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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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

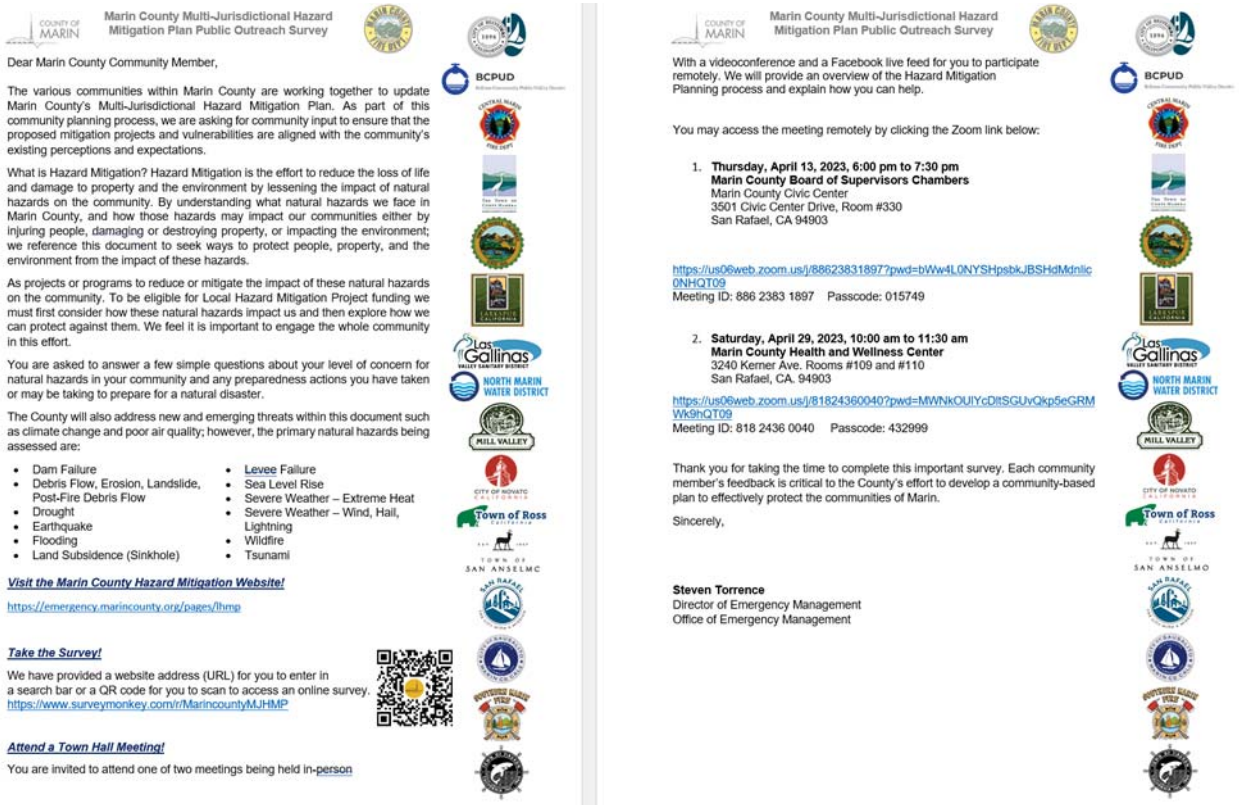
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete 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.

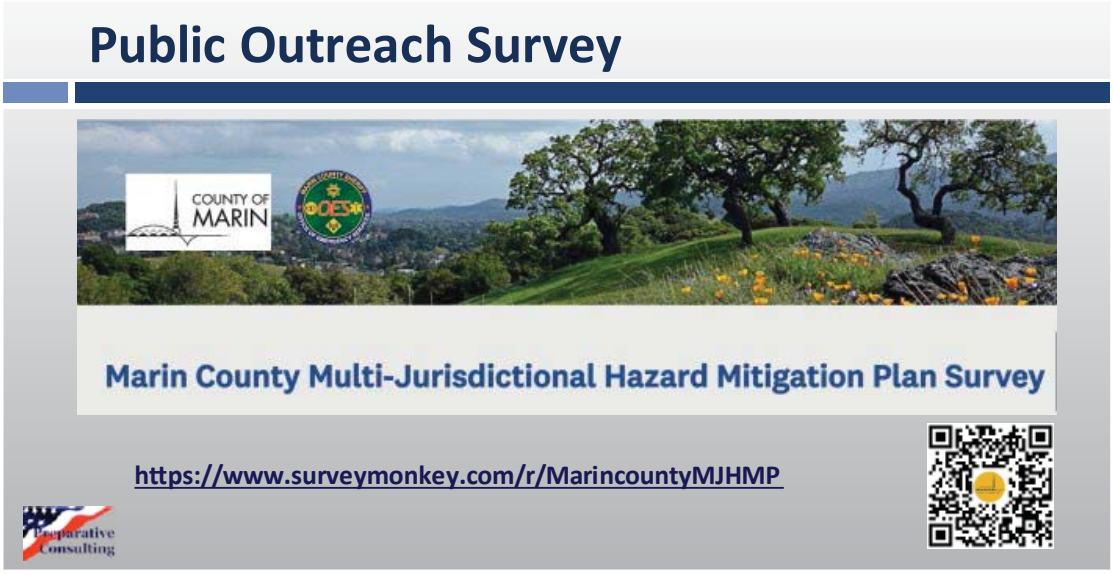


Figure 246: Hazard Mitigation Plan Survey

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.

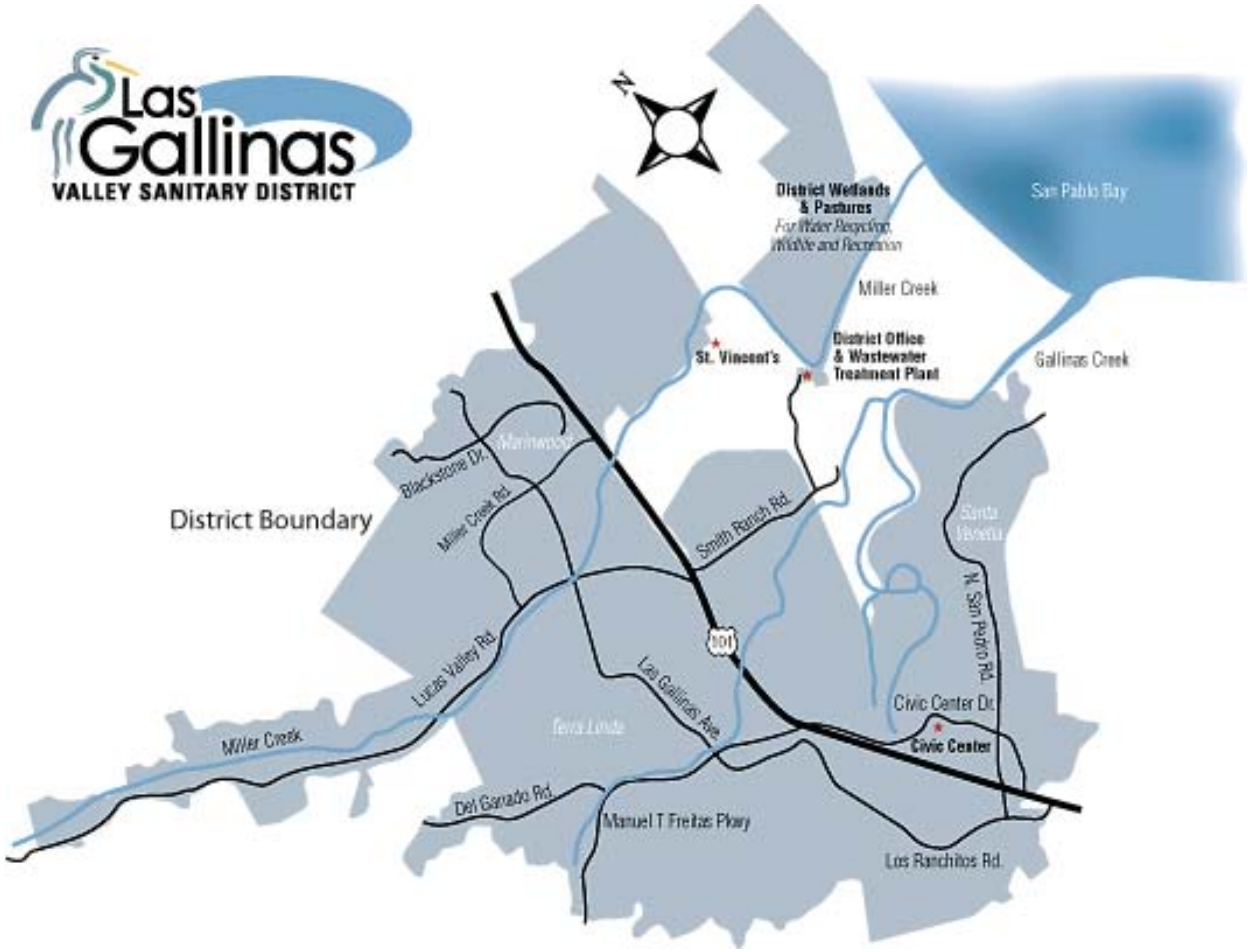


Figure 247: Map of the Las Gallinas Valley Sanitary District
Source: Marin County OEM

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.

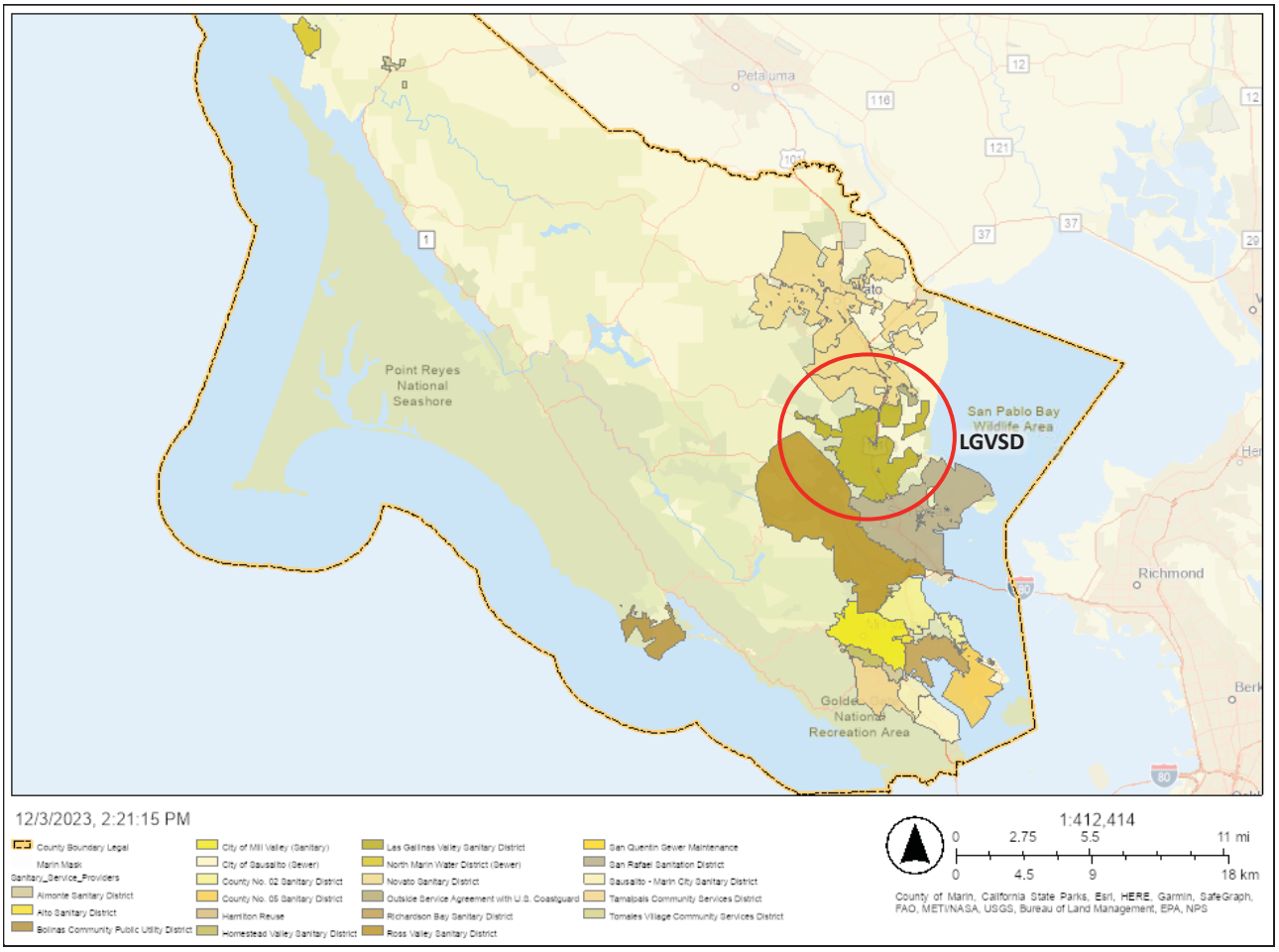


Figure 248: Map of the Las Gallinas Valley Sanitary District and Other Sanitary Districts
Source: Marin County OEM

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

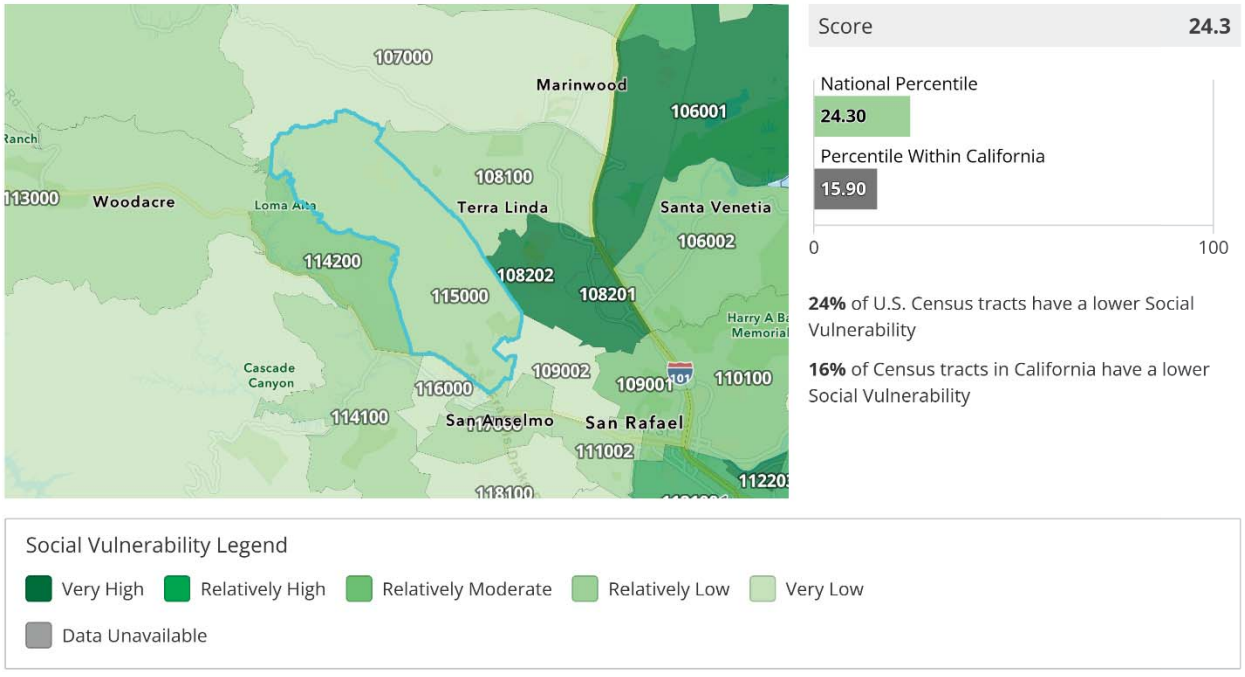


Figure 250: LGVSD Social Vulnerability Map Census Tract 1150.00
Source: FEMA National Risk Index 2023

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

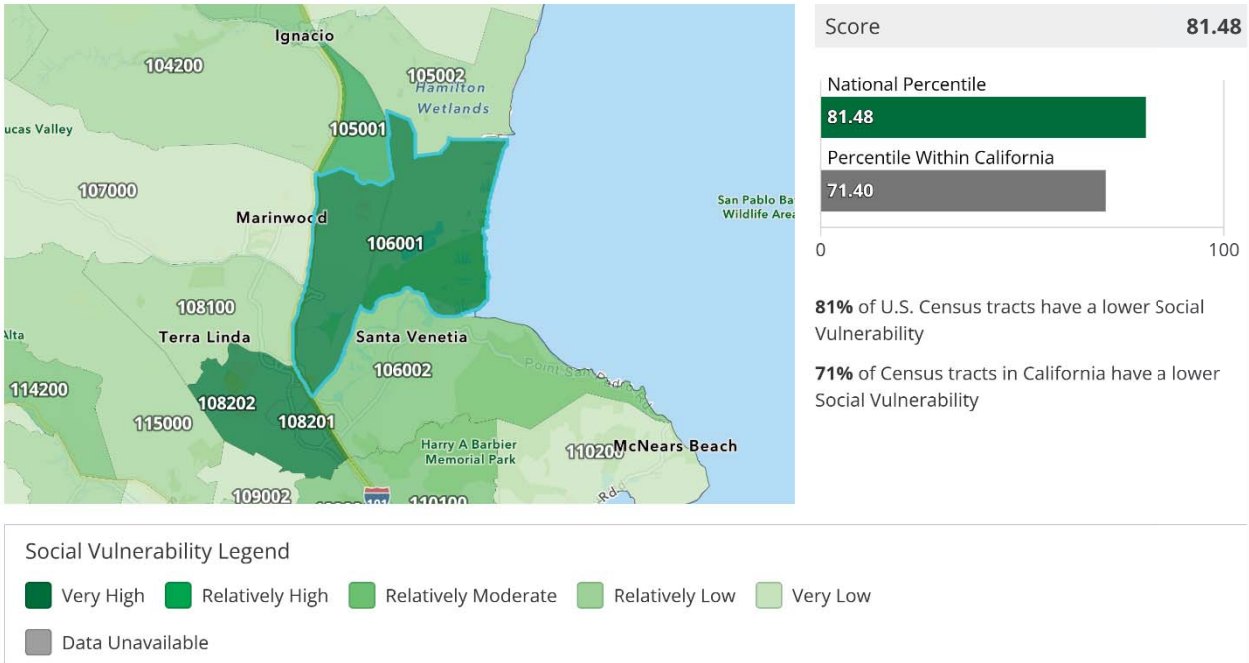


Figure 251: LGVSD Social Vulnerability Map Census Tract 1060.01
Source: FEMA National Risk Index 2023

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

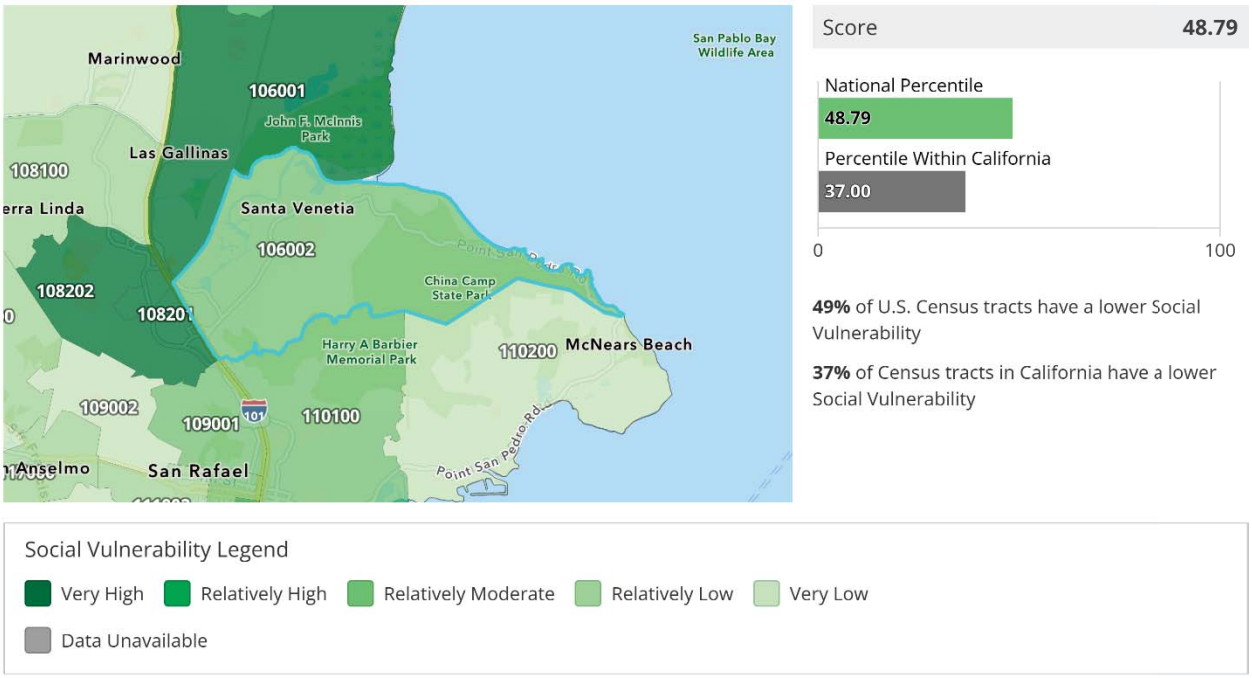


Figure 252: LGVSD Social Vulnerability Map Census Tract 1060.02
Source: FEMA National Risk Index 2023

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

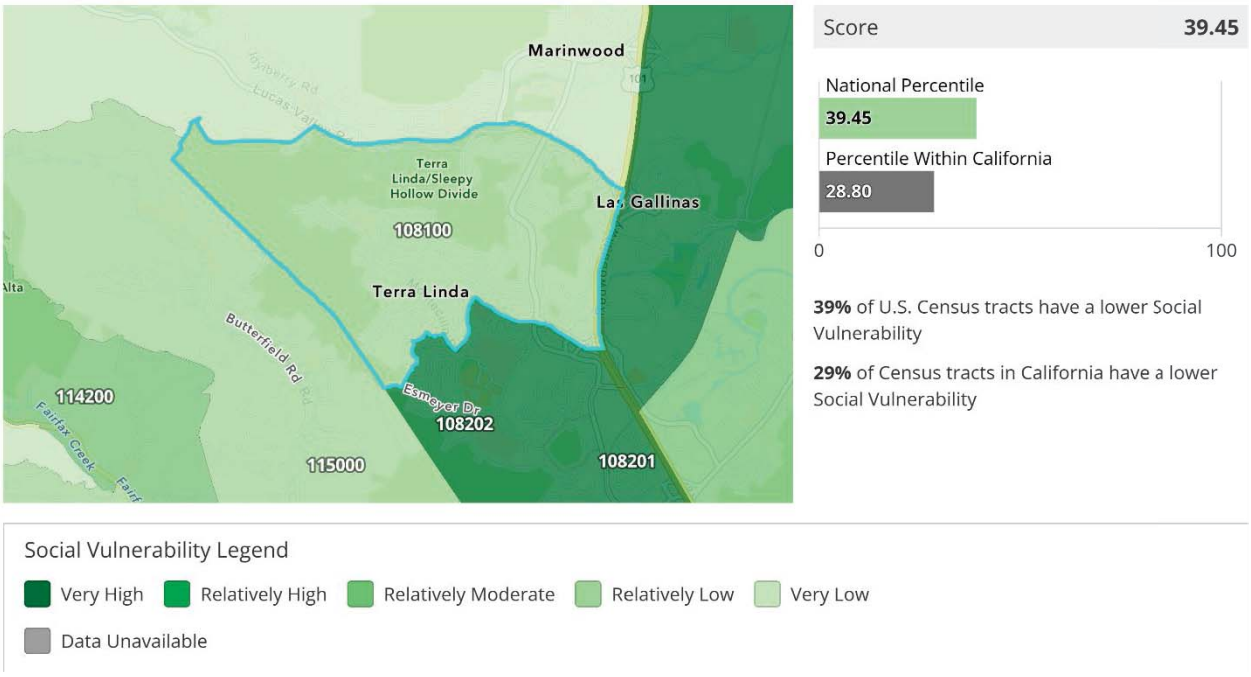


Figure 253: LGVSD Social Vulnerability Map Census Tract 1081.00
Source: FEMA National Risk Index 2023

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

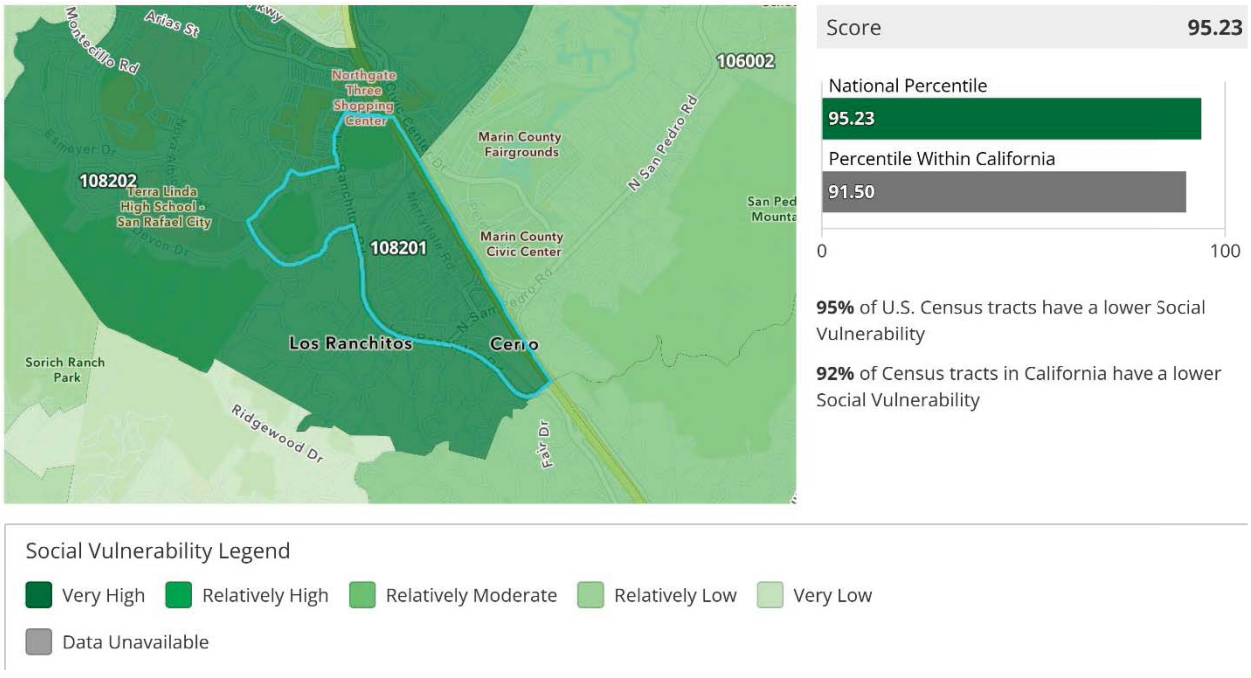


Figure 254: LGVSD Social Vulnerability Map Census Tract 1082.01
Source: FEMA National Risk Index 2023

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

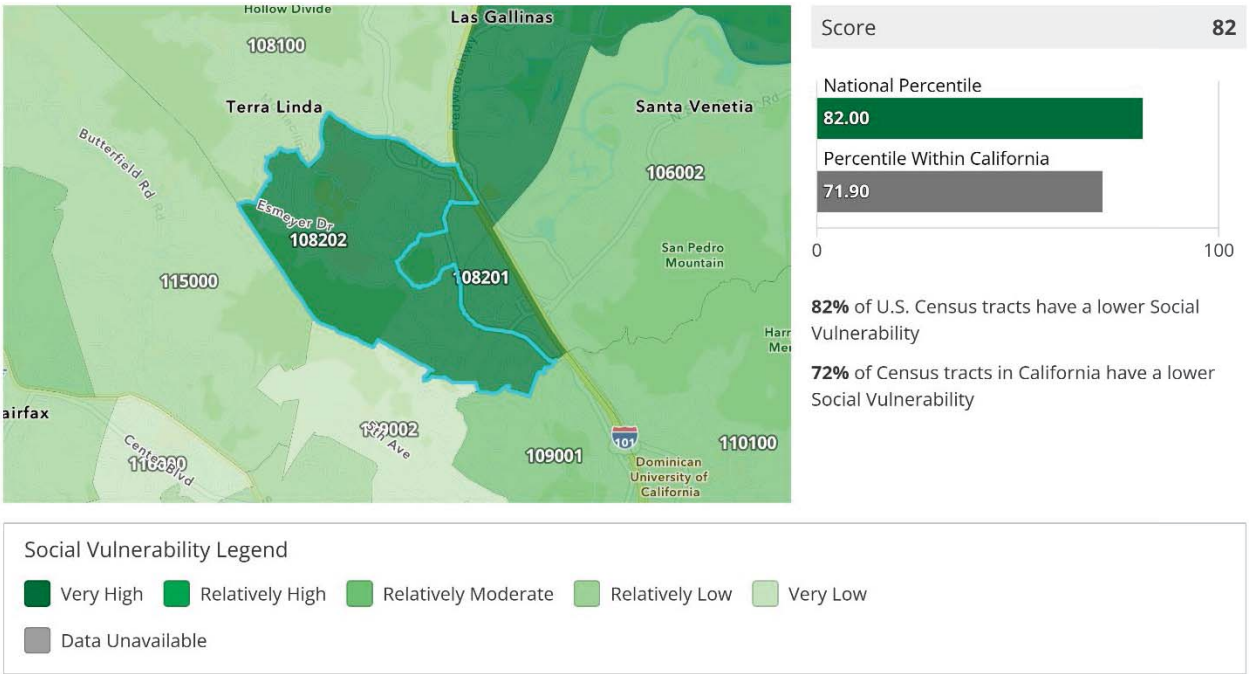


Figure 255: LGVSD Social Vulnerability Map Census Tract 1082.02
Source: FEMA National Risk Index 2023

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

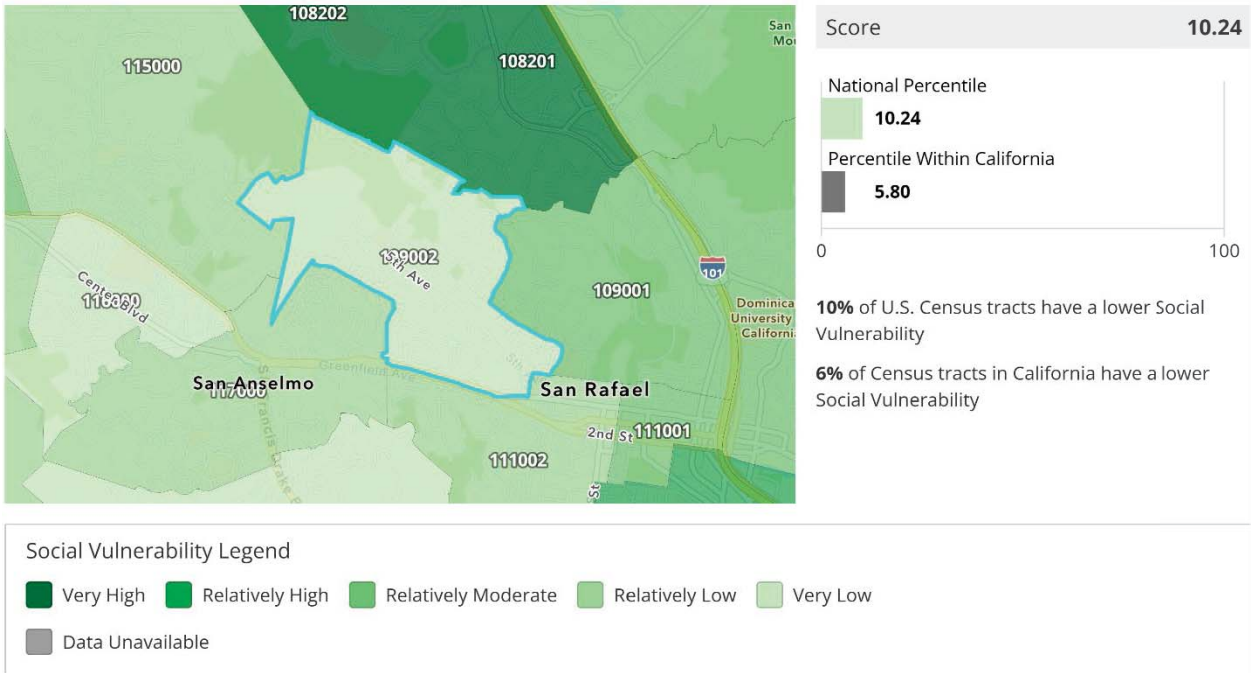


Figure 256: LGVSD Social Vulnerability Map Census Tract 1090.02
Source: FEMA National Risk Index 2023

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

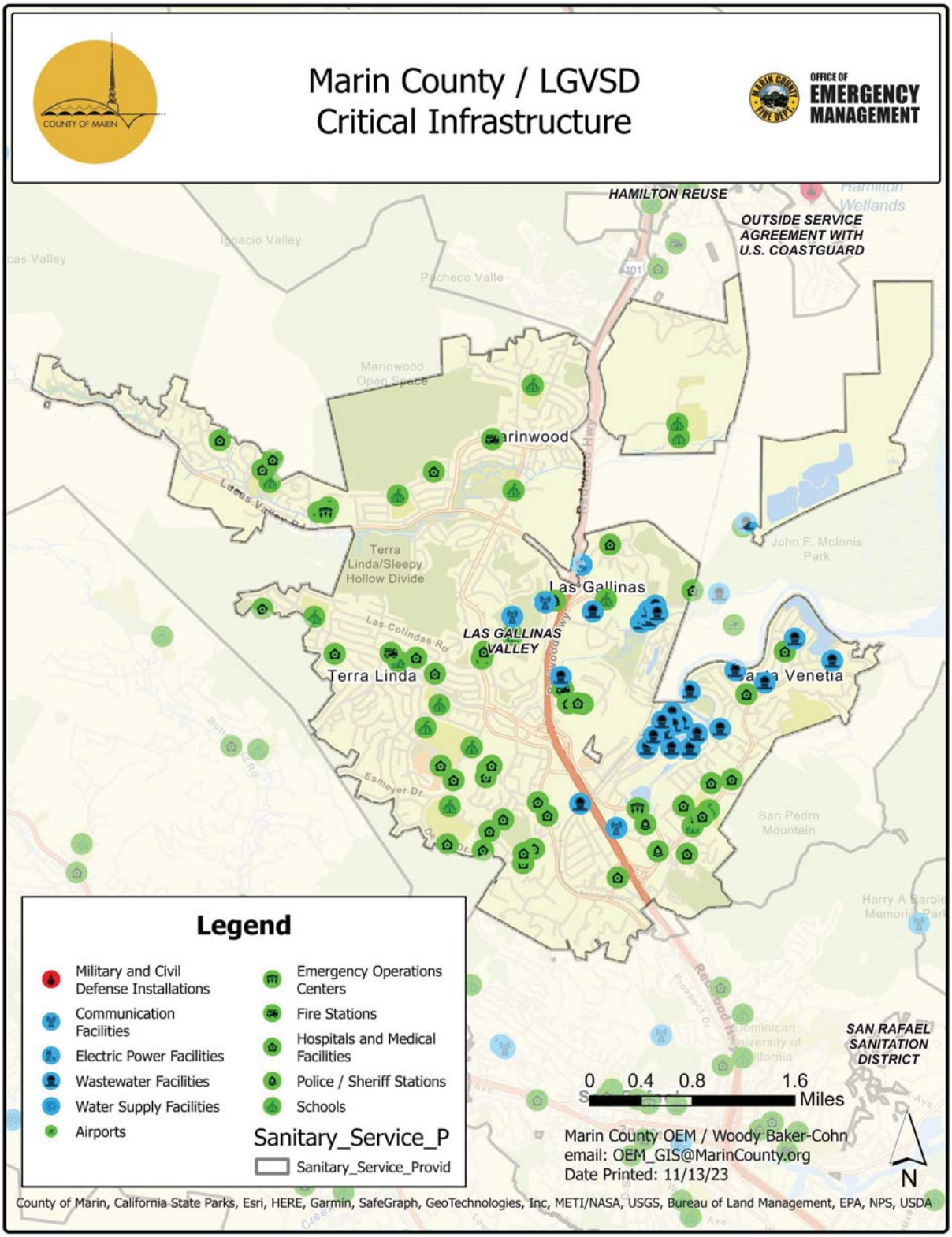


Figure 257: Map of the Las Gallinas Valley Sanitary District and Critical Facilities and Infrastructure within the District
Source: Marin County OEM

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.

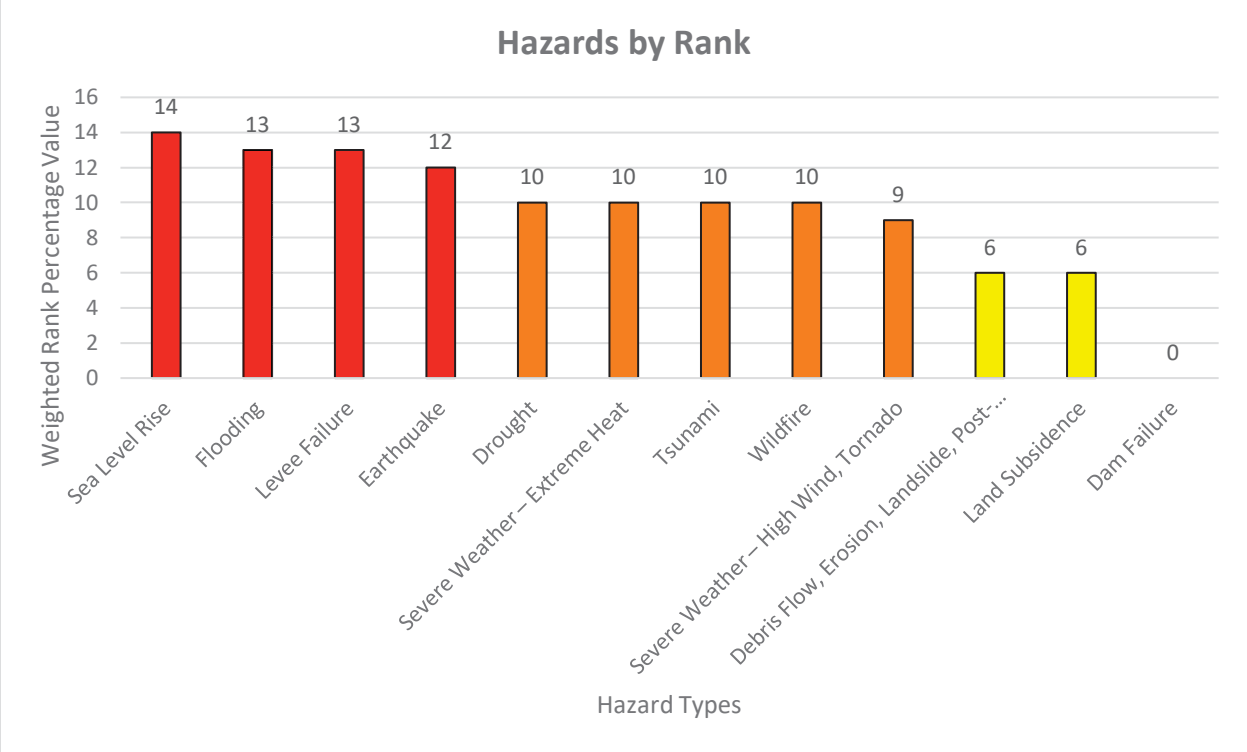


Figure 258: LGVSD Risk Assessment – Planning Team Top Hazards

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.

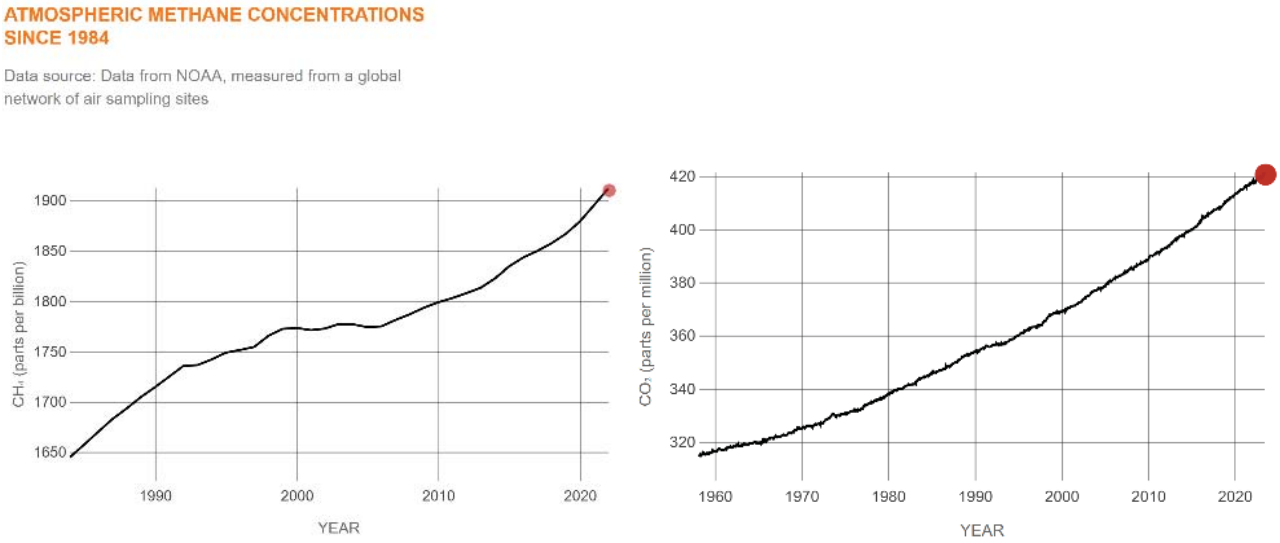


Figure 260: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

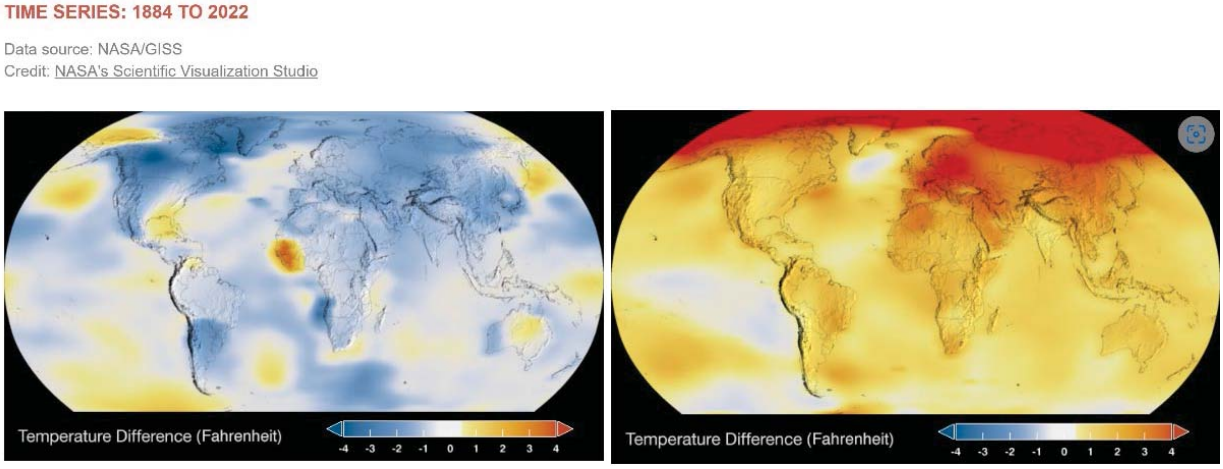


Figure 261: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

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.

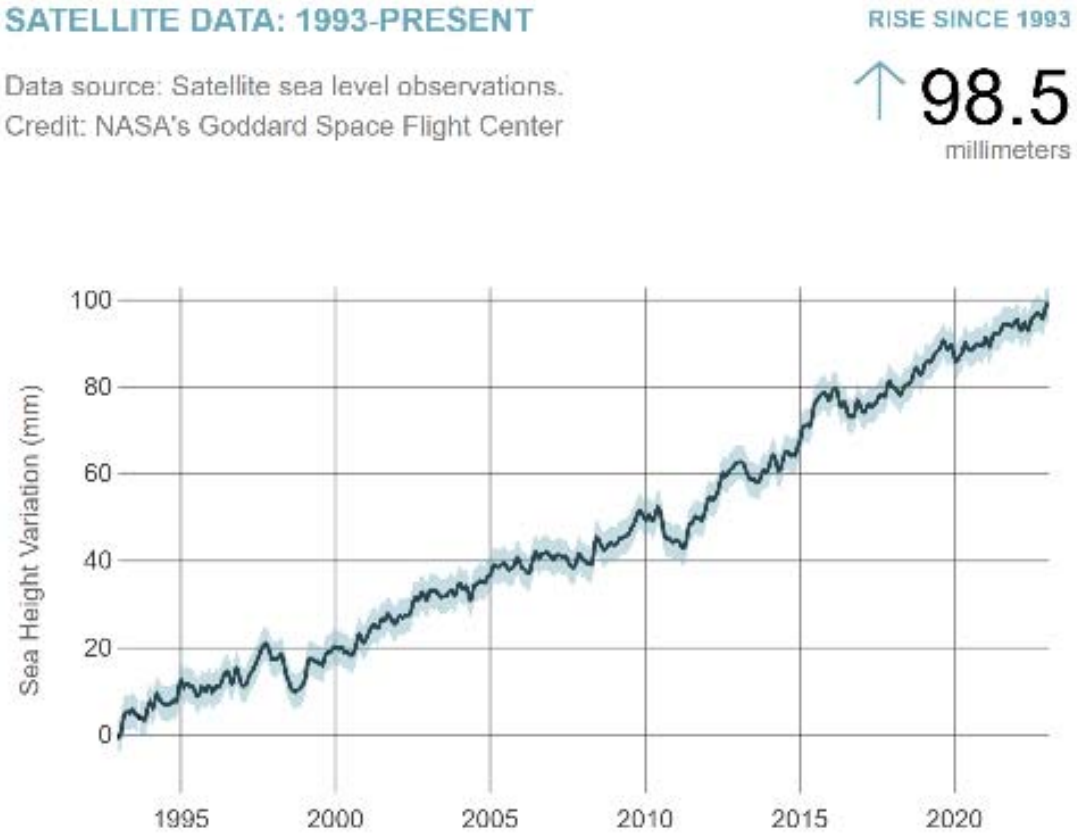


Figure 262: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

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).

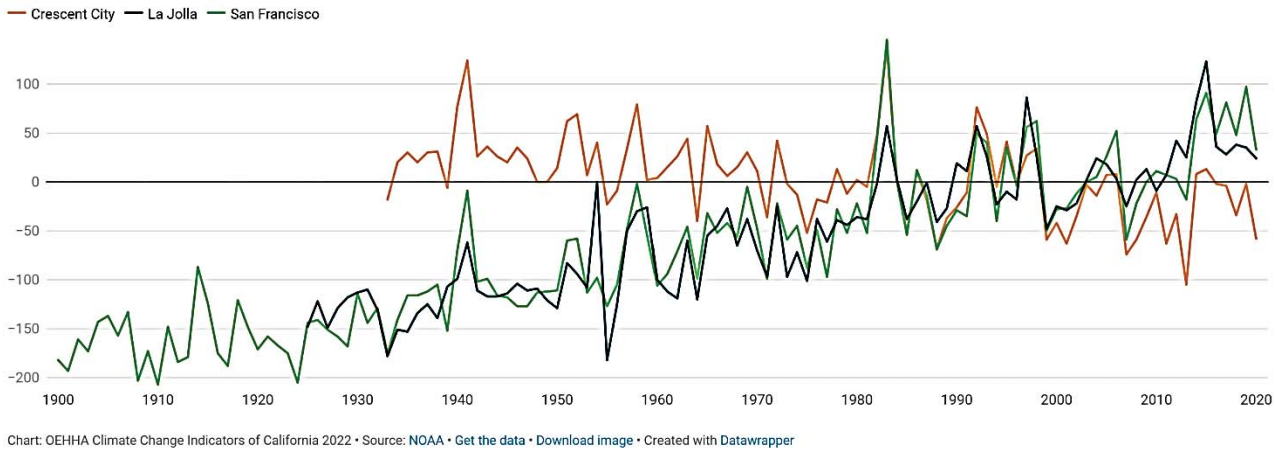


Figure 263: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

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.

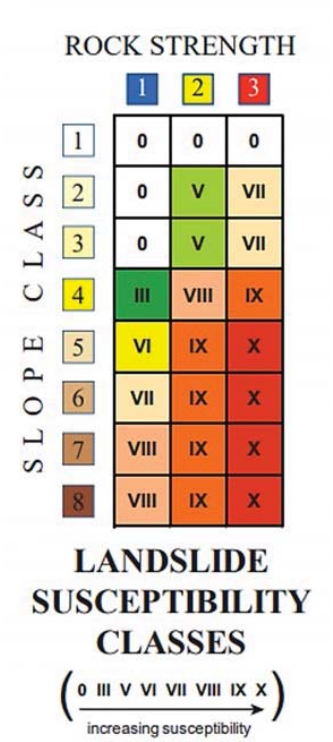


Figure 264: Landslide Susceptibility Classes
Source: USGS

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.

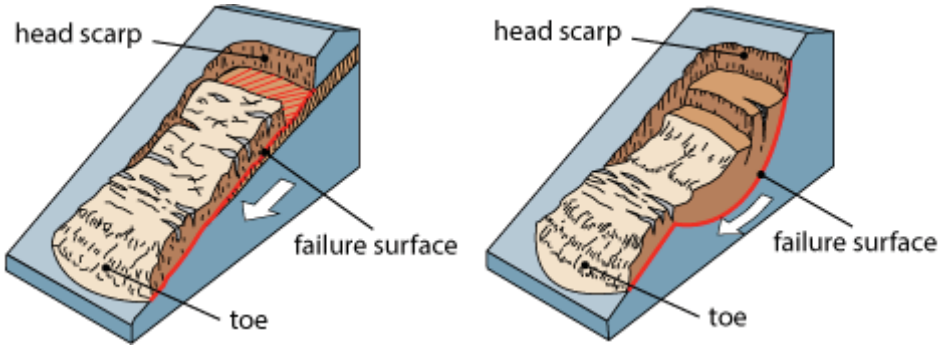


Figure 265: Mud Flow Areas
Source: Washington Department of Natural Resources

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.

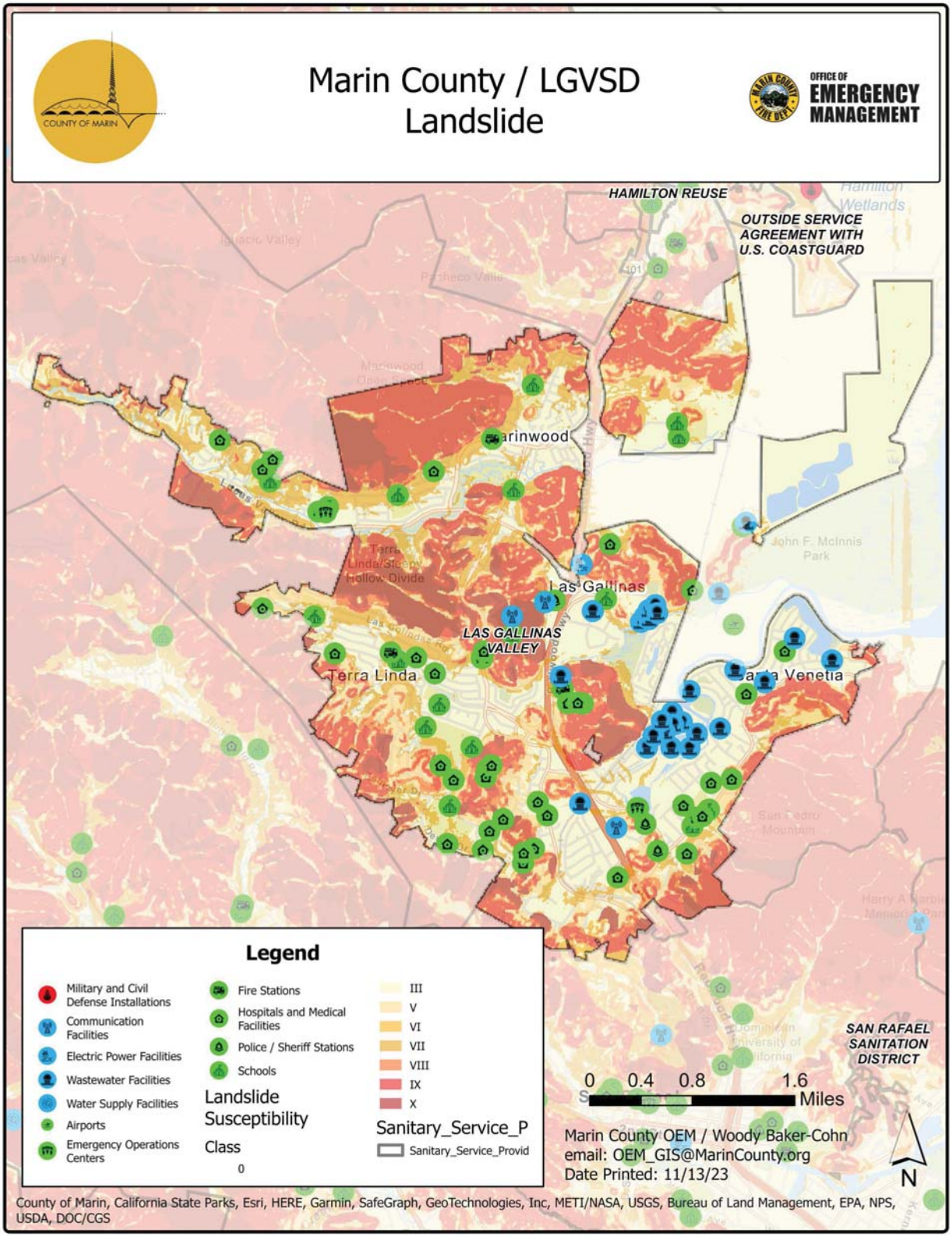


Figure 266: LGVSD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

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.

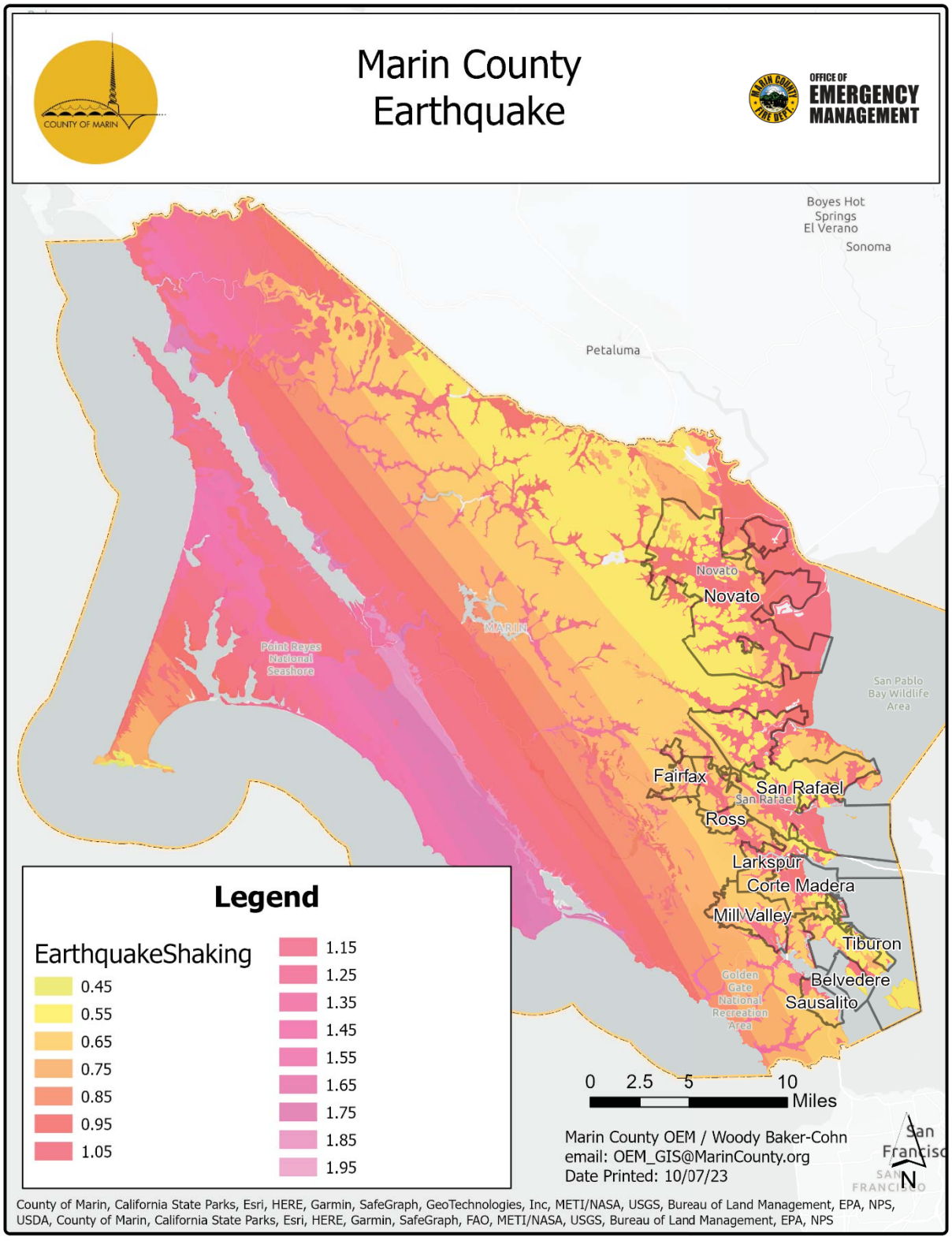


Figure 270: Marin County Earthquake Impact
Source: Marin County OEM

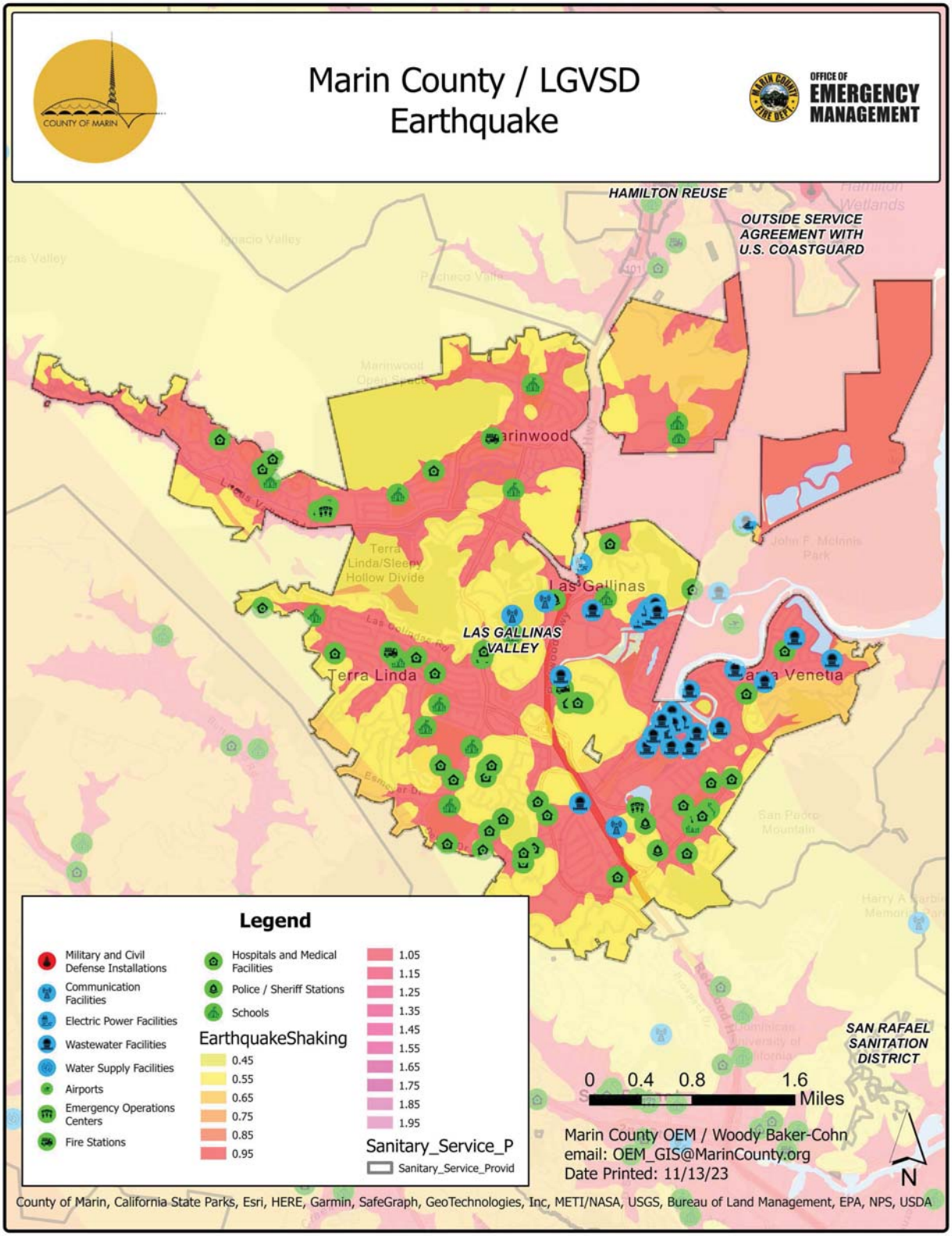


Figure 271: LGVSD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

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.

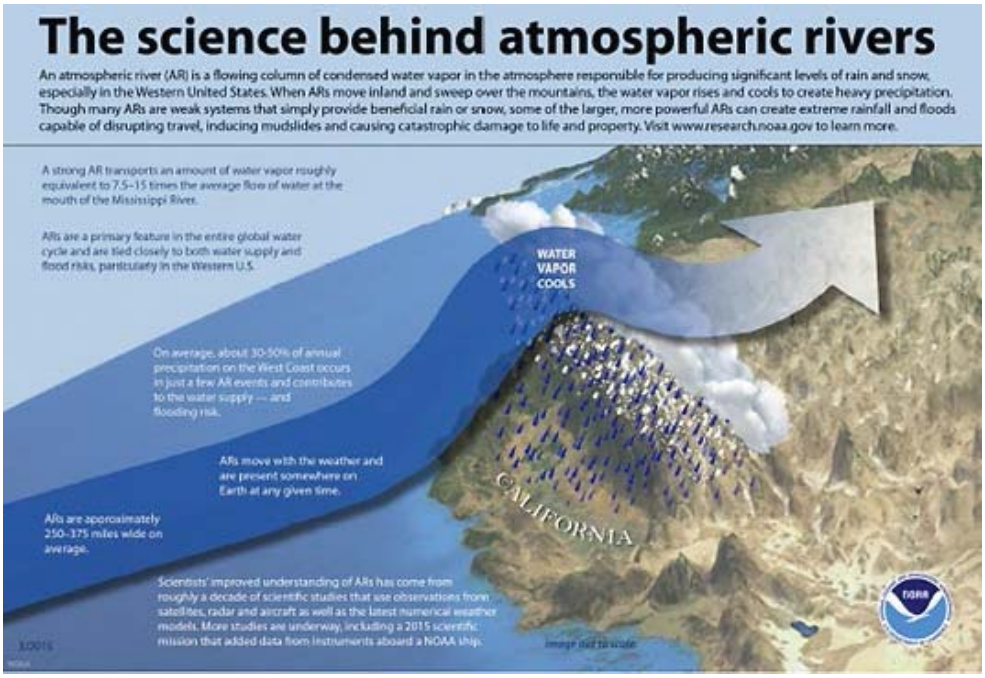


Figure 272: Diagram of an Atmospheric River Event
Source: NOAA

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.

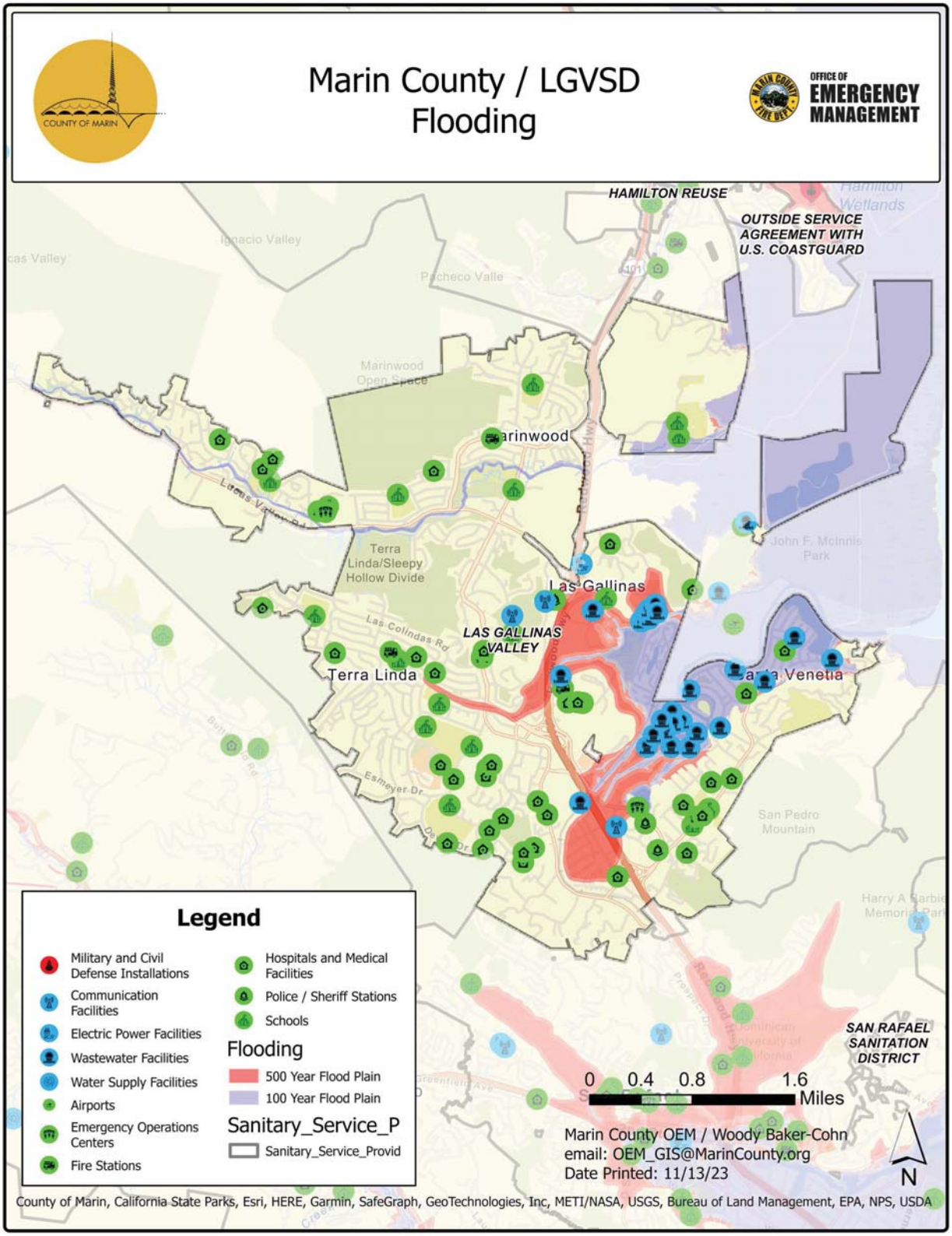


Figure 273: LGVSD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

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

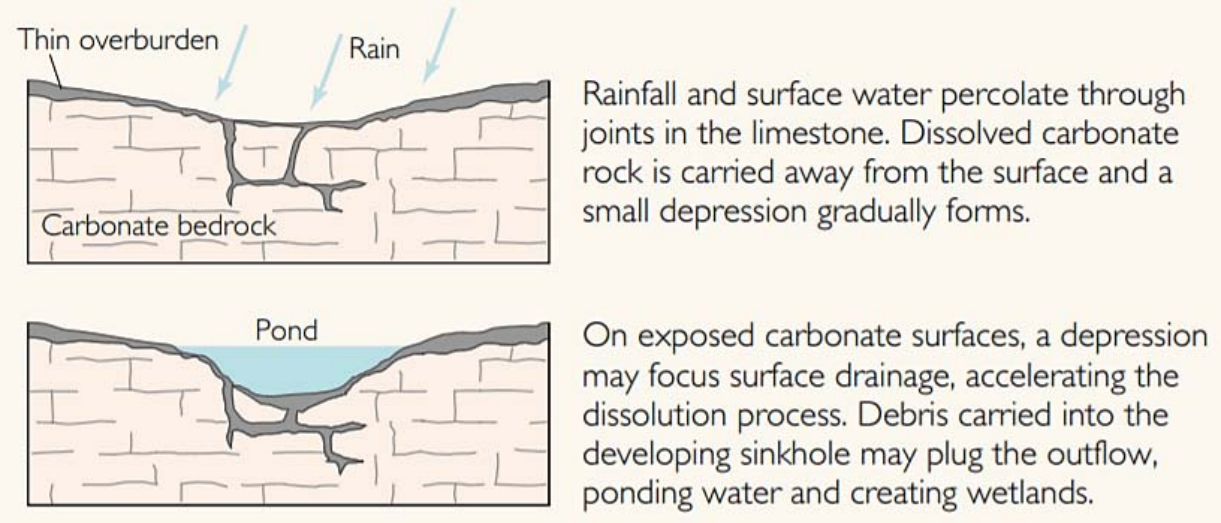


Figure 274: Dissolution Sinkhole Formation
Source: USGS

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.

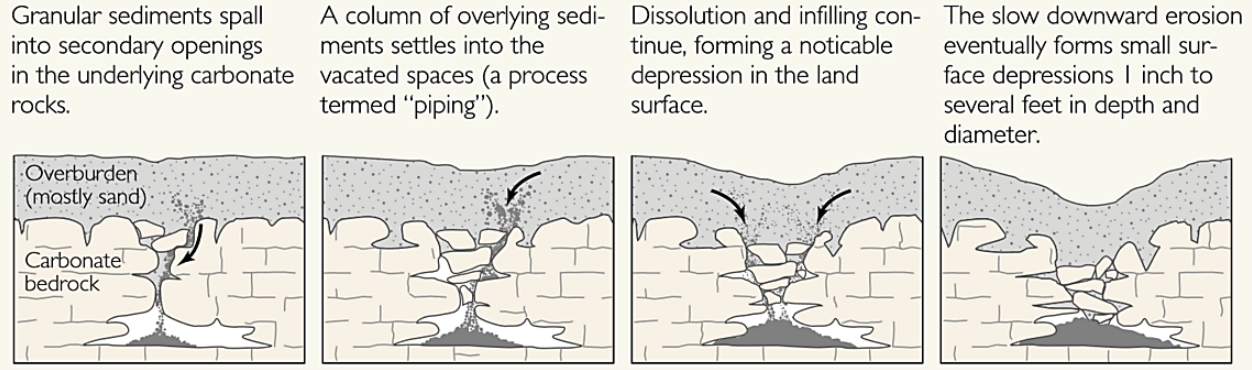


Figure 275: Cover-Subsidence Sinkhole Formation
Source: USGS

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.

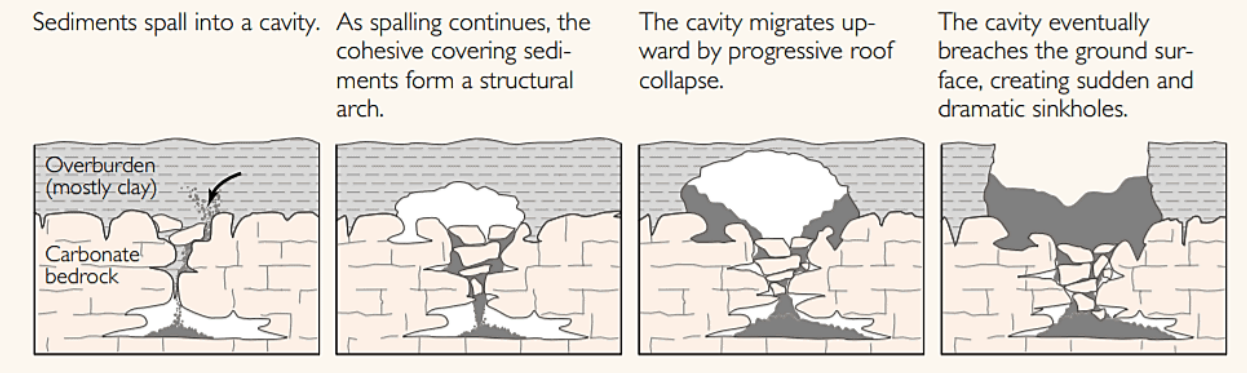


Figure 276: Cover-Collapse Sinkhole Formation
Source: USGS

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.

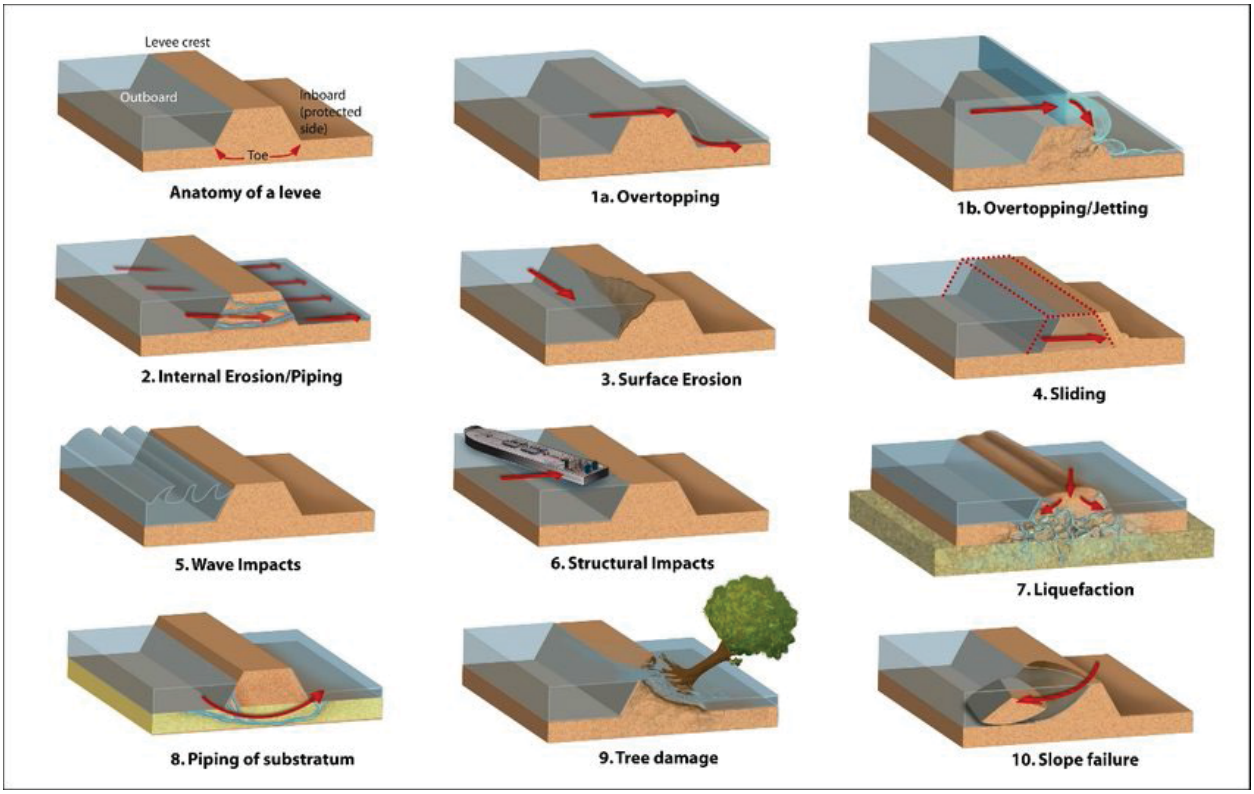


Figure 277: Levee Failure Mechanisms
Source: University of California

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.

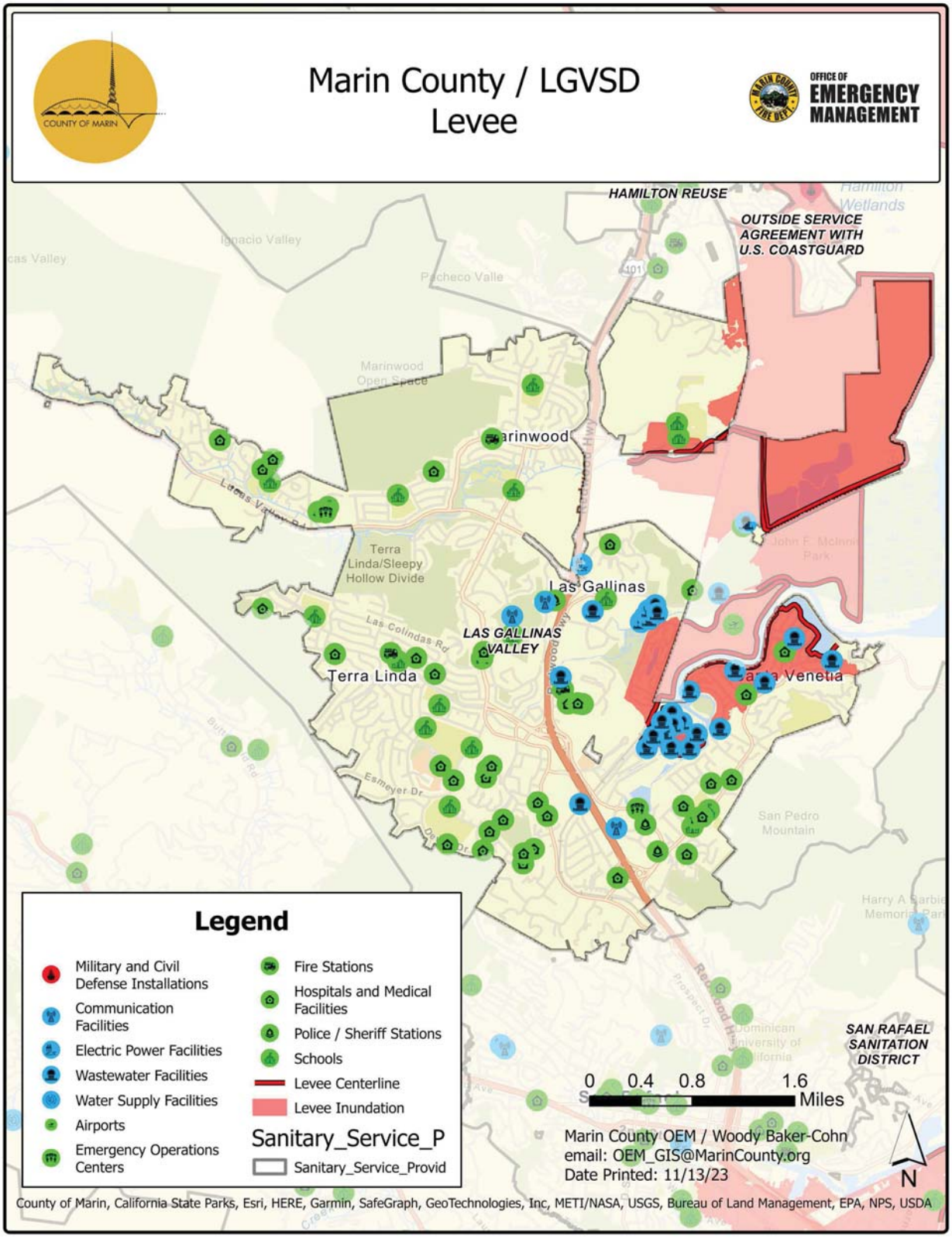


Figure 278: LGVSD Levee Inundation Map
Source: Marin County OEM

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.

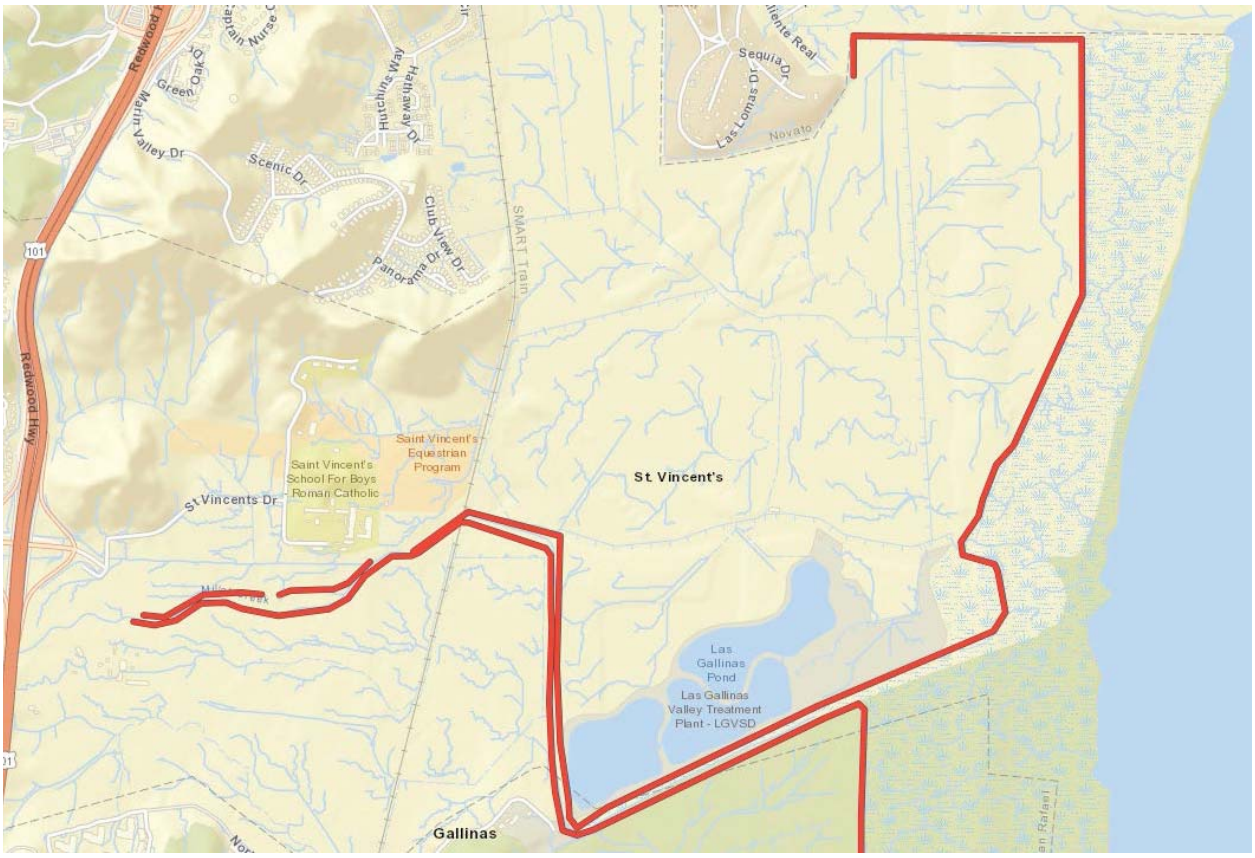


Figure 279: Marin County Levees 33 and 24 and the LGVSD Levee in St. Vincent
Source: U.S. Army Corps of Engineers

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.

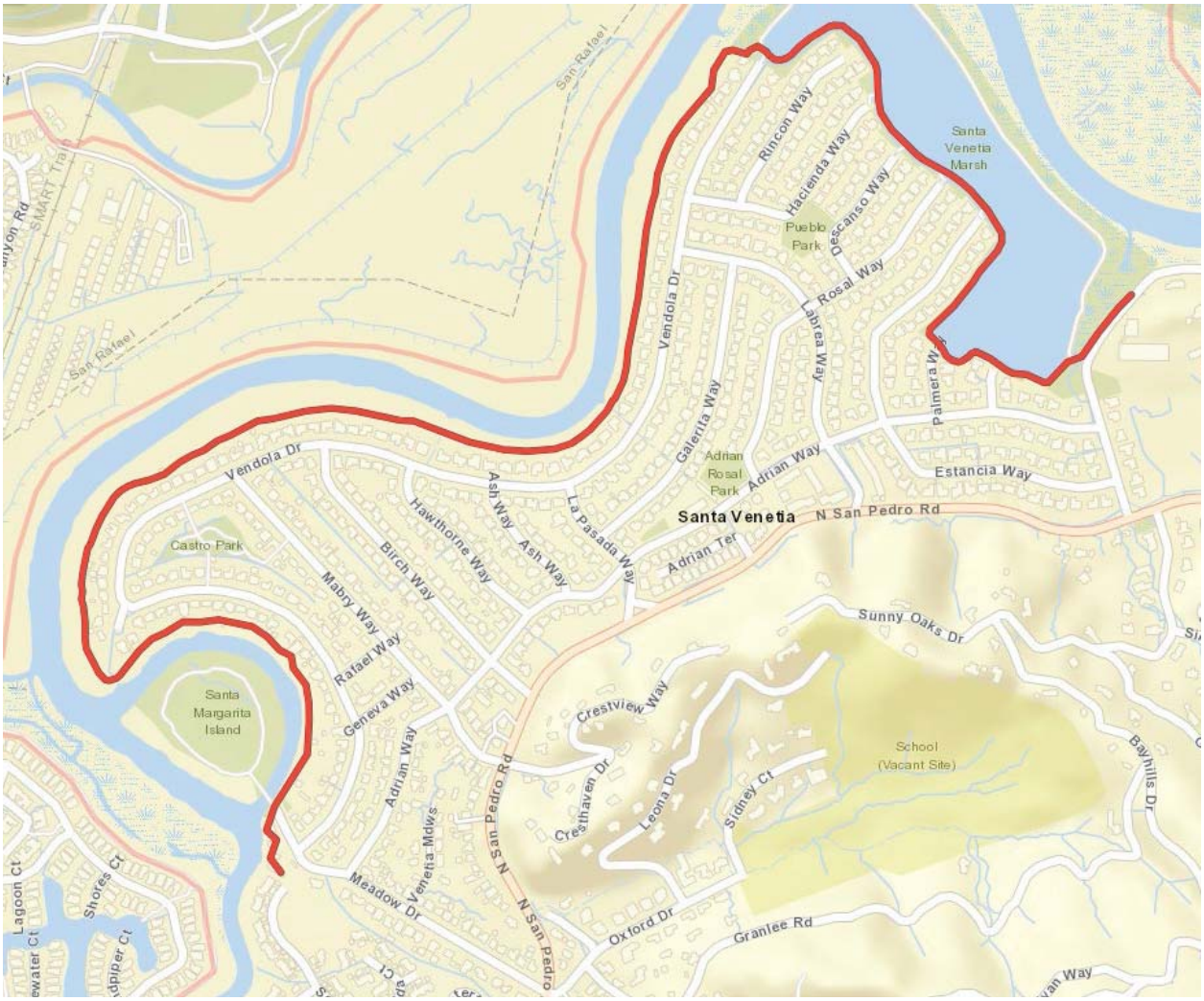


Figure 280: Santa Venetia Levee in Santa Venetia
Source: U.S. Army Corps of Engineers

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.

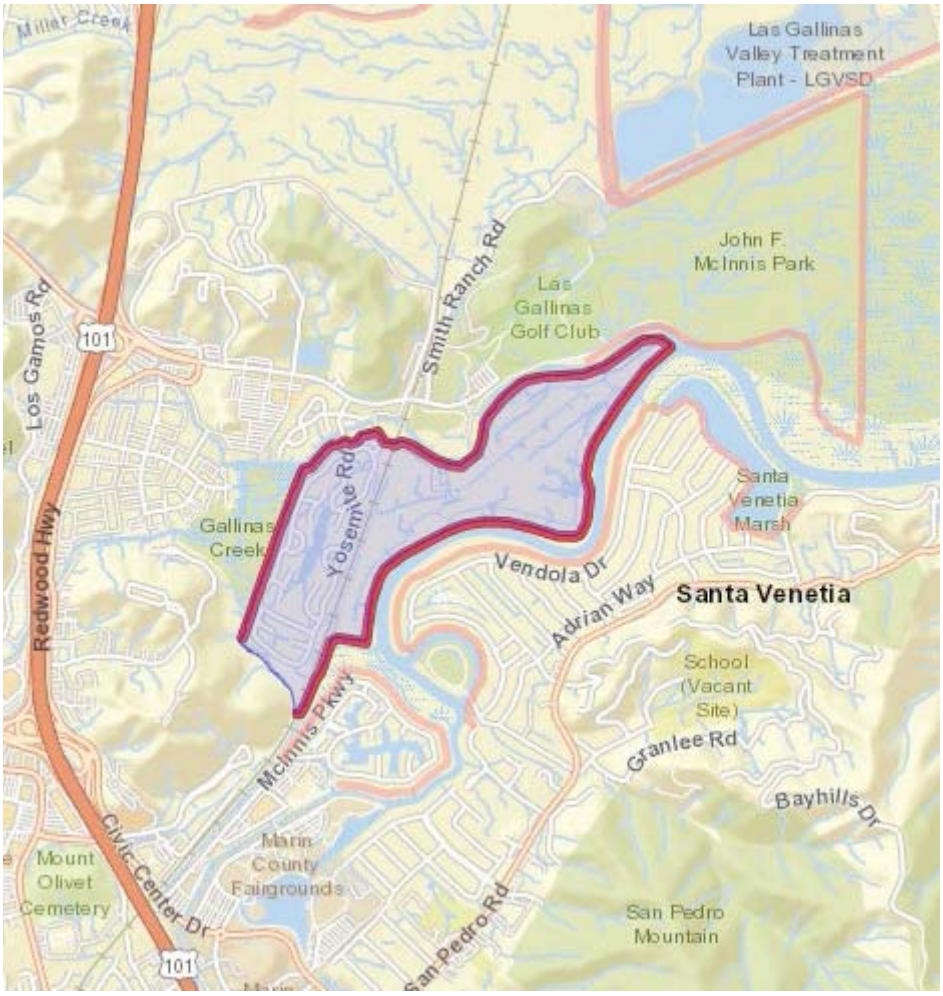


Figure 282: Smith Ranch Airport Levee
Source: U.S. Army Corps of Engineers

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.

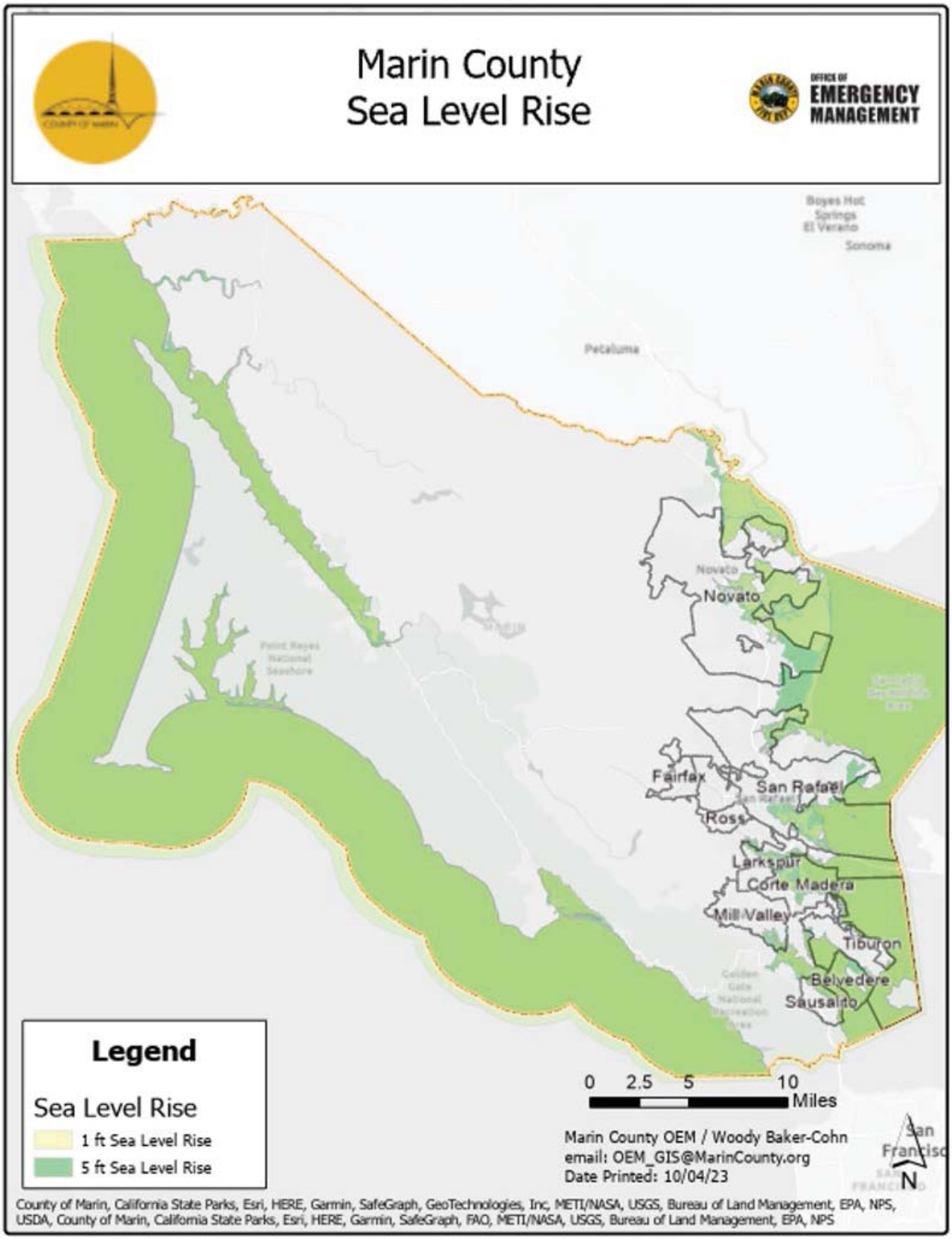


Figure 283: Marin County Sea Level Rise Impact
Source: Marin County OEM

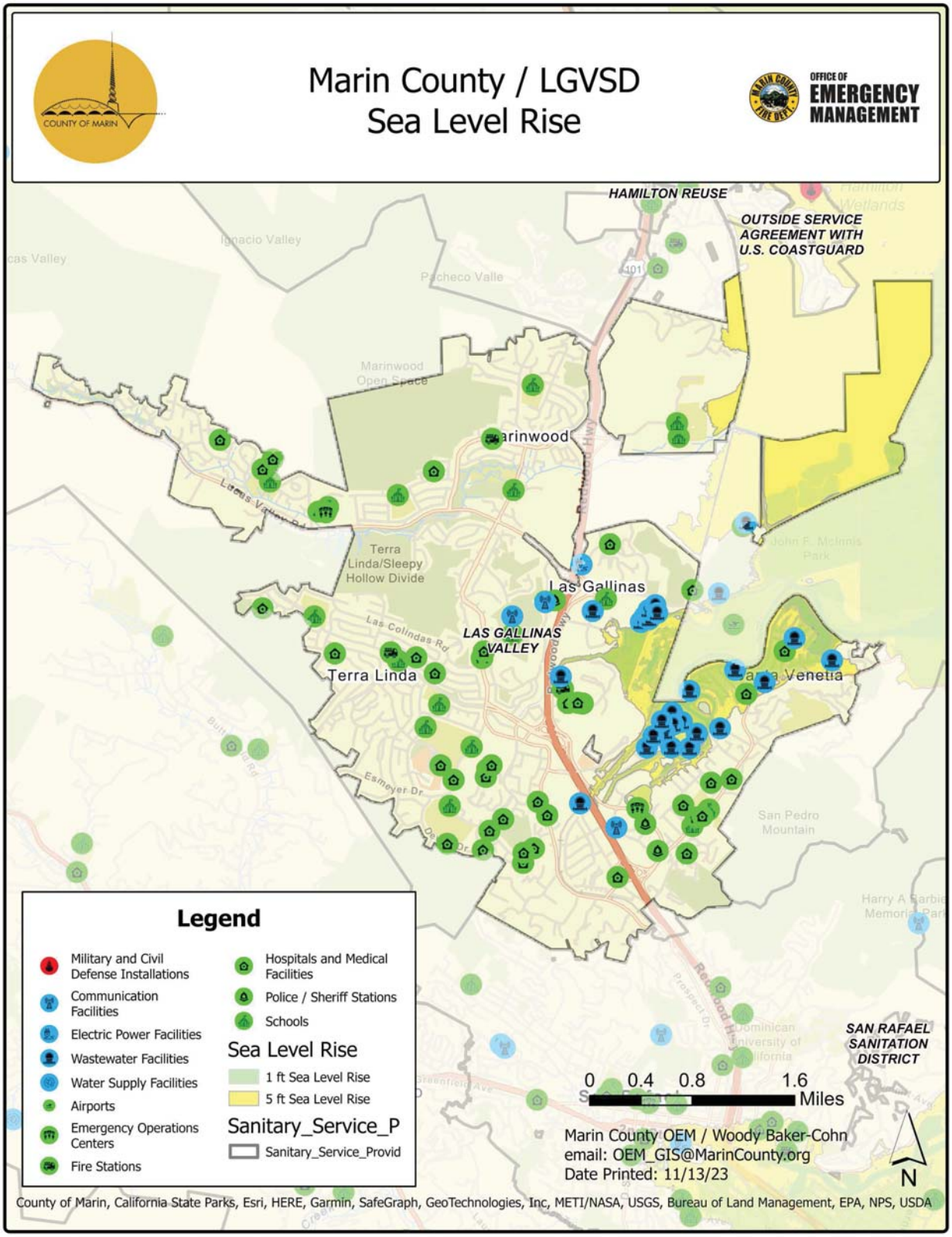


Figure 284: LGVSD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

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.

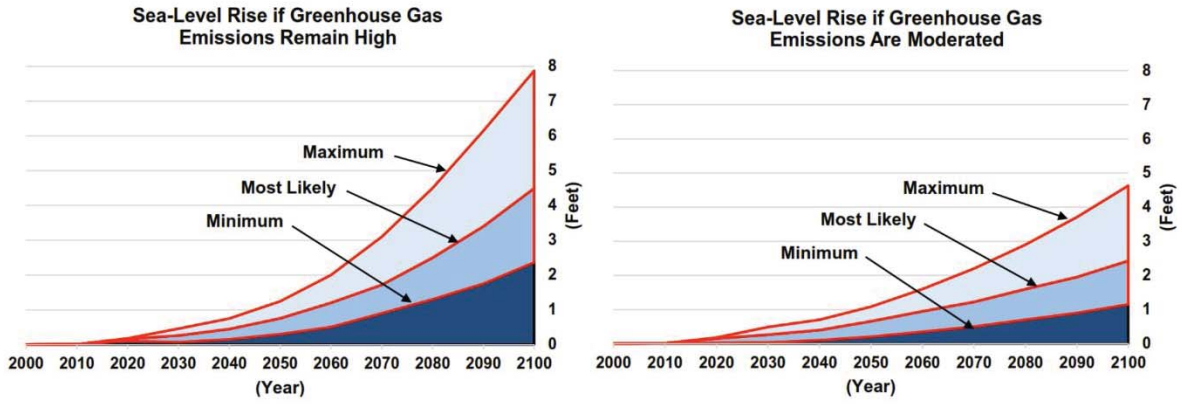


Figure 285: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

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):

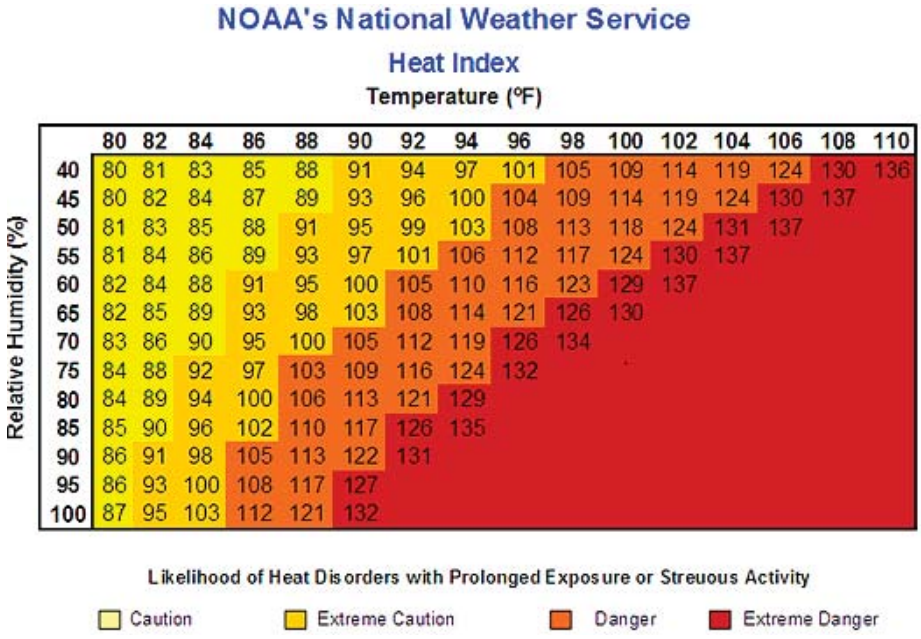


Figure 286: Heat Index
Source: NOAA

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.

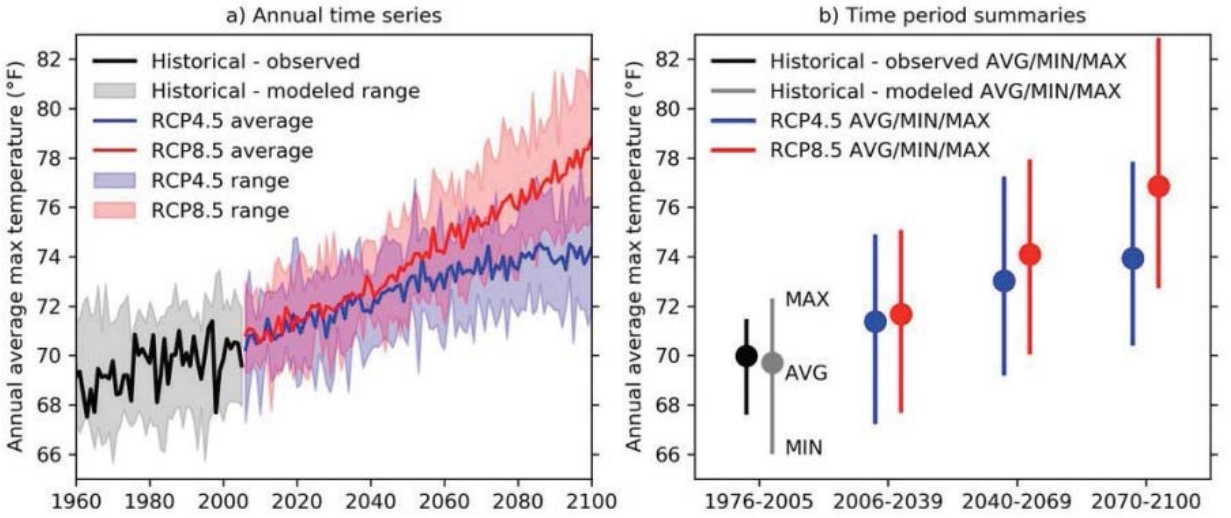


Figure 287: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

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.

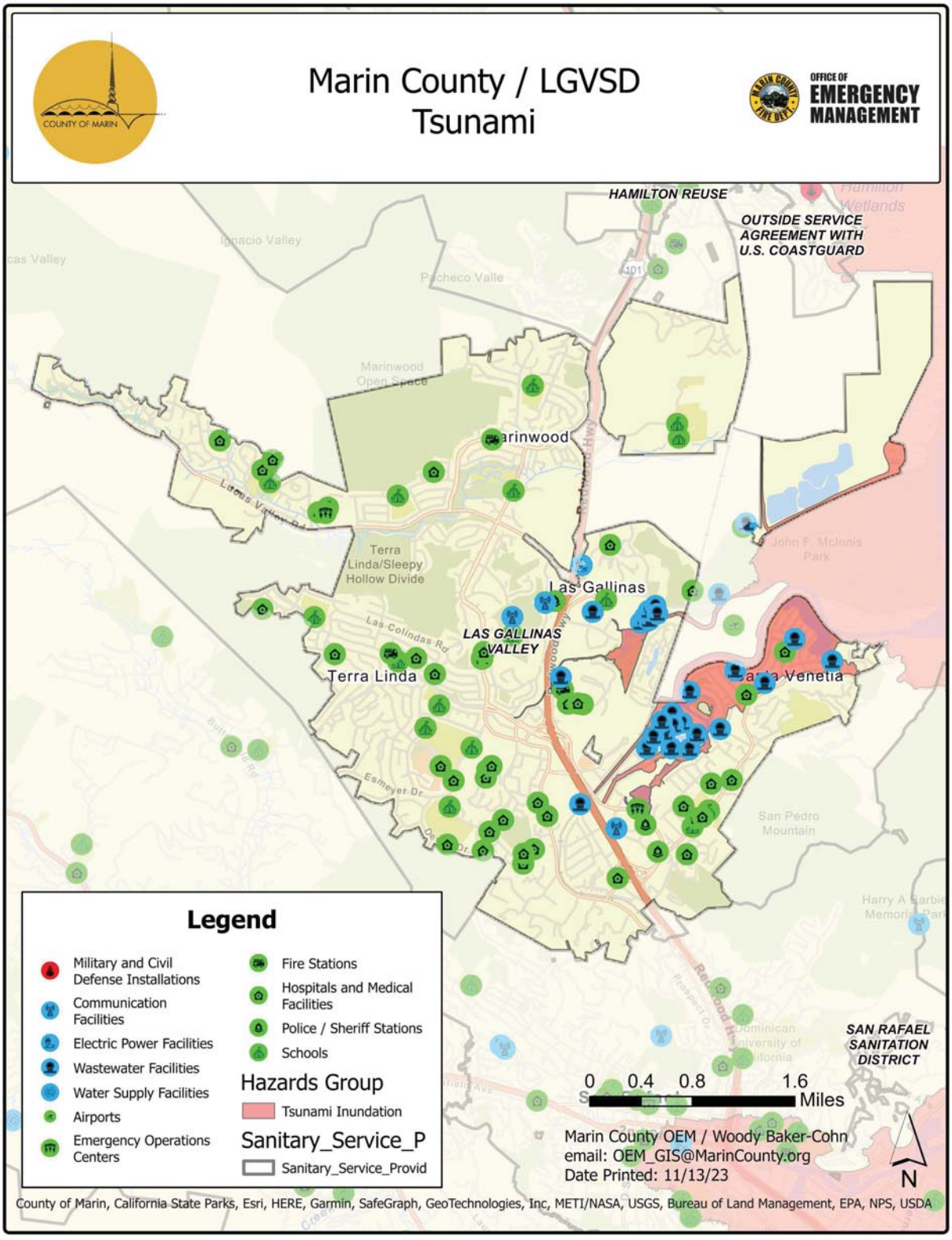


Figure 291: LGVSD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

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.

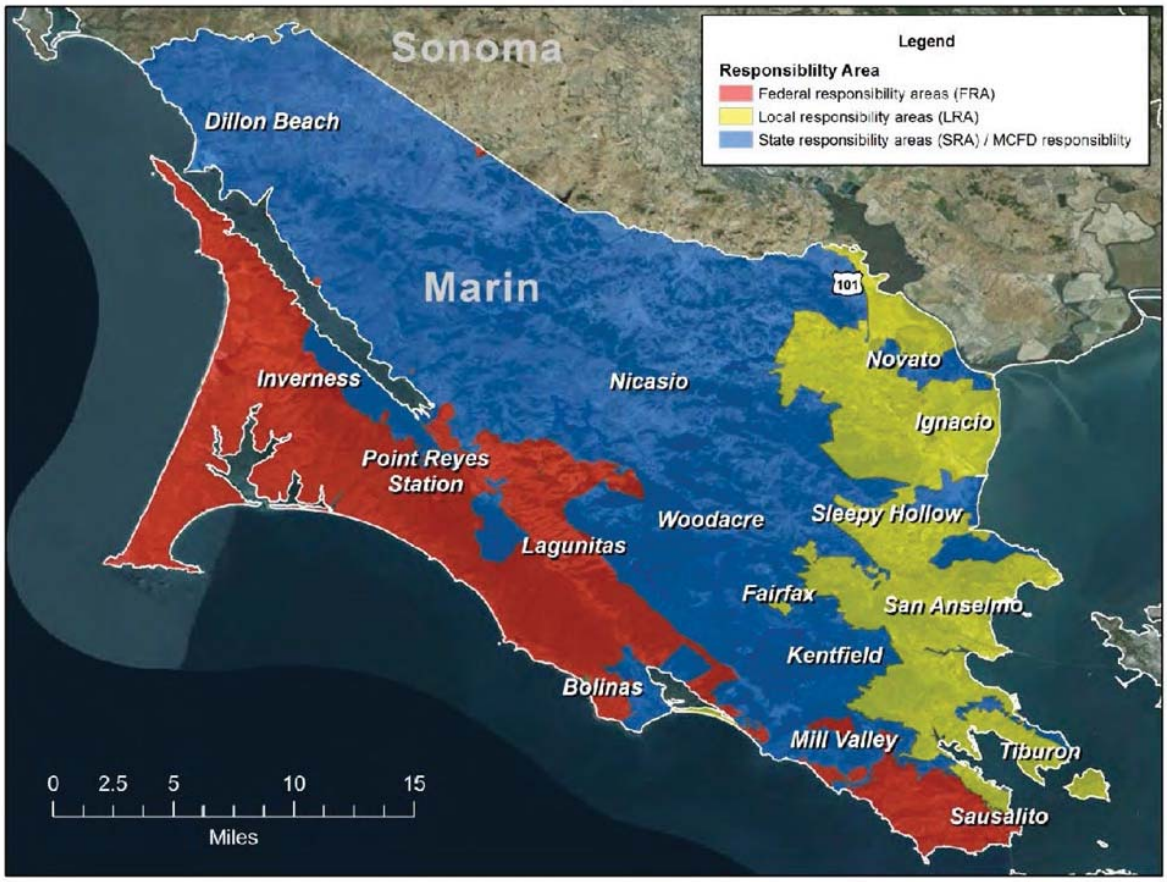


Figure 292: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

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.

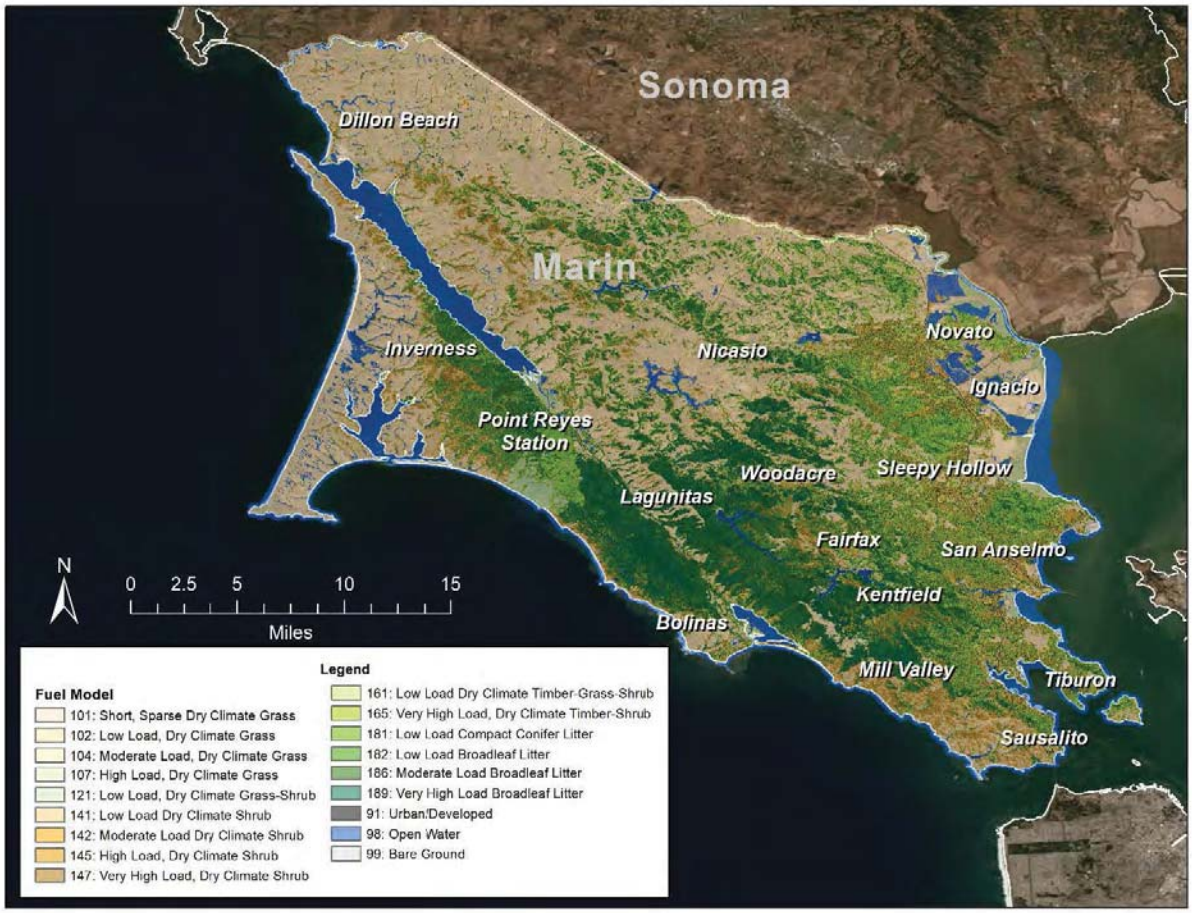


Figure 293: Fuel Model Map for the Marin County OA
Source: Unknown

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.

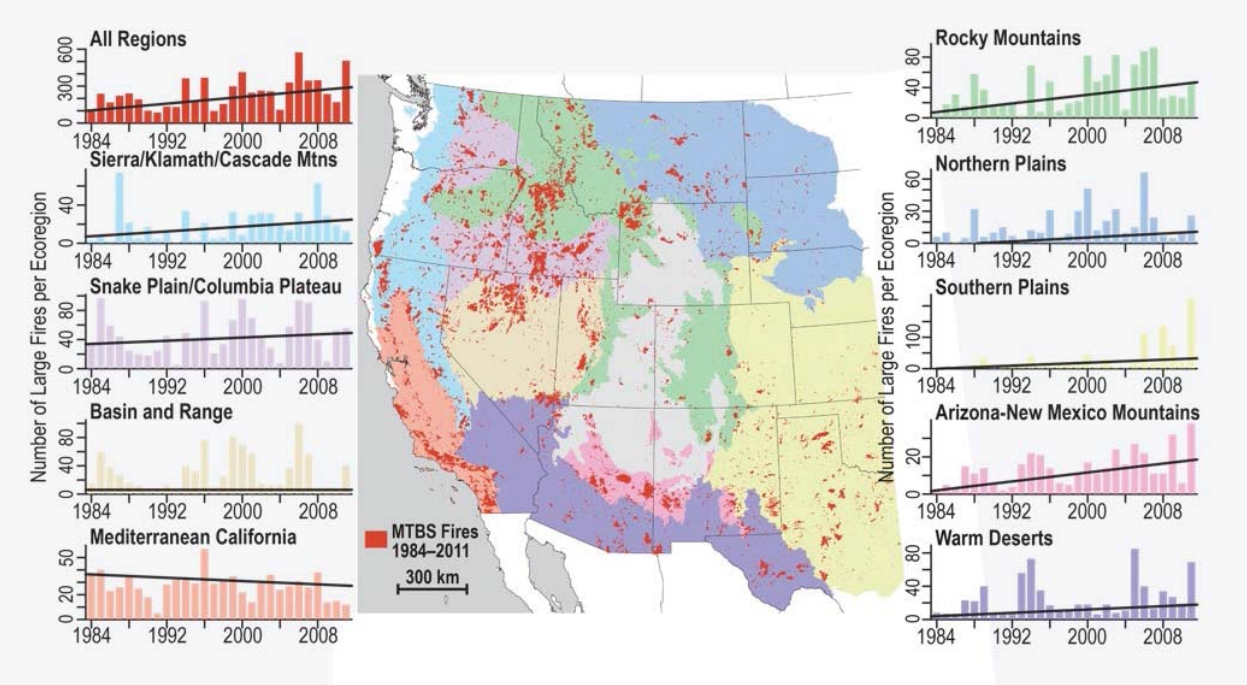


Figure 294: Trends in the Annual Number of Large Wildfires in the United States
Source: Fourth Climate Change Assessment, 01/04/23

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.

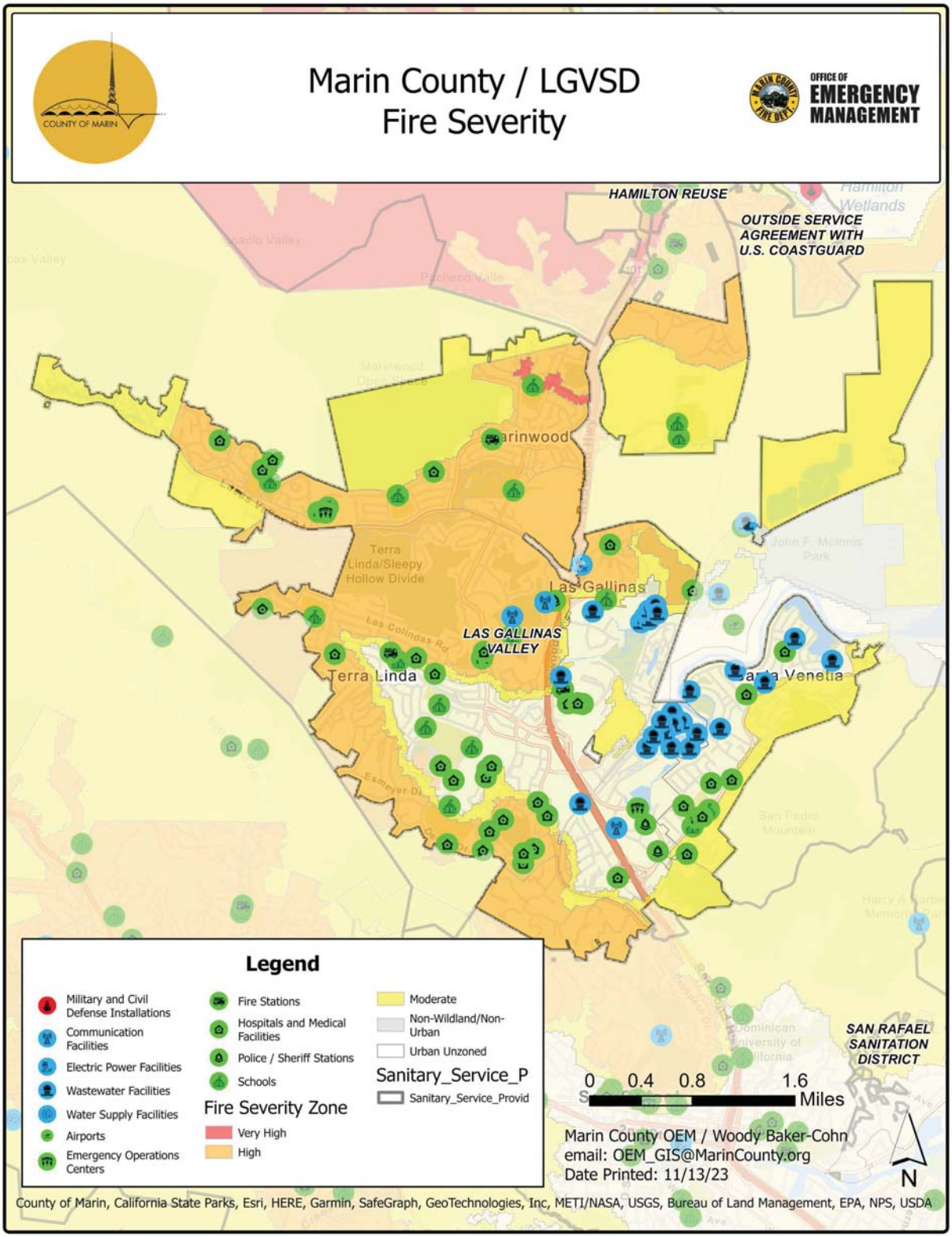


Figure 295: LGVSD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

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

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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