and other wildfires caused by power line infrastructure, Pacific Gas & Electric (PG&E) began initiating Public Safety Power Shutoff (PSPS) events in their service areas (including Marin County) to help prevent the start of future wildfires. PG&E will initiate a PSPS if conditions indicate potentially dangerous weather conditions in fire-prone areas due to strong winds, low humidity, and dry vegetation. During these events, PG&E will proactively turn off power in high fire risk areas to reduce the threat of wildfires. The most likely electric lines to be considered for a public safety power outage will be those that pass through areas that have been designated by the California Public Utilities Commission (CPUC) High Fire-Threat District at elevated (Tier 2) or extreme risk (Tier 3) for wildfire. Customers outside of these areas could have their power shut off, though, if their community relies upon a line that passes through a high fire-threat area or an area experiencing severe weather. PG&E will consider numerous factors and analyze historical data to help predict the likelihood of a wildfire occurring, and closely monitoring weather watch alerts from the National Weather Service (NWS). These factors generally include, but are not limited to:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

Pacific Gas & Electric Company (PG&E) operates a total of 1,179 miles of overhead electricity transmission and distribution lines in the Marin County OA. Overhead electricity lines and poles can be damaged or downed under severe weather conditions, particularly severe wind conditions, which increases the potential for wildfire ignition. 52 percent of PG&E’s overhead distribution lines and 41 percent of its overhead transmission lines are located in CPUC-identified High-Fire Threat Districts subject to elevated or extreme fire risk. PG&E is currently planning and implementing safety measures to prevent wildfires and reduce the impacts of Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

In October 2019 Marin County and the Town of Tiburon experienced two PSPS events.

These measures include installing weather stations; installing high-definition cameras; installing sectionalizing devices on its overhead lines to separate the grid into smaller sections; hardening the system by installing stronger power poles, covering lines, and undergrounding lines in

targeted areas; creating temporary microgrids to provide electricity during PSPS events; and enhancing existing vegetation management activities. From 2018 to July 2021, PG&E hardened three miles of overhead lines, installed 68 transmission and distribution sectionalizing devices, completed enhanced vegetation management on approximately 51 of overhead line miles, installed 28 weather stations, and installed 12 high-definition cameras in the Marin County OA. PG&E has also begun undergrounding several overhead transmission lines throughout California.

A wildfire in Tiburon would most likely occur in any of the open spaces throughout town, including the Ring Mountain Open space preserve on the north side of the town, the area around the numerous open spaces in the middle of the town, and the area around the Tiburon Uplands Nature Preserve and the Old St. Hilary Open Space Preserve on the south side of the town. These areas of Tiburon are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by wildfire. Many of the hillside neighborhoods are at risk of wildfires and have extremely limited ingress and egress for residents and emergency services. Much of Tiburon lies in a high FHSZ, including hundreds of residences, the St. Hilary School and a Marin Emergency Radio Authority antenna. Part of the downtown commercial area lies in a moderate FHSZ.

All of Tiburon could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in Marin County or the surrounding region. As wildland areas around Tiburon become drier due to climate change, the risk of a wildfire occurring and impacting the town will continue to increase. Brush fires in the town may increase over time as parks and other open spaces experience drier conditions.

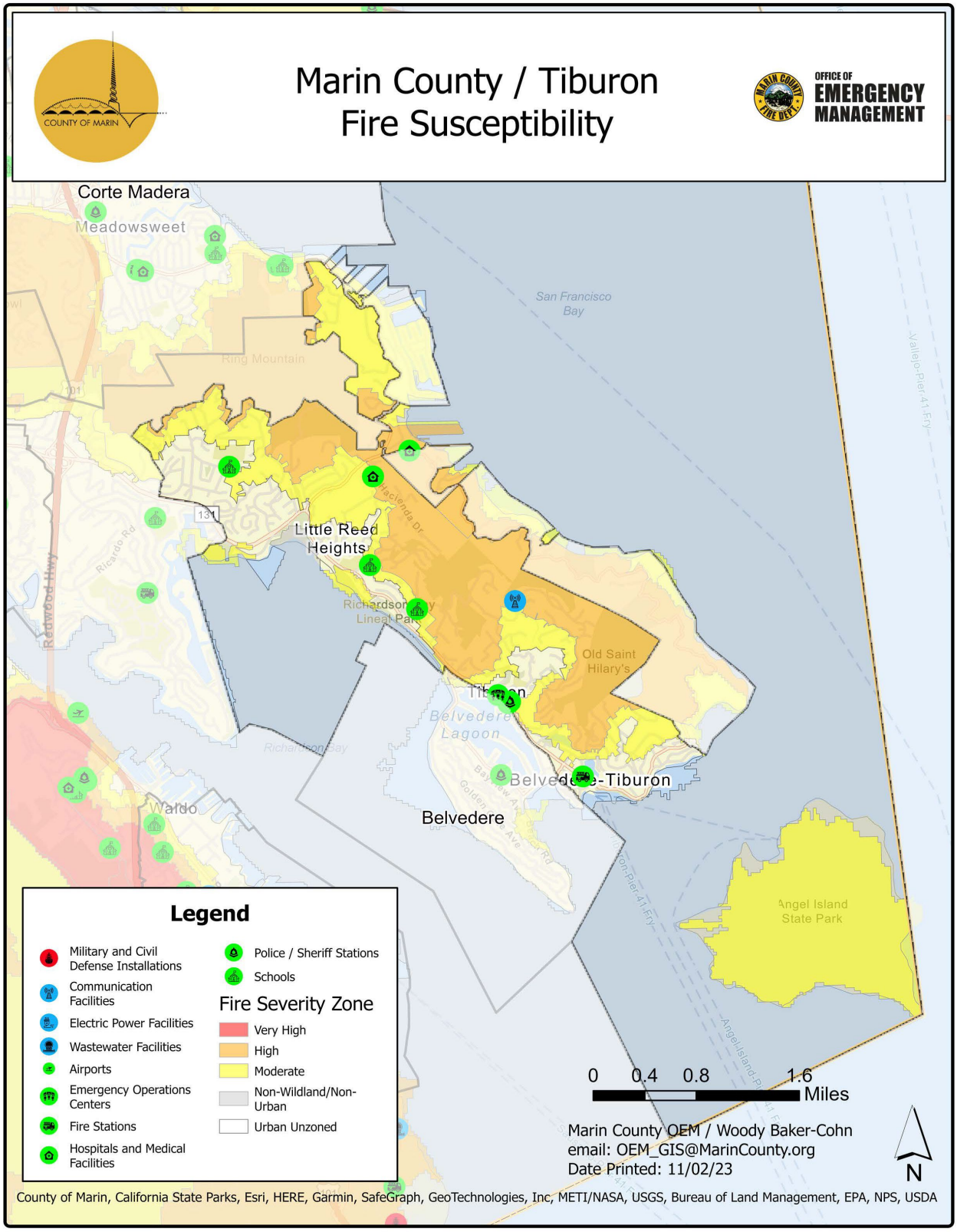


Figure 747: Town of Tiburon Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

Tiburon has historically experienced several huge fires before the formation of the Tiburon Fire Protection District, but none in the last century. On 11/13/1890, Tiburon was destroyed by an urban conflagration. There have been no major wildfires or brush fires in Tiburon since the last plan update.

On 7/7/2017, a brush fire on Gilmartin Drive threatened two houses in Tiburon. Defensible space created by residents allowed fire crews to access and douse the blaze. No injuries or property damage was reported by the blaze, the cause of which was undetermined.

On 6/15/2012, a three-acre brush fire was reported near Reed Ranch Road. Nearby homes and structures were not threatened by the blaze.

Climate Change and Future Development Considerations

Climate change can lead to an increase in wildfire events. Climate change has been a key factor in increasing the risk and extent of wildfires in the western United States. Changes in climate create warmer, drier conditions. Increased drought, and a longer fire season are boosting these increases in wildfire risk.

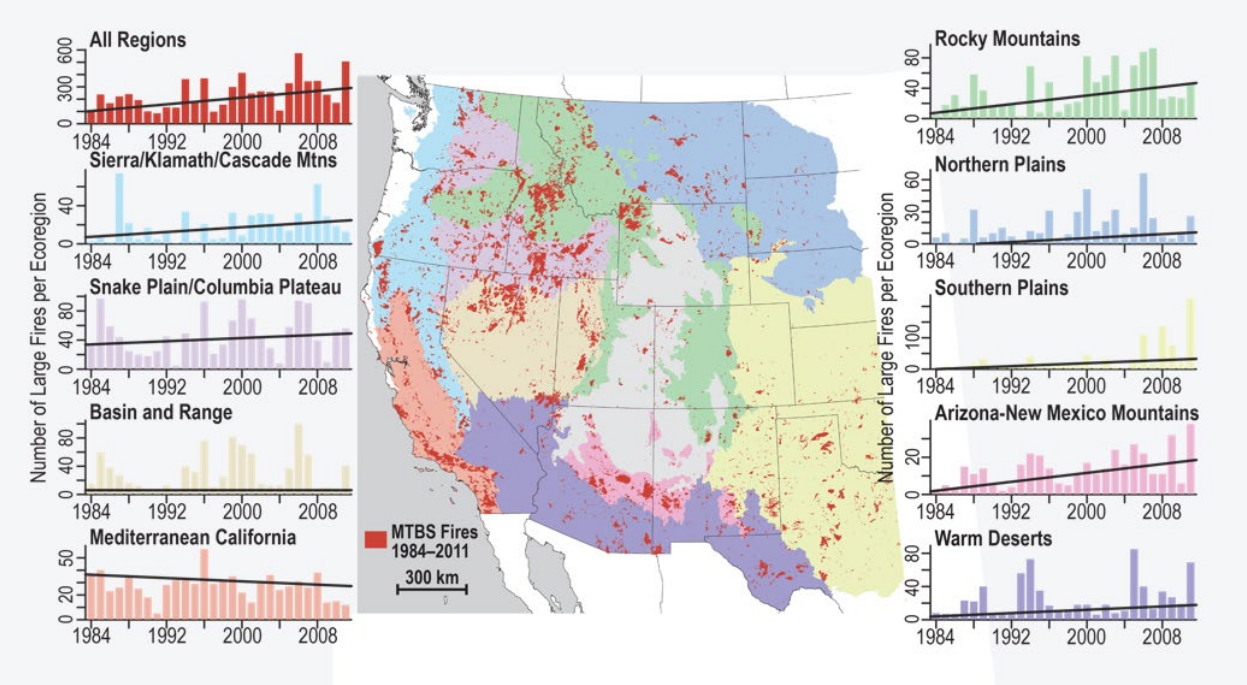


Figure 748: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including Tiburon is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail, sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Tiburon. Future development in the WUI throughout Tiburon will expose more people and property to the impacts of a potentially significant wildfire.

The growing number of people in the Tiburon WUI can increase risk to life, property and public health as a result of a wildfire.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character.

The Town of Tiburon is a community of approximately 9,400 residents and 4,050 housing units located on a relatively narrow four square mile peninsula extending into San Francisco Bay. The peninsula rises quickly from the Bay reaching a central spine known as the Tiburon Ridge. This ridge is prominent from widespread locations in the San Francisco Bay Area. Most of the peninsula is sloping land. Neighborhoods vary in age from the 1890's to the present. Over 95 percent of the Town's land area is comprised of residential neighborhoods, public parks, and secured open space. Tiburon is a community of neighborhoods covering a wide range of construction dates, housing types, architectural styles, and neighborhood design characteristics. At one end of the range is Old Tiburon, an 1890's-vintage subdivision of small lots on generally steep slopes with a variety of housing types and styles. At the other end of the range are newer multi-million dollar homes located on larger parcels in thoroughly modern estate-style subdivisions that were common in the 1980's and 1990's. In between are numerous subdivisions from the post-war boom of the late 1940's up through the 1950's and 1960's and into the 1970's. Neighborhoods and homes in Tiburon are quite well maintained and are desirable and attractive places to live.

The Council of Governments for Tiburon and the nine-county Bay Area region is the Association of Bay Area Governments (ABAG). ABAG, in collaboration with the Metropolitan Transportation Commission, develops a Regional Housing Needs Allocation Plan that assigns the regional housing need to the individual cities, towns and counties within the Bay Area. Tiburon's share of the regional housing need for the 2023-2031 planning period is 639 units, which represents 4.4 percent of the 14,405 units allocated to Marin County. The Town's Regional Housing Need Allocation (RHNA) is approximately eight times the previous 5th cycle allocation of 78 units.

The regional share is further allocated according to four income levels: very low income, low income, moderate income, and above moderate income. Tiburon's regional housing need of 639 units is distributed among the four income categories as follows:

- 193 units affordable to very low- income households (up 50 percent of the area median income)
- 110 units affordable to low-income households (50 to 80 percent of the area median income)
- 93 units affordable to moderate- income households (80 to 120 percent of the area median)
- 243 units affordable to above moderate-income households over 120 percent of the area median income)

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Tiburon has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

Table 20: Town of Tiburon Future Growth Areas						
Development	**# of Units**	**# of Parcels**	**Project Date**	**Acres**	**Fire Severity Zone**	**Flood Zone**
1525 Tiburon Blvd	19	1	N/A	0.66	Wildland Urban Interface (WUI)	AE
1535 Tiburon Blvd	21	1	N/A	0.72	Wildland Urban Interface (WUI)	AE
1601 Tiburon Blvd	17	1	N/A	0.57	Wildland Urban Interface (WUI)	AE
1601 Tiburon Blvd	32	1	N/A	1.07	Wildland Urban Interface (WUI)	AE
1550 Tiburon Blvd	66	1	N/A	2.21	Wildland Urban Interface (WUI)	AE
1620 Tiburon Blvd and 1640/50 Tiburon Blvd	26	2	N/A	0.87	Wildland Urban Interface (WUI)	AE
6 Beach Rd and 12 Beach Road	39	2	N/A	1.41	Wildland Urban Interface (WUI)	AE
1199 Tiburon Blvd.	58	1	N/A	2.9	Wildland Urban Interface (WUI)	AE
1100 Mar West St, 1110 Mar West St, and 1120 Mar West St	40	3	N/A	1.36	Wildland Urban Interface (WUI)	X
1555 Tiburon Blvd	25	1	N/A	0.86	Wildland Urban Interface (WUI)	AE
1599 Tiburon Blvd	49	1	N/A	1.66	Wildland Urban Interface (WUI)	AE
1600 Tiburon Blvd	11	1	N/A	0.39	Wildland Urban Interface (WUI)	AE
1610 Tiburon Blvd	3	1	N/A	0.13	Wildland Urban Interface (WUI)	AE
1660 Tiburon Blvd	12	1	N/A	0.43	Wildland Urban Interface (WUI)	AE
1680 Tiburon Blvd	8	1	N/A	0.29	Wildland Urban Interface (WUI)	AE
26 Main St./ 2 Juanita Ln	8	1	N/A	0.43	Wildland Urban Interface (WUI)	AE
4576 Paradise Dr	93	1	N/A	9.58	Wildland Urban Interface (WUI)	VE
Various- Anticipated number of new Accessory Dwelling Units	72	Various	N/A	Varies	Wildland Urban Interface (WUI)	Varies
Various - Anticipated number of new Single Family Dwellings	93	Various	N/A	Varies	Wildland Urban Interface (WUI)	Varies
1525 Tiburon Blvd	19	1	N/A	0.66	Wildland Urban Interface (WUI)	AE
Total	**692**					

Table 383: Town of Tiburon Future Growth Areas
Source: Town of Tiburon

3.2 Capability Assessment

The overall priorities in the Town of Tiburon have not changed since the 2018 MJHMP update. However, the strategies in which to support the overall town priorities have changed and are reflected in the sections below. There were many projects that were either ongoing day-to-day business activities or were response related that were completed or deleted from the 2018 MJHMP project list and not carried over to this plan update. Several actions were completed and new projects were added to coincide with the changes in priorities, progress in local mitigation efforts and changes in development.

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms where information from the 2018 MJHMP is incorporated and where updated hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The 2018 capability assessments have been successfully incorporated into the Town of Tiburon General Plan to include the Public Safety Element, Land Use Element, and Housing Element and the 2023 capability assessments will also be incorporated into the General Plan and these Elements. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 Regulatory Capabilities

The legal and regulatory capabilities include existing ordinances and codes that affect the Town's physical or built environment. Examples of legal and/or regulatory capabilities can include: a jurisdiction's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans. The table below lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place.

Table 21: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan/Master Plan	Y 2020	The General Plan outlines long-term direction for development and policy. It describes hazard areas and regulates current and future development based on known hazard areas. As this plan gets updated there is potential to improve it with updated risk information and strategies.
Strategic Plan	N	The Town does not currently have a separate strategic plan.
Capital Improvements Plan	Y	The Capital Improvement Plan (CIP) directs construction activities for Town owned facilities and infrastructure for the next five years. Mitigation actions may involve construction of new or upgraded facilities and infrastructure. As this plan gets updated there is potential to improve it with updated strategies.
Economic Development Plan	N	The Town does not currently have an independent

		Economic Development Plan,
Local Emergency Operations Plan	Y 2020	The Emergency Operation Plan is a guide to operations in the event of an emergency and EOC operation. The plan follows the ICS/NIMS structure and is consistent with other plans in Marin County
Continuity of Operations Plan	Y 2020	
Flood Mitigation Plan (FMP)	N	Hazards and preparedness are address through the Local Emergency Operations Plan, which is a joint partnership with the Town of Tiburon and City of Belvedere. The purpose of this plan is to address hazard mitigation and provide community resources for preparedness.
Engineering Studies for Streams	N	However, the General Plan, Climate Action Plan, and Floor Damage Prevention Ordinance account for mitigation and preventative measures in response to flooding.
Open Space Management Plan	Y	Open Space management influences risk of landslides, wildfire, and in some cases flooding. The Town manages 250 acres of open space. Fire hazard and fuel loading is the primary concern driving management of non-native species in this pan.
Regional Transportation Plan (RTP)	Y	The Town is part of the Metropolitan Transportation Commission and Association of Bay Area Governments' Plan Bay Area 2050 to address impacts and mitigation measures for housing, the economy, transportation, and the environment.
Stormwater Management Plan/Program	Y	The Town follows guidance established through the Marin County Stormwater Pollution Prevention Program to prevent comply with all state and federal regulations and prevent stormwater pollution.
Community Wildfire Protection Plan	Y 2023	Create Tiburon 2040, the updated General Plan, establishes policy and programs to retain existing environments and protect community wildlife.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y 2021	The updated Climate Action Plan was adopted in 2021 and has established goals and programs to reduce the Town's contribution to climate change and other hazards.
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	Y	All applicable Building codes are enforced through permits and verified through field inspections.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	Yes
Fire department ISO rating:	Y	The Tiburon Fire Protection District has been evaluated and received a PPC of 1.
Site plan review requirements	Y	The Fire District reviews all substantial construction and grading project subject to building permits or Planning

		Department. Minor exterior improvements are also reviewed when deemed appropriate.
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Municipal Code	Y	The Municipal Code includes several sections that address hazard mitigation including Title IV Land Improvement and Use, Title V Public Works, and Title VI Public Health, Safety and Welfare.
Zoning ordinance (Chapter 16 of Municipal Code)	Y	The Zoning Ordinance implements the General Plan by establishing specific regulations for development. It includes standards for where development can be located, how buildings must be sized, shaped, and positioned, and what types of activities can occur in an area. Mitigation actions that pertain to new or substantially redeveloped buildings can be adopted into the Zoning Ordinance.
Subdivision ordinance	Y	The purpose of the Town's Subdivision Ordinance is to implement and supplement the requirements of the Subdivision Map Act found in California Government Code title 7, division 2 concerning the design and improvement of subdivisions and regulating other divisions of land within the town including the form and content of all maps and the procedure to be followed in securing official approval.
Floodplain ordinance	Y	The Municipal Code includes a Flood Damage Prevention chapter which seeks to promote the public health, safety and general welfare, and to minimize public and private losses to flood conditions in specific areas.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	The Municipal Code includes various chapters and ordinance to address natural hazards including: Chapter 20A: Urban Runoff Pollution Prevention Chapter 16-21.040 - Residential zones development standards.
Flood insurance rate maps	Y	Chapter 13D- Flood Damage Prevention was established to minimize the public and private losses to flood conditions. Standards for construction are included within to account for areas in various flood zones.
Elevation Certificates	Y	Elevations are required during construction of new residences and other substantial projects.
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	Y	Tiburon Municipal Code section 20A-10 (Reduction of pollutant in stormwater) establishes requirements to mitigate the amount of pollution entering the Town's storm drain systems. Compliance with this section is done by review of the Department of Public Works during the zoning and building permit process and

		construction within the public right of way and Town maintained properties.

Table 384: Town of Tiburon Legal and Regulatory Capabilities
Source: Town of Tiburon

Town of Tiburon General Plan or Master Plan

California Government Code 65300 requires that every City and County in the state have a General Plan. The Town of Tiburon General Plan, adopted in May 22, 2023, was prepared over a one year period that included an extensive public review process. The General Plan is the most important policy and planning document in the Town and is used by virtually every department. The General Plan is the Town's statement of its vision for the future. The General Plan contains policies covering every aspect of the Town: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety. The Housing, Land Use, and Safety Elements of the General Plan were updated in 2023.

Town of Tiburon specific goals and policies related to mitigation of natural hazards are as follows:

Table 22: Town of Tiburon General Plan

Goal/Policy/ Program	Explanation
Land Use Element	
Goal	GOAL LU-B: Ensure that new development is sensitive to on-site and surrounding environmental resources and hazards and can be adequately served by public infrastructure.
Policy	POLICY LU-2: INFRASTRUCTURE FOR NEW DEVELOPMENT. Assure that sewer, water, and other essential infrastructure improvements must be available to the developer to serve new development by the time of completion of construction and that anticipated traffic levels are consistent with adopted Vehicle Miles Traveled (VMT) standards. New development shall pay its fair share of essential expanded infrastructure to the maximum extent allowed by law.
Program	Program LU-e: Infrastructure Capacity. Analyze project impacts on infrastructure capacity and services as part of CEQA review and require mitigation measures as needed in consultation with provider agencies.
Conservation and Open Space Element	
Goal	GOAL S-B: Reduce greenhouse gas emissions in the community and within government operations to mitigate the effects of climate change. GOAL C-A: Preserve and improve the quality of the environment through resource restoration and conservation, management, and pollution control.
Policy	POLICY C-10 FLOOD HAZARD ZONE. Avoid construction on lands that are shown to be within the 100-year flood hazard zone as shown on the current FEMA Flood Rate Insurance Map POLICY C-22 AIR QUALITY IMPACTS TO SENSITIVE RECEPTORS: Minimize exposure of sensitive receptors to concentrations of air pollutant emissions, toxic air contaminants, and odors.
Program	Program S-b Climate Action Plan: Implement the Town's Climate Action Plan and

Table 22: Town of Tiburon General Plan	
Goal/Policy/ Program	**Explanation**
	periodically update the plan to incorporate new emission reduction targets, strategies, and best practices.
Public Safety	
Goal	GOAL SR-C : Identify hazardous areas & discourage to the maximum extent feasible development of areas subject to hazards including, but not limited to, geotechnical hazards, unstable slopes, and flood-prone areas.
Policy	POLICY SR-1 EMERGENCY PREPAREDNESS: Ensure that the Town is prepared to effectively respond to any emergency or disaster, including hazardous material releases, in cooperation with other public agencies and appropriate organizations. POLICY SR-7 HAZARD REDUCTION. Actively encourage owners of developed property to repair or improve unstable slopes, install drainage facilities, and take other measures that may reduce potential safety hazards. POLICY SR-10 FLOOD RISK REDUCTION: Reduce the risk of loss of life, personal injury, and property damage resulting from flooding by properly maintaining storm drainage systems, natural flood control channels, and waterways and regulating runoff from new construction and development projects. Encourage flood control measures that retain the natural features and conditions of watercourses to the maximum extent feasible. POLICY SR-11 SEA LEVEL RISE PROJECTIONS: Integrate flooding and sea level rise projections into policies and regulations to inform the public of the future hazard areas, assess and address potential impacts to future development, inform future planning and building requirements, plan for opportunity areas for adaptation, and inform funding and financing decisions about short- and long-term adaptation projects. POLICY SR-15 MITIGATION OF STORM DRAINAGE IMPACTS: Ensure new development mitigates storm drainage impacts and potential increases in runoff through a combination of measures, including improvement of local storm drainage facilities. POLICY SR-17 FIRE RISK REDUCTION: Reduce the risk of loss of life, personal injury, and property damage resulting from wildfire and urban fire hazards through code enforcement and coordination the local Fire Districts and other agencies to ensure the safe delivery of emergency services and the effective evacuation of the community in the event of a disaster.
Program	Program SR-a Local Hazard Mitigation Plan: Implement the adopted Local Hazard Mitigation Plan to comply with the federal Disaster Mitigation Act of 2000 and maintain eligibility for hazard mitigation funding from FEMA. Program SR-d Identify Evacuation Routes: Work with the Tiburon Fire Protection District, the Southern Marin Fire Protection District, the Marin Wildfire Prevention Authority, and the Tiburon Police Department to identify and map residential developments in hazard areas that do not have at least two emergency evacuation routes and identify mitigation measures as feasible.

Table 22: Town of Tiburon General Plan	
Goal/Policy/ Program	**Explanation**
	Program SR-f Improve Evacuation Routes. Improve local evacuation capacity by identifying evacuation routes through signage and promotion of public safety route identification applications. Assess the feasibility of adding additional evacuation routes. Program SR-g Essential Facilities. Ensure essential public facilities are accessible and operational during flooding, seismic events, fires, extreme heat events, and other emergencies. Essential public facilities include, but are not limited to, hospitals and health care facilities, emergency shelters, emergency command centers, and emergency communications facilities. Program SR-h Post-Earthquake Assessments: Conduct an immediate post-earthquake assessment of critical facilities and buildings in the Planning Area to determine the extent of damages, if any, to essential Town infrastructure. This should be performed by trained professional(s) utilizing the current state-of-knowledge regarding post- earthquake assessment. Program SR-l Landslide Mitigation Policy: Require that new development in areas subject to land sliding comply with the Town's Landslide Mitigation Policy. Require physical improvements to landslides and to potential landslide areas in instances where avoidance is not feasible or appropriate, as determined through the development review process. Program SR-n Seismic Improvement Program: Create and implement a Seismic Improvement Program for public buildings and infrastructure. The Program shall include conducting a seismic risk assessment of existing Town infrastructure, which would help to create a list which would prioritize the buildings and equipment that should be retrofitted. Following risk assessment, the Town should adopt a Program that would upgrade vulnerable facilities based on the priority list. Program SR-y Special Flood Hazard Areas: Require new development and/or construction, where feasible, to be outside Special Flood Hazard Areas, which are defined by FEMA as areas that would be inundated by a flood having a 1% chance of occurring in any given year. Construction proposed within Special Flood Hazard Areas shall comply with the Town's Flood Damage Prevention Ordinance (Municipal Code Chapter 13D). Program SR-z Protection from Wave Action: Require structures constructed adjacent to areas subject to the 100-year tidal flood to be protected from destructive wave action. Program SR-dd Stormwater Detention: Utilize on-site detention of stormwater runoff to ensure that post-development peak flow rates from a site resulting from both the two-year and 100-year design rainstorms are not increased by new subdivisions or other permitted development projects.
Public Facilities Element	
Goal	GOAL OS-B: Permanently preserve as much open space as possible to protect shorelines, open water, wetlands, significant ridgelines, streams, drainageways, riparian

Table 22: Town of Tiburon General Plan	
Goal/Policy/ Program	**Explanation**
	corridors, steep slopes, rock outcroppings, special status species and their habitat, woodlands, cultural and historic resources, and areas of visual importance, such as views of and views from open space.
Policy	POLICY OS-15 LANDSLIDE MITIGATION: Avoid site grading that is not required by the Town's Landslide Mitigation Policy to the maximum extent feasible to retain natural landforms. POLICY OS-17 MINIMIZE GRADING IMPACTS: Minimize the impact of grading on adjacent properties, water quality, and air quality.
Program	Program OS-c Environmental Assessment: Require an environmental assessment for development proposed on sites that may contain sensitive biological resources including wetlands, occurrences of special-status species and sensitive natural communities, native wildlife nurseries and nesting locations, and native wildlife movement corridors. The assessment shall be conducted by a qualified professional to determine the presence, potential presence, or absence of any sensitive resources which could be affected by proposed development, shall provide an assessment of the potential impacts, and shall define measures to avoid significant adverse impacts to the resource. The development project shall be required to implement feasible measures to avoid or, if avoidance is not feasible, reduce significant adverse impacts.

Table 385: Town of Tiburon General Plan
Source: **Town of Tiburon General Plan**

3.2.2 Administrative and Technical Capabilities

The administrative and technical capability identifies the Town personnel responsible for activities related to mitigation and loss prevention. Many positions are full time and/or filled by the same person.

Table 23: Administrative and Technical Capabilities		
Administrative	Yes/No	Is coordination effective?
Planning Commission	Y	The Planning Commission serves as the planning agency for the Town and is the review authority for a variety of applications including (but not limited to) use permits, zoning amendments, and subdivision of land.
Administrative Services	Y	Administrative Services Department handles finance and purchasing, budgeting, risk management, information technology, and business licensing for the community. The department may be responsible for implementing mitigation actions related to the department's scope.
Hazard Mitigation Planning Committee	Y	The Town participates in the Marin County Multi-Jurisdictional Hazard Mitigation Planning Committee that meets quarterly to review and manage Hazard Mitigation

		projects and programs.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Chipper Days encourage residents to clear dry brush and vegetation and dispose of at no cost. "BroomBusters" and the Green Team are local volunteer groups that help clear flammable vegetation. The Town of Tiburon has hired goats to clear dry brush (Summer 2023)
Mutual aid agreements	Y	The Tiburon Police Department and the Tiburon Fire Protection District utilizes mutual aid agreements with local agencies and jurisdictions that provide public safety personnel in times of emergency.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone, text and email notification called Alert Marin utilizing reverse 911. There are six emergency sirens on the peninsula and when sounded alert people to tune in to 840am for local emergency information.
Hazard data and information	Y	Through documents such as the Emergency Operations Plan and General Plan.
Grant writing	Y	Grant writing has primarily been completed through full time Community Development and Administrative staff.
Hazus analysis	N	The Town relies on the information and resources provided through FEMA to asses this information.
Staff/Personnel Resources	Yes/No FT/ PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Y/FT	Yes to all.
Floodplain Administrator	Y/FT	The town engineer is appointed to administer and implement this chapter. The Town may explore certifying the Floodplain Administer to enhance this capability.
Emergency Manager	N/PT	Yes
Community Planner	Y/FT	There are two full time Planners on Town Staff who process current Planning projects and applications, serve as staff liaisons to the Design Review Board, Planning Commission, and Town Council, and assist the Director of Community Development with long range Planning projects. Staff will explore additional Hazard Mitigation Training.
Civil Engineer	Y/ PT	A Civil Engineer is contracted through the Town on a part time basis in addition to the full time Public Works and Engineering staff.
GIS Coordinator	N/FT	The GIS Sytem (MarinMap) used by the Town is maintained through the County of Marin.
Community Development Staff	Y/FT	There are currently two divisions under the Community Development Department. The Building Division is

		comprised of a Building Official, Building Inspection, Permit Technician, and Permit Clerk. The Planning Division is Comprised of the Director of Community Development, two Associate Planners, and a Planning Technician.
Town Planning, Building, and Public Works Staff	Y/FT	These departments are responsible for planning and building related activities including issuing permits, conducting environmental review, preparing planning documents, and addressing housing issues. Mitigation activities related to planning and building can be implemented by this department. Public Works Department is responsible for Town-owned infrastructure, including streets, bike lanes and sidewalks, storm drains, traffic signals, and streetlights. Mitigation actions involving new or retrofitted public infrastructure, as well as those related to water conservation, fall within the purview of the Public Works Department.
Police Department Staff	Y/FT	The Tiburon Police Department conducts emergency preparedness activities for the community. Mitigation activities related to emergency preparedness can be implemented by the Police Department.
Fire Protection District Staff	Y/FT	The Tiburon Fire District protects the town of Tiburon, the Town of Belvedere, and the surrounding area. The Fire District's boundaries represent a diverse community with responsibility for commercial, residential, wildland / urban interface, and parts of the San Francisco Bay. The Fire Protection District supports implementation of mitigation actions that reduce the risk of wildfire.

Table 386: Town of Tiburon Administrative and Technical Capabilities
Source: **Town of Tiburon**

3.2.3 Fiscal Capabilities

The fiscal capability assessment shows specific financial and budgetary tools available to the jurisdictions such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 24: Fiscal Capabilities		
Financial	Yes/No	Has the funding resource been used in the past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Funding has not been used in the past for mitigation, but could possibly fund future mitigation activities.
Authority to levy taxes for	Y	Funding has not been used in the past for mitigation but

specific purposes		could possibly fund future mitigation activities.
Fees for water, sewer, gas, or electric services	Y	Water, gas, and electric utilities are managed by other agencies. Sanitary funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Impact fees for new development	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Storm water utility fee	Y	The Town does not collect a storm water utility fee, however it could be a source of revenue in the future.
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Incur debt through private activities	N	
Community Development Block Grant	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
Other federal funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.
State funding programs	Y	Funding has not been used in the past for mitigation but could possibly fund future mitigation activities.

Table 387: Town of Tiburon Fiscal Capabilities
Source: **Town of Tiburon**

3.2.4 COMMUNITY OUTREACH

The outreach and partnerships capability assessment shows outreach and public education programs available to the Town of Tiburon and the Town of Tiburon partnerships utilized to promote those programs.

Table 25: Town of Tiburon Community Outreach		
Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The Tiburon Talk newsletter gets emailed every other month and often contains articles about hazard preparedness and mitigation, including how to sign up for Get Ready classes.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	A communications team, comprised of staff from Tiburon Town Hall, Public Works, Tiburon Fire and the Tiburon Police Department meet bi-weekly and disseminate information via e-newsletter, nextdoor, all social media outlets and other public messaging methods,
Natural disaster or safety related school programs	Y	GR5 – Get Ready 5th grade, teaches disaster preparedness and includes homework that gets their

		entire household involved and prepared
StormReady certification	Y	Achieved
Firewise Communities certification	Y	Certification and oversight by the Tiburon Fire Protection District
Community Rating System	Y	As part of the update to the General Plan, a new program was added to participate in the National Flood Insurance Program and to periodically update the Community Rating System to notify residents of hazards of living in a flood-prone area.
Public-private partnership initiatives addressing disaster-related issues	Y	The Get Ready program, developed in Marin County, is a free 2-hour course provided to the community. The course is designed to help residents plan for an emergency with a family plan, evacuation checklist, and strategies to keep residents and their families safe. (https://readymarin.org/get-ready/)

Table 388: Town of Tiburon Community Outreach
Source: **Town of Tiburon**

3.2.5 Participation in the National Flood Insurance Program

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Detailed below is a description of Town of Tiburon flood management program to ensure continued compliance with the NFIP.

Town of Tiburon has participated in the Regular Phase of the NFIP since May 16, 1977. Since then, the Town of Tiburon has administered floodplain management regulations that meet or exceed the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the Town of Tiburon. The Community Rating System (CRS) was created in 1990. It is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. Town of Tiburon are not currently CRS participants.

In addition to the capabilities in the municipal code regarding floodplains, the Town of Tiburon has additional capabilities. Table 26 shows the Town of Tiburon participation in and continued compliance with the NFIP, as well as identify areas for improvement that could be potential mitigation actions.

Table 26: Town of Tiburon NFIP Status	
NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	68 policies in force in the Town of Tiburon with $105,507 in premiums and 23,362,00 in coverage.
How many claims have been paid in the community? What is the total amount of	4 claims have been paid for a total of $256,396. No claims for substantial damage.

paid claims? How many of the claims were for substantial damage?	
How many structures are exposed to flood risk within the community? *"flood risk" is defined as the 1% annual chance flood (100-year flood. Numbers are from overlay of FEMA SFHA and building stock data.	13
Describe any areas of flood risk with limited NFIP policy coverage	None
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	No
Is floodplain management an auxiliary function?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	The Town has a dedicated website with resources for properties located in the floodplain. Projects in the floodplain are evaluated for whether they meet the threshold for "substantial improvement" and compliance with Chapter 13D - Flood Damage Prevention of the Tiburon Code od Ordinance.
What are the barriers to running an effective NFIP program in the community, if any?	Cost and staffing challenges.
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues (i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	2021
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	May 16, 1977
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Exceed the NFIP by State mandated building codes and adopted higher regulatory standards. • State regulations for required disclosure of flood hazards • Current building code adoption and enforcement • Freeboard requirements for residential and non-residential development • Cumulative substantial improvement • Foundation protection requirements with required compaction reports • Positive drainage from foundation walls per building code

Provide an explanation of the permitting process.	The Town of Tiburon Code of Ordinance implements a permitting process for properties located in flood zones. The ordinance clarifies that no development is allowed in floodways, and projects considered to be "substantial improvement" in a floodplain triggers special construction standards such as floodproofing and elevation above base flood elevation. These construction standards reduce risk of damage from future flood events. Standards must be met as a condition of approval of a building permit in a floodplain.
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
What categories and activities provide CRS points and how can the class be improved?	N/A
Does the plan include CRS planning requirements	N/A

Table 389: Town of Tiburon NFIP Status
Source: FEMA, Town of Tiburon

NFIP Insurance Coverage Details

Town of Tiburon joined the NFIP on May 16, 1977. The Town of Tiburon does not participate in the Community Rating System. NFIP insurance data provided by DWR indicates that as of August 8, 2023 there were 68 policies in force in the Town of Tiburon with $105,507 in premiums, resulting in $23,362,000 of insurance in force. There have been 45 closed paid losses totaling $439,490.16. None of the claims were considered substantial damage losses. Of these losses, no parcels were in A or V zones. Of the 68 claims, 53 claims were associated with pre-FIRM structures and 15 with post-FIRM structures. There was 1 repetitive loss structure in the town. There were not any severe repetitive loss properties in the Town of Tiburon.

Repetitive Loss Structures

Repetitive Loss Residential Structures: 1
Repetitive Loss Non-Residential Structures: 0
Severe Repetitive Loss Residential Structures: 0
Severe Repetitive Loss Non-Residential Structures: 0

3.3 MITIGATION GOALS

44 CFR Requirement § 201.6(c)(3)(i) [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long - term vulnerabilities to the identified hazards.

The information developed from the risk assessment was used as the primary basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention.

Hazard Risk Prioritization
↓
Mitigation Goals & Objectives
↓
Mitigation Project Identification
↓
Mitigation Project Implementation

Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

The following represents overarching strategic goals associated with the identification and eventual implementation of appropriate and meaningful hazard mitigation efforts in relation to prioritized hazards and threats confronting Marin County. These goals form the basis for specific supporting process objectives and are shown from the highest priority, at the top of the list, to those of lesser importance.

The establishment of hazard mitigation goals represents both individual and collective strategies that have been mutually agreed upon by the Steering Committee and have changed with the 2023 MJHMP update. Objectives were added to Goals 2 and 5. Eventually, these goals have been adopted by Marin County and its participating jurisdictions as the guiding policy behind local hazard mitigation efforts, in conjunction with other associated principles.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives

and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Goal 1: Minimize risk and vulnerability of the community to the impacts of natural hazards and protect lives and reduce damages and losses to property, economy, and environment in Marin County.

- Minimize economic and resource impacts and promote long-term viability and sustainability of resources throughout Marin County.
- Minimize impact to both existing and future development.
- Provide protection for public health.
- Prevent and reduce wildfire risk and related losses.

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Incorporate defensible space and reduce hazard vulnerability.
- Develop redundancies in utilities and services.
- Enhance resilience through enhanced construction.

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities.

- Enhance public outreach and participation in the Alert Marin Emergency Notification System.
- Enhance public outreach, education, and preparedness program to include all hazards of concern.
- Increase public knowledge about the risk and vulnerability to identified hazards and their recommended responses to disaster events, including evacuation and sheltering options.
- Provide planning and coordination for "At-Risk" populations.
- Provide planning and coordination for companion animals, livestock, and other animal populations.
- Increase community awareness and participation in hazard mitigation projects and activities.

Goal 4: Increase communities' capabilities to be prepared for, respond to, and recover from a disaster event.

- Improve interagency (local, state, federal) emergency coordination, planning, training, and communication to ensure effective community preparedness, response and recovery.
- Enhance collaboration and coordination of disaster-related plans, exercises, and training with local, state, and federal agencies, neighboring communities, private partners, and volunteers.
- Enhance the use of shared resources/Develop a strong mutual aid support system.
- Create and maintain a fully functional, interoperable radio and communication system with all regional public safety partners.

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Review hazard events and ongoing hazard mitigation projects annually.
- Assess the need to pursue or adjust hazard mitigation projects after significant hazard events.

Goal 6: Reduce exposure to High Hazard Dams that pose an unacceptable risk to the public.

- Improve alert and warning systems to provide residents downstream of a High Hazard Dam to receive timely warning to evacuation when threatened by potential or imminent dam failure.
- Enhance overall community preparedness to respond and evacuate a potential or imminent dam failure.
- Increase public awareness of the risk posed by High Hazard Dams and the potential for relocation of housing outside a possible inundation zone.
- Prioritize High Hazard Dam Mitigation projects and programs.

3.4 Status of Previous Mitigation Actions

Table 27 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 27: Status of Previous Hazard Mitigation Actions

Action Number / Name	Completed	Ongoing	Not Started	Included in Updated Action Plan
Also as part of the Capital Improvement Program, the Town will implement a foundation repair to a section of Paradise Drive in order to shore up the embankment by constructing a "soil nail" wall. This would help stabilize the exposed earthen bank that holds up Paradise Dr. just past the Caprice restaurant, which street segment could be susceptible to landslide as a result of earthquakes or storms.			X	X
The Town will continue to research the possibility of construction of a new LEED certified Public Works Corp Yard, as this is the Town's primary critical facility in need of repair/updating. Seismic retrofit work would be done simultaneously in order to ensure this critical facility could withstand the next major earthquake in the Bay Area. This project is largely dependent on funding.		X		X
In order to assist with the prevention of wildfires, the Town will work with Conservation Corps North Bay to obtain a matching Cal Fire Grant in order to implement the fire related items within the Town's Open Space Management Plan. The Town's Public Works Department will also begin working on a "zone approach" to remedy the highest priority areas in the open space to clear out invasive species and heavy brush. In addition, the Town will begin implementation of a program designed for residents living adjacent to open space, which outlines the guidelines for mowing grasses and vegetation clearing on open space lands.		X		X
Continue to facilitate the distribution of emergency preparedness materials and trainings through the Tiburon Office of Emergency Services		X		X

Table 27: Status of Previous Hazard Mitigation Actions				
Action Number / Name	**Completed**	**Ongoing**	**Not Started**	**Included in Updated Action Plan**
Continue to facilitate the distribution of emergency preparedness materials and trainings through the Tiburon Office of Emergency Services				
Conduct periodic tests of the emergency sirens and BEARS emergency warning systems		X		X
Continue to maintain the emergency operations center		X		X
Address coastal erosion along Main Street seawall		X		X
Use existing hydraulic analysis to design and implement improvements to Beach Road area drainage.			X	X
Culvert repair/replacement on San Rafael Ave at Lagoon where flooding occurred. (Belvedere-Tiburon joint project)			X	X

Table 390: Status of Previous Hazard Mitigation Actions
Source: Town of Tiburon

3.5 HAZARD MITIGATION ACTIONS

The 2023 Marin County MJHMP and Town of Tiburon Annex were revised to reflect progress in local mitigation efforts. Mitigation projects were selected for each hazard and for the Town of Tiburon based off the hazard risk assessment. The projects are supported by the mitigation goals and objectives, and are ranked using the following criteria; approximate cost, timeframe of completion, whether the project requires Town Council regulatory action, and an assumption as to whether or not the project would be subject to CEQA or NEPA requirements. Funding sources are identified for all projects. All projects consider new, future, and existing development. Project worksheets are used by the Planning Team and Marin County and Town of Tiburon Steering Committee to describe criteria for each project.

Based on the hazard profiles, threat assessment, capabilities assessment, community survey results, discussions among the Planning Team members, and existing best practices, a set of potential mitigation actions was developed and then evaluated based on the following criteria:

- FEMA requires local governments to evaluate the monetary and non-monetary costs and benefits of potential mitigation actions. Although local governments are not required to assign specific dollar values to each action, they should identify the general size of costs and benefits.
- The Planning Team may elect to include measures with a high cost or low benefits, but such measures should be clearly beneficial to the community and an appropriate use of local resources.

In addition, FEMA directs local governments to consider the following questions as part of the financial analysis:

- What is the frequency and severity of the hazard type to be addressed by the action, and how vulnerable is the community to this hazard?
- What impacts of the hazard will the action reduce or avoid?
- What benefits will the action provide to the community?

The Planning Team also chose to review and revise the potential hazard mitigation actions with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

As part of the mitigation actions development and review, the Planning Team also prioritized the actions. The prioritization efforts looked at the risks and threats from each hazard; lifesaving, life safety, property protection and lastly environmental protection; financial costs and benefits; technical feasibility; consideration for climate impact, and social vulnerability, and community values. Planning Team members were asked to identify their priority actions using the following criteria.

Implementation priority ratings were assigned as follows:

- **High Priority** - An action that meets multiple objectives, is linked to a high risk hazard, has benefits that exceed costs, and has a potential source of funding. Action can begin within the short term (1 to 5 years).
- **Medium Priority** - An action that meets multiple objectives, is linked to a high or medium risk hazard, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can begin within the short term (1 to 5 years) once funding is secured.
- **Low Priority** - An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions may be eligible for grant funding from programs that have not yet been identified.

Table 28 lists the Current Hazard Mitigation Actions for the Town of Tiburon.

Table 28: Town of Tiburon Current Hazard Mitigation Actions							
No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
T-1	Get Ready 94920 Disaster Preparedness Program	All Hazards/ 1, 2, 3, 4, 5	Town of Tiburon and Tiburon Office of Emergency Services	Existing	Cost: $4,600 per year, General Fund, BRIC, MHGP, FMA, CDAA Grants.	Ongoing, Very High	Program to educate residents how to protect themselves for disaster, including earthquakes, wildfires, storms, and power outages. Outreach is done through public meetings and individual training with residents.
T-2	Encourage participation in Alert Marin and other community alert & warning systems to ensure the public is aware of any potential emergencies.	All Hazards/ 1, 2, 3, 4, 5	Town of Tiburon and Tiburon Office of Emergency Services	Existing	Cost: TBD General Funds, BRIC, MHGP, FMA, CDAA Grants.	Ongoing, High	
T-3	Emergency Operations Center (EOC)	All Hazards/ 1, 2, 4, 5	Tiburon Office of Emergency Services	Existing	Cost: TBD General Fund, BRIC, MHGP, FMA, CDAA Grants.	Ongoing, Very High	Continue to maintain the Emergency Operations Center
T-4	Climate Action Plan	All Hazards/ 1, 2, 4, 5	Town of Tiburon	Existing	Cost TBD General Funds	Present To 2030, High	Establish programs and policies to mitigate climate change, including sea level rise and flooding.
T-5	Review and adopt current California Building and Fire codes	All Hazards/ 1, 2, 4, 5	Town of Tiburon, Tiburon Fire Protection District	Existing	Cost: TBD General Funds	1 – 3 years/ High	The Town continues to review and adopt current California Building and Fire codes.
T-6	Review and adopt current California Building codes for seismic, flood, fire and other disaster.	All Hazards/ 1, 2, 4, 5	Town of Tiburon	Existing	Cost: TBD General Funds	1 – 3 years/ High	The Town continues to review and adopt current California Building and Fire codes.
T-7	Open Space Management	All Hazards/ 1, 2, 4, 5	Town of Tiburon Public Works	Existing	Cost: $925,000, Capital Improvement Projects	2023-28, Medium	The plan sets forth priorities for managing approximately 250 acres of open space among 21 parcels. The primary emphasis of the pro-

Table 28: Town of Tiburon Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
							gram is the management of vegetation.
T-8	Assess Vulnerability to Landslides and Land Subsidence	Debris Flow, Land Subsidence/ 1, 2, 4, 5	Town of Tiburon	Existing	Cost: TBD General Funds	Ongoing/ Low	Review landslides and Land subsidence to date and geological data to determine areas at risk of future landslides or land subsidence.
T-9	Elevate or Retrofit Structures and Utilities	Debris Flow, Flooding/ 1,2, 4, 5	Town of Tiburon	Existing	Cost: TBD BRIC, MHGP, FMA, CDAA grants or privately funded	Ongoing/ High	Recommend and support property owners in raising their homes out of the flood zone.
T-10	Increase Awareness of Sea Level Rise	Sea Level Rise/ 1, 2, 3, 4, 5	Town of Tiburon	New (2023)	Cost: TBD General Funds	1-3 Years/ High	Updated Climate Action Plan and General Plan to provide information, policies, and programs related to sea level rise
T-11	Storm Drain Maintenance & Rehabilitation	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Town of Tiburon Public Works	Existing	Cost: $2,004,171, Capital Improvement Projects	2023-28, High	Design complete, (2) projects planned for FY23-24, storm drain lining and Railroad Marsh maintenance.
T-12	Main Street Seawall Repairs	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Town of Tiburon Public Works	Existing	Cost: $250,000, Capital Improvement Projects	2023-24, High	The design phase is underway. Construction to occur in FY23-24.
T-13	ORT Culvert Rehabilitation	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Town of Tiburon Public Works	New (2023)	Cost: $155,000, Capital Improvement Projects	2023-24, Medium	
T-14	Beach Road Drainage Improvements	Flooding, Sea Level Rise, Tsunami/	Town of Tiburon Public Works	New (2023)	Cost: $710,000, Capital Improvement Projects	2023-25, High	

Table 28: Town of Tiburon Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
		1, 2, 4, 5					
T-15	Main Street Sea Level Rise	Flooding, Sea Level Rise, Tsunami/ 1, 2, 4, 5	Town of Tiburon Public Works	New (2023)	Cost: TBD Capital Improvement Projects	Ongoing, High	
T-16	Fire Road Maintenance	Wildfire/ 1, 2, 4, 5	Town of Tiburon Public Works	Existing	Cost: $100,000, Capital Improvement Projects	2023-2024, Medium	
T-17	Vegetation Management Plans (VMP) for development in the Wildland-Urban Interface (WUI) areas.	Wildfire/ 2, 4, 5,	Town of Tiburon, Tiburon Fire Protection District	Existing	Cost: TBD General Funds	Ongoing, Very High	Reduces the chance of a wildland fire igniting the structure(s). Supports environmental restoration.
T-18	Follow MMWD and State guidelines on water conservation during droughts	Drought 1, 2, 3, 4, 5	Town of Tiburon	Existing	Cost: TBD General Funds	Ongoing/ Low	Follow MMWD and State guidelines on water conservation during droughts
T-19	Enhance Community facilities to support the socially vulnerable population during extreme weather events.	Severe Weather - Heat 1, 2, 4, 5	Town of Tiburon, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, CDAA, Private Local Grants	1 - 2 years/ High	
T-20	Vegetation Management around at risk PG&E power lines and electrical line undergrounding projects by PG&E.	Wildfire, Drought, Severe Weather – Heat & Wind 1, 2, 4, 5,	Town of Tiburon, Marin County, Fire Districts	New (2023)	Cost TBD: HMGP, BRIC, Fire Safe Marin, Private Local Grants	1 - 2 years/ High	Town properties with high amounts of dry, brushy, and other wind driven fire prone vegetation to have work done to remove this material.
T-21	Earthquake natural gas valves are required in new construction or during substantial remodel work.	Earthquake/ 1, 2, 4, 5	Town of Tiburon	New (2023)	Cost: TBD HMGP, BRIC, CDAA	2 -5 Years/ High	
T-22	Increase height and retrofit existing levees in town	Levee Failure/ 1, 2, 4, 5	Town of Tiburon Public Works	New (2023)	Cost: TBD HMGP, FMA, BRIC, CDAA Grants	5-20 Years/ High	Increase height and retrofit existing levees in town

Table 391: Town of Tiburon Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Town of Tiburon. Based on the planning meetings and the progress monitored by the steering committee members several mitigation actions were accomplished since the last planning cycle. Table 27 provides a brief description of the progress made in the local mitigation efforts and the plan for those mitigation actions that were not completed or are ongoing.

The planning team for the Town of Tiburon identified and prioritized the mitigation actions as detailed in Table 28, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

For hazard mitigation planning, "integration" means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning, capital facilities planning, emergency management, hazard specific planning, and that relevant information from those sources is also used in hazard mitigation. This section identifies where such integration is already in place from the 2018 MJHMP, and where the 2023 MJHMP will be used for further integration.

The planning team for the Town of Tiburon will maintain this plan and will serve as a lead staff for grant project applications on Town projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Town of Tiburon will use existing plans and/or programs to implement hazard mitigation actions. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Town of Tiburon already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

Town General Plan - Integrates hazard mitigation through the consideration of hazards most likely to impact the Town. These hazards are considered in the Safety Element, Housing Element and Open Space Element.

Town Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Town's planned response to hazards most likely to impact the Town.

County, City and Town Ordinances - Integrates hazard mitigation through the consideration of plans and policies outlined in the capability assessments in the jurisdictional annexes.

Flood/Storm Water Management/Master Plans - Integrates hazard mitigation through the consideration of strategies to reduce flood risk and storm water management for the protection of life and property.

Community Wildfire Protection Plan - Integrates hazard mitigation through the consideration of strategies to reduce fire hazard and the risk of catastrophic wildfires in the WUI, while promoting the protection and enhancement of the county's economic assets and ecological resources.

The successful implementation of this mitigation strategy will require review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community. A few examples of incorporation of the MJHMP into existing planning mechanisms include:

34. As recommended by Assembly Bill 2140, each community should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plans. Evidence of adoption (by formal, certified resolution) shall be provided to CalOES and FEMA
35. Integration of flood actions identified in this mitigation strategy with the actions and implementation priorities established in existing Flood Management Programs
36. Using the risk assessment information to update the hazards section in the County, City and Town Emergency Operations Plans

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

3.8 FUTURE DEVELOPMENT TRENDS

The Town of Tiburon is located in Marin County, approximately eight miles north of the Golden Gate Bridge. Incorporated in 1916, the Town of Tiburon encompasses approximately 4.5 square miles in total. However, 1.25 square miles of this area is submerged under bay waters and 0.67 square mile is protected marshland, leaving a net land area of 2.55 square miles. Parks, open space, and flood control areas comprise 0.38 square mile of this net land area. Highway 101, the main freeway connecting San Francisco with the Marin communities and Sonoma County, bisects Corte Madera. The Town's most significant growth period was from 1940 to 1970 when the community's population increased from 1,098 to 8,464. The Town currently has a population of 10,029 according to the California Department of Finance.

Housing affordability in Marin County and in the Bay Area has become an increasingly important issue. Tiburon's housing conditions are reflective of many area-wide and even nation-wide trends. Over the past several decades, housing costs have skyrocketed out of proportion to many people's ability to pay, with increasing construction and land costs contributing to the rise in housing prices. In the Bay Area, the high demand for housing pushes prices even higher. This mismatch in household incomes and housing costs has several implications: it becomes more difficult for employers to recruit and retain employees; new residents are pushed farther away from job centers where home prices are less expensive, leading to long traveling distances to work, higher greenhouse gas emissions from vehicles, and increasingly clogged highways; and many young families, longtime residents, their children, and other community members without high incomes relocate because they can no longer afford to live in the community.

The Town recognizes that it occupies the ancestral home of the Coast Miwok indigenous people. The Coast Miwok were displaced during Spanish colonization and the rise of missionaries, and were further excluded from their land during Mexican occupation and the ranching era. Today, there are few Native American people living in Tiburon and Marin County.

Historical lending and zoning practices, including redlining and exclusionary covenants, have resulted in segregated living patterns in Marin and racially disparate housing outcomes. People of color have not benefited from the generational transfer of home equity and homes themselves, as some white people have, and rapidly escalating housing costs in more recent decades have made it extremely difficult for people of color to get a foothold in the housing market. Anti-development sentiment throughout Marin County has also restricted new housing development, helping maintain patterns of segregation. As a result, Marin is one of the most segregated counties in the Bay Area, with five of the ten most segregated Census tracts in the region. Providing more housing and a variety of housing types at different affordability levels will help to diversify the Corte Madera community and result in more balanced and integrated living patterns throughout the Bay Area. It will also bring fresh perspectives, lived experiences, skills, and expertise to Tiburon, ensuring that the community is well equipped to face future challenges and opportunities.

As detailed in the "Climate Change and Future Development Considerations" section of each hazard profile, development in Tiburon has occurred and will continue to occur throughout the town in areas prone to all of its identified hazards. Increased growth in these areas may increase the vulnerability of people and structures to these hazards.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Town of Tiburon.

4.1 PLAN ADOPTION

Upon submission to the California Office of Emergency Services (CalOES) for review, and subsequent approval by the Federal Emergency Management Agency (FEMA), the Marin County MJHMP will be presented to local government for formal adoption. As appropriate, the adopted plan and accompanying Town of Tiburon Community Profile will then be incorporated into local general plans for integration into organizational policy.

4.2 PLAN MONITORING

The process of hazard mitigation does not end with the completion, approval, and adoption of the Marin County OA MJHMP. During the five-year lifespan the Marin County and Town of Tiburon plan, the County, cities, towns and special districts, along with community-based organizations will ensure that the mitigation goals and strategies identified are exercised and monitored under a collaborative and cooperative umbrella, and that the document itself is properly maintained.

The Marin County Office of Emergency Management, as lead coordinating agency for hazard mitigation planning within the Marin County OA, leads the Marin Operational Area Hazard Mitigation Working Group that meets quarterly to review and manage the plan, projects, and programs. The Town of Tiburon is a participating member of the Marin Operational Area Hazard Mitigation Working Group. The Town of Tiburon Public Works Director will monitor and update the Town of Tiburon Annex to the Marin County OA MJHMP.

The review will identify changing community priorities, updated or new planning documents and the progress or status of the mitigation actions as detailed in the mitigation strategy. Additional questions to complete the review will be considered as follows:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in the local, state, and federal policy?
- Status updates on all mitigation actions?
- Have the hazards or risks changed?
- Are current resources appropriate for implementing the MJHMP?
- Have the outcomes occurred as expected?
- Is the County and jurisdictions or districts participating in the plan implementation process as expected?

The Working Group is a subgroup of the Marin Disaster and Citizens Corps Council. During the five-year update cycle, the Marin Operational Area Hazard Mitigation Working Group will have quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. Further, Marin OEM will host an annual one-day mitigation summit to increase engagement and enhance collaboration on the plan and projects. The summit will also have the

goal to educate stakeholders on innovative approaches to mitigation, trends, and new plan requirements. Marin OEM, as the host, will seek subject matter experts, state and federal officials, and representatives from within the Marin OA to speak to mitigation and planning. The knowledge gathered and the coordination facilitated during the summit will be used to update the base plan and annexes.

Marin OEM has the capacity to lead the Working Group and Multi-Jurisdictional Planning with one coordinator assigned with direct maintenance of the plan, a department analyst assigned to support the coordinator with project and grant tracking, and a community preparedness coordinator assigned with conducting regular public outreach on the plan and education on mitigation. Community feedback and integration will continue through outreach events and OEM website, where residents and visitors are invited to provide feedback through a survey, available in English or Spanish.

Specific plan maintenance activities by the Marin County Office of Emergency Management and its participating jurisdictions/special districts may include:

- Hold quarterly update meetings with the Hazard Mitigation Planning Committee and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions.
- Annual Hazard Mitigation Summit
- Holding public meetings after the first quarter and third quarter update meetings.
- Maintaining the Marin County OEM Hazard Mitigation Website, which provides the public with the ability to access identified hazard impact maps, location address search capability, and a listing of hazard mitigation actions.
- Monitoring of the Marin County and all participating jurisdiction mitigation project activities and dissemination of status reports.
- Generation of reports relative to plan status, project management, and revision updates to executive leadership.
  Preparations for the plan's future revision and updating.

4.3 Plan Evaluation

Upon approval and adoption by the Town of Tiburon, the prioritized mitigation strategies will be further developed for funding and implementation by the lead agencies. The plan describes the potential sources of hazard mitigation funding, and general procedures to obtain that funding.

The mitigation strategies represented and adopted within this plan are recommendations only and must be approved and funded in order to be implemented as official mitigation solutions. Ultimately, it is the responsibility of jurisdictional and agency officials within the Marin County to undertake project implementation based upon identified mitigation strategies, funding availability, and local need when it arises. The Marin County Office of Emergency Management will meet with the Marin Operational Area Hazard Mitigation Working Group, including the Town of Tiburon, to evaluate the plan after each update meeting.

4.4 Plan Update

The Town of Tiburon Public Works Director will monitor and update the Town of Tiburon Annex to the Marin County OA MJHMP. During the five-year update cycle, the Town of Tiburon and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County

Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

Figures

Figure 1: Marin County OEM MJHMP Website 15-18
Figure 2: Marin County OEM MJHMP Public Town Hall Meeting 15-19
Figure 3: Hazard Mitigation Plan Public Outreach Press Release 15-20
Figure 4: Hazard Mitigation Plan Survey 15-21
Figure 5: Map of Town of Tiburon in Marin County 15-24
Figure 6: Map of the Town of Tiburon 15-25
Figure 7: The Town of Tiburon Precipitation and Monthly Temperatures 15-27
Figure 8: Races in Tiburon 15-28
Figure 9: Town of Tiburon Land Use Map 15-30
Figure 10: Town of Tiburon Social Vulnerability Map Census Tract 1212.00 15-33
Figure 11: Town of Tiburon Social Vulnerability Map Census Tract 1241.00 15-34
Figure 12: Town of Tiburon Critical Facilities 15-38
Figure 13: Town of Tiburon Risk Assessment – Planning Team Top Hazards 15-40
Figure 14: Hazard Risk Categorization 15-40
Figure 15: NASA Global Temperature Change CO2 Gas 15-44
Figure 16: NASA Global Temperature Change 1884 to 2022 15-44
Figure 17: NASA Global Temperature Change Sea Level 15-45
Figure 18: Annual Mean Sea Level Trends 15-47
Figure 19: Landslide Susceptibility Classes 15-52
Figure 20: Mud Flow Areas 15-53
Figure 21: Town of Tiburon Debris Flow Critical Facilities and Infrastructure 15-54
Figure 22: Landslide in Vistazio West (Tiburon) - February 2019 15-55
Figure 23: Modified Mercalli Intensity Scale 15-58
Figure 24: Mercalli Scale vs. Magnitude 15-58
Figure 25: Soil Types 15-59
Figure 26: Marin County Earthquake Impact and Fault Lines 15-61
Figure 27: Town of Tiburon Earthquake Critical Facilities and Infrastructure 15-62
Figure 28: Diagram of an Atmospheric River Event 15-65
Figure 29: Town of Tiburon Flooding Critical Facilities and Infrastructure 15-67
Figure 30: Town of Tiburon Flooding – January 5, 2023 15-70
Figure 31: Dissolution Sinkhole Formation 15-72
Figure 32: Cover-Subsidence Sinkhole Formation 15-72
Figure 33: Cover-Collapse Sinkhole Formation 15-73
Figure 34: Levee Failure Mechanisms 15-74
Figure 35: Town of Tiburon Levee Failure Critical Facilities and Infrastructure 15-76
Figure 36: Town of Tiburon Sea Level Rise 15-80
Figure 37: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100 15-81
Figure 38: Heat Index 15-82
Figure 39: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100 15-83
Figure 40: Beaufort Wind Scale 15-84
Figure 41: Enhanced Fujita Scale 15-85
Figure 42: Waterspout Formation 15-85
Figure 43: Town of Tiburon Tsunami Critical Facilities and Infrastructure 15-87

Figure 44: Town of Tiburon Tsunami Impacts – January 16, 2022 15-88
Figure 45: Federal, State and Local Responsibility Areas in the Marin County OA 15-90
Figure 46: Fuel Model Map for the Marin County OA 15-94
Figure 47: Town of Tiburon Wildfire Critical Facilities and Infrastructure 15-98
Figure 48: Trends in the Annual Number of Large Wildfires in the United States 15-99

List of Tables

Table 1: Local Hazard Mitigation Planning Team Members 15-8
Table 2: 2023 MJHMP Planning Team Members 15-12
Table 3: Town of Tiburon & Marin County MJHMP Planning Meetings 15-16
Table 4: Town of Tiburon Estimated Jurisdictional Population 15-27
Table 5: Population Change of The Town of Tiburon 15-27
Table 6: Languages Spoken in Tiburon 15-28
Table 7: Marin County Jurisdictional Housing Stock 15-29
Table 8: NRI Hazards and Marin County MJHMP Hazards 15-31
Table 9: NRI Hazard Type Risk Index for Tiburon Census Tract 1212.00 15-32
Table 10: NRI Hazard Type Risk Index for Tiburon Census Tract 1241.00 15-33
Table 11: Household Income for The Town of Tiburon as of 2021 15-35
Table 12: Town of Tiburon Civilian Employed Population 16 years+ by Industry 15-36
Table 13: Town of Tiburon Critical Facilities 15-37
Table 14: Historic Sites in Tiburon 15-39
Table 15: Select Hazards Magnitude/ Severity Scale or Index 15-41
Table 16: Town of Tiburon Hazard Risk Assessment 15-49
Table 17: Hazard Risk Assessment 15-50
Table 18: Residential Structures in The Town of Tiburon by Flood Zone 15-69
Table 19: Town of Tiburon Critical Facilities in the Flood Zones 15-70
Table 20: Town of Tiburon Future Growth Areas 15-102
Table 21: Town of Tiburon Legal and Regulatory Capabilities 15-106
Table 22: Town of Tiburon General Plan 15-109
Table 23: Town of Tiburon Administrative and Technical Capabilities 15-111
Table 24: Town of Tiburon Fiscal Capabilities 15-112
Table 25: Town of Tiburon Community Outreach 15-113
Table 26: Town of Tiburon NFIP Status 15-115
Table 27: Status of Previous Hazard Mitigation Actions 15-119
Table 28: Town of Tiburon Current Hazard Mitigation Actions 15-123

ACRONYMS/ABBREVIATIONS

Acronym	Definition
ABAG	Association Bay Area of Governments
ADU	Accessory Dwelling Units
AQI	Air Quality Index
ARP	Address Resolution Protocol
ASL	American Sign Language
ATSDR	Agency for Toxic Substances and Disease Registry
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
BCEGS	Building Code Effectiveness Grading Schedule
BCPUD	Bolinas Community Public Utility District
BFE	Base Flood Elevation
BRIC	Building Resilient Infrastructure and Communities
CA	California
CAC	Community Assistance Contact
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CAP	Climate Action Plan
CASPER	Community Assessment for Public Health Emergency Response - California Department of Public Health
CAV	Community Assistance Visit
CDAA	California Disaster Assistance Act
CDC	Centers for Disease Control and Prevention
CDI	Certified Deaf Interpreter
CEQA	California Environmental Quality Act
CERT	Community Emergency Response Team
CGS	California Geological Survey
CIP	Capital Improvement Plan
CIR	Conservation Incentive Rate
CITR	Conservation Incentive Tier Rate
CMFD	Central Marin Fire District
CMSA	Central Marin Sanitation Agency
CNRA	California Natural Resource Agency

CO	Carbon Monoxide
COVID-19	Coronavirus Disease 2019
COYL	Coyote Creek Left Bank Levee
CPUC	California Public Utilities Commission
CRF	Community Risk Factor
CRI	Community Resilience Index
CRS	Community Rating System
CRT	Community Response Team
CSA	County Service Area
C-SMART	Sea-level Marin Adaption Response Team
CWPP	Community Wildfire Protection Plan
DDoS	Distributed Denial of Service
DMA	Disaster Mitigation Act
DNS	Domain Name System
DOF	California Department of Finance
DoS	Denial-of-Service
DPW	Department of Public Works
DR	Disaster Relief
DSOD	Division of Safety of Dams - California Department of Water Resources
DWR	California Department of Water Resources
EAL	Expected Annual Loss
EAS	Emergency Alert System
ECC	Emergency Command Center
EOC	Emergency Operation Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPC	Emergency Preparedness Commission
ESHA	Environmentally Sensitive Habitat Areas
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHSV	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FMP	Flood Mitigation Plan

FOG	Fats, Oils, & Grease
FPA	Floodplain Administrator
FRA	Federal Responsibility Areas
FY	Fiscal Year
GGBHTD	Golden Gate Bridge, Highway and Transportation District
GGNRA	Golden Gate National Recreation Area
GGNRA	Golden Gate National Recreation Area
GIS	Geographic Information System
Gov	Government
GPAC	General Plan Advisory Committee
H2S	Hydrogen Sulfide
HFHSZ	High Fire Severity Zone
HIRA	Hazard Identification and Risk Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HLR	Historic Loss Ratio
HMGP	Hazard Mitigation Grant Program
IoT	Internet of Things
IP	Intellectual Property
IPAWS	Integrated Public Alert and Warning System
IPCC	Intergovernmental Panel on Climate Change
ISEPA	Identified Site Emergency Planning Application
JPA	Joint Powers Agreement
LCP	Local Coastal Program
LGVSD	Las Gallinas Valley Sanitary District
LHMP	Local Hazard Mitigation Plan
LOMA	Letters of Map Amendment
LOMR	Letters of Map Revision
LRA	Local Responsibility Areas
LRAD	Long-Range Acoustic Device
LSAC	Levee Safety Action Classification
Marin IJ	Marin Independent Journal
MCEP	Marin Climate Energy Partnership
MCFD	Marin County Fire Department
MCOSD	Marin County Open Space District

MCPIO	Marin County Public Information Officers
MCSTOPP	Marin County Stormwater Pollution Prevention Program
MERA	Marin Emergency Radio Authority
MERS	Middle Eastern Respiratory Syndrome
MFHSZ	Moderate Fire Severity Zone
MG	Million Gallons
MGD	Million Gallons Per Day
MHOAC	Medical/Health Operational Area Coordinator
MHW	Mean High Water
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MMRC	Marin Medical Reserve Corps
MMWD	Marin Municipal Water District
MRZ	Mineral Resource Zones
MV2040	Mill Valley General Plan 2040
Mw Scale	Moment Magnitude Scale
MWPA	Marin Wildfire Prevention Authority
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NIH	National Institute for Health
NMWD	North Marin Water District
NPDES	National Pollutant Discharge Elimination System
NPR	Northwestern Pacific Railroad
NR	National Register of Historic Places
NRI	National Risk Index
NWS	National Weather Service
O3	Ozone
OA	Operational Area
OEM	Office of Emergency Management
OHP	Office of Historic Preservation

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

UCERF3	Uniform California Earthquake Rupture Forecast, Version 3
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VHFHSV	Very High Fire Severity Zone
VMP	Vegetation Management Plans
WC/ATWC	West Coast/Alaska Tsunami Warning Center
WHO	World Health Organization
WSCP	Water Shortage Contingency Plan
WUI	Wildland Urban Interface
WWTP	Waste Water Treatment Plant
XSS	Cross-Site Scripting