SOUTHERN MARIN FIRE PROTECTION DISTRICT PROFILE

Marin County Multi-Jurisdictional Hazard Mitigation Plan 2023

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ACKNOWLEDGEMENTS

The Southern Marin Fire Protection District and Preparative Consulting would like to thank those collaborators and partners who participated in the planning and development of this document.

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

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

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1.1 INTRODUCTION

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

1.2 PLANNING PROCESS

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

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

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

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

In addition to providing representation on the coordinated Marin County and SMFD Multi-Jurisdictional Hazard Mitigation Plan Steering Committee, the SMFD involved additional internal planning team members to support the broader planning process. The SMFD jurisdictional representatives for the coordinated Marin County Multi-Jurisdictional Hazard Mitigation Plans Steering Committee and the Planning Team Members are represented below.

1.2.1 Steering Committee Members (District Representatives)

Primary Point of Contact
Marshall Nau, Deputy Fire Marshal
Telephone: 415-388-8182
E-mail: mnau@smfd.org

Alternate Point of Contact
Chris Tubbs, Fire Chief
Telephone: 415-388-8182
E-mail: ctubbs@smfd.org

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

Table 1: SMFD Local Hazard Mitigation Planning Team Members

Jurisdiction	Name	Title/ Department	Phone	Email
SMFD	Chris Tubbs	Fire Chief/Southern Marin Fire Protection District	415-388-8182	ctubbs@smfd.org
SMFD	Fred Hilliard	Fire Marshal/Southern Marin Fire Protection District	415-388-8182	fhilliard@smfd.org
SMFD	Matt Barnes	Deputy Chief/Southern Marin Fire Protection District	415-388-8182	mbarnes@smfd.org
SMFD	Marshall Nau	Deputy Fire Marshal/Southern Marin Fire Protection District	415-388-8182	mnau@smfd.org
Mill Valley	Patrick Kelly	Department of Planning & Building	415-388-4039	pkelly@cityofmillvalley.org
Mill Valley	Daisy Allen	Senior Planner	415-384-4811	daisy.allen@cityofmillvalley.org
Mill Valley	Jared Barrilleaux	Deputy Director of Engineering	415-384-4818	jbarrilleaux@cityofmillvalley.org
Sausalito	Kevin McGowan	Public Works Director	415-289-4176	kmcgowan@sausalito.gov
Sausalito	Brandon Phipps	Planning Director	415-289-4142	bphipps@sausalito.gov

Table 1: SMFD Local Hazard Mitigation Planning Team Members

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

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

appropriate, participating jurisdictions will organize local mitigation groups to facilitate and administer internal activities.

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

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

1.2.2 Steering Committee Planning Process

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

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

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

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

1.2.3 Coordination with Stakeholders and Agencies

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

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

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

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

Table 2: 2023 MJHMP Local Planning Team Members

No.	Agency	Point of Contact	Title
1	Belvedere	Laurie Nilsen	Emergency Svs, Coord.
2	Belvedere	Rebecca Markwick	Planning Director
3	Belvedere	Samie Malakiman	Associate Planner
4	Bolinas Com. PUD	Jennifer Blackman	General Manager
5	Bolinas Fire Protection Dist.	Stephen Marcotte	Asst. Fire Chief
6	Central Marin Fire District	Matt Cobb	Battalion Chief/Fire
7	Central Marin Fire District	Ezra Colman	Battalion Chief/Fire
8	Central Marin Fire District	Rubin Martin	Fire Chief
9	Corte Madera	RJ Suokko	Director of Public Works
10	Corte Madera	Chris Good	Senior Civil Engineer
11	Sanitary District No. 2	RJ Suokko	District Manager
12	Fairfax	Loren Umbertis	Public Works Director
13	Fairfax	Mark Lockaby	Building Official
14	Larkspur	Dan Schwarz	City Manager
15	Larkspur	Julian Skinner	Public Works Director/ City Engineer
16	Larkspur	Robert Quinn	Public Works Superintendent
17	Las Gallinas Valley Sanitary District	Dale McDonald	Administrative Services Mgr.
18	Las Gallinas Valley Sanitary District	Greg Pease	Safety Manager

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
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 Protection District	Chris Tubbs	Fire Chief/Southern Marin Fire Dist.
36	Southern Marin Fire Protection District	Marshall Nau	Deputy Fire Marshall/Southern Marin Fire Dist.
37	North Marin Water District	Eric Miller	Asst. General Manager
38	North Marin Water District	Tim Fuette	Senior Engineer
39	Novato	David Dammuller	Engineering Services Mgr.
40	Novato	Dave Jeffries	Consultant/JPSC
41	Ross	Richard Simonitch	Public Works Director
42	San Anselmo	Sean Condry	Public Works & Building Director
43	San Anselmo	Erica Freeman	Building Official
44	San Anselmo	Scott Schneider	Asst. PW Director
45	San Rafael	Quinn Gardner	Deputy Emergency Services Coord.
46	San Rafael	Cory Bytof	Sustainability
47	San Rafael	Joanna Kwok	Senior Civil Engineer
48	San Rafael	Kate Hagemann	Climate Adaptation & Resilience Planner
49	Sausalito	Andrew Davidson	Senior Engineer/ DPW
50	Sausalito	Kevin McGowan	Director of Public Works
51	Sausalito	Brandon Phipps	Planning Director
52	Tiburon	Sam Bonifacio	Assistant Planner
53	Tiburon	Dina Tasini	Director of Community Development
54	Tiburon	Laurie Nilsen	Emergency Services Coord.
Special Districts & Partner Agencies			
55	Bolinas Fire Protection District	Stephen Marcotte	Assistant Fire Chief
56	County of Marin Disability Access Program	Laney Davidson	Disability Access Manager/ ADA Coordinator

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
57	County of Marin Disability Access Program	Peter Mendoza	Disability Access Manager/ ADA Coordinator
58	Emergency Medical Services	Chris Le Baudour	EMS Authority
59	Fire Departments	Jason Weber	Fire Chiefs
60	Golden Gate Bridge, Highway & Transportation District	Daniel Rodriguez	Security, Emergency Management Specialist
61	Golden Gate Bridge, Highway & Transportation District	Dennis Mulligan	General Manager & CEO,
62	Marin City Climate Resilience and Health Justice	Terrie Green	Executive Director
63	Marin Center for Independent Living	Peter Mendoza	Director of Advocacy and Special Projects
64	Marin City Community Services District	Juanita Edwards	Interim General Manager
65	Marin County Community Development Agency	Leslie Lacko	Community Development Agency
66	Marin County Flood Control & Water Conservation District	Garry Lion	Advisory Board Member
67	Marin County Office of Education	Michael Grant	Director, Marin County Office of Education
68	Marin County Parks	Max Korten	General Manager and Director
69	PG&E	Mark Van Gorder	Government Affairs, North Bay
70	PG&E	Ron Karlen	PG&E Public Safety Specialist
71	Sonoma Marin Area Rail Transit (SMART)	Jennifer McGill	Chief of Police
72	Transportation Authority of Marin (TAM)	Anne Richmond	Executive Director
73	Willow Creek School	Itoco Garcia	Superintendent
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			

Table 2: 2023 MJHMP Local Planning Team Members			
No.	**Agency**	**Point of Contact**	**Title**
81	Army Corps of Engineers	Jessica Ludy	Flood Risk Management, Equity, and Environmental Justice
82	National Park Service	Stephen Kasierski	OneTam
83	US Coast Guard	LT Tony Solares	Sector SF Waterways Safety Branch
84	US Coast Guard	MST1 Brandon M. Ward	Emergency Management Specialist
85	US Coast Guard	LT William K. Harris	USCG SEC San Francisco

Table 2: 2023 MJHMP Planning Team Members

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

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

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

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

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

The following planning meetings were held with the planning team:

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
1	10/26/22	Steering Committee	Project Overview Meeting	• Plan Overview – Steps and Timeline • Planning Process • Steering Committee Role
2	11/9/22	Steering Committee	Steering Committee Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment • Stakeholders and Planning Team Identification
3	12/6/22	Steering Committee, Planning Team	Planning Team Kickoff Meeting	• Hazard Mitigation and Emergency Management Overview • Plan Overview – Steps and Timeline • Community Overview • Planning Process • Hazard Identification and Risk Assessment
4	02/07/23	Steering Committee	Steering Committee Hazard Profile Meeting	• Jurisdictional Letter of Commitment • Identify Planning Team Members • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
5	03/07/23	Steering Committee/ Planning Team	Planning Team Public Outreach Strategy Meeting	• Planning Goals and Objectives • Hazard Risk Ranking Worksheets • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update • Public Outreach Strategy
6	04/04/23	Steering Committee	Steering Committee Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach • Planning Goals and Objectives

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings

No.	Date	Attendees	Meeting	Planning Meeting Objectives
				• Jurisdictional Hazard Vulnerability Maps • Jurisdictional Profiles • Jurisdictional/ District Capability Assessment • 2018 Hazard Mitigation Project Status Update
7	04/13/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #1 (In-person and virtual on Zoom) Thursday, 6:00 pm to 7:30 pm Marin County BOS Chambers	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
8	04/29/23	General Public, Steering Committee, Planning Team	Public Outreach Town Hall Meeting #2 (In-person and virtual on Zoom) Saturday, 10:00 am to 11:30 am Marin County Health and Wellness Center	• Meeting translated live in Spanish with 29 language subtitle capability for virtual participants. • Meeting also interpreted in American Sign Language • Meeting recorded and posted on Hazard Mitigation website. • Hazard Mitigation and Emergency Management Overview • Planning Process • Hazard Identification and Risk Assessment • Planning Goals and Objectives • Hazard Mitigation Projects • Community Input
9	05/31/23	Steering Committee	Steering Committee Hazard Ranking Meeting	• HMGP (DR-4683) Funding Timeline • Public Outreach Status • Jurisdictional Hazard Vulnerability Maps • OEM Overview of Hazard Maps and Marin Maps

Table 3: Southern Marin Fire Protection District & Marin County MJHMP Planning Meetings				
No.	**Date**	**Attendees**	**Meeting**	**Planning Meeting Objectives**
				• Marin Co. MJHMP Risk Assessment Tool Overview • 2018 Hazard Mitigation Project Status Update • Hazard Working Groups
10	06/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• HMGP (DR-4683) & BRIC Grant Funding Timeline • Public Outreach Status • Jurisdictional Hazard Risk Assessment Tool • OEM Overview of Hazard Maps and Marin Maps • Marin County Hazards over the Last 5-Years • 2018 Hazard Mitigation Project Status Update • 2023 Hazard Mitigation Projects/Capital Improvement Projects • Hazard Working Groups
11	07/01/23-09/01/23	Steering Committee Members	Steering Committee Members Plan Development Sessions	• Individual phone or conference calls with planning jurisdictions and districts to answer specific questions and assist them in developing their profile annex.
12	11/27/23	Steering Committee, Planning Team	Marin County Planning Team Meeting	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes
13	11/28/23	General Public	Public Outreach Presentation on Marin County Office of Emergency Management Website	• Presentation and review of the Draft Marin County OA MJHMP and Jurisdictional/District Annexes. • Opportunity for public comment and questions and answers.

Table 3: SMFD & Marin County MJHMP Planning Meetings

1.2.4 Public Engagement

Early discussions with the Marin County OEM established the initial plan for public engagement to ensure a meaningful and inclusive public process with a focus on equity and accessible to the whole community. The Public Outreach efforts mirrored the Planning Team approach with a unified effort, led by the County OEM and the Southern Marin Fire Protection District, involving all participating jurisdictions and districts. Public outreach for this plan update began at the beginning of the plan development process with a detailed press release from Marin County and

the Southern Marin Fire Protection District informing the community of the purpose of the hazard mitigation planning process for the Marin County OA planning area and to invite the public to participate in the process.

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

Equity and Whole Community Approach

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

Engaging hard-to-reach populations

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

Translation and Interpretation Services

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

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

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

- Development and publishing of an MJHMP public outreach article
- Providing press releases to local newspapers and radio stations

- Posting meeting announcements on the local County MJHMP website
- Email to established email lists
- Personal phone calls

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

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

WEBSITE

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

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

Figure 1: Marin County OEM MJHMP Website

PUBLIC MEETINGS

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

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

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

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

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

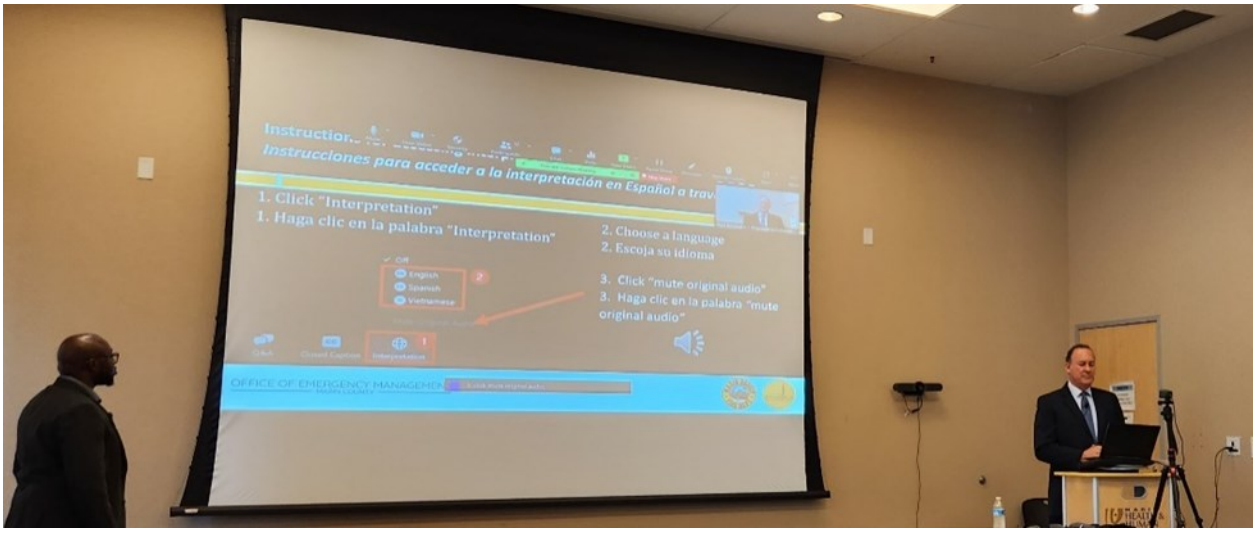


Figure 2: Marin County OEM MJHMP Public Town Hall Meeting

SOCIAL MEDIA

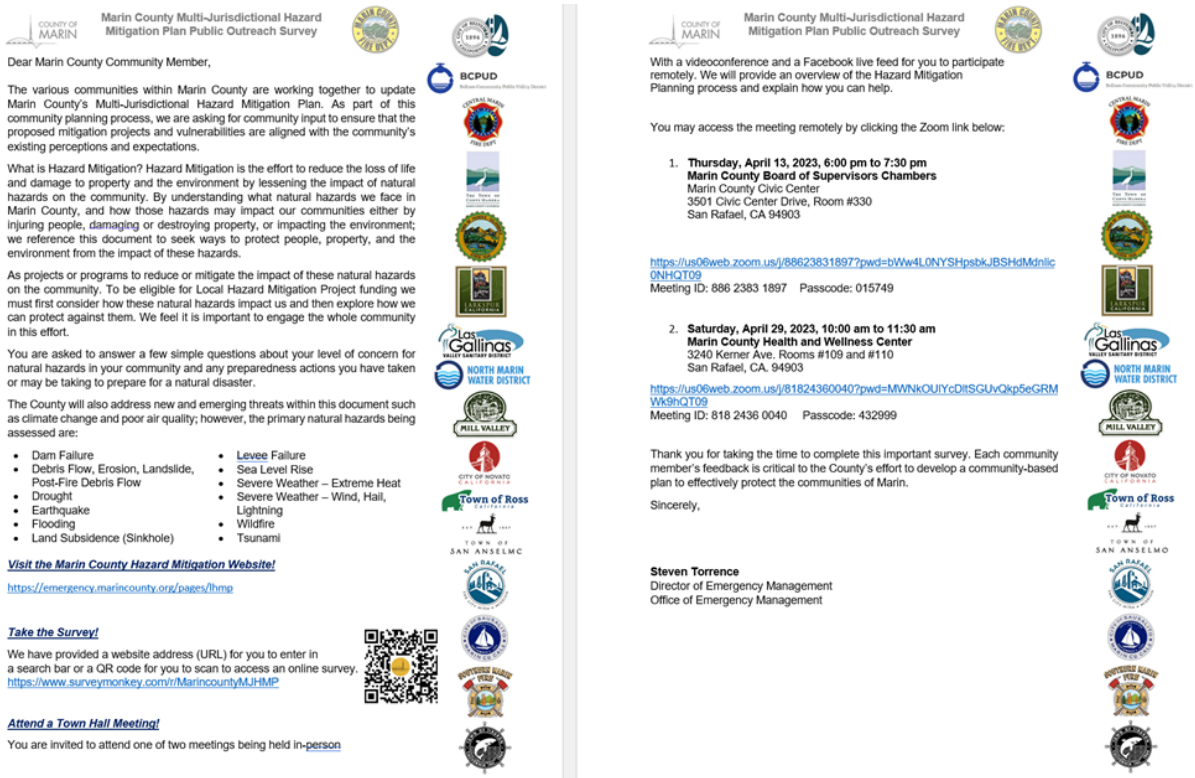
Marin County and its participating jurisdictions utilized several forms of social media to reach residents and customers. Information about the Hazard Mitigation Planning process was communicated to the public via Facebook, Twitter, and local access TV. Residents and customers were invited to complete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

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

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

PRESS RELEASES

Press releases were distributed over the course of the plan's development as key milestones were achieved and prior to each Marin County 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 3: Hazard Mitigation Plan Public Outreach Press Release

SURVEY

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

Public Comments Considered by the Planning Team

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

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

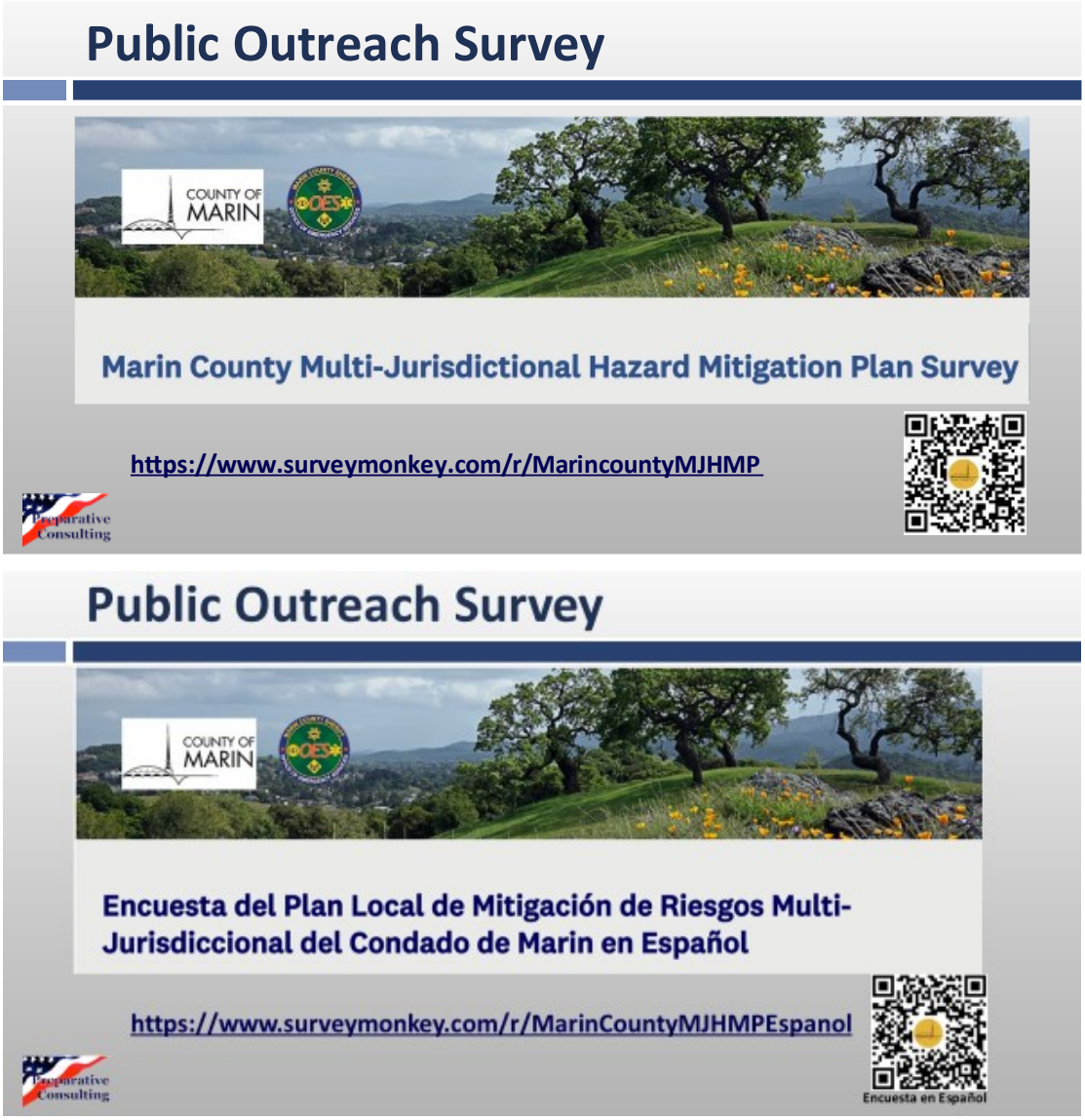


Figure 4: Hazard Mitigation Plan Survey

PUBLIC COMMENT ON THE PLAN

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

their top hazards of concern, elicit feedback on the plan and offer a place for them to share projects to reduce risk in their community. The survey collected responses from the community in English and in Spanish.

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

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

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

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

Public Comments Considered by the Planning Team

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

1.3 Overview and History

The Southern Marin Fire Protection District is an independent special district established by the Marin County Board of Supervisors in July of 1999. Its statutory authority is provided through the California Fire District Law of 1987, (Health & Safety Code §13800, et seq). The District was formed by the merger of the Alto-Richardson Fire Protection District and the Tamalpais Fire Protection District.

On June 24, 2012, the City of Sausalito Fire Department was annexed into the Fire District. In October of 2010 the District signed a contract with the National Park Service to provide services to the Marin Headlands and Fort Baker areas of the Golden Gate National Recreation Area. On July 1, 2023, the City of Mill Valley was annexed into the Fire District.

The District has 95 full time employees including a Fire Chief, 2 Deputy Fire Chiefs, 1 Fire Marshal, 1 Deputy Fire Marshal, 4 Battalion Chiefs, 15 Fire Captains, 17 Engineer Firefighters, 17 Engineer Paramedics, 7 Firefighter Paramedics, 16 Firefighters, 1 HR Manager, 1 Finance Manager, 1 Finance Assistant, 1 Communications Coordinator, 1 IT Coordinator, 1 Administrative Aide, 3 Fire Inspector/Plan Reviewers, 2 Wildfire Mitigation Specialists, and 2 Vegetation Management Specialists, and 1 NRG Coordinator.

1.4 Service Area

The Southern Marin Fire Protection District serves the cities of Sausalito, and Mill Valley, and communities of Tamalpais Valley, Almonte, Homestead Valley, Alto, Strawberry, approximately 1/4 of the town of Tiburon, the City of Mill Valley, Fort Baker and the Marin Headlands. The District covers over 25.3 square miles, a population of approximately 41,576 and over 20,500 homes and commercial properties. Each of our zones is protected by one Type I engine with each of the zones cross-staffing at least one specialty piece of equipment such as a Ladder Truck, Rescue, Fire Boat, Jet Skis, Inflatable Rescue Boat, and Type 3 Engine. The District also provide ALS transport services. The District has 2 ambulances and 1 ALS Medium Rescue.

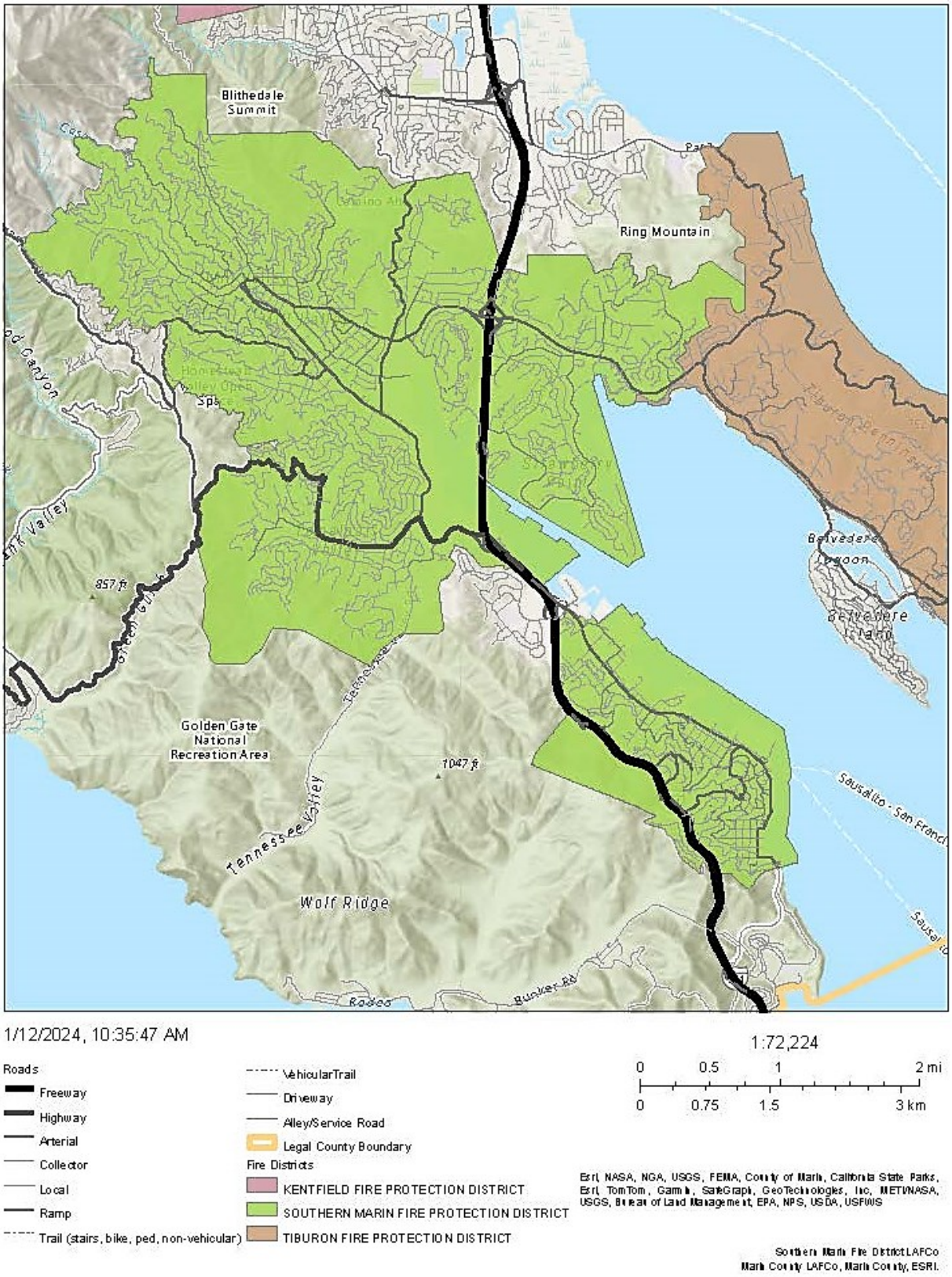


Figure 5: Map of the Southern Marin Fire Protection District
Source: SMFD, LaFCO

Figure 6 illustrates the Southern Marin Fire Protection District service area in purple with the red circle in relation to the other Marin County Fire Districts.

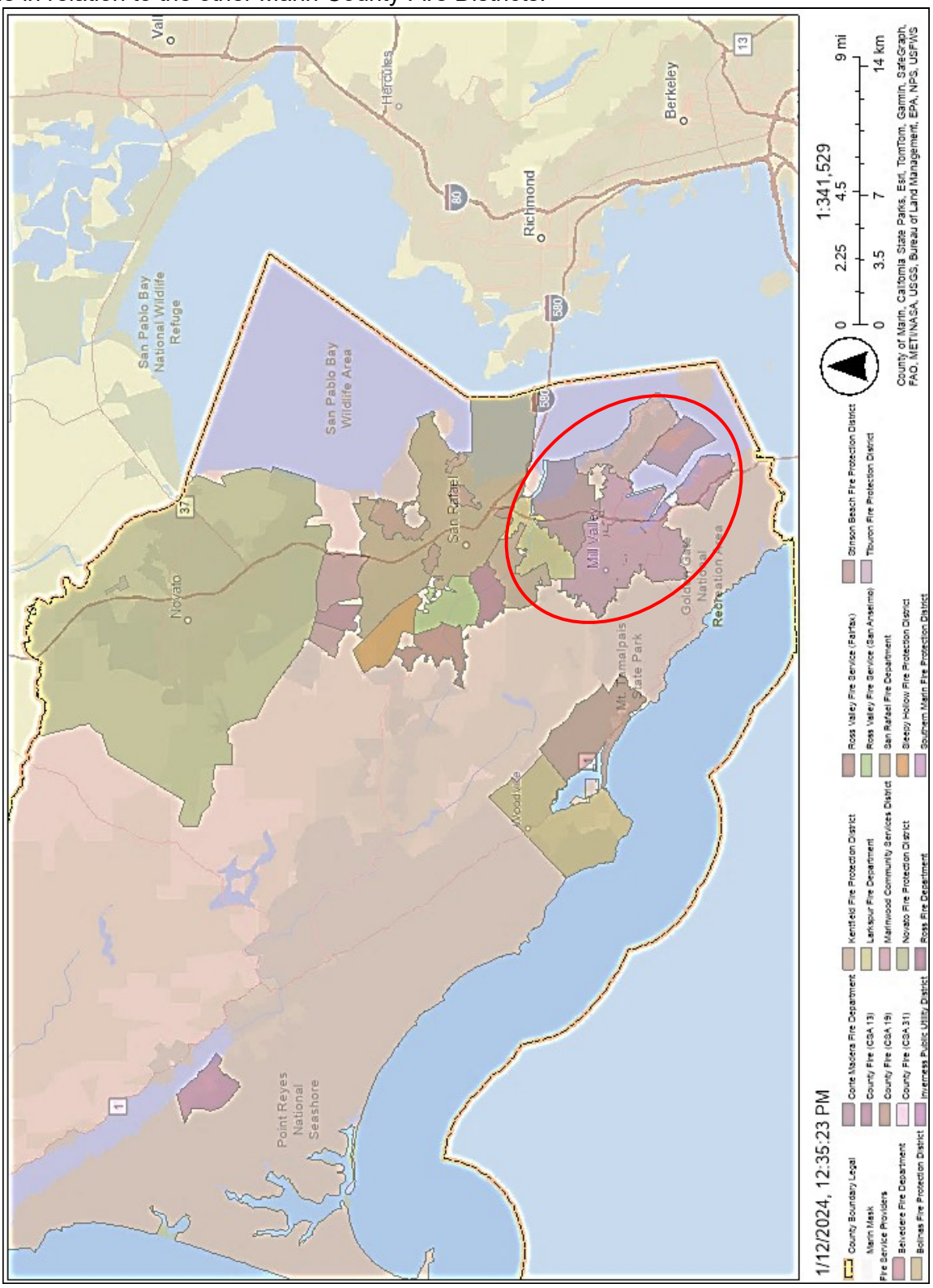


Figure 6: Map of the Southern Marin Fire Protection District and Other Fire Districts
Source: Marin County OEM

1.5 ADMINISTRATION

The Southern Marin Fire Protection District is governed by a seven-member Board of Directors. Board Directors are elected by the residents, serve four-year terms and Board members must live within the Fire District boundaries. The SMFD Board of Directors meets on the fourth Wednesday of each month at the Administration Headquarters located at 28 Liberty Ship Way, Suite 2800, Sausalito, California 94965. The public is encouraged to attend and participate in District Board Meetings.

Fire District elections are managed by the Marin County Election's office. Board members are elected or re-elected every four years during the Uniform District Elections in November. The terms of office are four-year, staggered terms. SMFD Board Directors must live within the District boundaries.

1.6 FINANCING

The primary economic drivers of the District's finances are property tax revenue and personnel costs. The District's Board of Directors is committed to long-term financial resiliency, and a thorough understanding of these aforementioned primary drivers is required in order to achieve and maintain long-term fiscal resiliency. The recent passage of Measure U was a major accomplishment towards increasing the District's revenues and thereby maintaining an organization with long-term financial resiliency. The District utilizes long-range financial planning tools to measure the District's financial health, identify potential fiscal challenges and guide current decision making, and keep the District on a fiscally sustainable path going forward. Two of the tools the District uses are a ten-year general operating cash flow model, and a twelve-year Capital Improvement Plan (CIP). In addition to the adoption of Measure U, the District has implemented a number of other cost-saving measures to ensure the long-term resiliency of the organization, such as:

- To address the OPEB liability, the District eliminated OPEB for employees hired after 1/1/2014, instead offering retiree health savings accounts.
- Prior to PEPRA, the District's safety members were the first in the County to modify retirement benefits from 3%@50 to 3%@55.
- Submitted winning grants in excess of $1.3 million.
- The District started making contributions to a trust for OPEB liabilities in 2011, and in 2019 made its first pension contribution. The combined balance of this trust as of June 30, 2021 exceeded $6.2M.
- Implemented employee cost-sharing of medical premium costs.
- The Board of Directors formally adopted a Reserve Policy to ensure the District has adequate working capital to cover operational costs and mitigate against potential adverse impacts stemming from an economic downturn. This policy calls for a minimum of 40% of current year operating and equipment expenditures to be in a separate cash fund. As of June 30, 2021, this cash fund balance was $6.7M.

1.7 WEATHER AND CLIMATE

The Southern Marin Fire Protection District serves the communities of Mill Valley and Sausalito. The City of Mill Valley is approximately 79 feet above sea level and while the low areas City of Sausalito are approximately 10 feet above sea level. The majority of housing is located on the adjacent hillsides well above sea level and the industrial areas of Sausalito known as the

Marinship are approximately 10 feet above sea level. In the Cities of Mill Valley and Sausalito, the summers are long, comfortable, arid, and mostly clear and the winters are short, cold, wet, partly cloudy and mostly clear with the exception of fog sometimes occurring daily in the summers. Over the course of the year, the temperature typically varies from 43°F to 73°F and is rarely below 36°F or above 84°F. The difference in precipitation between the driest month and the wettest month is 8 inches. The annual rainfall is between 33- 45 inches. The month of highest relative humidity is February (80%). The month with the lowest relative humidity is June (69%). The month which sees the most rainfall is January. The driest month of the year is July.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	9.4 °C (48.9) °F	10.2 °C (50.3) °F	11.3 °C (52.4) °F	12.3 °C (54.1) °F	14 °C (57.2) °F	15.9 °C (60.7) °F	16.3 °C (61.3) °F	16.7 °C (62) °F	16.8 °C (62.3) °F	15.3 °C (59.6) °F	12.2 °C (53.9) °F	9.6 °C (49.4) °F
Min. Temperature °C (°F)	6.1 °C (43) °F	6.9 °C (44.4) °F	7.9 °C (46.2) °F	8.6 °C (47.6) °F	10.2 °C (50.3) °F	11.7 °C (53) °F	12.4 °C (54.3) °F	12.9 °C (55.2) °F	12.6 °C (54.7) °F	11.4 °C (52.5) °F	8.7 °C (47.7) °F	6.6 °C (43.9) °F
Max. Temperature °C (°F)	13.7 °C (56.7) °F	14.5 °C (58.1) °F	15.9 °C (60.6) °F	17 °C (62.7) °F	18.9 °C (66.1) °F	21.5 °C (70.6) °F	21.8 °C (71.3) °F	22.2 °C (72) °F	22.8 °C (73.1) °F	20.9 °C (69.6) °F	16.8 °C (62.2) °F	13.6 °C (56.5) °F
Precipitation / Rainfall mm (in)	118 (4)	124 (4)	88 (3)	41 (1)	22 (0)	5 (0)	1 (0)	2 (0)	2 (0)	25 (0)	58 (2)	114 (4)
Humidity(%)	78%	80%	77%	72%	71%	69%	74%	75%	72%	71%	75%	77%
Rainy days (d)	8	7	6	4	3	1	0	0	0	2	5	7
avg. Sun hours (hours)	5.7	6.4	7.8	9.4	10.0	10.6	9.3	8.5	8.7	7.8	6.7	5.6

Figure 7: The Southern Marin Fire Protection District Precipitation and Monthly Temperatures
Source: En.Climate-Data.org

1.8 Social Vulnerability and Risk

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

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

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

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

Table 4: NRI Hazards and Marin County MJHMP Hazards	
NRI Hazards	Marin County MJHMP Hazards
Earthquake	Earthquake
Riverine Flooding	Flooding
Coastal Flooding	Flooding
Wildfire	Wildfire
Landslide	Debris Flow
Drought	Drought
Heat Wave	Severe Weather -Extreme Heat
Tsunami	Tsunami
Strong Wind	Severe Weather – Wind, Tornado

Table 4: NRI Hazards and Marin County MJHMP Hazards
Source: FEMA National Risk Index 2023

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

Calculating the Risk Index

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

Hazard Type Risk Index

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

The following Tables and Figures illustrates the NRI Hazard Type Risk Index and the Social Vulnerability Map for the Southern Marin Fire Protection District for the various Census Tracts within their service area.

Tables 5 – 12 illustrate the NRI Hazard Type Risk Index for the SMFD service area Census Tracts.

Table 5: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,347,641	Very Low	Very High	0.66	$894,146	90.4
Riverine Flooding	$893,441	Very Low	Very High	0.66	$592,789	97.1
Wildfire	$14,195	Very Low	Very High	0.66	$9,418	83.6
Heat Wave	$9,305	Very Low	Very High	0.66	$6,173	43.2
Tornado	$5,176	Very Low	Very High	0.66	$3,434	8
Landslide	$3,082	Very Low	Very High	0.66	$2,045	76.5
Coastal Flooding	$1,675	Very Low	Very High	0.66	$1,112	81.4
Tsunami	$505	Very Low	Very High	0.66	$335	94.3
Drought	$0	Very Low	Very High	0.66	$0	0

Table 5: NRI Hazard Type Risk Index for Mill Valley Census Tract 1261.00
Source: FEMA National Risk Index 2023

Figures 8 - 15 illustrate the Social Vulnerability Maps for the SMFD service area Census Tracts.

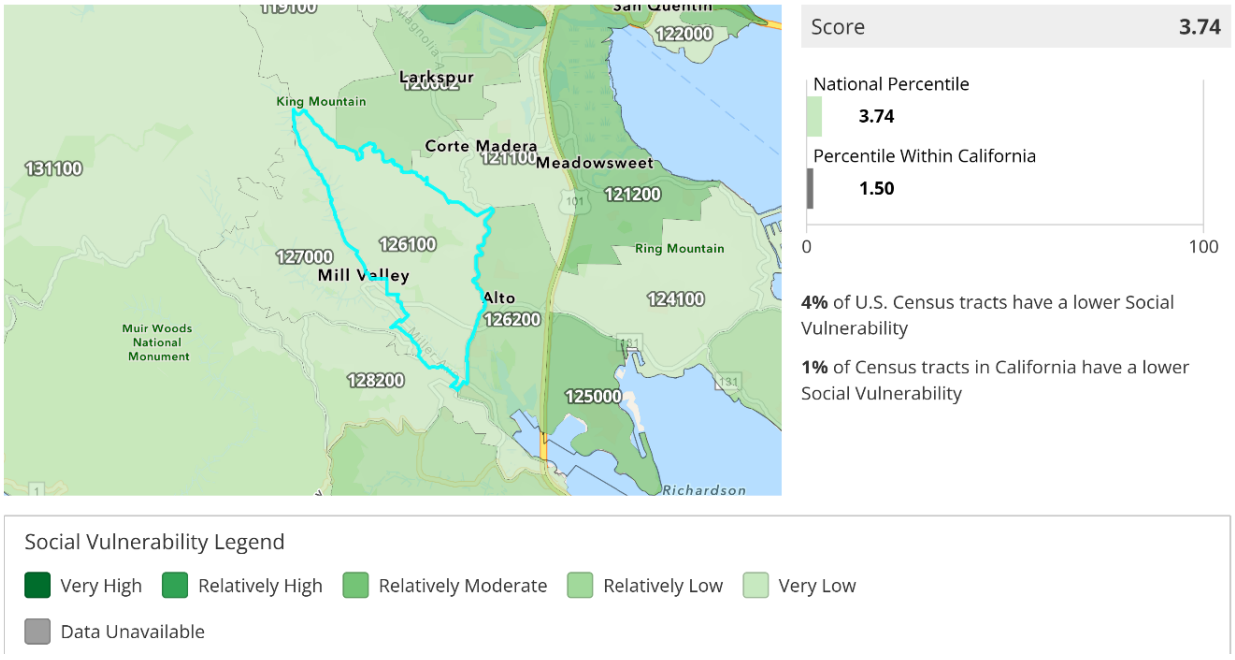


Figure 8: City of Mill Valley Social Vulnerability Map Census Tract 1261.00
Source: FEMA National Risk Index 2023

Table 6: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,077,596	Relatively Low	Very High	0.94	$1,009,900	91.3
Riverine Flooding	$779,681	Relatively Low	Very High	0.94	$730,701	97.7
Coastal Flooding	$23,958	Relatively Low	Very High	0.94	$22,453	92.4
Heat Wave	$7,024	Relatively Low	Very High	0.94	$6,582	44.3
Tornado	$3,739	Relatively Low	Very High	0.94	$3,504	8.1
Landslide	$2,757	Relatively Low	Very High	0.94	$2,584	80.4
Tsunami	$1,144	Relatively Low	Very High	0.94	$1,072	96.5
Wildfire	$575	Relatively Low	Very High	0.94	$538	56

Table 6: NRI Hazard Type Risk Index for Mill Valley Census Tract 1262.00
Source: FEMA National Risk Index 2023

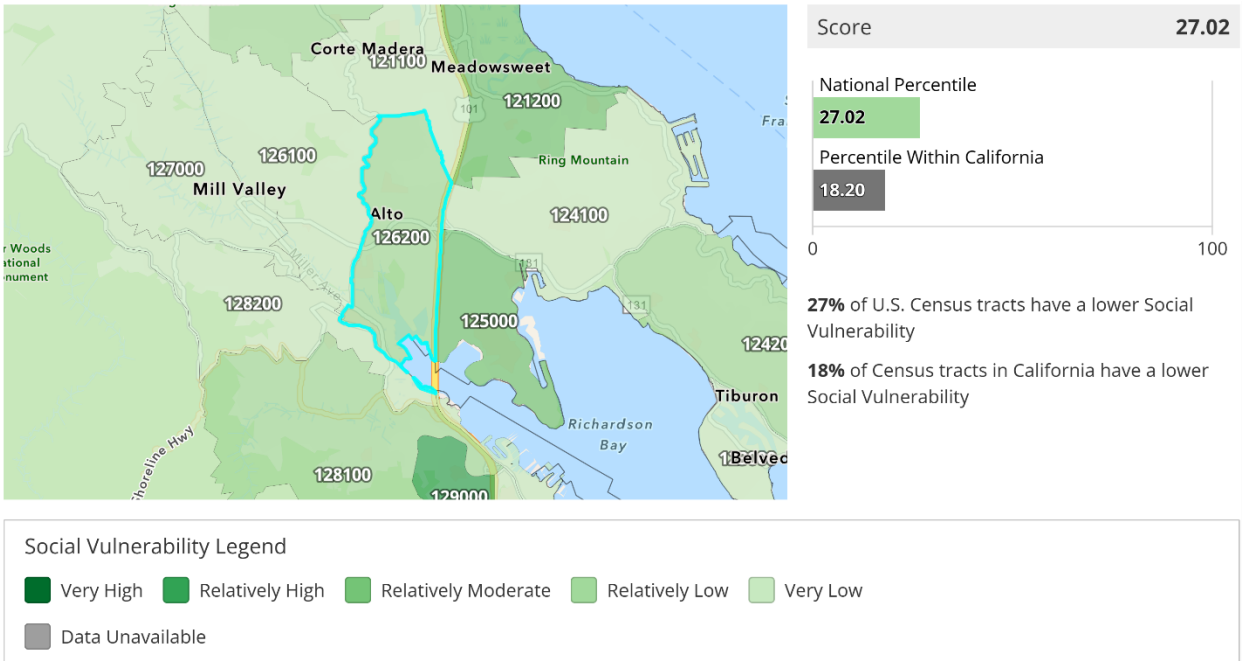


Figure 9: City of Mill Valley Social Vulnerability Map Census Tract 1262.00
Source: FEMA National Risk Index 2023

Table 7: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00						
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Score
Earthquake	$1,217,445	Very Low	Very High	0.72	$880,410	90.3
Riverine Flooding	$176,890	Very Low	Very High	0.72	$127,920	87.5
Wildfire	$40,457	Very Low	Very High	0.72	$29,257	88.9
Heat Wave	$5,300	Very Low	Very High	0.72	$3,832	35.9
Tornado	$4,570	Very Low	Very High	0.72	$3,305	7.6
Landslide	$1,624	Very Low	Very High	0.72	$1,175	67.2
Strong Wind	$256	Very Low	Very High	0.72	$185	7
Coastal Flooding	$0	Very Low	Very High	0.72	$0	0
Drought	$0	Very Low	Very High	0.72	$0	0
Tsunami	$0	Very Low	Very High	0.72	$0	0

Table 7: NRI Hazard Type Risk Index for Mill Valley Census Tract 1270.00
Source: FEMA National Risk Index 2023

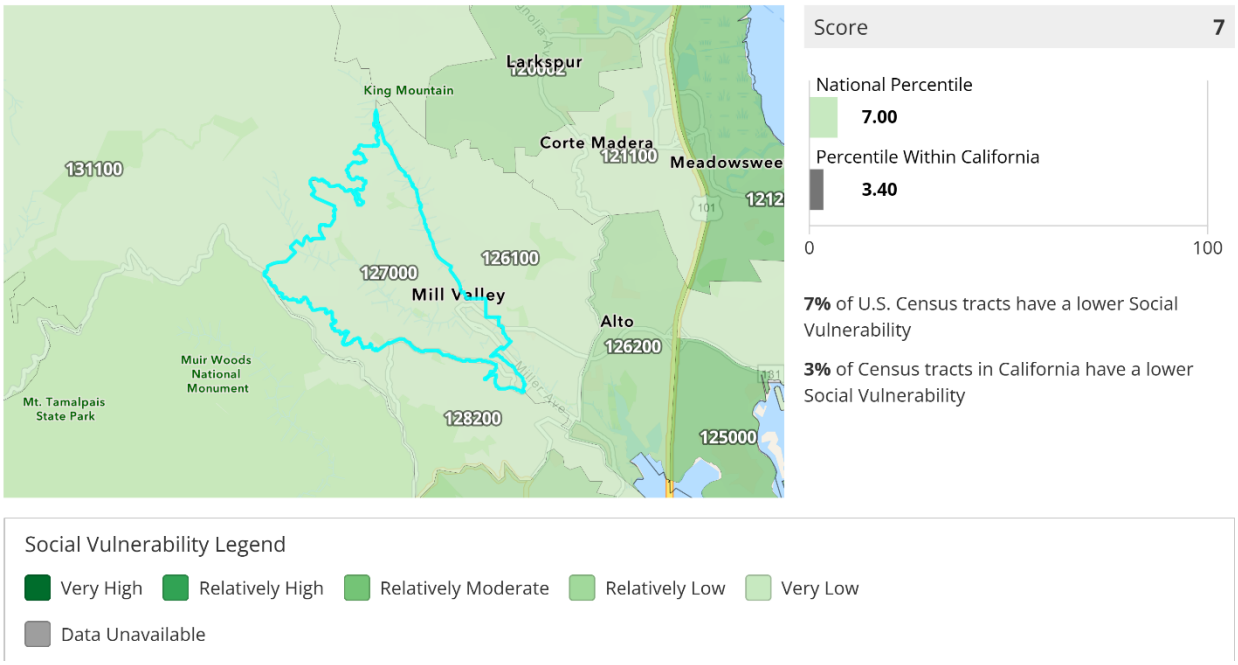


Figure 10: City of Mill Valley Social Vulnerability Map Census Tract 1270.00
Source: FEMA National Risk Index 2023

Table 8: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$704,009	Very Low	Very High	0.79	$553,971	87.3
Riverine Flooding	$48,101	Very Low	Very High	0.79	$37,850	72.8
Coastal Flooding	$5,117	Very Low	Very High	0.79	$4,026	86.2
Landslide	$3,202	Very Low	Very High	0.79	$2,519	80
Tornado	$3,181	Very Low	Very High	0.79	$2,503	5.8
Heat Wave	$359	Very Low	Very High	0.79	$282	17.1
Strong Wind	$188	Very Low	Very High	0.79	$148	6
Tsunami	$1	Very Low	Very High	0.79	$1	88.4
Drought	$0	Very Low	Very High	0.79	$0	0
Wildfire	$0	Very Low	Very High	0.79	$0	0

Table 8: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.01
Source: FEMA National Risk Index 2023

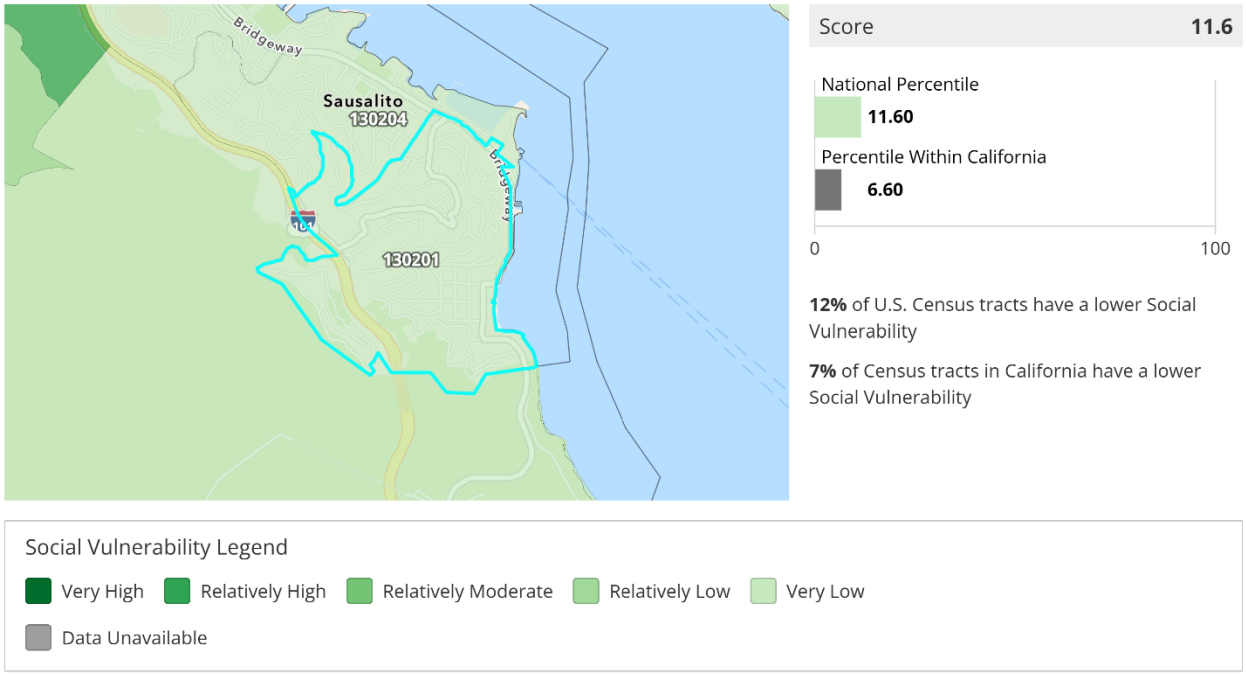


Figure 11: City of Sausalito Social Vulnerability Map Census Tract 1302.01
Source: FEMA National Risk Index 2023

Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$277,560	Very Low	Very High	0.81	$224,222	82.3
Landslide	$7,589	Very Low	Very High	0.81	$6,131	92.2
Tornado	$1,283	Very Low	Very High	0.81	$1,037	2.9
Tsunami	$1,239	Very Low	Very High	0.81	$1,001	96.4
Wildfire	$200	Very Low	Very High	0.81	$162	40.9
Heat Wave	$176	Very Low	Very High	0.81	$142	16.4
Strong Wind	$86	Very Low	Very High	0.81	$70	3.6
Coastal Flooding	$10	Very Low	Very High	0.81	$8	71.8
Drought	$0	Very Low	Very High	0.81	$0	0
Riverine Flooding	$0	Very Low	Very High	0.81	$0	0

Table 9: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.03
Source: FEMA National Risk Index 2023

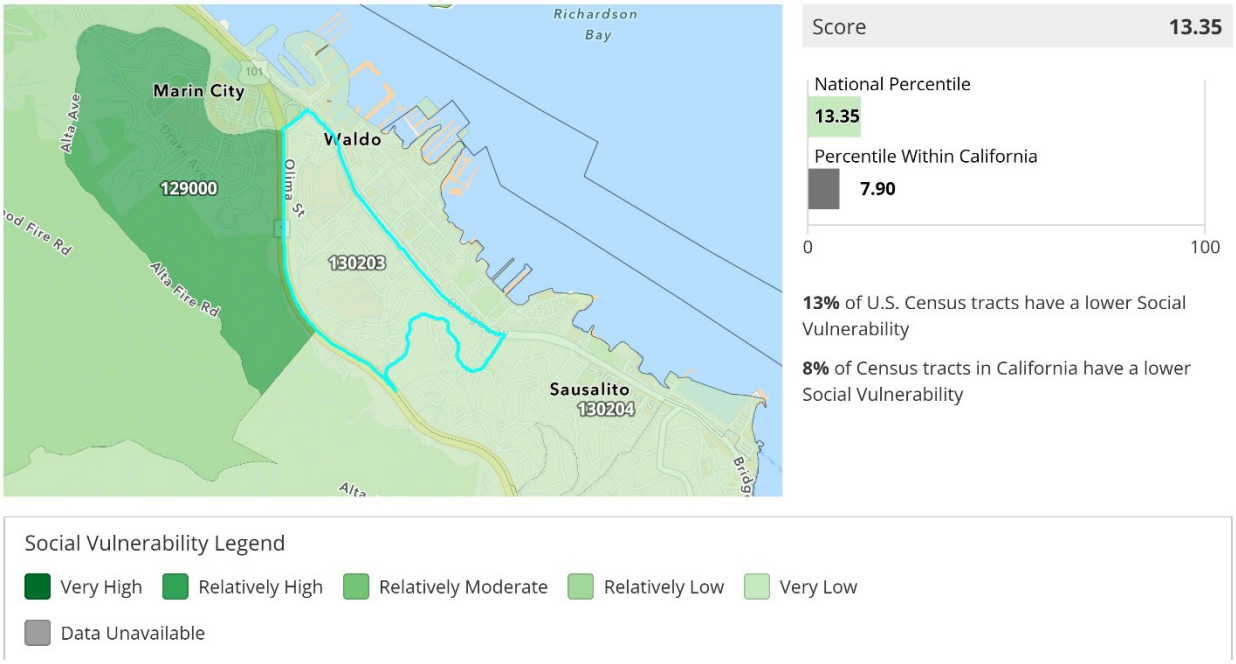


Figure 12: City of Sausalito Social Vulnerability Map Census Tract 1302.03
Source: FEMA National Risk Index 2023

Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,169,125	Very Low	Very High	0.58	$683,563	88.5
Riverine Flooding	$778,574	Very Low	Very High	0.58	$455,216	96.1
Coastal Flooding	$124,477	Very Low	Very High	0.58	$72,779	95.6
Tsunami	$14,622	Very Low	Very High	0.58	$8,549	99.1
Tornado	$3,340	Very Low	Very High	0.58	$1,953	4.6
Landslide	$2,262	Very Low	Very High	0.58	$1,322	69.1
Heat Wave	$852	Very Low	Very High	0.58	$498	18.3
Strong Wind	$166	Very Low	Very High	0.58	$97	4.5
Wildfire	$15	Very Low	Very High	0.58	$9	26.5
Drought	$0	Very Low	Very High	0.58	$0	0

Table 10: NRI Hazard Type Risk Index for Sausalito Census Tract 1302.04
Source: FEMA National Risk Index 2023

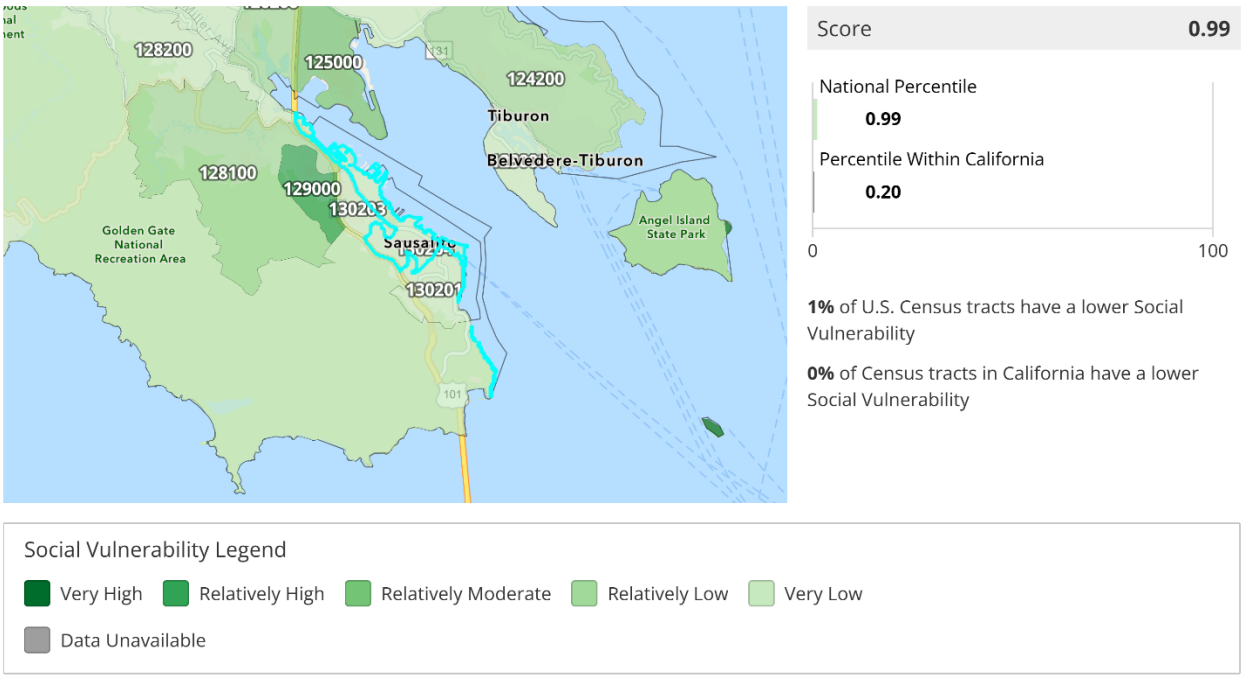


Figure 13: City of Sausalito Social Vulnerability Map Census Tract 1302.04
Source: FEMA National Risk Index 2023

Table 11: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1281.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$1,282,203	Relatively Low	Very High	0.97	$1,242,403	92.8
Riverine Flooding	$359,276	Relatively Low	Very High	0.97	$348,124	94.9
Coastal Flooding	$49,671	Relatively Low	Very High	0.97	$48,129	94.5
Landslide	$40,069	Relatively Low	Very High	0.97	$38,825	99.1
Wildfire	$29,347	Relatively Low	Very High	0.97	$28,436	88.8
Tornado	$5,603	Relatively Low	Very High	0.97	$5,429	13.1
Heat Wave	$726	Relatively Low	Very High	0.97	$703	19.7
Strong Wind	$363	Relatively Low	Very High	0.97	$351	11.4
Tsunami	$261	Relatively Low	Very High	0.97	$253	93.8
Drought	$0	Relatively Low	Very High	0.97	$0	0

Table 11: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1281.00
Source: FEMA National Risk Index 2023

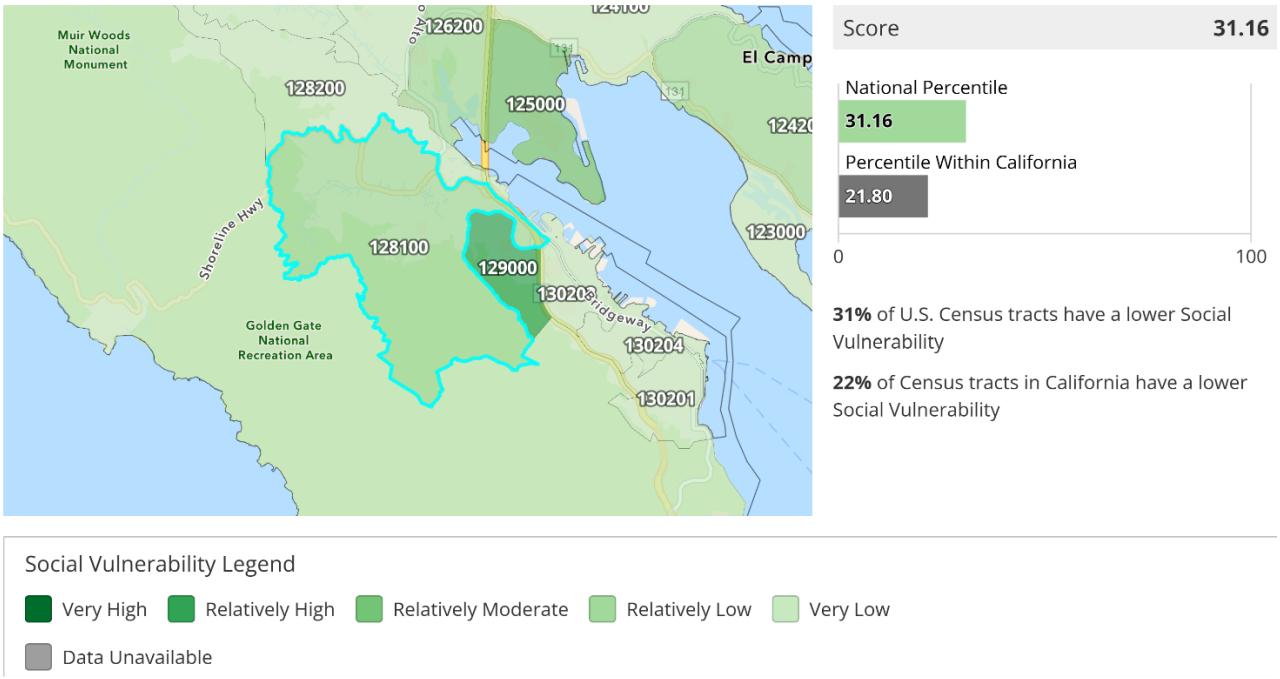


Figure 14: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1281.00
Source: FEMA National Risk Index 2023

Table 12: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1282.00						
Hazard Type	**EAL Value**	**Social Vulnerability**	**Community Resilience**	**CRF**	**Risk Value**	**Score**
Earthquake	$911,472	Very Low	Very High	0.75	$685,000	88.5
Riverine Flooding	$124,366	Very Low	Very High	0.75	$93,465	84.3
Wildfire	$34,470	Very Low	Very High	0.75	$25,905	88.3
Coastal Flooding	$15,955	Very Low	Very High	0.75	$11,991	90.2
Tornado	$3,999	Very Low	Very High	0.75	$3,006	6.9
Heat Wave	$1,320	Very Low	Very High	0.75	$992	21.8
Landslide	$1,134	Very Low	Very High	0.75	$852	62.2
Strong Wind	$255	Very Low	Very High	0.75	$192	7.2
Tsunami	$188	Very Low	Very High	0.75	$141	92.7
Drought	$0	Very Low	Very High	0.75	$0	0

Table 12: NRI Hazard Type Risk Index for SMFD Unincorporated County Census Tract 1282.00
Source: FEMA National Risk Index 2023

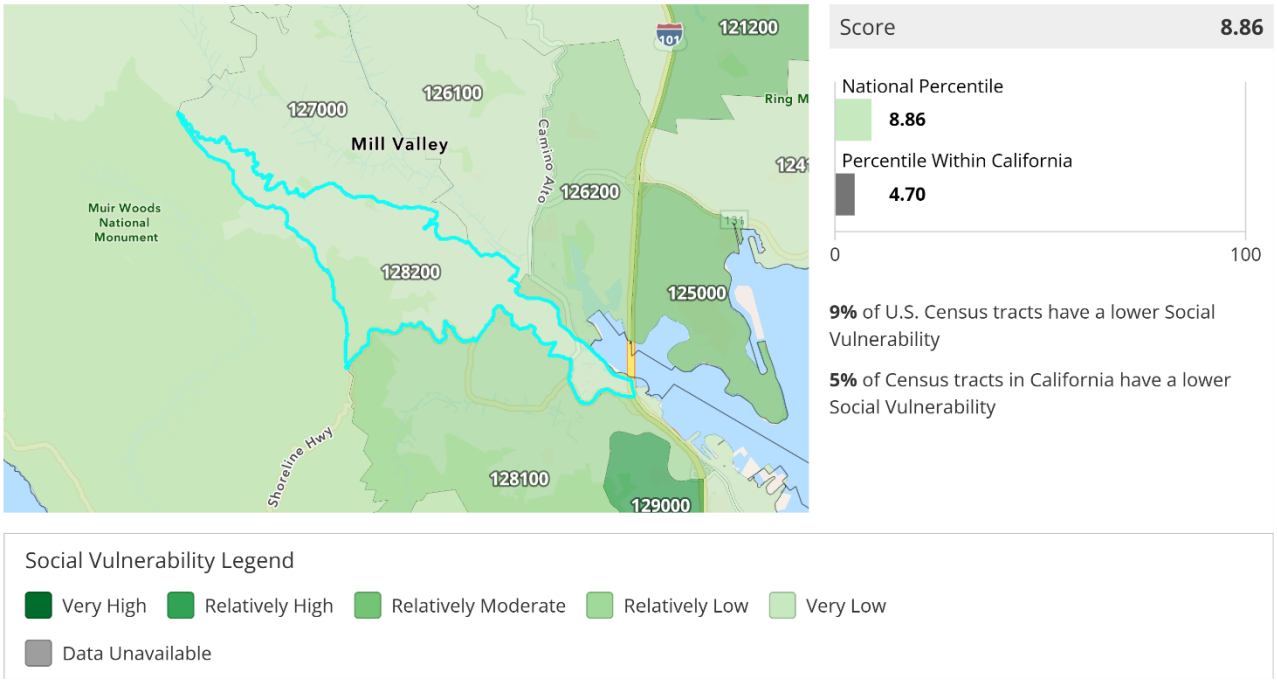


Figure 15: City of SMFD Unincorporated County Social Vulnerability Map Census Tract 1282.00
Source: FEMA National Risk Index 2023

Social Vulnerability in Marin County and the Southern Marin Fire Protection District

Most socially vulnerable residents in the Marin County OA reside in parts of Novato, parts of San Rafael, including in and around the Canal District, the Greenbrae neighborhood of Larkspur, and the unincorporated areas of Marin City and Santa Venetia.

The median income for a household in the City was $179,529 and the per capita income for the City was $110,356. Approximately 2.4 percent of families and 4.5 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low or Relatively Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

The median income for a household in the City of Sausalito was $140,410 and the per capita income for the City was $111,167. Approximately 0 percent of families and 7.3 percent of the population were below the poverty line (2020 data, U.S. Census Bureau). All three census tracts reflect a Very Low Social Vulnerability Index in the City, which reflects the City's SVI position within the County.

Customers within the Southern Marin Fire Protection District reside within census tracts that have a Social Vulnerability Index of "Relatively Low" to "Very Low", the Southern Marin Fire Protection District's ability to serve this community is limited to the Fire and Emergency Medical Services they provide.

1.9 Critical Facilities

The following list of facilities has been determined to be critical to the ability of the Southern Marin Fire Protection District to fulfill the requirements of its mission during an emergency:

Table 13: Southern Marin Fire Protection District Critical Facilities

Category	Name	Address	Fire Severity Zone	Flood Zone
Critical Facilities				
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	VH	X
Fire	City of Mill Valley SMFD (SOM) & City Hall Building/ Fire Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	H	X/AE
Fire	Southern Marin Fire Protection District (SOM)/ Station 4	309 Poplar Street Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM)/ Station 9	308 Reed Blvd Mill Valley, CA 94941	U	X
Fire	Southern Marin Fire Protection District Main Office (SOM) / EOC	28 Liberty Ship Way, Suite 2800, Sausalito, CA 94965	U	VE
Fire	City of Mill Valley SMFD (SOM) & Public Safety Building /Fire St. 7	1 Hamilton Dr, Mill Valley, CA 94941	U	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	VH	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	H	X

Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	VH	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	H	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	H	X
School Lycee Francais	Private School, K-6	100 Ebbtide, Sausalito, CA	H	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	H	X
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	H	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	VH	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	U	X
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	U	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	H	AE
Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	M	X
Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	VH	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	U	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	M	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	H	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941	VH	X

		(Unincorporated Marin Co but serves Mill Valley)		
High Potential Loss Facilities				
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	H	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	M	X
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	H	X
Critical Infrastructure				
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	VH	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	M	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	U	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	H	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	H	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	VH	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	VH	X
Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	VH, H, M	X, VE, AE
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	VH	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941 37.906425, -122.531301	H	X
Water Supply Facilities	H-Line Fire Road	H-Line Fire Road 37.927032, -122.556641	VH	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	VH	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	VH	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	VH	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	VH	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	VH	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	H	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	VH	X

Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	H	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	X	X
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	H	X
Communications	MERA Radio Antena Site - GGNRA Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	H	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	M, L	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	H	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	M	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	VH	X
Transportation	32 miles of City Roadways	Sausalito CA	VH, H, M	X, AE
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	H	D
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	H	X, AE
Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	M, H	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	VH	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	VH, H	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 3- Homestead	Montford Ave Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 16 - Sausalito	Hecht Ave Sausalito, CA 94965 **Lat:** 37.846963° N **Lon:** 122.483571° W	H	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 2 - Sausalito	300 Spencer Ave., Sausalito, CA 94965	H	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 1 - Sausalito	Rodeo Ave., Sausalito, CA 94965 **Lat:** 37.861804° N **Lon:** 122.498587° W	M	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 6 - Mill Valley	Edgewood Ave Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 5– Tam Valley	Eastwood Park Mill Valley, CA 94941	VH	X
Local Government	City of Mill Valley / LRAD Site 12 - Cascade	Cascade Ave Mill Valley, CA 94941	VH	X
Local Government	City of Mill Valley / LRAD Site 13 – Golf Course	City Golf Course, Mill Valley, CA 94941 **Lat:** 37.912321° N **Lon:** 122.532580° W	H	X

Local Government	City of Mill Valley / LRAD Site 14 – Vasco Ct	Vasco Ct, Mill Valley, CA 94941 **Lat:** 37.909892° N **Lon:** 122.524649° W	H	X
Local Government	City of Mill Valley / LRAD Site 15 – Ralston White	Ralston White Mill Valley, CA 94941	VH	X
Fire	Southern Marin Fire Protection District (SOM) – Bel Aire School RUSD / LRAD Site 8- Tiburon	277 Karen Way Mill Valley, CA 94941 **Lat:** 37.902517° N **Lon:** 122.495679° W	U	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 17- Marin City	850 Drake Ave, Marin City Mill Valley, CA 94941	VH	X
Fire/Local Government	Publicly Maintained Hydrants	1,929 individual site locations within the District.	VH, H, M	X, VE, AE
Fire/Local Government	Public Emergency Fire Roads	9.59 miles of non-paved emergency access fire roads	VH, H, M	X, VE, AE

Table 13: Southern Marin Fire Protection District Critical Facilities
Source: Southern Marin Fire Protection District

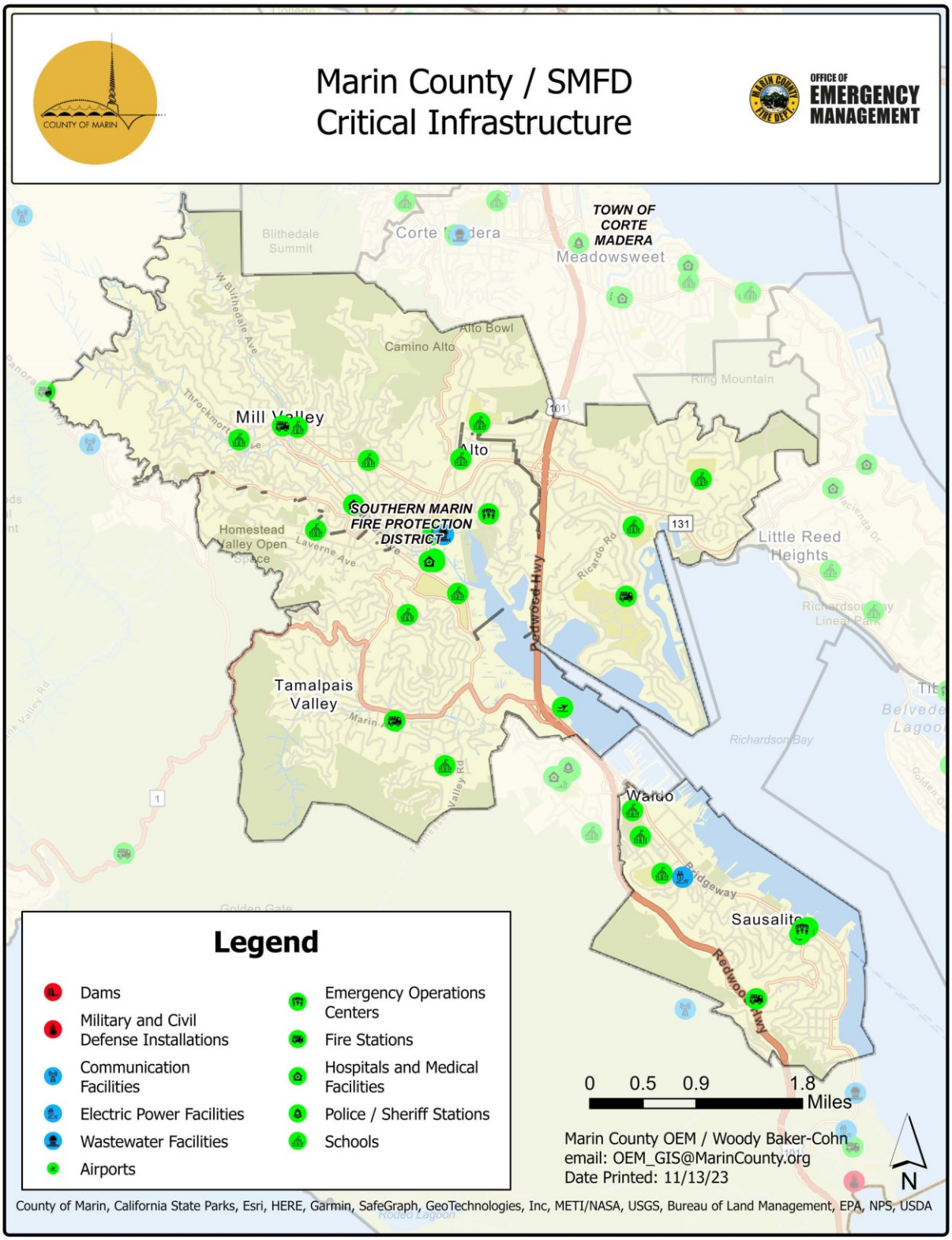


Figure 16: Map of the Southern Marin Fire Protection District and Critical Facilities and Infrastructure within the District
Source: Marin County OEM

SECTION 2.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Southern Marin Fire Protection District identified hazards that affect the District and developed natural hazard profiles based upon the countywide risk assessment, past events and their impacts. Figure 17 shows the top hazards that the Jurisdiction is at risk from according to the hazard mitigation Steering Committee.

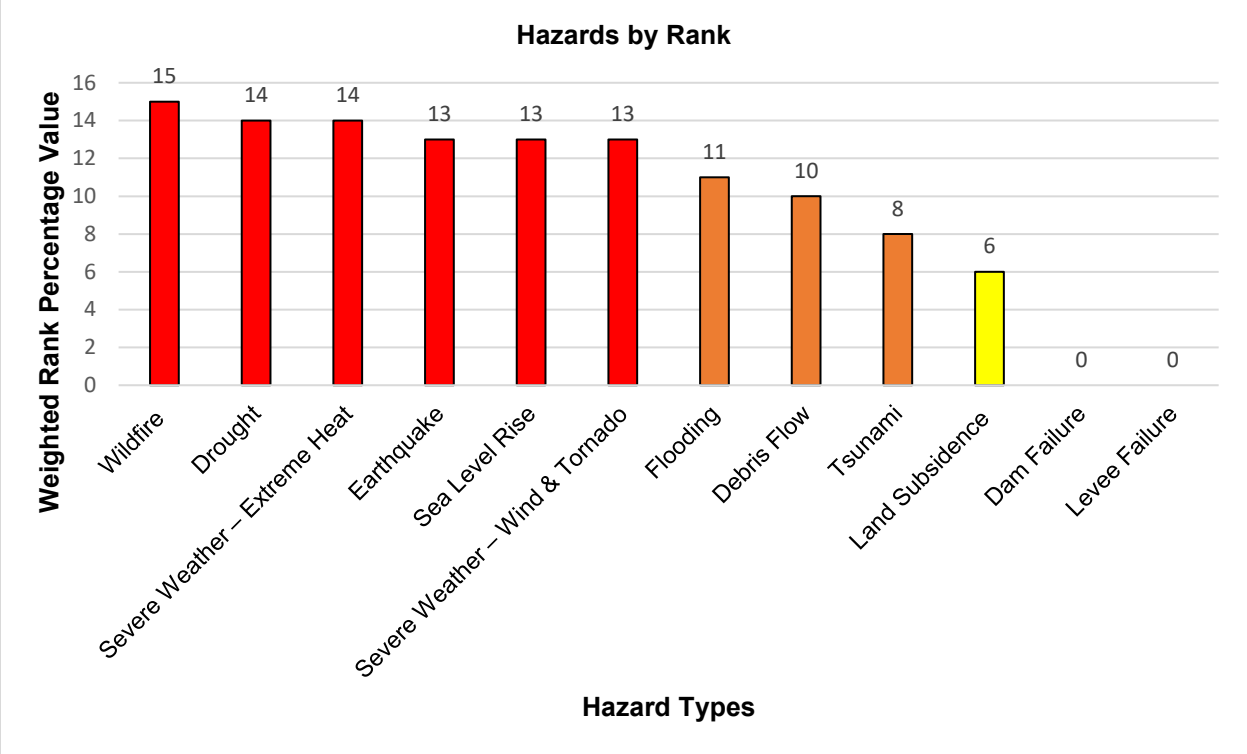


Figure 17: SMFD Risk Assessment – Planning Team Top Hazards

Figure 18: Risk Rank Categorization	
Risk Level	Risk Numerical Score
High Risk	**12 - 16**
Serious Risk	**8 - 11**
Moderate Risk	**4 - 7**
Low Risk	**1 - 3**

Figure 18: Hazard Risk Categorization

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

The planning process used the available FEMA tools to evaluate all the possible threats faced. The primary tool selected was the Hazard Assessment and Prioritization Tool. This matrix allowed

the participating jurisdiction or organization to assess their own level of vulnerability and mitigation capability. Each participating Jurisdiction and organization assessed the top hazards for:

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

Probability/ Likelihood of Future Events

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

Geographic Extent

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

Magnitude/ Severity

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

Table 14: Select Hazards Magnitude and Severity Scale

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

Table 14: Select Hazards Magnitude/ Severity Scale or Index

Climate Change Influence

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

Significance

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

2.1 CLIMATE CHANGE

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

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

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

GLOBAL OBSERVED AND PROJECTED IMPACTS AND RISKS

Source: Intergovernmental Panel on Climate Change, Headline Statements from the Summary for Policymakers, 2022

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

FUTURE TRENDS/ IMPACTS

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

Global Warming

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

ATMOSPHERIC METHANE CONCENTRATIONS
SINCE 1984

Data source: Data from NOAA, measured from a global network of air sampling sites

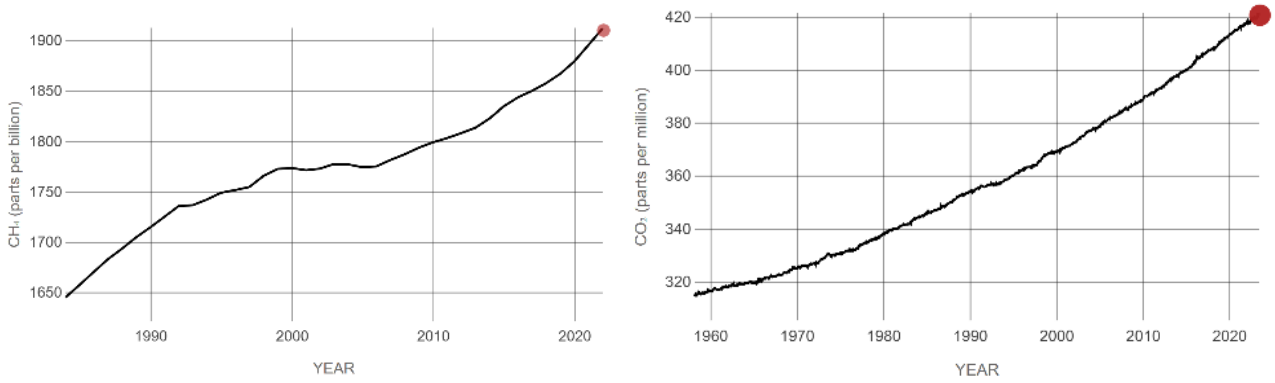


Figure 19: NASA Global Temperature Change CO2 Gas
Source: NASA Global Climate Change, 2022

TIME SERIES: 1884 TO 2022

Data source: NASA/GISS
Credit: NASA's Scientific Visualization Studio

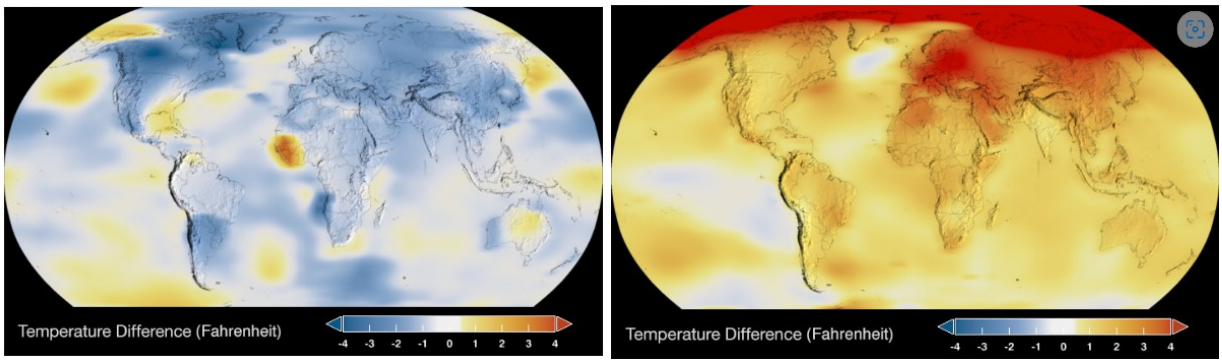


Figure 20: NASA Global Temperature Change 1884 to 2022
Source: NASA Global Climate Change, 2022

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.

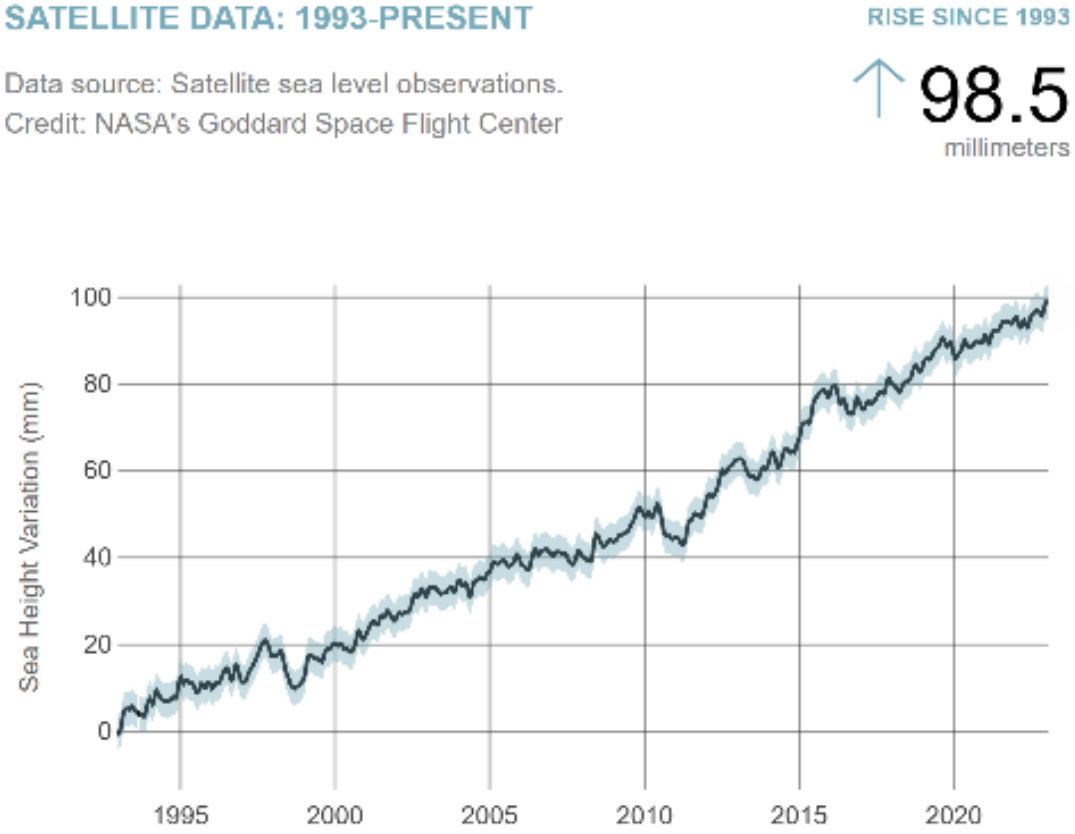


Figure 21: NASA Global Temperature Change Sea Level
Source: NASA Global Climate Change, 2022

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).

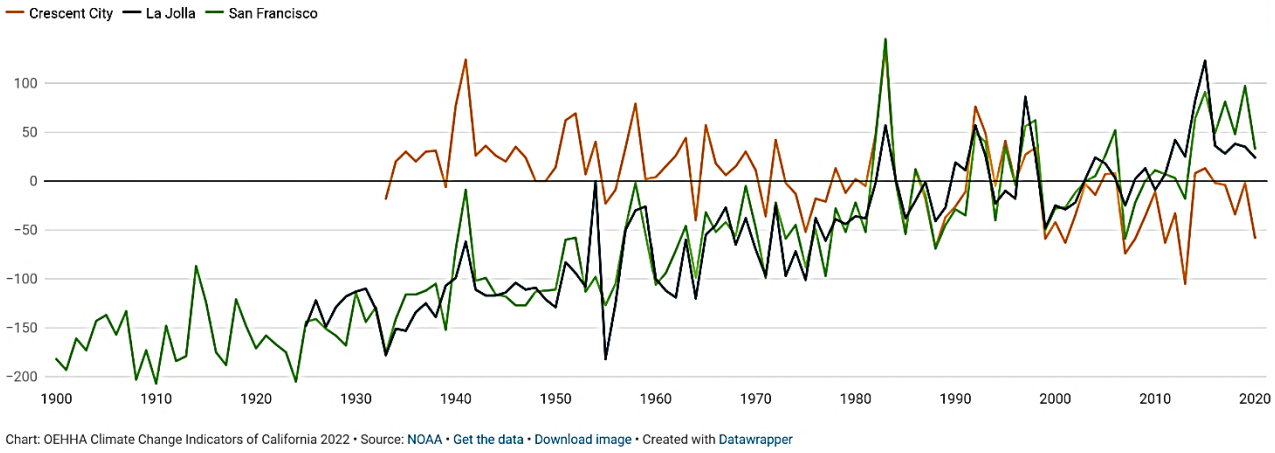


Figure 22: Annual Mean Sea Level Trends
Source: 2022 Report: Indicators of Climate Change in California | OEHHA

Climate Change in the Marin County Operational Area

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

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

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

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

The Marin County OA has adopted numerous planning initiatives and mitigation measures to help combat the effects of climate change across the OA. The Marin Climate Energy Partnership (MCEP), which is a partnership program of Marin County jurisdictions, the County, and Marin County regional agencies, adapted a model Climate Action Plan (CAP) that is intended to support countywide implementation efforts and is currently being used to update additional climate action plans for other jurisdictions in Marin County. The CAP supports the Climate Action Plan for the unincorporated County, which was completed in 2020. The MCEP also collects data and report on progress in meeting each County jurisdictions' individual greenhouse gas emission targets. In October 2022, the County published the Greenhouse Gas Inventory for Unincorporated Community Emissions for the Year 2020. Marin County OA jurisdictions have already met their greenhouse reduction goals for 2020 and are about halfway to meeting the statewide goal to reduce emissions 40% below 1990 levels by the year 2030. Marin County also formed a Sea Level Marin Adaptation Response Team in 2018 and had a Sea Level Rise Vulnerability Assessment and associated Adaptation Report completed for the County and each of its jurisdictions in 2017 as part of their Bay Waterfront Adaptation and Vulnerability Evaluation. Additional Marin County OA climate change mitigation initiatives

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

2.2 HAZARDS

Of the hazards profiled in the Marin County OA MJHMP, those noted in the table are specific for the Southern Marin Fire Protection District as per the planning team.

Table 15: County of Marin Hazard Risk Assessment						
Hazard	Probability/ Likelihood of Future Events	Geographic Extent	Magnitude/ Severity	Climate Change Influence	Significance	Risk Score
Debris Flow	Occasional	Extensive	Severe	Medium	Medium	**13.00**
Drought	Highly Likely	Extensive	Moderate	High	High	**16.00**
Earthquake	Highly Likely	Extensive	Extreme	None	High	**15.00**
Flooding	Highly Likely	Limited	Severe	High	Medium	**14.00**
Land Subsidence	Occasional	Limited	Moderate	Medium	Medium	**10.00**
Levee Failure	Unlikely	Negligible	Moderate	Medium	High	**9.00**
Sea Level Rise	Highly Likely	Limited	Extreme	High	High	**16.00**
Severe Weather – Extreme Heat	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Severe Weather – Wind, Tornado	Highly Likely	Extensive	Moderate	High	Medium	**15.00**
Tsunami	Highly Likely	Limited	Extreme	Medium	High	**15.00**
Wildfire	Highly Likely	Significant	Severe	High	High	**16.00**

Table 15: SMFD Hazard Risk Assessment
Source: Southern Marin Fire Protection District

Omitted Hazards

Dam Failure: There are no dams within the district that a failure of which would impact the Southern Marin Fire Protection District service area. The district service area is not in any dam inundation zone.

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

Table 16: County of Marin Hazard Risk Assessment
Source: Marin County

2.2.1 Debris Flows

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

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

Landslide material types are often broadly categorized as either rock or soil, or a combination of

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

Natural conditions that contribute to landslide include the following:

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

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

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

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment. Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops. Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

Landslide susceptibly can be characterized by looking at both slope class and rock strength. Landslide susceptibility classes express the generalization that on very low slopes, landslide susceptibility is low even in weak rock, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Figure 23 shows landslide susceptibility classes.

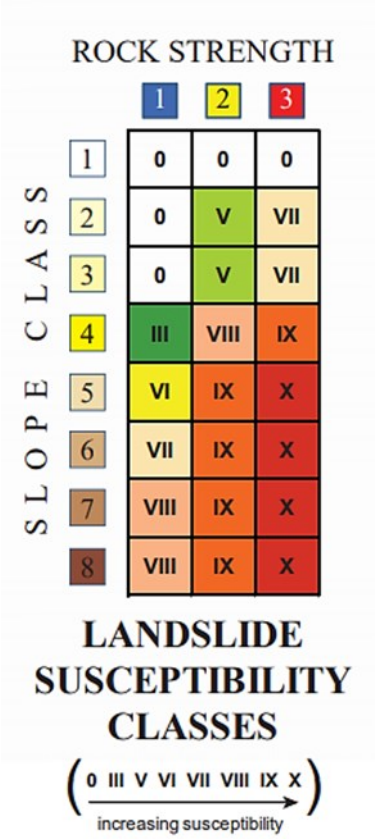


Figure 23: Landslide Susceptibility Classes
Source: USGS

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

The point where a muddy material begins to flow depends on its grain size and the water content. Fine grainy material or soil has a smaller friction angle than a coarse sediment or a debris flow, but falling rock pieces can trigger a material flow, too. When a mud flow occurs it is given four named areas, the 'main scarp', in bigger mud flows the 'upper and lower shelves', and the 'toe'. See Figure 24 for the typical areas of a mud flow, with shelves (right) and without (left). The main scarp will be the original area of incidence, the toe is the last affected area(s). The upper and lower shelves are located wherever there is a large dip (due to mountain or natural drop) in the mud flow's path. A mud flow can have many shelves.

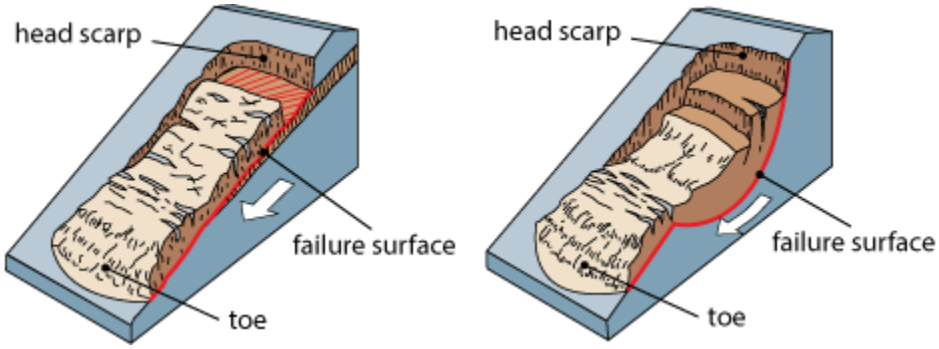


Figure 24: Mud Flow Areas
Source: Washington Department of Natural Resources

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

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

A landslide in the SMFD would most likely occur in any of the areas throughout the District where the terrain is steeper and is more susceptible to movement of hill slope materials.

A landslide having major impacts on any of the critical facilities in the District could affect the provision of District services. An earthquake has the potential to cause landslides throughout this area. A wildfire and subsequent rain event in any of the open spaces in the District could contribute to debris flows throughout the District.

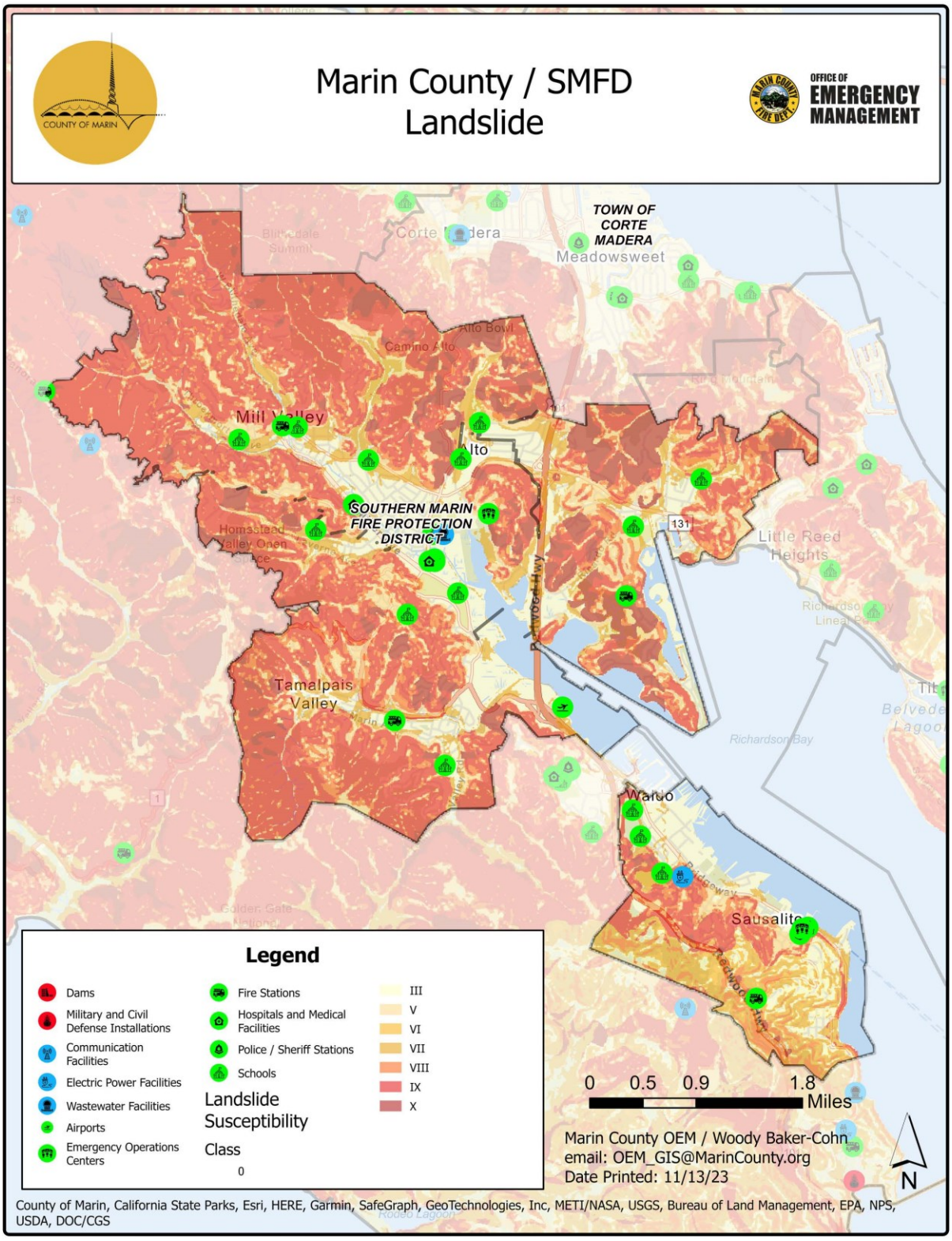


Figure 25: SMFD Debris Flow Critical Facilities and Infrastructure
Source: Marin County OEM

Unincorporated County of Marin
Much of Tamalpais Valley and the outskirts of Marin City lie in an area of high landslide susceptibility. There are hundreds of residences along with several schools, community centers and emergency facilities that lie in this area. While Alto has low landslide susceptibility, most of Strawberry down to Harbor Point lies in an area of moderate to high landslide susceptibility. There are hundreds of residences and several schools and community centers in these areas, as well as the SMFD Station #9. A landslide having major impacts on any of the roads in these areas could affect the ability of residents' ingress and egress to their property. Earthquakes also have the potential to cause soil instabilities throughout these areas. A major wildfire and/or rain soaking event in these areas could threaten communities with a debris flow.

Sausalito
The western side of Sausalito is in an area of high landslide susceptibility and is primarily residential with some businesses along sections of the Bridgeway. It consists of numerous winding streets and hillside homes that may sustain damage from soil movement in the area. All of Sausalito's critical facilities lie in areas of low landslide susceptibility but are adjacent to areas of high landslide susceptibility. Transportation challenges may be of particular concern with a landslide in the Sausalito. Major roads that traverse Sausalito, including all of Highway 101 and sections of the Bridgeway along with roads that connect Bridgeway with Highway 101 including Spencer Avenue/San Carlos Avenue and Rodeo Avenue/Nevada Street are located on steep hillsides which may be susceptible to landslides. Ingress and egress into part of Sausalito may be impacted by a landslide.

A landslide having major impacts on any of the roads in this area could affect the ability of residents' ingress and egress to their property. Earthquakes also have a potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Sausalito may contribute to soil instabilities and pose a risk to properties and infrastructure in Sausalito's jurisdiction. several small watersheds originate above Sausalito in the Golden Gate National Park's jurisdiction and flow towards San Francisco Bay through Sausalito's jurisdiction. Erosion from these small watersheds can add to soil instability.

During the storms of 1982 severe storm caused numerous mudslides across the city and within the County of Marin. One such slide impacted a private home by moving the structure off its foundation and sending it into and adjacent structure which resulted in a fatality. The same storm event impacted Highway 101, above Sausalito, by developing a slide that closed Highway 101 which closed the main County of Marin highway. Further weakening of saturated soils threatened to destabilize a 250,000-gallon water tank. Other soils instabilities occurred during this event including the north slope of the Waldo Grade area, weakening Highway 101 and threatening collapse of the Robin Williams (then Waldo) Tunnel which is located above the city. On 2/14/2019 a storm caused 50 homes to be evacuated after a mudslide occurred on National Park Property in the Hurricane Gulch neighborhood, sending at least one home sliding 75 yards down a hill. Sausalito Boulevard and Crescent Avenue were inundated with mud during the event. The landslide caused hundreds of thousands of dollars in damage. The City as well as the state and federal government declared the event a disaster.

Figure 26: Mudslide in Sausalito – 2019
Source: San Jose Mercury News

12/12/2022 – A landslide closed all southbound lanes of Highway 101, affecting traffic.

The City of Sausalito formed a Landslide Task Force following the events of 2019. The task force developed recommendations for the city to consider including but not limited to the development of a Geologic Hazard Study of Sausalito. That study has been initiated and is expected to be completed in early 2024. Other recommendations from the Landslide Task force may be considered such as establishing geologic hazard areas or possible code changes to address known instabilities.

Mill Valley
Most of Mill Valley is extremely susceptible to landslides due to the steepness of the terrain around the city. A landslide in Mill Valley could occur anywhere in the city where the terrain may be susceptible to soil movement. These areas primarily consist of numerous winding and dead end streets and hillside homes that may sustain damage from soil movement. Development in these areas was mostly done in the 1920s and 1930s before landslides were factored into design and construction regulations. Most of the downtown and commercial area of Mill Valley between Miller Avenue and E. Blithedale Avenue from Thockmorton Avenue to Camino Alto lies on relatively flat land with low to no landslide susceptibility. Approximately half of Mill Valley's critical facilities lie in areas of no landslide susceptibility but are adjacent to areas of moderate to high landslide susceptibility. The Old Mill Elementary School, The Mill Valley Fire Station #6, the Greenwood School, Park Elementary School, the Helix School, and Edna Maguire Elementary School all lie in areas of the city that have some landslide susceptibility. The Mill Valley Police Department and SMFD Fire Station #7 lie directly adjacent to an area of very high landslide susceptibility.

Transportation challenges may be of particular concern with a landslide in the city, particularly in the hilly and mountainous residential areas around the city. Ingress and egress into these areas may be impacted by a landslide.

Earthquakes also have the potential to cause soil instabilities throughout this area. Wildfires and subsequent rain events in the Marin Headlands and any of the open space above Mill Valley may contribute to soil instabilities and pose a risk to properties and infrastructure in Mill Valley. Several small watersheds originate above Mill Valley in the Muir Woods National Monument and Mount Tamalpais State Park and flow towards Richardson Bay through Mill Valley. Erosion from these small watersheds can add to soil instability and could contribute to debris flows. Homes along Old Mill Creek, Arroyo Corte Madera del Presido and Warner

Creek are particularly susceptible to a debris flow, which could destroy bridges and other road infrastructure.

On 10/24/2021, a severe storm caused a mudslide that damaged the Guidepost Montessori School.

On 4/12/2006, a mud flow coursed down the steep slope behind a home at 70 Bolsa Avenue, uprooting oak trees before crashing into the master bedroom. The debris flow was about 50 feet wide and 12- to 14-feet deep and it killed a resident who was found under 12 feet of mud.

Tiburon

Most of the District area of Tiburon has steeper terrain, with the area around the Ring Mountain Open Space Preserve on the north side of the town being most susceptible. These areas are primarily residential and consist of numerous winding streets and hillside homes that could be damaged or destroyed by a landslide. The Bel Aire School lies in this area. A landslide having major impacts on any of the roads on the northern Tiburon Peninsula could affect the ability of residents to reach their homes and could affect the provision of emergency and essential services. An earthquake has the potential to cause landslides in the areas of Tiburon with landslide susceptibility. A wildfire and subsequent rain event in the Ring Mountain Open Space Preserve could potentially contribute to debris flows and mudslides in Tiburon.

Climate Change and Future Development Considerations

Extreme storm events and more frequent wildfires as a result of climate change have the potential to increase the amount and severity of landslides, including disastrous debris flows. Climate change is leading to more volatile precipitation patterns around the world with very dry stretches punctuated by storms that drop large amounts of rain in a short amount of time. Landslides in wetter regions of California, including the Marin County OA, move on average faster and farther downhill during rainy periods compared to drought years, according to a 2022 study by the American Geophysical Union (AGU)[1], showing the increased potential for landslides in the Marin County OA in rainy years. As development increases in the numerous canyons and around the many open spaces of the Marin County OA, the potential for significant impacts from a landslide and/or mudflow increases. Further development of the residential areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon that have a higher landslide susceptibility will expose more people and property to landslide risk. With increased wildfire potential as a result of climate change, more residents in Southern Marin Fire Protection District service area could be susceptible to post-fire debris flows. Future development should take into account the movement of mud and debris in waterways after a major rain event. Adequate space adjacent to susceptible waterways should be maintained free of development to allow for the passage of mud and debris, and catchment basins should be built in these areas to help capture any excess mud and debris.

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

2.2.2 DROUGHT

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

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

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

Drought can occur in all areas of the SMFD, though its effects would be most felt in the mountainous areas around the Tamalpais Valley, Mill Valley, Sausalito and Tiburon where the risk of wildfire would increase. Dry trees throughout the district may become a safety hazard to the public due to falling trees or its limbs.

Climate Change and Future Development Considerations

Climate change increases the odds of worsening drought. Warmer temperatures enhance evaporation, which reduces surface water and dries out soils and vegetation. This makes periods with low precipitation in the summer drier than they would be in cooler conditions. Climate also alters the timing of water availability as warmer winter temperatures cause less precipitation to fall. During droughts, communities in the Marin County OA including in the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon may have limited access to water for household use, including drinking, cooking, cleaning, and watering plants, as well as for agriculture, transportation, and power generation. Drought may lead to higher water costs, rationing, or even the decimation of important water sources like wells in the Marin County OA. As more people move into the Marin County OA, including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, additional strain will be placed on the OA's water supply. Drought can affect livestock and crops

in the Marin County OA, impacting its economy. Drought can increase the occurrence and severity of wildfires and tree mortality in the Marin County OA including in the open spaces in and around the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Impacts to residents and infrastructure from wildfire as a result of drought will increase as more development occurs in the mountainous areas of the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon where wildfires are more likely to occur. Drought also has the potential to dry out the marshlands along the shoreline of Sausalito, increasing the chances of brush fires there. Future development in this area, in the mountainous areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon could expose people to drier summer conditions that could increase their vulnerability to wildfire. Drought also increases the amount of carbon dioxide in the atmosphere, including by decreasing land productivity, which reduces the amount of vegetation storing carbon dioxide. In addition, increases in drought-related wildfire and soil erosion can release carbon dioxide sequestered in trees and plants back into the atmosphere. This will only worsen climate change for the Marin County OA into the future. When considering future development, the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon can help prepare for both future droughts and climate change by practicing and promoting water conservation and enhancing water efficiency throughout landscapes, city plans, and water infrastructure. The Marin County OA can also identify alternative water supplies, create drought emergency plans, and encourage farmers to plant drought-resistant crops.

2.2.3 EARTHQUAKE

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

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

The other commonly used measure of earthquake severity is intensity, which is an expression of the amount of shaking at any given location on the ground service. Intensity is most commonly measured on the Modified Mercalli Intensity (MMI) Scale (see Figure 27).

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

Figure 27: 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 28: 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 29: Soil Types
Source: USGS

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

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

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

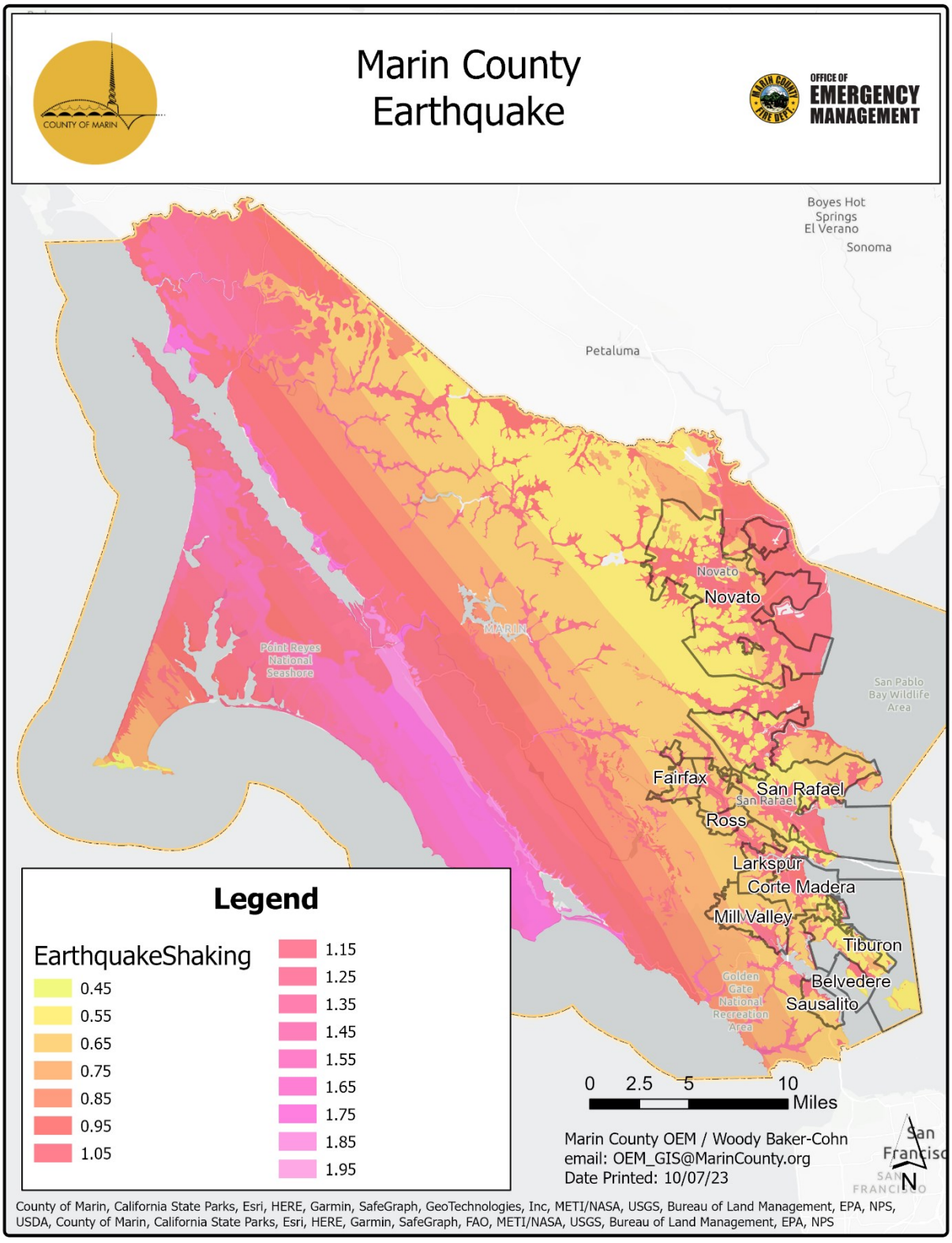


Figure 30: Marin County Earthquake Impact
Source: Marin County OEM

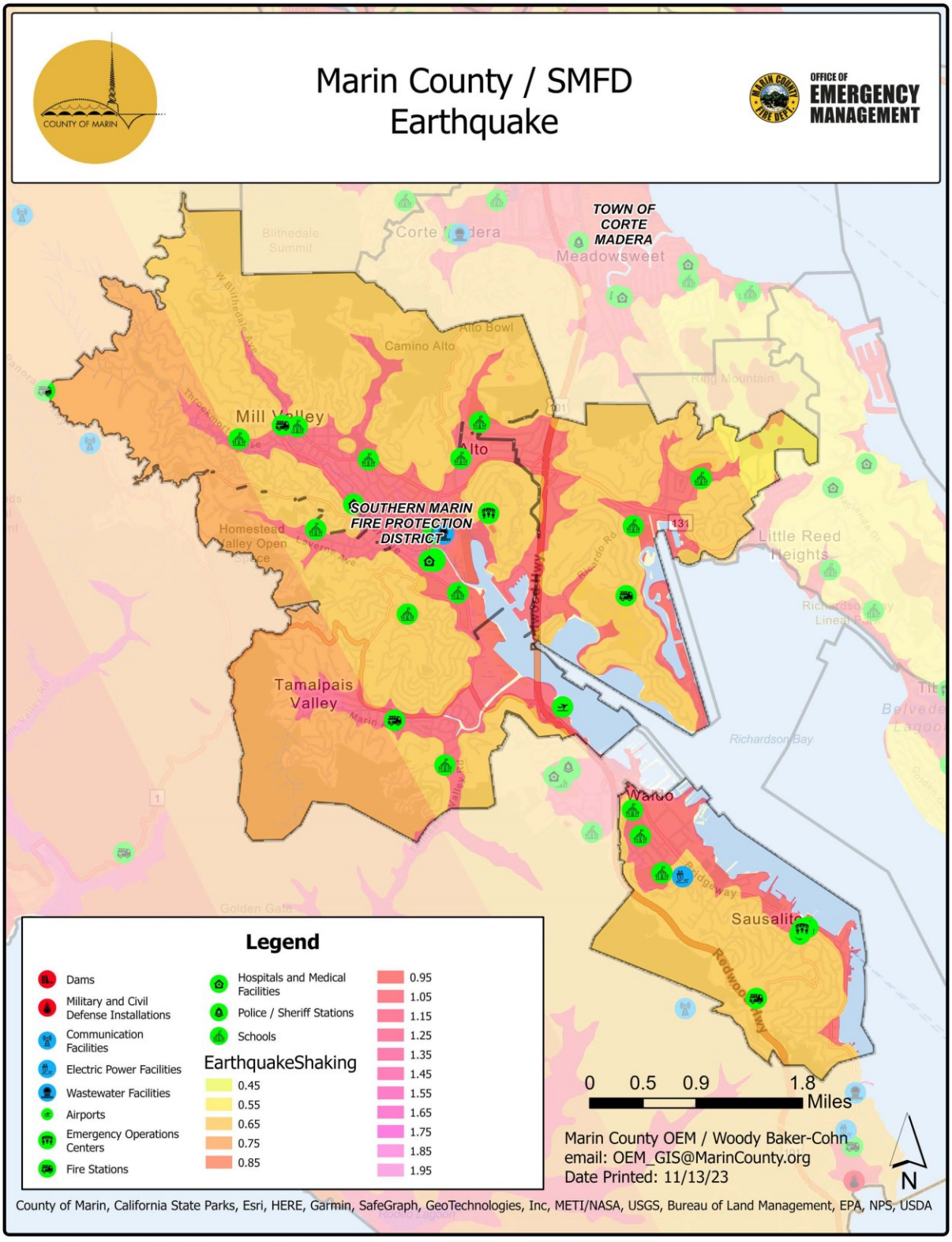


Figure 31: SMFD Earthquake Critical Facilities and Infrastructure
Source: Marin County OEM

The District is located directly between the San Andreas and Hayward faults. A moderate to extreme earthquake originating from either of these major faults or any of the other faults in the region could have major impacts to the District.

Unincorporated County of Marin
There is increased risk of shaking and liquefaction in the District's unincorporated area along creeks and on bay mud and current and former marshlands. This includes the area of Tamalpais Valley along Coyote Creek where hundreds of homes and the SMFD Fire Station #4 are located, Alto and along the shoreline of Strawberry where dozens of homes are located. Landslides in the unincorporated County as a result of an earthquake may cause damage to homes and roads as a result of shifting soils.

Sausalito
There is increased risk of shaking and liquefaction in Sausalito from an earthquake, particularly in the lowland areas north and east of Bridgeway where superficial deposits and fill are more prevalent. This includes residences and the primary commercial areas the Bridgeway corridor where there are numerous businesses, marinas and other docking facilities. A residential neighborhood that includes the Lycee Francais de San Francisco and the Dr. Martin Luther King Jr. Academy also lies in this area, along with the part of the Southern Marin Fire Protection District Station #1 and the City's Police Station. The highest risk areas due to liquefaction are in the Marinship area, which was filled in for the building of the wartime Marinship shipyards in 1942. Other areas along Bridgeway in the downtown area were also filled to create new space for housing and businesses in the late 1800's. There may also be increased risk of landslides in Sausalito due to an earthquake based on the steepness of the terrain throughout the city. This includes most of the residential area of Sausalito west of Bridgeway and central part of the City between Highway 101 and the Bridgeway. Vulnerable structures include a bridge and older buildings that have not undergone major seismic retrofitting. Utility infrastructure throughout the city may also be impacted by an earthquake.

Landslides in Sausalito as a result of an earthquake may cause damage to homes and roads as a result of shifting soils.

Mill Valley
In the upland areas of the City, most modern single-family buildings with foundations to bedrock should perform well to shaking. Modern multi-story buildings with foundations to bedrock should not be subject to collapse, although some serious damage may occur. There is increased risk of earthquake shaking and liquefaction in certain parts of Mill Valley, particularly in the area of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 where superficial deposits and fill are more prevalent. This area has greater development density and includes residences and the primary downtown and commercial areas of the City. Residential areas of the city along the lower reaches of Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creek also have an increased risk of earthquake shaking. All of the City's critical facilities lie areas of moderate earthquake shaking susceptibility. Unreinforced masonry buildings in the downtown area could suffer moderate to severe damage from an earthquake. Falling debris could endanger those in the vicinity of these older buildings. "Pancaking" of these older structures during business hours may entrap many people. The City's densely settled alluvial lowlands have a potential for heavy damage. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base.

Landslides in Mill Valley as a result of an earthquake may cause damage to homes and roads as a result of shifting soils, effecting ingress and egress in the hilly and mountainous residential areas of the city where there are numerous windy and dead-end roads. Many hillsides in Mill Valley are unstable in their natural state, and even minor changes in the shape of the land surface could create major landslide problems.

Mill Valley hasn't yet experienced a significant earthquake. The Marin County OA was sparsely populated at the time of the 1906 San Francisco Earthquake, and the effects across the County were relatively minimal. Likewise, the 1989 Loma Prieta Earthquake caused minimal impacts across the Marin County OA as the epicenter of the quake was further south in Santa Cruz County. Smaller earthquakes with minimal to no impacts are routinely felt in Mill Valley On 12/31/2020, a 3.6 magnitude earthquake originating from the San Andreas Fault struck near Mill Valley. There were no reports of damages or injuries.

In 2023, the Mill Valley City Council approved an ordinance that requires retrofitting for some apartment buildings built before 1978. The ordinance applies to "soft-story" apartment buildings or those with a wood-frame target story design and three or more residences. Approximately 50 to 90 buildings could meet the criteria according to the city.

Tiburon

All buildings located in Tiburon are vulnerable to earthquake damage, but depending upon construction, some buildings are expected to perform better than others. There is increased risk of shaking and liquefaction in lowland areas of Tiburon in the District from an earthquake, particularly in the area north of the Cove Shopping Center. where superficial deposits and fill are more prevalent. Dozens of residences and the Bel Aire School lie in this area. Earthquakes could also cause landslides in open space areas around Tiburon in the District with steeper terrain, including around the Ring Mount Open Space Preserve, causing damage to homes and roads as a result of shifting soils.

Climate Change and Future Development Considerations

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

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

development in these areas could expose more people and infrastructure to earthquake shaking as a result of climate change.

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

2.2.4 FLOODING

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

Flooding can occur in several ways:

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

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

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

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

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

A weather pattern called the “Atmospheric River” contributes to the flooding potential of the area. An Atmospheric River brings warm air and rain to the West. A relatively common weather pattern brings southwest winds to the Pacific Northwest or California, along with warm, moist air. The moisture sometimes produces many days of heavy rain, which can cause extensive flooding. The warm air also can melt the snowpack in the mountains, which further aggravates the flooding potential. In the colder parts of the year, the warm air can be cooled enough to produce heavy, upslope snow as it rises into the higher elevations of the Sierra Nevada or Cascades. Forecasters and others on the West Coast often used to refer to this warm, moist air as the “Pineapple Express” because it comes from around Hawaii where pineapples are grown. A diagram of an atmospheric river event is shown in Figure 32.

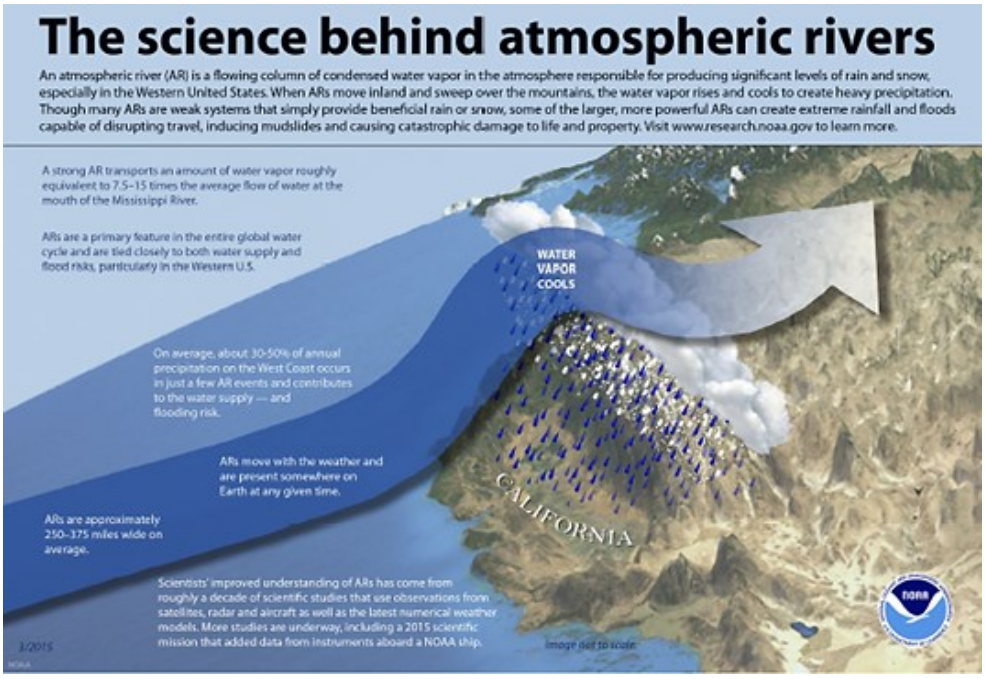


Figure 32: Diagram of an Atmospheric River Event
Source: NOAA

The Marin County OA is susceptible to various types of flood events. In coastal areas, flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Other types of flooding in Marin include isolated ponding and stormwater overflow. Isolated ponding is when pools form on the ground and can occur in any area that doesn't drain effectively – for example, in a natural depression in the landscape. Stormwater overflow is when storm drains back up. Stormwater drainage systems quickly convey rainwater through underground culverts (pipes) to creeks and the Bay. When the storm drains are obstructed or broken or when the water bodies to which they lead are already full, water backs up onto the streets and into the riparian area surrounding the drainage way. Although stormwater overflow and isolated ponding also occur throughout the County, the effects are typically not widespread or significantly damaging. Floodwaters can be deep enough to drown people and move fast enough to sweep people and vehicles away, lift buildings off foundations, and carry debris that smashes into buildings and other property. Flood waters can cause significant erosion which can lead to slope instability, severely damaging transportation and utility infrastructure by undermining foundations or washing away pavement. If water levels rise high enough to get inside buildings, flooding can cause extensive damage to personal property and the structure itself. Flood events that develop very quickly are especially dangerous because there may be little advance warning. Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line.

Flooding in the SMFD generally results from creek flooding and tidal flooding in low-lying areas. Approximately half of the lowland areas in the District are in the 100-year floodplain, with the other half in the 500-year floodplain.

Unincorporated County of Marin
Major county watersheds where significant numbers of structures are at risk from riverine flooding include Coyote Creek in the Tamalpais Valley area of the District. Most of the Tamalpais Junction area of Tamalpais Valley along Coyote Creek and the creek along Tennessee Valley Road lies in the 100-year floodplain, with a smaller section lying in the 500-year floodplain. Numerous residences lie in the 500-year floodplain and could be susceptible to either creek flooding or flooding from Richardson Bay. Hundreds of residences, a church, the Tamalpais Valley Community Center, part of the Tamalpais Valley Elementary School, a large shopping center with numerous businesses, the CalTrans Manzanita Station, sections of Highway 1, a section of Highway 101 and the Commodore Center Heliport all lie in the 100-year floodplain and could be susceptible to flooding. Most of the Strawberry and Alto areas lie outside the 100 and 500-year floodplain, though dozens of residences, several apartment complexes, numerous commercial buildings and part of the Strawberry Point Middle School lie in the 100-year floodplain and could be susceptible to flooding.

Mill Valley
Many developed and undeveloped Mill Valley lands are subject to flooding due to a combination of factors, including periodic heavy winter rainfalls, tidal fluctuations, and potential for tsunami due to seismic activity. Mill Valley has numerous drainage basins which lead to small riparian streams and creeks which drain to Richardson Bay. Flooding in Mill Valley generally results from a combination of creek flooding along Old Mill Creek, Arroyo Corte Madera del Presidio and Warner Creeks as well as from high tides and storm runoff in low-lying areas along Richardson Bay. Mill Valley drains into Richardson Bay mainly by way of the Arroyo Corte Madera del Presidio. The creek drains an area of about six square miles from the upper reaches of Mount Tamalpais. Creek bank gradients are, therefore, exceptionally steep in the upper elevations, and flatten markedly as the creek continues over alluvial plains and enters the tidal marshlands along the periphery of Richardson Bay. Consequently, the creek often overflows its banks in the lower reaches during periods of heavy rainfall. Sunny-day king tide flooding has become a common occurrence along the bay in Mill Valley. Several lowland areas in Mill Valley, particularly the alluvial fan where its creeks converge, are in the 100-year floodplain, with several pockets in in the 500-year floodplain. Significant encroachment by urban development and vegetative growth has occurred along Arroyo Corte Madera del Presidio. Both factors have imposed extreme limitations on channel flow capacities along substantial portions of the creek, resulting in flood problems. During heavy rainfall conditions, floodwaters cascade down the steep upper reaches of the main tributary streams and flow through central Mill Valley, where they overflow the flatter, generally constricted and inadequate channels. Damaging floods have periodically occurred over this area as a result. Part of the downtown area, the commercial areas along Miller Avenue, E. Blithedale Avenue east of Lomita Drive and along Redwood Highway adjacent to Highway 101, and numerous residences lie in the 100-year floodplain and could be susceptible to flooding. Part of the Mill Valley City Hall and Fire Station #6, the Marin Terrace and Redwoods medical facilities, Tamalpais High School and part of the Mill Valley Treatment Plant lie in the 100-year floodplain. Part of the Mill Valley Middle School, the Redwoods medical facility, the Mill Valley Treatment Plant and dozens of homes and businesses lie in the 500-year floodplain and could be susceptible to flooding.

Tide elevations within Richardson Bay have the potential to significantly impact the Mill Valley storm drain system. Mill Valley already sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. Mill Valley areas subject to frequent flooding in the past are predominantly former marshlands (Bay Mud areas) that have previously been filled for urban expansion purposes. Consequently, the flood problem in Mill Valley has increased with time.

Mill Valley has experienced the impacts of flooding from winter storms, most notably in 1982, 1997, 1998, 2005 and 2006.

On 01/10/2023, roads and schools closed in Mill Valley as storms doused the region. Saturated soil caused fallen trees and landslides to impact roads. Power outages impacted thousands. Flooding in Mill Valley prompted closures at Sycamore Avenue and Locust Avenue and Miller Avenue at Evergreen Avenue, according to Southern Marin Fire Protection District.

On 12/23/2022, king tides in Mill Valley peaked preceding a storm. Water pooled on roads in some places, including the ramps on and off Highway 101 outside city limits, and along the San Francisco Bay Trail and on Miller Avenue and E Blithedale Avenue and at the SASM WWTP within city limits. The City worked to ensure that drains and debris were clear.

On 10/21/2021, a storm caused flooding in Mill Valley, particularly in the Sycamore Triangle neighborhood. Residents were told to move their vehicles to higher ground at the Mill Valley Community Center. Miller Avenue was closed at three spots due to localized flooding including Montford Avenue, at Camino Alto, and between Camino Alto and Almonte Boulevard. Residents living along the Arroyo Corte Madera del Presidio were advised to monitor their properties closely for flooding.

On 1/3/2018, a king tide caused flooding in Mill Valley, inundating the shoreline in several places.

On 2/7/2017, a storm caused flooding across Mill Valley. Miller Avenue was closed at Almonte Street and along parts of Camino Alto, police said. Golden Gate Transit suspended bus service at the Manzanita Park and Ride lot because of flooding.

On 12/3/2014, storms caused such significant flooding across roads in Mill Valley that the city advised all residents to stay home due to heavy traffic congestion and so emergency crews could work.

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Sausalito

Sausalito has a total of five primary drainage basins which lead to small riparian streams which drain to San Francisco Bay. Flooding in Sausalito generally results from a combination of high tides and storm runoff in low-lying areas along Richardson Bay. Sunny-day king tide flooding has become a common occurrence in Sausalito. Several lowland areas in Sausalito are in the 100-year floodplain, with several areas in the 500-year floodplain. The central commercial area of Sausalito and a southern area along both sides of the Bridgeway lies in the 500-year floodplain. A large commercial area, known as the Marinship, in the northern part of the City between the Bridgeway and Richardson Bay lies in the 100-year floodplain. There are numerous commercial buildings and businesses in this area, along with some residences that could be susceptible to flooding. Most of Sausalito's critical facilities lie outside of the floodplain, but part of the Southern Marin Fire Protection District Station #1 lies in the 500-year floodplain and could be susceptible to flooding.

Flooding may occur when strong winds or tides result in a surge of seawater into areas that are above the normal high tide line. Tide elevations within Richardson Bay have the potential to significantly impact the Sausalito storm drain system. Sausalito already sees flooding from king

tides in Richardson Bay and this is only expected to increase with sea level rise and climate change. There is frequent flooding of Gate 5 Road and Swede's Beach.

On 12/21/2022, king tides in Sausalito caused flooding along the San Francisco Bay Trail. The City worked to ensure that drains and debris were clear.

On 1/3/2018, a king tide caused flooding in Sausalito, inundating the shoreline in several places.

On 11/7/2010, significant rains and a king tide of over six feet backed up storm drains and caused flooding across numerous parking lots. Residents in the City were affected by flooding.

Tiburon

Flooding in the District area of Tiburon generally results from a combination of high tides from Richardson Bay and from storm runoff in low-lying areas. The lowland area in the District in Tiburon includes the area around Cove Shopping Center, which is in the 500-year floodplain and includes numerous residences and commercial buildings. Tiburon sees flooding from king tides in Richardson Bay and this is only expected to increase with sea level rise and climate change.

Climate Change and Future Development Considerations

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

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

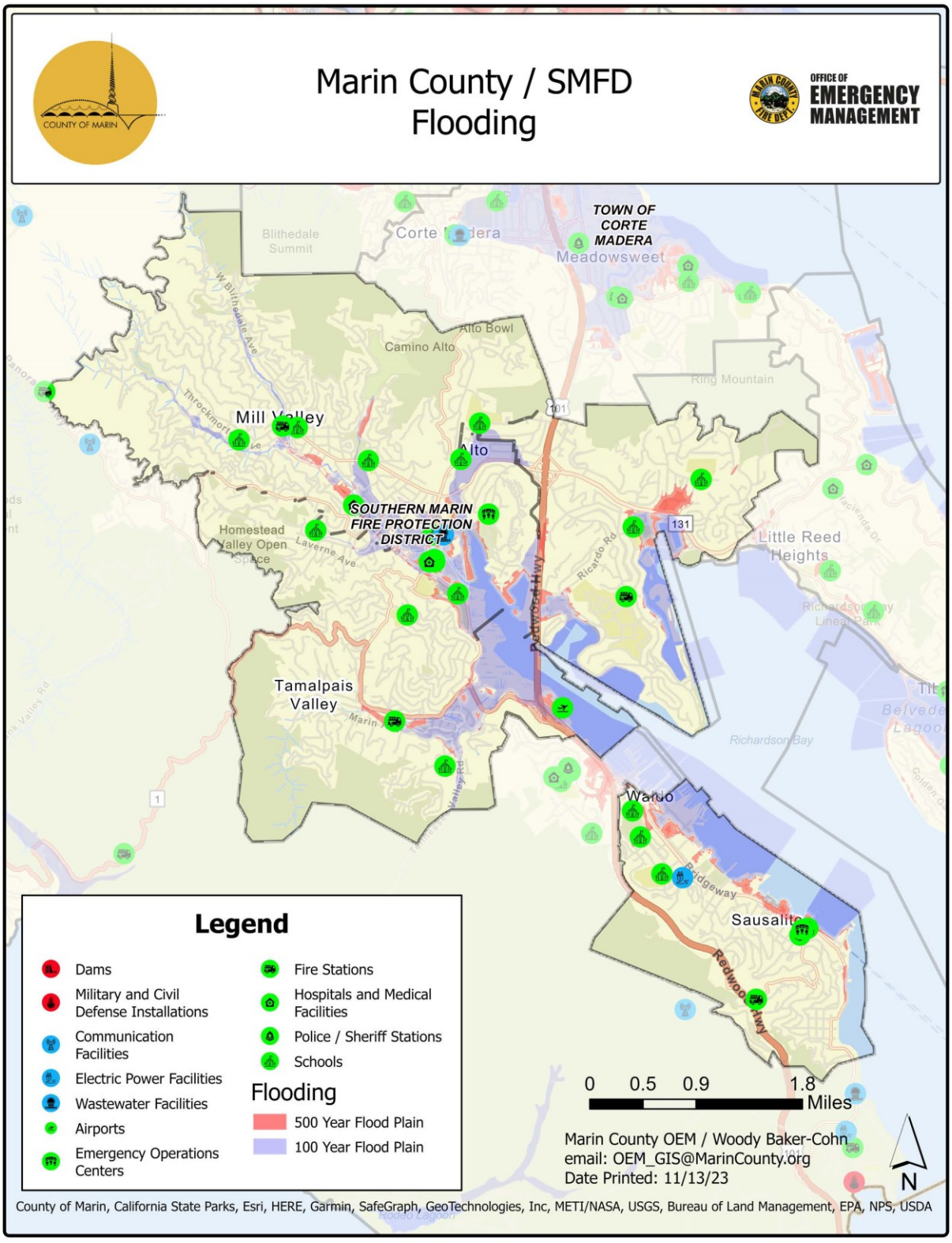


Figure 33: SMFD Flooding Critical Facilities and Infrastructure
Source: Marin County OEM

Table 17 shows the number of Southern Marin Fire Protection District critical facilities by flood zone.

Table 17: Southern Marin Fire Protection District Critical Facilities

Category	Name	Address	Flood Zone
Critical Facilities			
Fire	Fire: Southern Marin Fire Protection Dist. Station 1	333 Johnson St. Sausalito, CA 94965	X
Fire	City of Mill Valley SMFD (SOM) & City Hall Building/ Fire Station 6	26 Corte Madera Avenue Mill Valley, CA 94941	X/AE
Fire	Southern Marin Fire Protection District (SOM)/ Station 4	309 Poplar Street Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM)/ Station 9	308 Reed Blvd Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District Main Office (SOM) / EOC	28 Liberty Ship Way, Suite 2800, Sausalito, CA 94965	VE
Fire	City of Mill Valley SMFD (SOM) & Public Safety Building /Fire St. 7	1 Hamilton Dr, Mill Valley, CA 94941	X
Law	Sausalito Police HQ	29 Caledonia St., Sausalito	X
Local Government	Sausalito City Hall	420 Litho St., Sausalito	X
Emergency Operations Center	Southern Marin Fire Station #1	333 Johnson St. Sausalito, CA 94965	X
Health / Medical	Alta Mira Recovery Center	126 Harrison Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (135 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
Health / Medical	Alta Mira (125 Bulkley)	125 Bulkley Ave., Sausalito, CA 94965	X
School Sausalito Marin City School District	Willow Creek School (K-5 Elementary)	636 Nevada Street Sausalito, CA 94965	X
School	Lycee Francais, Private School, K-6	100 Ebbtide, Sausalito, CA	X
Evacuation Shelter	MLK Campus Gym	100 Ebbtide and 610 Coloma Street, Sausalito CA 94965	X
Local Government	Mill Valley City Hall	26 Corte Madera Ave Mill Valley, CA 94941	X/AE
Local Government	Mill Valley Library	375 Throckmorton Ave 94941	X
Local Government	Mill Valley Community Center	180 Camino Alto Mill Valley, CA 94941	X
Hospitals and Medical Facilities	Golden Gate Urgent Care, Kaiser Permanente Medical Offices	750 Redwood Highway, Mill Valley, CA 94941 (unincorporated Marin Co but serves Mill Valley)	X
Hospitals and Medical Facilities	Marin Terrace (assisted living and memory care)	297 Miller Avenue, Mill Valley, Ca 94941	AE

Hospitals and Medical Facilities	The Redwoods (independent living, assisted living, skilled nursing)	40 Camino Alto, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Mill Valley School District	411 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Edna Maguire Elementary School	80 Lomita Drive, Mill Valley, CA 94941	X
Schools and Educational Facilities	Old Mill Elementary School	352 Throckmorton Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Mill Valley Middle School	425 Sycamore Ave, Mill Valley, CA 94941	X/AE
Schools and Educational Facilities	Terra Marin School (PK-8)	70 Lomita Dr, Mill Valley, CA 94941	X
Schools and Educational Facilities	North Bridge Academy (special ed school)	17 Buena Vista Ave, Mill Valley, CA 94941	X
Schools and Educational Facilities	Marin Horizon School	305 Montford Ave, Mill Valley, CA 94941 (Unincorporated Marin Co but serves Mill Valley)	X
High Potential Loss Facilities			
Military/Civil Defense	US Coast Guard Station Golden Gate	435 Murray Circle, Sausalito, CA 94965	D
Military/Civil Defense	US Corps of Engineers (EOC)	2100 Bridgeway St., Sausalito, CA 94965	X
Dams	Cascade Canyon Dam	560 Cascade Dr, Mill Valley, CA 94941	X
Critical Infrastructure			
Water/ Wastewater	Sausalito Marin City Sanitary District Treatment Plant	1 East Rd., Sausalito, CA 94965	D, VE
Water/ Wastewater	Whiskey Springs Sanitary Pump Station	SW corner of Coloma and Bridgeway, Sausalito CA	X
Water/ Wastewater	Gate 5 Road Pump Sanitary Station	East side of the Coloma/Gate 5 Intersection, Sausalito CA	AE
Water/ Wastewater	Spinnaker Sanitary Pump Station	Spinnaker Parking Lot, Sausalito CA	AE
Water/ Wastewater	Anchor Street Sanitary Pump Station	Lot 1 at Spinnaker Drive, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Rodeo Avenue, Sausalito CA	X
Water/ Wastewater	MMWD Water Tank	Cloud View Road, Sausalito CA	X
Water/ Wastewater	Sanitary Collection System (22 Miles of Pipe)	Within City R/W and City Easements	X, VE, AE
Water Supply Facilities	Water tank	241/2 Greenwood Way, Mill Valley, CA 94941 37.912935, -122.544041	X
Water Supply Facilities	Water tank	131/2 Escalon Dr, Mill Valley, CA 94941	X

		37.906425, -122.531301	
Water Supply Facilities	H-Line Fire Road	H-Line Fire Road 37.927032, -122.556641	X
Water Supply Facilities	Water Tank	Camino Alto Fire Rd 37.916306, -122.528707	X
Water Supply Facilities	Elinor Ave Water Tank	9 Via Van Dyke (adjacent)	X
Water Supply Facilities	Fern Canyon Water Tank	Fern Canyon Rd, Mill Valley, CA 94941 37.919004, -122.563224	X
Water Supply Facilities	Lower Summit Ave Water Tank	500 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Upper Summit Ave Water Tank (and Slide Gulch Pump Station)	575 Summit Ave, Mill Valley, CA 94941	X
Water Supply Facilities	Water Tank	417 Summit Dr, Corte Madera (adjacent to Mill Valley neighborhood)	X
Water Supply Facilities	Water tank	2001 Ridgecrest Blvd, Mill Valley, CA 94941 (unincorporated Marin Co – Mt Tam)	X
Water Supply Facilities	Water tank	100 Old Railroad Grade Fire Road (unincorporated Marin Co- Mt Tam)	X
Water Supply Facilities	Water tank	816 Panoramic Highway (unincorporated Marin Co)	X
Power Utility	PG&E Substation - Sausalito	Sausalito, CA 94965	X
Communications	MERA Radio Antena Site - GGNRA Sausalito	Wolfback Ridge Road, Sausalito, CA 94965	X
Transportation	Fuel Dock, Clipper Marina	310 Harbor Dr., Sausalito, CA 94965	AE
Transportation	Sausalito Ferry Terminal, Downtown	Parking Lot #1, Sausalito CA 94965	X,VE
Transportation	Sausalito Boat Launch	Turney Street, Sausalito CA 94965	VE
Communications	Fire Station #2 – Antenna Array	300 Spencer Ave, Sausalito CA	X
Transportation	32 miles of City Roadways	Sausalito CA	X, AE
Transportation	Robin Williams Tunnel (CalTrans)	Highway 101 above Sausalito	D
Transportation	Marin City Interchange (CalTrans/County)	Bridge Blvd., Marin City	X, AE
Transportation	Golden Gate Bridge (GGBHTD)	Highway 101 south of Sausalito	V
Transportation	Wolfback Ridge Overpass (CalTrans)	Wolfback Ridge road, Sausalito CA	X
Transportation	Spencer Avenue Undercrossing (CalTrans)	Spencer Avenue at Highway 101	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 3- Homestead	Montford Ave Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 16 - Sausalito	Hecht Ave Sausalito, CA 94965 **Lat:** 37.846963° N **Lon:** 122.483571° W	X

Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 2 - Sausalito	300 Spencer Ave., Sausalito, CA 94965	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 1 - Sausalito	Rodeo Ave., Sausalito, CA 94965 **Lat:** 37.861804° N **Lon:** 122.498587° W	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 6 - Mill Valley	Edgewood Ave Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM)/ LRAD Site 5– Tam Valley	Eastwood Park Mill Valley, CA 94941	X
Local Government	City of Mill Valley / LRAD Site 12 - Cascade	Cascade Ave Mill Valley, CA 94941	X
Local Government	City of Mill Valley / LRAD Site 13 – Golf Course	City Golf Course, Mill Valley, CA 94941 **Lat:** 37.912321° N **Lon:** 122.532580° W	X
Local Government	City of Mill Valley / LRAD Site 14 – Vasco Ct	Vasco Ct, Mill Valley, CA 94941 **Lat:** 37.909892° N **Lon:** 122.524649° W	X
Local Government	City of Mill Valley / LRAD Site 15 – Ralston White	Ralston White Mill Valley, CA 94941	X
Fire	Southern Marin Fire Protection District (SOM) – Bel Aire School RUSD / LRAD Site 8- Tiburon	277 Karen Way Mill Valley, CA 94941 **Lat:** 37.902517° N **Lon:** 122.495679° W	X
Fire	Southern Marin Fire Protection District (SOM) / LRAD Site 17- Marin City	850 Drake Ave, Marin City Mill Valley, CA 94941	X
Fire/Local Government	Publicly Maintained Hydrants	1,929 individual site locations within the District.	X, VE, AE
Fire/Local Government	Public Emergency Fire Roads	9.59 miles of non-paved emergency access fire roads	X, VE, AE

Table 17: Southern Marin Fire Protection District Critical Facilities in the Flood Zones
Source: Marin County/FEMA DFIRM

2.2.5 Land Subsidence/Sinkholes

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

Sinkholes can form in three primary ways. Dissolution sinkholes form when dissolution of the limestone or dolomite is most intensive where the water first contacts the rock surface. Aggressive dissolution also occurs where flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and in the zone of water-table fluctuation where groundwater is in contact with the atmosphere. See Figure 34 for a picture and description of how dissolution sinkholes form.

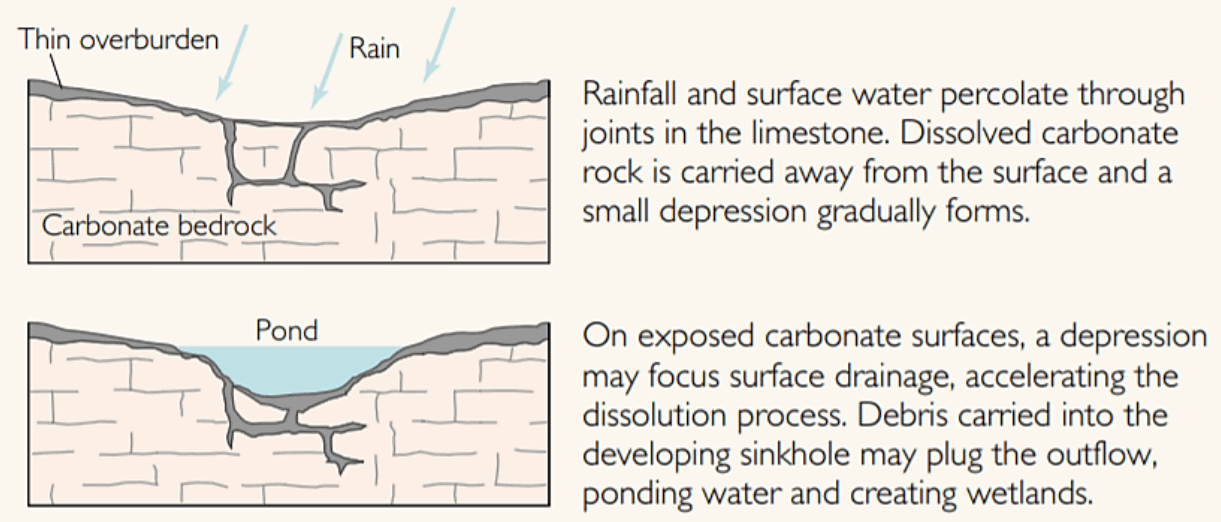


Figure 34: Dissolution Sinkhole Formation
Source: USGS

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.

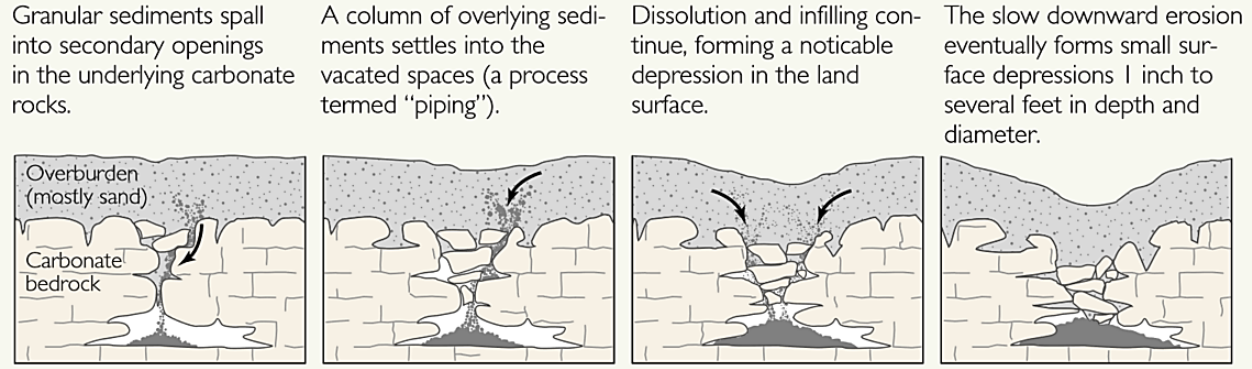


Figure 35: Cover-Subsidence Sinkhole Formation
Source: USGS

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.

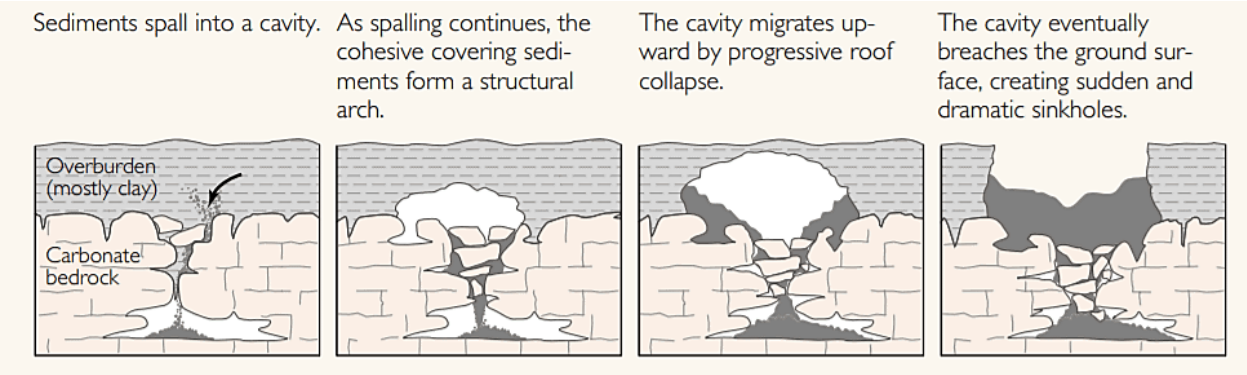


Figure 36: Cover-Collapse Sinkhole Formation
Source: USGS

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

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

Land subsidence and sinkholes would most likely occur in the lowland areas of the SMFD where superficial deposits and fill are more prevalent. These areas could anticipate increased

rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for the District, including the settling of District facilities as well as the shifting of District infrastructure.

Unincorporated County of Marin
The areas of the Marin County OA most vulnerable to land subsidence are those underlain with the younger Holocene unconsolidated alluvial and colluvial sediments, and even more so the younger bay muds. In general, Marin County unincorporated community shoreline properties, especially those in Southern Marin on fill in the low-lying areas east of US Highway 101, including Strawberry and Alto, are the most exposed and vulnerable to subsidence. This impacts buildings, roads, and utility infrastructure. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below.

Land subsidence is an ongoing issue in the low-lying exposed areas of nearly every unincorporated Bayshore community, and sea level rise associated with climate change would only exacerbate existing subsidence impacts.

Mill Valley
Large areas of former bay mud marshlands in Mill Valley have been artificially filled over the years. Land subsidence and sinkholes would most likely occur in these lowland areas of Mill Valley along Richardson Bay where superficial deposits and fill are more prevalent. This includes the area around Bothin Marsh, Bayfront Park and the SASM WWTP. Southeast from La Goma Street to the bay is unconsolidated fill, and the Sutton Manor area is of the same base. There are several schools, medical facilities, and commercial buildings in area of increased land subsidence susceptibility. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. The Redwoods medical facility, Mill Valley Middle School, the Mill Valley Community Center, the Mill Valley Fire Station #7 and the Mill Valley Police Station are all located within very high liquefaction risk areas. Land subsidence could have numerous impacts for Mill Valley, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

There have been no major sinkholes recorded in Mill Valley, however, there have been several smaller sink holes around the city caused by a variety of factors.

Sausalito
Land subsidence and sinkholes would most likely occur in the lowland areas of Sausalito along Richardson Bay where superficial deposits and fill are more prevalent. This includes the primary commercial area of City along the Bridgeway where Marinship was located. These areas could anticipate increased rates of subsidence as bay waters saturate the soil from below. Land subsidence could have numerous impacts for Sausalito, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the City.

On 8/24/2020, a small sinkhole formed at the corner of Spring Street and the Bridgeway. It was caused by a leaky corrugated storm drainpipe under the Bridgeway.

Tiburon
Areas of Tiburon within the District designated with very high potential for land subsidence are generally located in the Cove Shopping Center area. Thia areas consist of numerous residences and commercial buildings. Land subsidence could have numerous impacts for

Tiburon, including the settling of businesses and homes as well as the shifting of roadways and utility infrastructure that run through the town. The lowland areas of Tiburon could anticipate increased rates of subsidence as bay waters saturate the soil from below.

Climate Change and Future Development Considerations

Climate change could indirectly influence land subsidence as more severe and prolonged periods of drought may encourage more groundwater withdrawals. In coastal areas like the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, land subsidence leads to higher sea levels and increased flood risk. The rate of land subsidence could increase across the Marin County OA including the lowland areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon as a result of climate change. The impacts of land subsidence on infrastructure, including roads and underground utilities in the District could increase with future development in the lowland populated areas of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon where land subsidence is more likely to occur.

2.2.6 Levee Failure

Levee failure is the overtopping, breach or collapse of the levee. Levees can fail in the event of an earthquake, internal erosion, poor engineering/construction or landslides, but levees most commonly fail as a result of significant rainfall or very high tides. During a period of heavy rainfall, the water on the water-body side of the levee can build up and either flow over the top ("overtopping") or put pressure on the structure causing quickening seepage and subsequent erosion of the earth. The overflow of water washes away the top portion of the levee, creating deep grooves. Eventually the levee weakens, resulting in a breach or collapse of the levee wall and the release of uncontrollable amounts of water. Figure 37 shows a levee and the multiple ways it can fail.

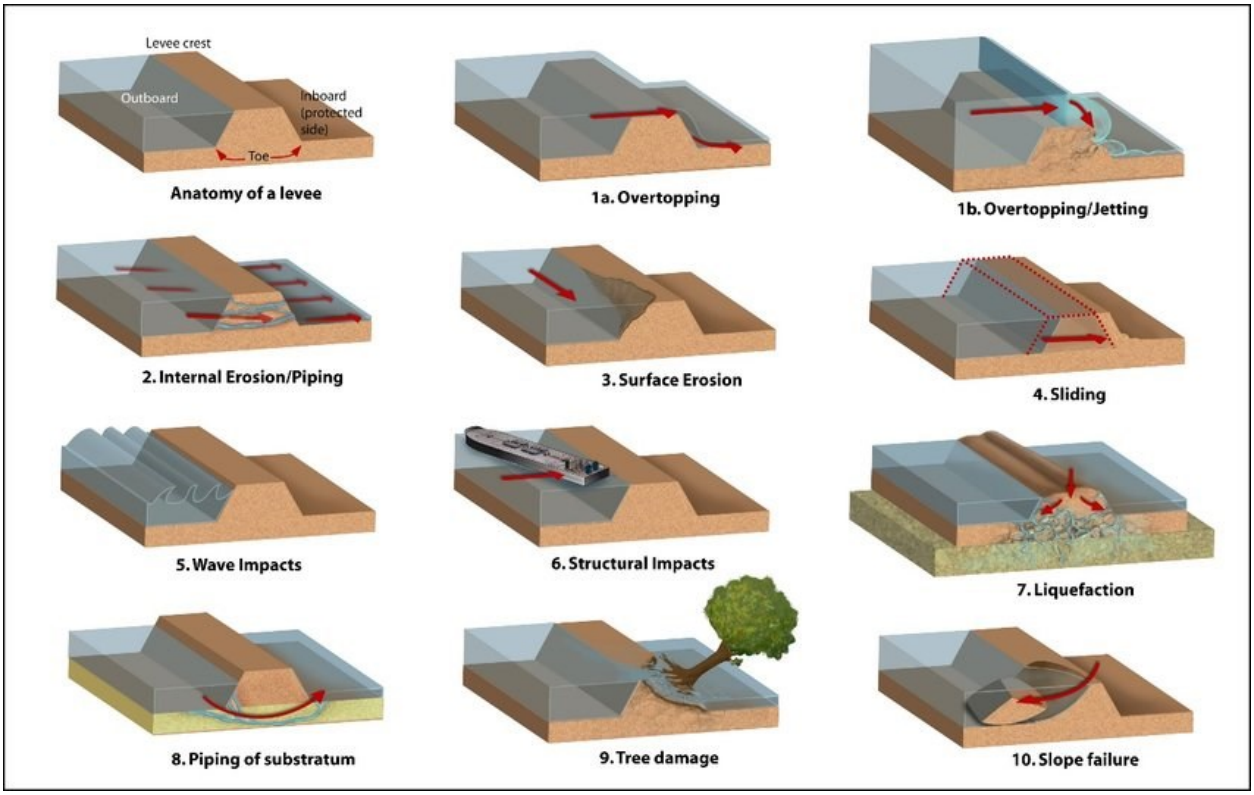


Figure 37: Levee Failure Mechanisms
Source: University of California

Several Marin County OA communities in the District including Tamalpais Valley, parts of Strawberry and Mill Valley are protected by levees. The City of Sausalito and the area of the District in the Town of Tiburon have no levees and are not at risk of levee failure.

A small area of Tamalpais Valley in the District is protected from the Coyote Creek Levees (COYL) and could be susceptible to a levee failure. The Coyote Creek Left Bank Levee System (COYL) is a federally authorized and non-federally operated and maintained project and is located in the County of Marin on the west shore of Richardson Bay, an arm on the western side of San Francisco Bay where the Coyote Creek drains approximately 2,200 acres of the eastern slopes of the Marin Peninsula. The COYL is 0.96 miles long with a maximum height of four feet. The COYL is one of the two flood protection systems of the Coyote Creek flood control project and is situated along the left bank of the creek when looking downstream. The other system is along the right bank of Coyote Creek. There is only one segment within the COYL. The subject levee system is located along the left bank of Coyote Creek and is approximately 1.5 miles long. The purpose of the levee is to provide flood protection to the community of Tamalpais Valley, California. The channel improvement project for Coyote Creek, located in the County of Marin, California, was authorized by the Chief of Engineers on January 15, 1963, under the provisions of Section 205 of the Flood Control Act of 1948, as amended by the Flood Control Act of 1962. The COYL was completed in February 1965. Improvements to the project to address the local subsidence were completed in 1977. The public sponsor of the COYL is the Marin County Department of Public Works. The other Coyote Creek Levee system is an additional smaller levee that was constructed on the right bank in 1965. It is 0.22 miles long with a maximum height of four feet. The levee from the Highway 1 bridge to the downstream end is no longer

maintained. This area of Tamalpais Valley protected by the Coyote Creek levees includes dozens of homes along with several commercial buildings and a section of Highway 1. Approximately 206 people and 105 buildings are at risk from a failure of the COYL levee, with a property value risk of around $59.4 million. Approximately 557 people and 265 buildings are at risk from the levee on the southern bank of Coyote Creek, with a property value risk of around $156 million. The risk is considered to be low LSAC 4 (Levee Safety Action Classification) for both levees prior to overtopping and overtopping breach scenarios. The levee has an overtopping recurrence of 1/100 USACE with low life safety risk. Seepage has not been documented since the construction of a seepage barrier in 2005 (the levee was loaded 75% in 2008). Some uncertainty exists in the condition of culvert penetrations. Areas of oversteepened slope and erosion at the waterside levee toe are also moderate concerns. No loss of life is anticipated, and economic damages are anticipated to be low.

Two small areas of Strawberry in the District are protected by levees and could be susceptible to levee failure. The Seminary Marsh Levee on the west side of Strawberry is 0.19 miles long with an undocumented height. The Strawberry Levee on the east side of Strawberry is 0.26 miles long with an undocumented height. The area protected by the Seminary Marsh Levee consists of several businesses adjacent to Highway 101. Approximately 325 people and 13 buildings are at risk from a failure of the Seminary Marsh Levee, with a property value risk of $20.9 million. The area protected by the Strawberry Marsh Levee consists of several homes and Strawberry Elementary School. Approximately 488 people and 36 buildings are at risk from a failure of the Strawberry Marsh Levee, with a property value risk of around $17.2 million.

The City of Mill Valley has one existing levee in the District. Marin County Levee 57 is 0.32 miles long with an undocumented height and surrounds the SASM WWTP on three sides. It is maintained by the SASM and according to the Mill Valley Department of Public Works, the levee at the SASM is above the high tide water mark and is not technically a levee but rather a berm to hold extra water storage at the side. It is not acting as a flood wall. Twenty-six people and four buildings with a property value of $4.48 million are at risk from a failure of the Marin County 57 levee.

Climate Change and Future Development Considerations

Climate change is expected to lead to an increase in the frequency and severity of major storm events, which can place added strain on levee systems. An increase in rainfall and runoff as a result of climate change will increase the potential for higher water levels in leveed areas across the Marin County OA including in the unincorporated County and the City of Mill Valley, increasing the potential for a levee failure.

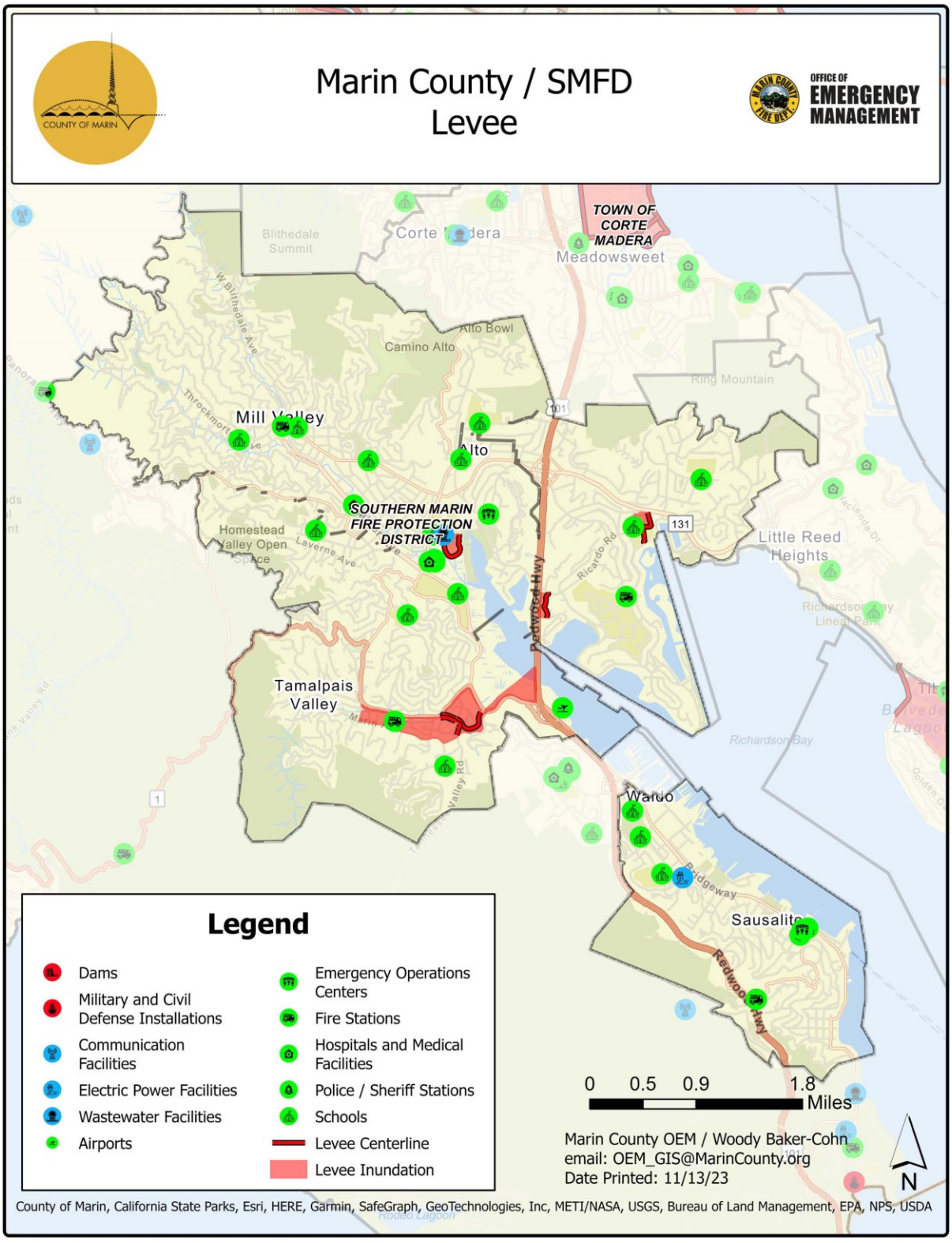


Figure 38: SMFD Levee Inundation Map
Source: Marin County OEM

2.2.7 Sea Level Rise

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

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

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

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

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

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

Unincorporated County of Marin
All residents in the unincorporated County, including in the Tamalpais Valley and Strawberry areas of the District, are susceptible to sea level rise. In the medium-term, portions of Tamalpais Valley homes, and Strawberry Circle, Strawberry Village Shopping Center and homes along Seminary Drive in Strawberry could face impacts from sea level rise. Smaller public and private marinas and boat launches along the bay in Strawberry could be flooded out and unusable. Storm surges can be powerful enough to damage and sink boats, including those belonging to the SMFD. Most concerning, however, is the potential inability of emergency professionals and vehicles to access people in or through flooded areas. Storm surge flooding could be 10 inches with a 100-year storm surge and extend further inland beyond the marshy areas of Strawberry.

Mill Valley
While only a small area of the Mill Valley could flood tidally from Richardson Bay, several key access routes and public facilities used by entire communities are in the exposed low-lying areas surrounding the Bay. The lowland areas of Mill Valley close to the Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, Camino Alto, Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are vulnerable to sea level rise and may experience between one and six feet of inundation based latest predictions of sea level rise in this area in the next 100 years.

Numerous commercial areas, dozens of residences, the Mill Valley Sewerage Agency of Southern Marin (SASM) Wastewater Treatment Plant (WWTP), Tamalpais High School, and the Redwoods medical facility lie in areas of Mill Valley susceptible to sea level rise. Several main thoroughfares including Miller Avenue and Camino Alto also lie in this area and already experience tidal flooding. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates Mill Valley could anticipate impacts to over 13,000 people and over 1,000 living units with $550 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, 44 acres of the City could be exposed to sea level rise. In the long-term, 190 acres of the City could be exposed to sea level rise; and 273 acres could be exposed with an additional 100-year storm surge. Ten percent of Mill Valley’s land area could be exposed to five feet of sea level rise and a 100-year storm surge. Miller Avenue could be flooded in the near-term. This area already experiences seasonal flooding that extends to Tamalpais High School fields. Homes and businesses along and near Shelter Cove, Hamilton Drive, and the Frontage Road could expect near-term flooding impacts. The Redwoods, a retirement community, is vulnerable in the medium-term. The SASM WWTP, serving six sanitary districts and 30,000 people, including Mill Valley residents, could expect flooding impacts in the medium and long-term. The Mill Valley-Sausalito Bike Path could flood a majority of the year during average high tides in the medium-term. This Path currently floods regularly during major storms. Mill Valley Middle School could expect sea level rise impacts to the grounds and could expect flood waters reach the buildings with the 100-year storm

coincidence. Bothin Marsh habitat could transition to mudflats without adequate sediment supply because the marsh does not have options for inland migration. Loss of marshland vegetation would remove natural buffers to stormwater inundation from Richardson Bay. The Mill Valley Recreation Center fields could be vulnerable to sea level rise in the long-term. A 100-year storm surge could impact nearly the whole site. Camino Alto, between Miller and Blithedale Avenues, and the neighborhood north of it, could expect flooding in the long-term.

Relative to other East Marin communities, Mill Valley has a low number of buildings vulnerable to sea level rise and a 100-year storm surge. However, several areas already vulnerable to stormwater backups could expect these conditions to worsen with added saltwater. Most of Mill Valley's buildings are wood-framed. While it is unclear how many buildings are older than 30 years, many in the low-lying areas are. Newer buildings typically have drilled piles 20-30 feet deep with reinforced steel cages and concrete to connect the homes to the foundation. This feature can help buildings withstand lateral forces from wind and water. However, even if buildings remain structurally intact, utility-related equipment could be vulnerable. Moreover, material and content damage from water and salt could occur.

Sausalito

Numerous businesses and residences and part of the Southern Marin Fire Protection District Station #1 lie in areas of Sausalito susceptible to sea level rise. The 2017 Marin Shoreline Sea Level Rise Vulnerably Assessment estimates t that Sausalito could anticipate impacts to over 7,000 people and over 265 living units with $400 million in assessed property value as a result of a 100-year sea level rise scenario and including storm surge. In the near-term, twenty-six acres of the city could be exposed to sea level rise. In the long-term, 84 acres of the city could be exposed to sea level rise; and 150 acres could be exposed with an additional 100-year storm surge. Several shoreline restaurants, hotels, and business could be vulnerable to flooding in the near-term. Numerous assets in the low-lying areas primarily east of Bridgeway may be vulnerable to storm surges and sea level rise. Northerly access to Sausalito could be blocked in the Waldo Point community near Gate 6 Road. Shoreline homes in Old Town could be impacted by erosion, storm surges, and high tides. Bridgeway leading to Old Town is also vulnerable in the long-term. The main wastewater force main leading to Sausalito Marin City Sanitary District treatment plant is in places under Bridgeway Blvd. Swede's and Tiffany beaches, and all other shoreline parks, could be vulnerable in the near term. Inflow and infiltration of tide waters into underground pipes could increasingly burden the wastewater treatment facilities. Several small shoreline parks and festival areas at Schoonmaker Point are susceptible to flooding, degrading public facilities and impeding public use. Several residents live in boats in marinas and unauthorized boats out in Richardson's Bay that are especially vulnerable during storms and could be vulnerable to damage at the marinas that host them. Sea level rise is projected to inundate parts of Sausalito's Downtown Historic District in the near term, with storms expanding the vulnerable area and exacerbating impacts. Both water and land routes to Sausalito's Downtown Historic District could be vulnerable in the near-term. The Sausalito Ferry terminal could experience inundation in the near-term. In the long-term, parts of Bridgeway could be tidally flooded, and impacts will worsen with storms. In other parts of Sausalito, a handful of private properties on the city's Historic Resources Inventory could also be vulnerable to sea level rise. Sausalito's Ark Row District includes seven noteworthy properties vulnerable to more than six feet of water in the near-term and more than six feet of water in the long-term. An additional ten other properties could be vulnerable in the long-term, including the original

firehouse. Two of Sausalito's landmark buildings, Castle by the Sea and the Ice House, could be vulnerable to a 100-year storm surge in the long-term. Marinship was built on bay fill on top of bay mud, and some areas, such as Heath Way, have experienced approximately five feet of subsidence since 1943 based on photographic records and are more susceptible to sea level rise. This is a primary employment area in the city.

Tiburon

Parts of Tiburon in the District are at a lower elevation than many of the coastal areas in Marin County. As such, the lowland areas in Tiburon in the District, including the area around the Cove Shopping Center, are particularly vulnerable to sea level rise and could experience between one and six feet of inundation (Mean High Water (MHW)), especially as these residences continue to subside over time. (Marin Shoreline Sea Level Rise Vulnerability Assessment, 2017). The Cove Shopping Center is vulnerable in the long-term to sea level rise, though could suffer sooner from combinations of higher tides and stormwater. A batch of homes could suffer tidal impacts just east of the Cove Shopping Center in the long-term. Vehicular access along Tiburon Boulevard could be compromised at the Cove Shopping Center in the long-term.

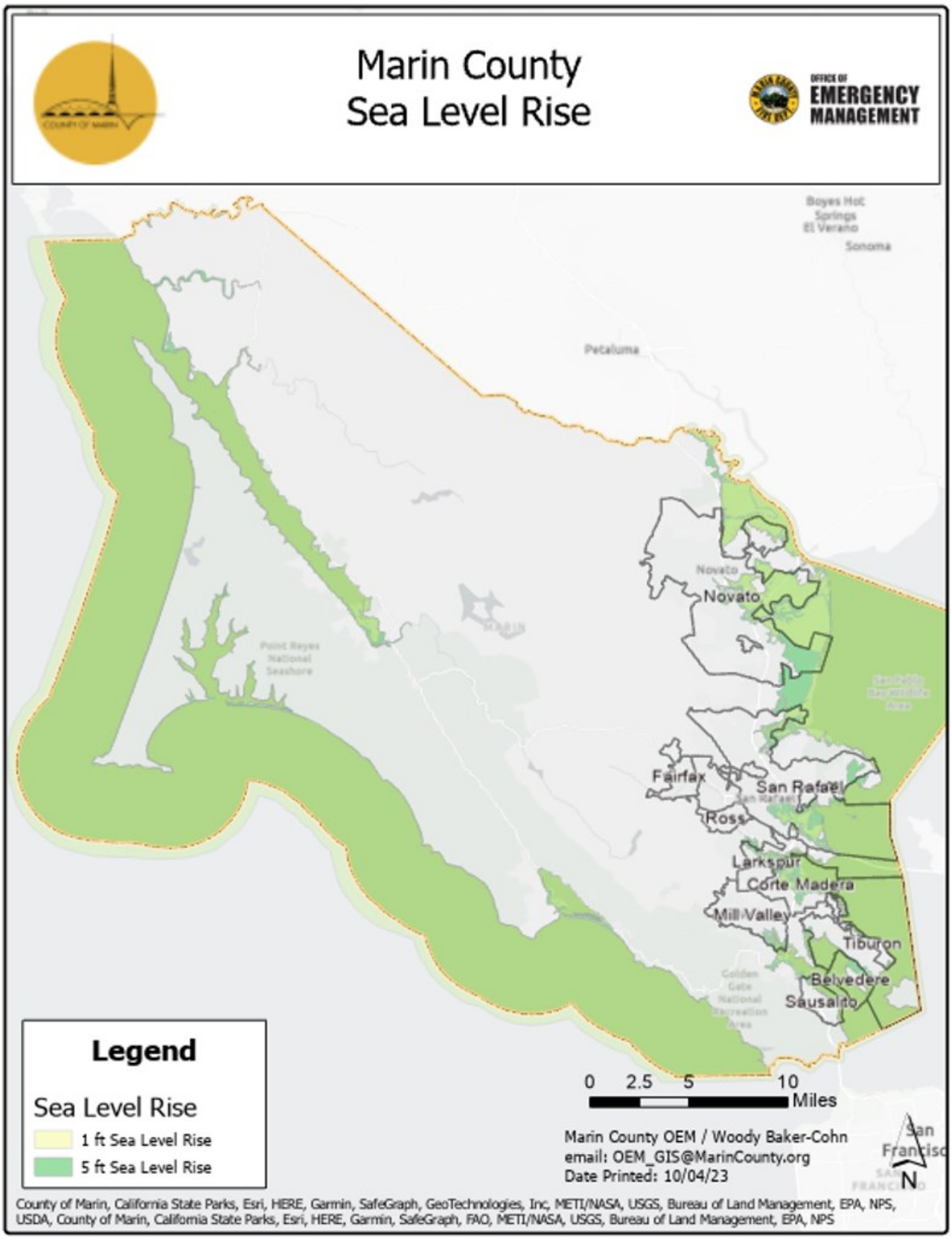


Figure 39: Marin County Sea Level Rise Impact
Source: Marin County OEM

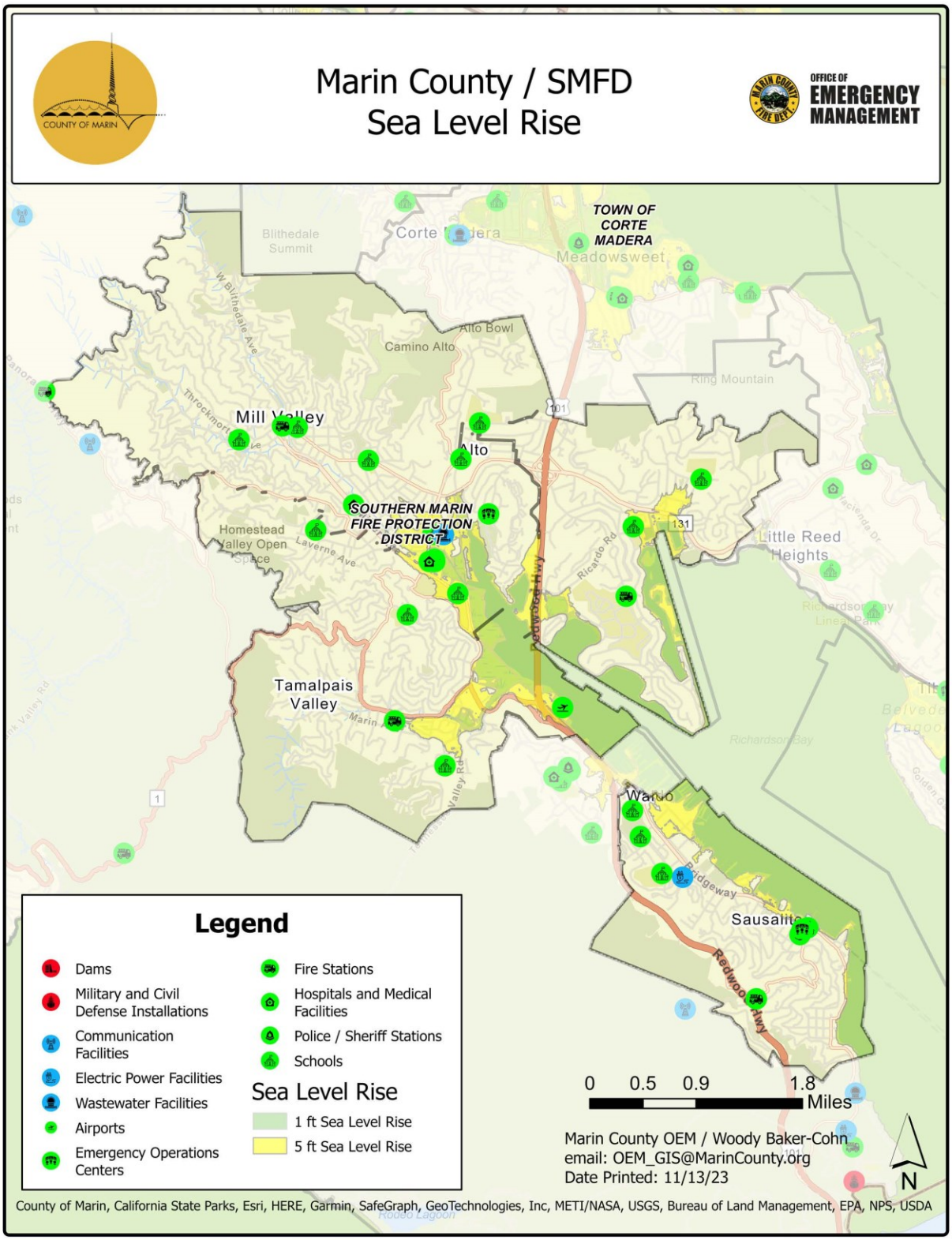


Figure 40: SMFD Sea Level Rise Impact on Critical Facilities
Source: Marin County OEM

Critical facilities throughout the District can become damaged extensively with their foundations compromised over time. Of particular concern are those facilities that have not been elevated to projected sea level rise heights over the next century. Sea level rise in the District has the potential to exacerbate inland flooding when a significant rain or tidal event occurs, pushing water from local creeks over their banks and into areas were critical facilities lie. Sea level rise can also cause increased subsidence in the District, which may damage underground water and wastewater pipelines and disrupt services.

Climate Change and Future Development Considerations

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

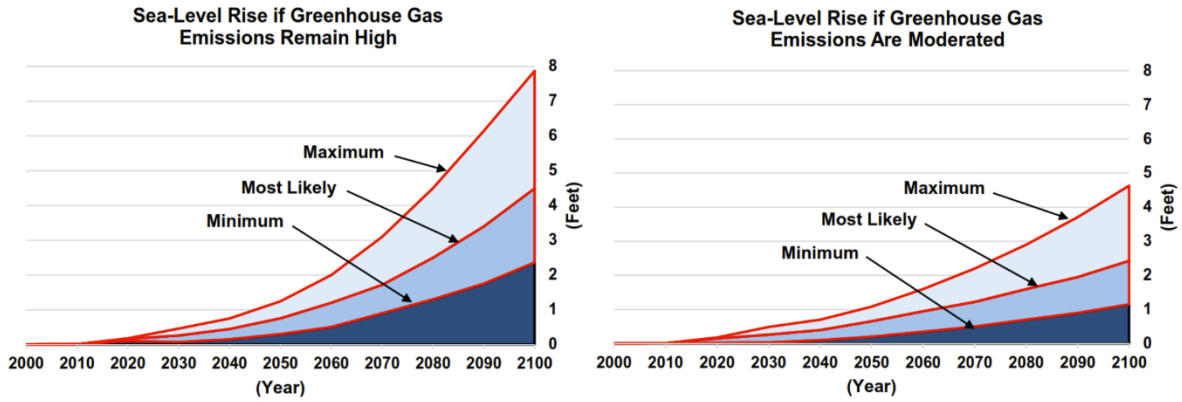


Figure 41: Projections of Sea Level Rise in the San Francisco Bay Area, 2000-2100
Source: 2019–2020 Marin County Civil Grand Jury, Climate Change: How Will Marin Adapt?

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

2.2.8 Severe Weather – Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. A heat wave is an extended period of extreme heat, often with high humidity. When relative humidity is factored in, the temperature can feel much hotter as reflected in the Heat Index (see Figure 42):

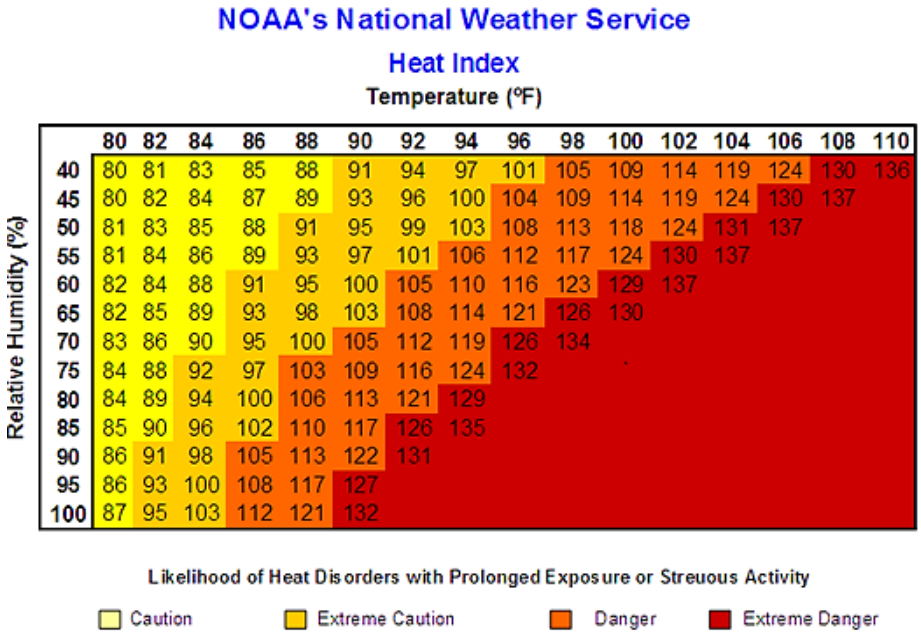


Figure 42: Heat Index
Source: NOAA

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

Extreme heat has the potential to impact all areas the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon and would be felt more in areas where there is a widespread presence of concrete and asphalt, which stores heat longer. This includes the lowland areas of Tamalpais Valley and Alto in the unincorporated County; and most of the downtown and commercial area of Mill Valley between Miller Avenue and E. Blithedale Avenue. There are dozens of residences in these areas. The lowland areas of the District in Strawberry, Sausalito and Tiburon lie along Richardson Bay where cool bay breezes would help mitigate the effects of high temperatures. Heat waves can cause power outages and can sicken people who are exposed to high temperatures too long, particularly infants and the elderly.

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

Climate Change and Future Development Considerations

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

by approximately 4.4 degrees by 2050 and 7.2 degree by the end of the century unless significant efforts are made to reduce greenhouse emotions according to California's latest climate change assessment.

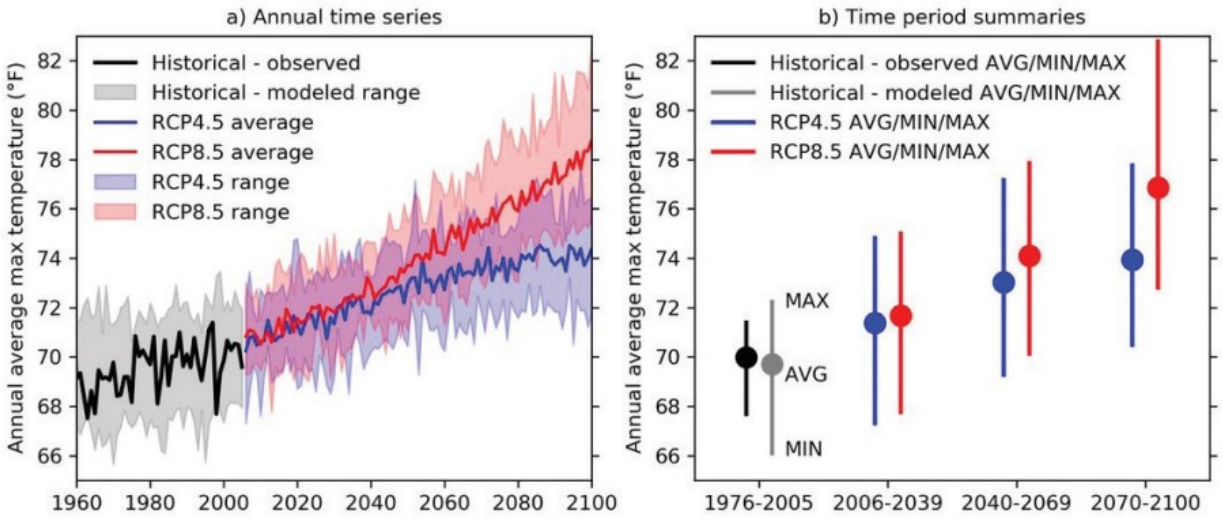


Figure 43: Annual Average Temperatures in the San Francisco Bay Area, 2000-2100
Source: California Climate Change Assessment (Fourth Edition)

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

2.2.9 Severe Weather – High Wind & Tornado

High Wind

High wind is defined as a one-minute average of surface winds 40 miles per hour or greater lasting for one hour or longer, or winds gusting to 58 miles per hour or greater regardless of duration that are either expected or observed over land. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms. The Beaufort scale is an empirical measure that relates wind speed to observed conditions on land and is a common measure of wind intensity (see Figure 44).

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

Figure 44: Beaufort Wind Scale
Source: NOAA

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

All of the SMFD is susceptible to storms and damage from wind and tornadoes, though the hilly and mountainous areas throughout the District have increased susceptibility due to a higher presence of trees. Drought can increase the susceptibility of trees toppling over in a high wind event. Fallen trees could damage critical facilities and infrastructure. Power lines could be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the delivery of services and access to critical facilities.

Tornado

Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist, and damage paths can be in excess of one mile wide and 50 miles long. The Enhanced Fujita Scale (see Figure 45) is commonly used to rate the intensity of tornadoes in the United States based on the damages that they cause.

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

Figure 45: 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 46: Waterspout Formation
Source: MarineInsights

All of the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon are susceptible to storms and damage from wind, though the hilly and mountainous areas of the Tamalpais Valley, Mill Valley and Sausalito have increased susceptibility due to a higher presence of trees. There are numerous windy and dead end roads in these areas where a downed tree could hinder access. Tamalpais Valley, Mill Valley, Sausalito and Tiburon are unlikely to experience a tornado due to the terrain but it could experience a waterspout originating from Richardson Bay. Drought coupled with high winds which frequently occur may increase the susceptibility of trees toppling and falling branch damages to property. Fallen trees may damage homes and other facilities. Power lines may be impacted by fallen trees and wind, causing power outages. Roadways could also become blocked by fallen trees, affecting the ability of residents to reach their homes.

Mill Valley
On 1/17/2023, a tree fell and destroyed a garage at 56 Monte Vista.

On 1/13/2023, a storm caused a large tree to fall, closing Marion Avenue.

On 1/16/2019 a man was struck and killed by a car as he was trying to avoid a falling tree at the intersection of Laverne Avenue and North Ferndale Avenue during a storm. A huge downed tree fell across the street from the Horizon School during the storm, crushing the rear of a car and narrowly missing the people inside. Nobody was hurt. A 125-foot-tall redwood tree fell off Molino Avenue splitting a power pole in two. It cut power to about 60 homes.

On 2/17/2017, a storm with high winds caused 2,100 people in Mill Valley to lose power.

Sausalito

On 3/21/2023, a torrent of powerful winds caused several trees to topple throughout the City with only minor damage. Damage occurred at Harrison Street and along Bridgeway Blvd. Wind gusts reached 68 mph on Wolfback Ridge in the City with slightly less wind throughout the City of Sausalito. Sausalito reported that 1,778 meters lost power in the City and in Fort Baker and the Marin Headlands in the unincorporated County of Marin.

On 1/19/2021, winds reached 61 mph in Sausalito, causing numerous boats to come adrift in Richardson Bay. One boat came to shore on Schoonmaker Beach, another behind the Pelican Yacht Harbor and a third near the Sausalito Cruising Club. Over 7,200 meters in the City lost power.

On 2/14/2019, a severe storm with high winds caused significant power outages and numerous tree to topple across the City.

On 12/16/2017, strong winds and high waves caused a boat in Richardson Marina in Sausalito to flip over. Multiple people were rescued. A nearby buoy recorded winds peaking at 31 mph.

Climate Change and Future Development Considerations

It is anticipated that the atmospheric rivers that deliver storms to Northern California may intensify because of climate change. This increase in storm intensity may bring more intense winds and potential tornados to Northern California, including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. Significant wind events and tornados can topple trees, particularly those that may be saturated, or drought stressed as a result of climate change. An increase in fallen trees in Sausalito as a result of increased storms due to climate change can lead to an increase in power outages. Future development in any of the forested areas of Mill Valley and Sausalito's mountainous residential areas will increase the effects of severe wind events.

2.2.10 TSUNAMI

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

A tsunami experienced by the SMFD would most likely occur from an earthquake, the location of which would determine the amount of time that the tsunami waves would reach the District. Much of the lowland areas of the Tamalpais Valley, Strawberry, the cities of Mill Valley and Sausalito and the Town of Tiburon lie in a tsunami inundation zone.

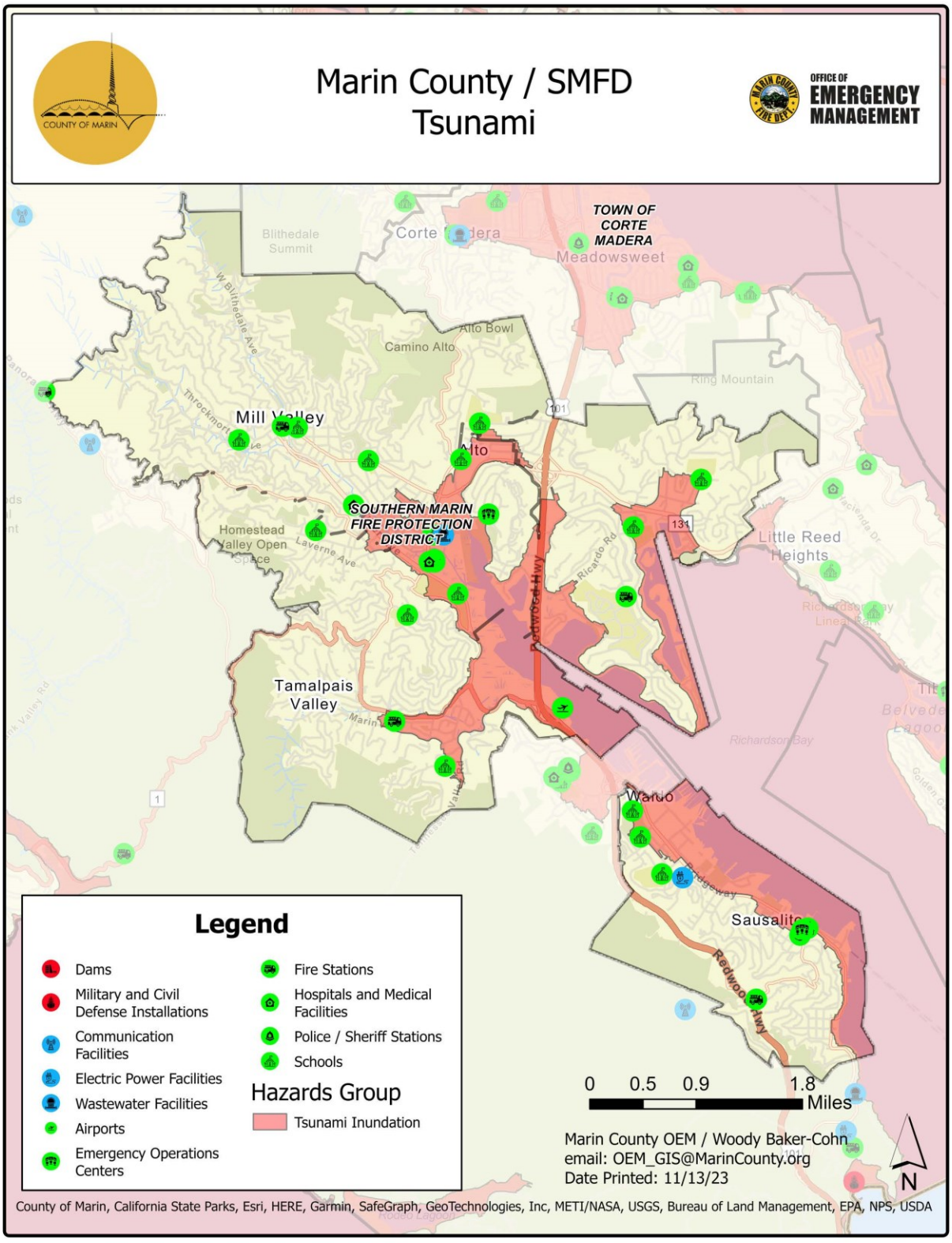


Figure 47: SMFD Tsunami Critical Facilities and Infrastructure
Source: Marin County OEM

Unincorporated County of Marin
A large section of Tamalpais Valley, including smaller sections to the north adjacent to and including the City of Mill Valley, lie in a tsunami inundation zone and could be susceptible to a tsunami pushing water up Coyote Creek. There are hundreds of homes, commercial buildings, the Southern Marin Fire Protection District Station #4 and part of Tamalpais Valley Elementary School that lie in this area. Most of the commercial core of Marin City, including the Gateway Shopping Center, the Martin Luther King Jr. Academy, the Marin City Fire Station, and numerous residences lie in a tsunami inundation zone and could be susceptible to a tsunami. The Waldo Point community consisting of dozens of floating homes in Richardson Bay could be susceptible to a tsunami. The area around the intersection of Highways 1 and 101 including the highways themselves, the Commodore Heliport and several businesses lie in a tsunami inundation zone and could be susceptible to a tsunami.

Both sides of the Strawberry Peninsula lie in a tsunami inundation zone and could be susceptible to a tsunami. There are dozens of homes in this area along with numerous commercial buildings, the Strawberry Point elementary school and a large section of Highway 101 that could be susceptible to a tsunami. There are also several homes in the northwest corner of Strawberry near Alto that lie in a tsunami inundation zone and could be susceptible to a tsunami.

Mill Valley
The entire shoreline of Mill Valley along Richardson Bay is in a lowland area and lies in a tsunami hazard area. The lowland areas of Mill Valley close to Richardson Bay, including part of the city south of E. Blithedale Avenue and north of Miller Avenue, as well as lowland areas around Bothin Marsh, Bayfront Park, the Mill Valley Treatment Plant, along Shelter Bay Avenue and around the Redwood Highway commercial area adjacent to Highway 101 are in a tsunami hazard area and may be susceptible to a tsunami. Tamalpais High School, Mill Valley Middle School and the Redwood medical facility lie in this area.

Sausalito
The entire shoreline of Sausalito is in a lowland area and lies in a tsunami hazard area. This includes the entire commercial area of the City along both sides of the Bridgeway and the main commercial area on both sides of Caledonia Street. There are numerous residences, businesses, marinas and other docking facilities in this area that could be susceptible to a tsunami. The Southern Marin Fire Protection District, the Sausalito Police Department and the Headlands Preparatory School also lie in this area and could be susceptible to a tsunami.

Tiburon
Areas of Tiburon in the District in the 500-year floodplain are at a lower elevation and lie in a tsunami hazard area, including most of the Cove Shopping Center where there are numerous residences and commercial buildings.

Mill Valley and Sausalito have experienced minor tsunamis in the past. Similar of other San Francisco Bay fronting communities, major tsunami wave energy is dissipated by the fact that these waves would have to propagate through the water way under the Golden Gate Bridge. Nevertheless, major tsunamis may impact District areas along Richardson Bay in Tamalpais Valley, Strawberry, the cities of Mill Valley and Sausalito. Flooding from a tsunami may be

similar to king tide flooding already experienced by Marin County OA with the exception that a tsunami occurs in a shorter time frame and may impact the City's vibrant harbor systems. Roadways and infrastructure may become inundated with salt water, causing transportation issues and utility disruptions.

On 1/15/2022, an undersea volcano erupted in the Pacific Ocean near Tonga causing a minor surge in Sausalito from Richardson Bay. Rough waters were reported with no significant damage. A dock pulled away from an apartment in Tiburon

Climate Change and Future Development Considerations

The biggest threat to tsunamis is sea level rise which is a direct result of climate change. Sea level rise can make tsunamis worse than they already are because higher sea levels allow for tsunamis to travel further inland and cause even more damage. Sea level rise results in more vulnerable coastlines which make coastal communities even more vulnerable to an incoming tsunami as the natural buffer to absorb the energy of an incoming tsunami will cease to exist. This is particularly true in the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon, where a large segment of the developed population lies in an area vulnerable to sea level rise. Furthermore, it has been theorized that ocean warming, caused by climate change, can impact the tectonic plates that rest below large bodies of water. Ultimately, this can result in more geological activities and worse tsunamis. Climate change has also affected ocean patterns, which could eventually lead to tsunamis distributing themselves across the ocean and impacting areas that are currently not susceptible to a tsunami. Tsunamis as a result of climate change and associated sea level rise will exacerbate the impacts of flooding in the lowland areas of the Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon. This is particularly true around the marshland areas of Mill Valley and Sausalito where additional storm surge as a result of a larger tsunami could cause greater impacts. Future development in these areas will expose more people and infrastructure to the effects of flooding in the Marin County OA as tsunami inundation areas expand with climate change. Development in marshland in Mill Valley and Sausalito would expose additional people and infrastructure to flooding as marshlands act as a natural buffer to a tsunami.

2.2.11 WILDFIRE

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

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

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

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

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

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

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

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

The Southern Marin Fire Protection District (SMFD) provides wildland fire protection and fire prevention activities for the City of Mill Valley as LRA. As a JPA of the Marin County OA, SMFD has response areas within the County for both LRA and SRA.

Figure 48 indicates the federal responsibility areas, state responsibility areas and local responsibility areas in the Marin County OA.

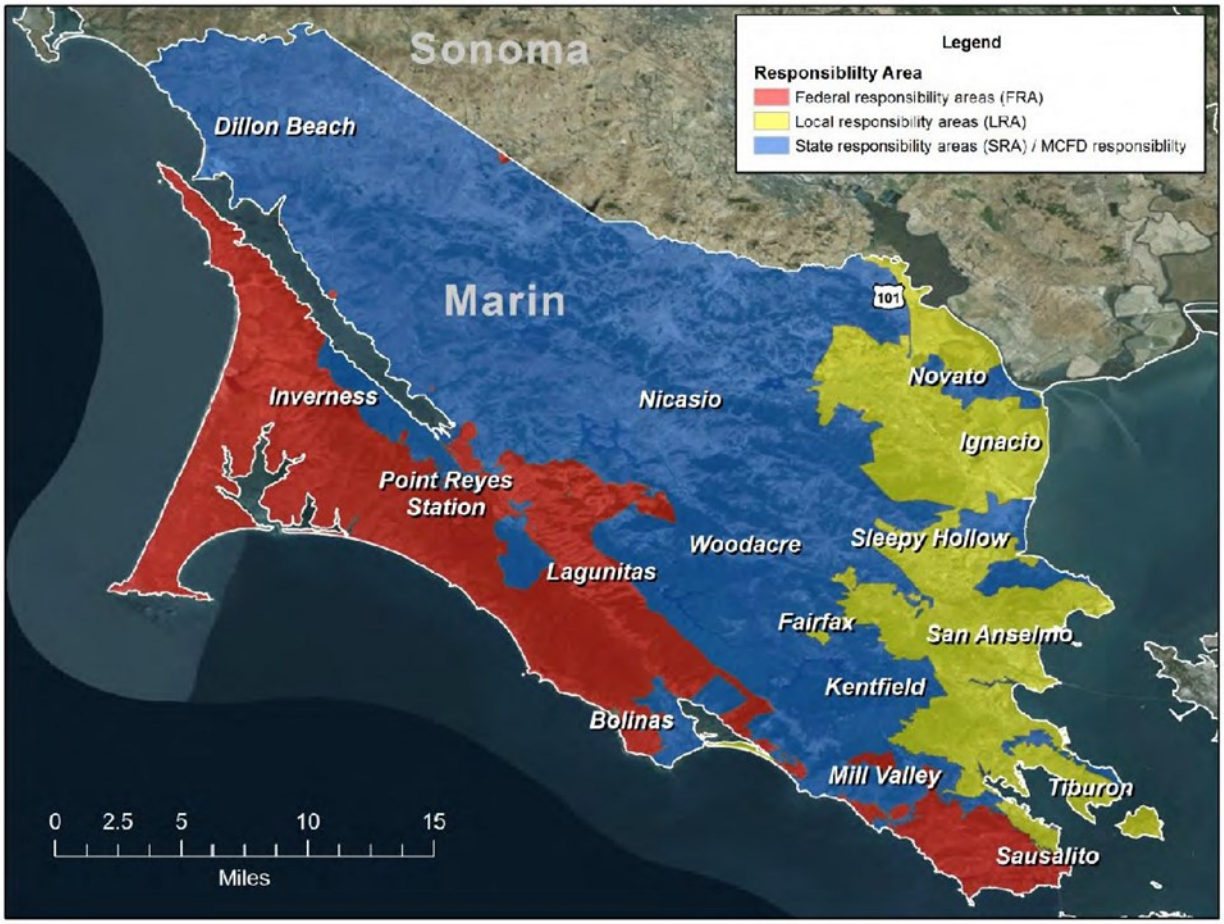


Figure 48: Federal, State and Local Responsibility Areas in the Marin County OA
Source: Marin Community Wildfire Protection Plan

The mix of weather, diverse vegetation and fuel characteristics, complex topography, and land use and development patterns in the Marin County OA are important contributors to the fire environment. The MCFD Woodacre Emergency Command Center (ECC) currently manages the data from four Remote Automated Weather Stations (RAWS) for predicting fire danger utilizing the National Fire Danger Rating System (NFDRS) during the fire season. The RAWS are

located in Woodacre, Middle Peak, Barnabe, Big Rock and a new station will be coming online in Novato.

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

In the late spring through early fall, the combination of frequent and strong high-pressure systems (known as the Pacific High) over California combined with the cool waters of the ocean/bays results in persistent fog and low clouds along the coast (including over the southern Marin County OA near the San Francisco Bay) with winds. The fog often penetrates into the inland valleys of the northern and central Marin County OA, especially during overnight hours. At the coastline, mist from fog can keep the land surfaces modestly moist while inland land surfaces above the fog or inversion are often very dry.

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

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

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

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

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

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

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

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

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

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

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

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

Grasslands with a mixture of native and nonnative annual and perennial plant species occur most often in the northern and western parts of the county due to a combination of soil type, lower rainfall, and a long history of ranching. The southern and western facing slopes tend to have a higher percentage of grasslands, which in turn have the potential to experience higher rates of fire spread. Grassland fires are dangerous even without extreme fire weather scenarios due to the rapid rate of fire spread; in some cases, fires spread so quickly that large areas can burn before response resources are able to arrive.

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

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

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

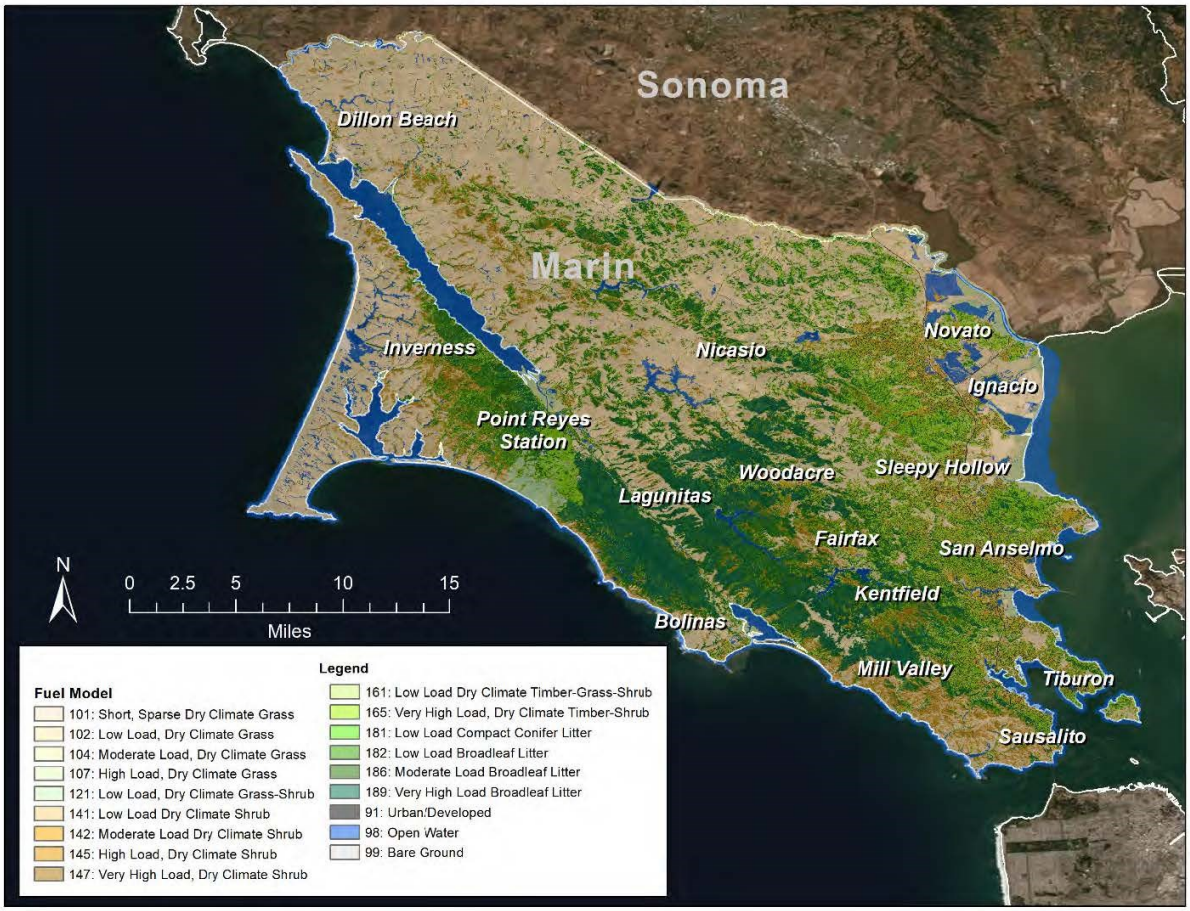


Figure 49: Fuel Model Map for the Marin County OA
Source: Unknown

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

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

Two other plant diseases prevalent in the Marin County OA are pitch canker (which affects conifers such as Bishop pine and other pine species), and madrone twig dieback (which affects Pacific madrones). Pitch canker is caused by the fungus Fusarium circinatum (F. subglutinans, F. sp. pini), which enters the tree through wounds caused by insects. While some trees do recover, most infected trees are eventually killed by the fungus. Management of this disease

largely focuses on containment to reduce the fungus spreading to other trees. Pitch canker is a particular issue in the NPS lands of Pt. Reyes National Seashore, where many acres of young Bishop Pines that were seeded on the Inverness Ridge by the Mount Vision Fire of 1995 have been infected.

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

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

Topography characterizes the land surface features of an area in terms of elevation, aspect, and slope. Aspect is the compass direction that a slope faces, which can have a strong influence on surface temperature, and more importantly on fuel moistures. Both elevation and aspect play an important role in the type of vegetation present, the length of the growing season, and the amount of sunlight absorbed by vegetation. Generally, southern aspects receive more solar radiation than northern aspects; the result is that soil and vegetation on southern aspects is warmer and dryer than soil and vegetation on northern aspects. Slope is a measure of land steepness and can significantly influence fire behavior as fire tends to spread more rapidly on steeper slopes. For example, as slope increases from 20 – 40%, flame heights can double and rates of fire spread can increase fourfold; from 40 – 60%, flame heights can become three times higher, and rates of spread can increase eightfold.

The Marin County OA is topographically diverse, with rolling hills, valleys and ridges that trend from northwest to southeast. Elevation throughout the county varies considerably, with Mt. Tamalpais' peak resting at 2,574 feet above sea level and many communities at or near sea level. Correspondingly, there is considerable diversity in slope percentages. The San Geronimo Valley slopes run from level (in the valley itself) to near 70%. Mt. Barnabe has slopes that run from 20 to70%, and Throckmorton ridge has slopes that range in steepness from 40 – 100%. These slope changes can make fighting fires extremely difficult.

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

The dispersion of burning embers from wildfires is the most likely cause of home ignitions. When embers land near or on a structure, they can ignite near-by vegetation or accumulated

debris on the roof or in the gutter. Embers can also enter the structure through openings such as an open window or vent and could ignite the interior of the structure or debris in the attic.

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

Sausalito's upper areas are generally Golden Gate National Park and are heavily vegetated with various fuel types. In addition, a significant number of properties and structures are located on existing steep hillsides which are also heavily vegetated. Sausalito experiences strong winds throughout the summer months and into the fall with the marine layer crossing over the hill from the Pacific Ocean.

Public Safety Power Shutoff (PSPS) Events

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

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels, generally 20 percent and below
- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry material on the ground and live vegetation (moisture content)
- On-the-ground, real-time observations from PG&E's Wildfire Safety Operations Center and field crews

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

Public Safety Power Shutoff (PSPS) events on communities in the Marin County OA and throughout California.

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

PSPS events have occurred in the Marin County OA, including the District, in years past. While PG&E continues to address safety issues with their systems by installing equipment that can segregate their system in order to continue to provide power to their customers wildfires from overhead electrical systems. While wildfires can start anywhere, the high winds and high abundance of fuels within and upslope of Tamalpais Valley, the Cities of Mill Valley and Sausalito and the Town of Tiburon may be the most likely location for a wildfire to occur. Areas which are also heavily vegetated and are primarily residential and consist of numerous winding streets and hillside homes may be damaged or destroyed by a wildfire.

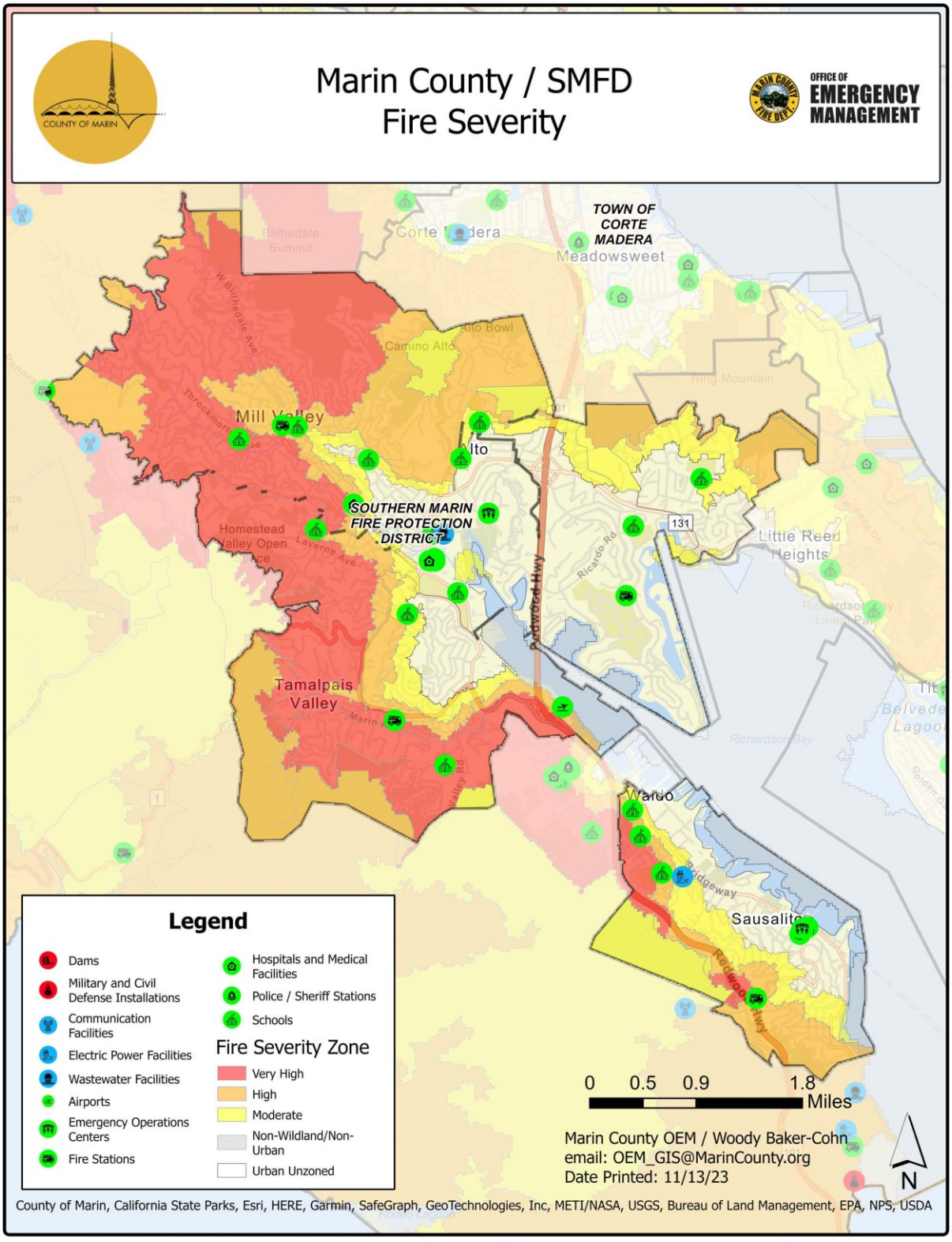


Figure 50: SMFD Wildfire Critical Facilities and Infrastructure
Source: Marin County OEM

A wildfire in the SMFD would most likely occur in the areas of the District where there is more forested terrain. District critical facilities, including the SMFD Station #4 are located in Very High FHSZ and could be impacted by a wildfire originating around the slopes of Mount Tamalpais. As wildland areas around the District become drier due to climate change and drought, the risk of a wildfire or brush fire occurring and impacting the District will continue to increase as open spaces experience drier conditions.

Specific communities in the Tamalpais Valley, Mill Valley and Sausalito are in a Very High FHSZ and are at a higher risk of wildfire. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access.

Unincorporated County of Marin
Most of Tamalpais Valley lie in a Very High FHSZ. There are thousands of homes and buildings in this area of Tamalpais Valley, along with a MERA antenna site, the Marin Horizon School, the SMFD Station #4 and the Tamalpais Valley Elementary School that could have a very high susceptibility to wildfire. Populations in this area are particularly susceptible to wildfire due to the presence of numerous cul de sacs and windy secondary roads that could impede an evacuation. The Very High FHSZ in Tamalpais Valley is bordered to the east by a High FHSZ. Hundreds of homes and numerous businesses along with the Commodore Center Heliport lie in the High FHSZ and could have higher susceptibility to wildfire. The Mount Tamalpais School lies in the Moderate FHSZ and could be susceptible to wildfire.

A small area in the north of Strawberry lies in a High FHSZ with a larger area that lies in a moderate FHSZ. There are several homes in this area that could have higher susceptibility to wildfire.

Mill Valley
Specific communities in Mill Valley around the northern side of the city are in a Very High FHSZ and are at a higher risk of wildfire. This area includes numerous residential communities with hundreds of homes and consists mostly of windy and dead-end roads that could hinder an evacuation and access. The Old Mills Elementary school lies in this area. Hundreds of homes and parts of the downtown and commercial area along Miller Avenue in Mill Valley lie in a High FHSZ and could be susceptible to wildfire. The Mill Valley Fire Station #6, the Greenwood School and the Marin Terrace medical facility lie in this area. Dozens of residences and parts of the commercial areas along Miller Avenue and E. Blithedale Avenue east of Lomita Drive lie in a Moderate FHSZ and have some susceptibility to wildfire. The Helix School and Edna Maguire Middle School lie in this area. Marshland around Bayfront Park is also in a moderate FHSZ and could be susceptible to a brush fire when vegetation is dry. All of Mill Valley could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Mill Valley, including in Muir Woods National Monument, Mount Tamalpais State Park and the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City may continue to increase. Brush fires in the City may increase over time as parks, and other open spaces experience drier conditions.

On 9/27/2022, a brush fire broke out on a populated hillside adjacent to the Camino Alto Open Space Preserve near Kite Hill Lane and Camino Alto in Mill Valley. The fire burned a half-acre.

In 1929, the base of Mt. Tamalpais in Mill Valley experienced a significant fire known as the Great Mill Valley Fire. That fire's footprint is now developed with more than 1,100 homes

(valued at over $1 billion) which have significantly altered the natural vegetation through urban and suburban development.

Sausalito
Specific communities in Sausalito are in a Very High FHSZ and are at a higher risk of wildfire. This area includes the Wolfback Ridge neighborhood and the residential area along Lincoln Drive between Highway 101 and Nevada Street. Part of the Lycee Francais de San Francisco lies in this area. Hundreds of homes in Sausalito lie in a High FHSZ and could be susceptible to a wildfire. Most of the commercial area of Sausalito, including most of the Citys critical facilities lie outside a FHSZ though there are some commercial buildings along the Bridgeway in the northern part of the City that like in a Moderate FHSZ and could be susceptible to a wildfire. All of Sausalito could be impacted by a Power Safety Shutoff (PSP) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Sausalito, including in the Marin Headlands, become drier due to climate change, the risk of a wildfire occurring and impacting the City will continue to increase. Brush fires in the City may increase over time as parks, and other open spaces experience drier conditions.

On 7/18/2022, a brush fire broke out near Sausalito closing northbound Highway 101, Golden gate National Park area south of Marin City. Residents in the Anchorage Apartments in Sausalito, off Lincoln Drive, were advised to shelter in place. The fire emitted a large plume of smoke.

On 2/10/2022, an arson fire and explosion at a homeless encampment in Marinship Park caused the City to declare a local emergency. One tent fully was engulfed in flames that spread to another tent causing minimal damage. No injuries were reported.

On 9/12/2021, a fire broke out in the Golden Gate National Recreation Area near Sausalito. Between five to ten acres were burned with no damage to structures.

On 10/17/2017, two small vegetation fires broke out in Sausalito along Rodeo Avenue near Highway 101, causing southbound lane closures on the highway. The flames spread into eucalyptus trees and headed uphill toward the Wolfback Ridge neighborhood. People living near the fires were asked to evacuate. No residential damage or major injuries were reported. Air quality readings were classified as either unhealthy or unhealthy for sensitive groups from this event.

Sausalito's largest fire in its history occurred on September 19, 1919. A raging fire originating from an outdoor burn pile caused the loss of twelve homes and five stores. Fires on the roofs of multiple homes and businesses were extinguished before any significant damage. The Holy Family Hall on Third Street was totally destroyed. The South End Grocery Store was saved with slight fire damage. Many grass fires and roof fires were also promptly extinguished. A spark landed on and set fire to the canvas covering on a power boat cruiser moored five hundred feet offshore.

Tiburon
A wildfire in the District area of Tiburon would most likely originate from the Ring Mountain Open Space Preserve in the unincorporated County on the north side of the town, This area of Tiburon is in a high FHSZ, is primarily residential and consists of numerous winding streets and hillside homes that could be damaged or destroyed by wildfire. The hillside neighborhoods in this area have extremely limited ingress and egress for residents and emergency services.

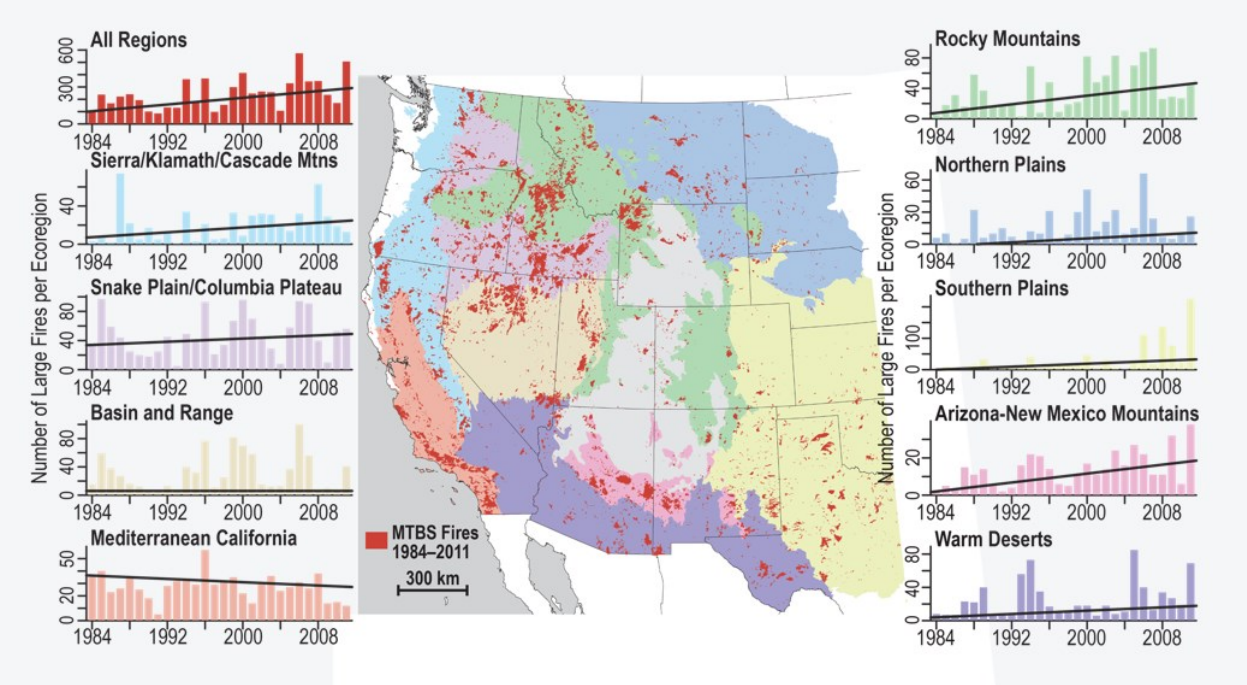
Tiburon has historically experienced several huge fires before the formation of the Tiburon Fire Protection District, but none in the last century. On 11/13/1890, Tiburon was destroyed by an urban conflagration. There have been no major wildfires or brush fires in Tiburon since the last plan update.

On 6/15/2012, a three-acre brush fire was reported near Reed Ranch Road. Nearby homes and structures were not threatened by the blaze.

The entire District could be impacted by a Public Safety Power Shutoff (PSPS) event and/or suffer poor air quality from smoke as a result of a wildfire in the Marin County OA or the surrounding region. As wildland areas around Tamalpais Valley, Mill Valley, Sausalito and Tiburon, including in Muir Woods National Monument, Mount Tamalpais State Park and the Marin Headlands, and the Ring Mountain Open Space become drier due to climate change, the risk of a wildfire occurring and impacting the District may continue to increase. Brush fires in the District may increase over time as parks and other open spaces experience drier conditions.

Climate Change and Future Development Considerations

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



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

As summer conditions in Northern California become hotter and drier due to climate change, the occurrence and severity of wildfires will only increase. The Marin County OA including the unincorporated County, the Cities of Mill Valley and Sausalito and the Town of Tiburon is particularly susceptible to these future impacts of climate change on wildfire, as the OA's climate has generally been wet enough historically to avoid major wildfires. Extreme heat events and high wind events could cause electrical systems to become overloaded and fail,

sparking wildfires. An increase in wildfires as a result of climate change could lead to more significantly burned areas that could contribute to debris flows after a significant storm event, particularly in the open space areas around Mill Valley and Sausalito. Future development in the WUI throughout Tamalpais Valley, Mill Valley, Sausalito and Tiburon will expose more people and property to the impacts of a potentially significant wildfire. The growing number of people in the Tamalpais Valley, Mill Valley, Sausalito and Tiburon WUI can increase risk to life, property and public health as a result of a wildfire. Future development around the Mill Valley and Sausalito marshlands would expose more people to the effects of brush fires as the marshlands dry out in the summer due to climate change.

SECTION 3.0: MITIGATION STRATEGY

3.1 CHANGES IN DEVELOPMENT

The various Marin County Jurisdiction's General Plans guide growth and development across the County based on maintaining the County's small communities with their own unique character. Future large development in the County is not expected within the next 5 years, however, some managed development has been identified, approved, or submitted.

There has been a significant amount of development within the Southern Marin Fire Protection District since the last plan update in 2018. However, the development has been to existing facilities or within the facility footprint of the SMFD. There has not been any increased risk to the District as a result of new development since the last plan update in 2018.

Future land use and growth management strategies in the Southern Marin Fire Protection District are consistent with priorities detailed in the 2018 Marin County MJHMP and aim to concentrate future development into and toward existing areas away from locations where natural characteristics may limit development (e.g., steep slopes or sensitive habitats), and to areas that have, or can readily be supplied with, adequate public facilities and services. This is done through various policies relating to zoning and minimum development standards and requirements. No further development is planned for the next five years.

3.2 CAPABILITY ASSESSMENT

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

Capabilities are the programs and polices currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capability assessment identifies the local planning mechanisms and hazard mitigation information from this 2023 MJHMP will be incorporated once approved. The capability assessment is divided into four sections: regulatory, administrative and technical, fiscal, and outreach and partnerships.

3.2.1 REGULATORY CAPABILITIES

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

Opportunities for Enhancement

The 2023 Marin County OA MJHMP update provided the Southern Marin Fire Protection District an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

- **Local Emergency Operations Plan and Continuity of Operations Plan**: The Cities of Mill Valley and Sausalito would benefit from the development of our own emergency operations Plan and Continuity of Operations Plan. These Plans are currently being updated and will allow the Cities to develop response and contingency plans for the risk and vulnerability of the City to the hazards identified in the Hazard Mitigation Plan.
- **Community Wildfire Protection Plan:** The cities of Mill Valley and Sausalito plan to take an active role in mitigation actions to enhance wildfire protection.
- **StormReady certification and Firewise Communities certification:** The cities of Mill Valley and Sausalito will consider participation in these programs.

Table 18: Legal and Regulatory Capabilities

Plans	Yes/No Latest Update	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive /Master Plan	No	N/A
Strategic Plan	Yes 2016	Guiding document determining vision including vision to implement the Hazard Mitigation Action table. Does not address hazards. Can be used to identify goals but not to implement mitigation actions.
Capital Improvements Plan	No	N/A
Economic Development Plan	Yes 2021 Annually	The SMFD has an Annual Comprehensive Financial Report that ensures funds are addressing identified hazard mitigation and public safety programs. The plan helps to implement the hazard mitigation strategy and programs.
Local Emergency Operations Plan (EOP)	Yes	The EOP is being updated and developed to include a collaborative EOC between Sausalito, Mill Valley, and SMFD. Details of the plan may be able to be implemented as a mitigation strategy once completed.
Continuity of Operations Plan	Yes	In 2022, SMFD adopted a Continuity of Operations Plan for Infectious Respiratory Pandemics. This could benefit from additional support with the LHMP. Yes, the plan can be used to implement mitigation actions.

Flood Mitigation Plan (FMP)	Yes	Sausalito is part of the community rating system initiated through FEMA
Engineering Studies for Streams	No	N/A
Open Space Management Plan	No	N/A
Regional Transportation Plan (RTP)	No	N/A
Stormwater Management Plan/Program	No	N/A
Community Wildfire Protection Plan	Y	Mill Valley and Sausalito are represented through SMFD with the County of Marin CWPP. This plan provides a science-based assessment of wildfire hazards and threats to homes in the WUI of Marin County. The purpose of the plan is to provide fire agencies, land managers and other stakeholders in Marin County with guidance and strategies to reduce fire risk in the WUI while promoting protection and enhancement of economic assets and ecological resources. Implementation of this plan serves to mitigate fire risk. Multiple hazard mitigation projects are identified in the plan. Directly tied to mitigation efforts.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	No	N/A
Building Code, Permitting, and Inspections	Y/N	Are codes adequately enforced?
Building Code	N	
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	
Fire department ISO rating:	N	
Site plan review requirements	N	
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	Y	District Code allows for collection of sewer service fees and capacity fees to fund mitigation projects. Program is adequately administered. No enforcement.
Zoning ordinance	N	
Subdivision ordinance	N	

Floodplain ordinance	N	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N	
Flood insurance rate maps	N	
Elevation Certificates	N	
Acquisition of land for open space and public recreation uses	N	
Erosion or sediment control program	N	

Table 18: Southern Marin Fire Protection District Legal and Regulatory Capabilities
Source: Southern Marin Fire Protection District

Southern Marin Fire Protection District Comprehensive Plan or Master Plan

Southern Marin Fire Protection District boundaries overlap unincorporated areas of Marin County and the Cities of Mill Valley and Sausolito, both of which are required to have a General Plan or Master Plan per California Government Code 65300. Please see their respective General Plan or Master Plan for details.

3.2.2 Administrative and Technical Capabilities

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

Table 19: Administrative and Technical Capabilities

Administrative	Yes/No	Is coordination effective?
Administrative Services	Y	Administrative staff works with the Fire Chiefs to handle finance and purchasing, budgeting, risk management, information technology, and billing for the District. The admin staff may be responsible for implementing mitigation actions related to the District's activation of an EOC/DOC.
Hazard Mitigation Planning	Y	The Prevention Division commissioned a Hazard & Risk assessment in 2020 that is the guiding document for much of the vegetation work in the District.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Partner agency in the Marin Wildfire Protection Authority (MWPA). Provides fuel reduction and evacuation route clearing as a primary focus. Additional funds are allocated to provide similar services across the District.

Mutual aid agreements	Y	Expanded response area into Marin City with a JPA with all Marin County fire services.
Technical	Yes/No	Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Utilizes the emergency warning systems through the County EAS system as their primary warning capability. Utilizes the emergency warning systems through telephone notification utilizing reverse 911. Utilizes an outdoor notification network of sirens as a redundant communication for evacuations for wildfires. The Southern Marin Emergency Notification system currently utilizes 15 L.R.A.D. outdoor sirens to warn of wildfires and ongoing efforts to sound map the response from testing is conducted through the District's "Did You Hear It" program.
Hazard data and information	Y	Marin County and the Southern Marin Fire Protection District have maintained hazard mitigation data in the form of WUI Hazard Assessments of the District and the Marin County Community WUI Protection Plan.
Grant writing	Y	The District has been awarded multiple past grants for wildfire fuels reductions.
GIS Mapping	Y	GIS mapping tools and data collection systems have been implemented to track progress and establish on going status changes for areas of mitigation efforts. Examples; tracking wildfire fuels reductions programs, fire hydrant infrastructure, water supply reliability.
Staff/Personnel Resources	Yes/No Full Time/ Part Time	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Fire Chiefs	Y/FT	Fire Chiefs are in place to designate representatives to enforce regulations. Hazard mitigation training is provided to establish functional implementation standards for staff. The Fire Chiefs facilitate a role between multiple agency representatives.
Division Chief – Fire Marshal	Y/FT	Oversees the operations of the Prevention Division as the designated authority by the Fire Chief. Supports staff and acts as a PIO and Investigator with the County fire investigation team.
Deputy Fire Marshal	Y/FT	Oversees the daily operations of Fire Inspectors and Investigators. Supports staff and acts as a PIO and Investigator with the County fire investigation team.
Communications Coordinator	Y/FT	Maintains the social media presents and analytics of the District while supporting the messaging from the District for emergency preparedness and hazard mitigation. Serves a role as a PIO.

Safety - Fire Prevention Staff **Inspectors/Investigators/ Code Enforcement**	Y/FT	Develops and maintains amendments to the adopted Fire Code and Standards. Implements building and fire code standards for the District. Serves as Fire Prevention Specialist in public outreach and education. Supports the County fire prevention officers and the fire investigation team.
Admin – Fire Prevention Staff Inspectors/Code Enforcement	Y/FT	Develops and executes fuel and hazard mitigation projects for the District and land owners within the service area of the District. Provides community outreach and education on
NRG Coordinator	Y/PT	Provides community outreach for CERT and NRGs while facilitating community meetings and training. Plans evacuation drills and coordinates community drills between NRGs and CERT members.
Fire Department Front Line Staff	Y/FT	Southern Marin Fire Protection District protects the District from the effects of fire and other hazardous conditions and supports implementation of mitigation actions that reduce the risk of wildfire.

Table 19: Southern Marin Fire Protection District Administrative and Technical Capabilities
Source: **Southern Marin Fire Protection District**

3.2.3 Fiscal Capabilities

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

Table 20: Southern Marin Fire Protection District Fiscal Capabilities

Financial	Yes/No	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Fire water supply improvement programs, wildfire fuels reductions, roadway access for emergency vehicles, flood water rescue training and equipment. Allocated funds could be used to improve on past efforts for future mitigation actions.
Authority to levy taxes for specific purposes	Y	The Fire District has been approved with past tax measures to enhance wildfire mitigation efforts through staffing and community programs. These initiatives will continue to be augmented through local taxes.
Fees for water, sewer, gas, or electric services	Y	The Fire District has an established Fee Schedule for services rendered by the Fire Prevention Division. These fees provide cost recovery for staff and can be used to enhance staffing capabilities for an EOC/DOC and other

		mitigation actions.
Impact fees for new development	N	The Fire District could impose new development fees on projects in the Wildland Urban Interface to fund future mitigation actions for water supply upgrades and access roads for emergency vehicles.
Storm water utility fee	N	Not at this time. The Fire District has not used this funding source in the past
Incur debt through general obligation bonds and/or special tax bonds	N	The District will review applicable funding sources depending on projects and timelines.
Incur debt through private activities	N	The Fire District has not used this funding source in the past.
Community Development Block Grant	N	The Fire District has not used this grant source in the past.
Other federal funding programs	Y	Federal funding has been used in the past to mitigate roadside fuels reduction for evacuations and wide shaded fuel breaks. Federal funding could be used in the future to fund various mitigation projects including flood control, wildfire risk reduction, infrastructure upgrades, emergency response, and climate adaption.
State funding programs	Y	State funding has been used in the past to mitigate roadside fuels reduction for evacuations and wide shaded fuel breaks. Federal funding could be used in the future to fund various mitigation projects including flood control, wildfire risk reduction, infrastructure upgrades, emergency

Table 20: Southern Marin Fire Protection District Fiscal Capabilities
Source: **Southern Marin Fire Protection District**

3.2.4 Community Outreach

The outreach and partnerships capability assessment shows outreach and public education programs available to the Southern Marin Fire Protection District and the Southern Marin Fire Protection District partnerships utilized to promote those programs.

Table 21: Southern Marin Fire Protection District Community Outreach

Outreach and Partnerships	Yes/No	Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	The District has several volunteer groups that can help hazard mitigation efforts including the local Emergency Preparedness Committees, Neighborhood Response Groups, and the CERT program. These groups are both personnel resources and can make recommendations to the District Board, the governing body, which can update local codes. Volunteer resources for events, education, and data collection.
Ongoing public education or information program	Y	Educating Volunteer resources for events, education, and data collection.

(e.g., responsible water use, fire safety, household preparedness, environmental education)		
Natural disaster or safety related school programs	Y	Annually, SMFD visits schools during Fire Prevention week to educate K- Second graders. Building a school ambassador program that could be supported by LHMP. Yes, this program could enhance and benefit future efforts for mitigation efforts. Fourth grade ambassador program at local schools. Seventh grade emergency prep training.
StormReady certification	N	Marin County is a National Weather Service StormReady and TsunamiReady site. The Fire District could use this program with Marin County and other local municipalities to improve storm resiliency and fund future mitigation actions.
Firewise Communities certification	Y	The Southern Marin Fire Protection District has 19 established Firewise USA sites. Yes, the Firewise USA plan identifies local hazards to the site. Yes, the plan can be mitigated by larger projects and requests the community to implement mitigation identified in the plan.
Community Rating System	N	Marin County is a CRS participating community as of 5/1/2016. The Fire District has not participated in this program.
Public-private partnership initiatives addressing disaster-related issues	Y	ReadyMarin is a comprehensive source of emergency preparedness information for Marin County, and coordinates public agency resources and neighborhood response groups.

Table 21: Southern Marin Fire Protection District Community Outreach
Source: **Southern Marin Fire Protection District**

3.2.5 Participation in the National Flood Insurance Program

As a Special District the Southern Marin Fire Protection District does not participate in the national flood insurance program.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.4 Status of Previous Mitigation Actions

The Southern Marin Fire Protection District did not participate in the 2018 Marin County MJHMP and therefore, did not have any previous mitigation actions.

3.5 Hazard Mitigation Actions

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

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

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

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

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

The Planning Team also chose to review and revise the potential hazard mitigation actions

with consideration for climate impact and social vulnerability. Projects and programs were assessed with consideration of these variables.

Prioritization

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

Implementation priority ratings were assigned as follows:

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

Table 22 lists the Current Hazard Mitigation Actions for the Southern Marin Fire Protection District.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SMFD-1	Create Local Funding Mechanisms for Hazard Mitigation (MU-9)	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $12,000 year/ General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	Partner with local stakeholders and public schools to establish hazard mitigation projects that require additional funding sources. Prioritize and support efforts to implement local programs with hazard mitigation funding sources.
SMFD-2	**Fire Code**. Review and adopt current California Fire codes. Amend Fire Code to reduce damage to structures from hazard risk specific to Southern Marin Fire Protection District. (MU-8)	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	Existing	Cost: TBD General Fund, fees based	1 – 3 years/ High	Fire code was most recently updated December 2022. Southern Marin Fire Protection District continues to review and adopt current California Fire codes with updates specific to the District as necessary.
SMFD-3	Develop emergency supply cache storages for providing disaster relief and logistic aid to local municipalities and public volunteers.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, Tam Valley Community Service District, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ High	Work with local municipalities to identify strategic storage locations across the Fire District. These locations would be used to house emergency supplies and receive palletized shipments.
SMFD-4	Develop a multilingual and culturally appropriate business outreach program, in concert with existing business organizations and planning partners, to educate businesses on risk and risk reduction and to identify policies and programs to help businesses become more resilient.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	Partner with local businesses to establish hazard mitigation projects that require additional funding sources. Prioritize and support efforts to implement local programs with hazard mitigation funding sources.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
SMFD-5	Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD	Ongoing/ Medium	Develop a Safety Element in the general plan for the district that ties in an updated version of the SMFD WUI Hazard Mitigation Plan and the MJLHMP.
SMFD-6	Develop model policy templates to assist with coordinated development and implementation of resiliency policies, such as the Safety Elements.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	This is designed to provide a model for the public and private sectors of the District to implement for resiliency and mitigation of hazards.
SMFD-7	Develop a list of vulnerable populations that could benefit from an emerging emergency notification technology or system.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	Collect beneficial data from the public for determining what emerging emergency notification systems could provide the District with advanced warning.
SMFD-8	Integrate emerging emergency notification technologies or systems to serve vulnerable populations.	All Hazards 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	Identify the best use of emerging technologies to serve the communities of the District that are vulnerable to advancing natural disasters.
SMFD-9	Map Community Risk	Debris Flow/ 1,2,4,5	SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ Medium	Develop a standardized GIS dataset for modeling hazards and impacts for regional and jurisdictional assessment purposes. Implement a program to digitally map historical hazard events and future hazard events and impacts (for example, new fire

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
							hazard severity mapping and social vulnerability data produced by federal, state, or local sources that would apply to the entire planning area).
SMFD-10	Educate the public and local nurseries on drought tolerant plants. Develop an educational program to allow for fire safety planting and drought safe landscapes to occur.	Drought/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $20,000/year General Fund, HMPG, BRIC, CDAA Grant funded	Ongoing/ Medium	Develop a local educational program around best practices in drought conditions to conserve water based on plant types, while also integrating in fire safe landscaping techniques. Provide resources for the public to ensure that this training can be implemented.
SMFD-11	Expand public emergency outreach/education including, but not limited to, emergency preparedness, CERT, evacuation planning and earthquake threat. (EQ-4, EQ-7, EQ-9)	Earthquake/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $20,000/year General Fund, HMPG, BRIC, CDAA Grant funded	Ongoing/ Medium	Reach out to schools and private sector groups to establish preparedness and evacuation education opportunities. Host live training and drills to prepare staff with the training and knowledge needed to assist in a disaster.
SMFD-12	Develop a program for local officials to receive building inspection training and establish lists of trained inspectors. (EQ-8)	Earthquake/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $10,000/year General Fund, HMPG, BRIC, CDAA Grants	Ongoing/ Medium	Work with local municipalities to provide detailed training between building officials and inspectors to be able to safely and effectively assist with post-earthquake structure assessment. Develop a training and certification process to allow for local officials to be training and establish a list of certified individuals.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
SMFD-13	Subsidence Study. Analyze and monitor subsidence in low elevation areas of Sausalito [FEMA Project SU-4]	Subsidence/ 1, 2, 4, 5	Sausalito Public Works Dept, SMFD	New (2024)	Cost: TBD General Fund	Every 5 years	Evaluate subsidence over time in Sausalito's bay side areas.
SMFD-14	Tsunami Analysis and Improvements: Develop an analysis, recommendations and improvements to address Tsunami impacts and Sea Level Rise along Sausalito's Shoreline [FEMA Project TSU-5, F-19]	Tsunami, Flooding, Sea Level Rise/ 1,2,3, 4	Sausalito Public Works Dept, SMFD	New (2024)	Cost TBD General Fund, HMPG, BRIC, FMA, CDAA Grants	Ongoing /High	Example Projects: Installation of a Sea Wall on the east side of Bridgeway between Princess and Richardson.Installation of protective measures on Humboldt and along the entire Sausalito waterfront.
SMFD-15	Severe Storms. Reduce Sausalito's vulnerability to severe storms and associated hazards. [FEMA Project SW-4 Protect Power Lines and Infrastructure]	Severe Weather-Wind, Tornado/ 1, 2, 4, 5	Sausalito Public Works Dept, SMFD	Existing (2018)	Cost TBD General Fund, HMPG, BRIC, CDAA grants as needed	Ongoing/ Medium	Example projects: Undergrounding power lines on Bridgeway. Replace signal systems on Bridgeway that are impacted by Wind. Install preemption and changeable message signs on signals to alert the public of evacuation routes.
SMFD-16	Develop localized flood risk mapping for use in preparing the community with educational tactics and additional flood barrier resources. (SLR-1,SRL-4)	Sea Level Rise/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ low	Utilize available mapping and data to develop localized programs and strategies to educate the public on hazard mitigation approaches. Provide additional resources for the public to prepare for flooding and king tides.
SMFD-17	Establish local procedures to educate the public on health risks associated with severe weather and provide community resource programs to ensure the public is prepared based on the event. (ET-2,ET-3,ET-4)	Severe Weather-Heat/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000 General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ low	Based on the extreme weather event, provide the public with educational information to better prepare against adverse health risks associated with the weather event. Develop programs and plans to implement

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

No.	Mitigation Actions	Hazards Mitigated/ Goals Met	Jurisdiction/ Responsible Agency	New, Existing, Completed, Removed	Estimated Cost and Potential Funding Source	Timeline/ Priority	Comments/ Progress
							community support and outreach, example: cooling centers, clear air shelter.
SMFD-18	**Fire Engine Access Improvements.** Hillside neighborhoods adaptation projects to protect against wildfire risk including widening narrow roads and adding road pullouts, increasing number of emergency egress roads from neighborhoods, continue vegetation management in highest risk areas, and other projects listed in the assessment.	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, Tam Valley Community Services District, Homestead Sanitary District, SMFD	New (2023)	Cost: $100,000/year General Fund, Municipal Service Tax, HMPG, BRIC, CDAA grants, Fire Safe Marin	Ongoing/ High	Analysis of the roadway systems that feed in and out of the District's vulnerable hillside communities would be utilized to determine where additional widening efforts could prove beneficial. Enhancing evacuation times and emergency response during large scale evacuation efforts.
SMFD-19	Community All Hazards Safety Evacuation Route Mitigation	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: TBD General Fund, HMPG, BRIC, CDAA grants, Fire Safe Marin	Ongoing/ Medium	Enhancing evacuation routes in the hillside communities by developing steps, lanes, and paths to allow for both downhill and uphill evacuation options.
SMFD-20	Expand and upgrade the resiliency of the water supply system by adding additional fire hydrant and infrastructure. (D-7)	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD, MMWD	New (2023)	Cost: $50,000/year General Fund, HMPG, BRIC, CDAA grants, Fire Safe Marin Grant funded, Special Tax	Ongoing/ High	Identifying fire hydrants that require increased water flow and access for wildfire efforts in the hillside communities is essential. Determining what fire hydrants are becoming subject to extreme weather conditions that indicate need for early replacement to avoid massive water leaks during droughts and/or failure during wildfires.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions							
No.	**Mitigation Actions**	**Hazards Mitigated/ Goals Met**	**Jurisdiction/ Responsible Agency**	**New, Existing, Completed, Removed**	**Estimated Cost and Potential Funding Source**	**Timeline/ Priority**	**Comments/ Progress**
SMFD-21	**Steps, Lanes and Paths**. Maintain and improve SLP pedestrian evacuation network through the SLP Annual Maintenance Program and SLP Design and Construction Program.	Wildfire/ 1, 2, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD, MMWD	New (2023)	Upgrades/Maintenance: Cost: $20,000/year General Fund	Ongoing/ Medium	Replace damage stair systems utilized as evacuation routes as funding is available.
SMFD-22	Develop a community outreach program for education around early warning systems and notification. (TSU-1, TSU2)	Tsunami/ 1, 2, 3, 4, 5	City of Mill Valley, Town of Tiburon, County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA grants	Ongoing/ Medium	Outdoor early warning sirens are installed and require additional public education for general awareness and education.
SMFD-23	Develop a community outreach program for vulnerable communities that focuses on reducing the risk of wildfire around all residential structures and vessels. (TSU-3)	Tsunami/ 1, 2, 3, 4, 5	County of Marin, City of Sausalito, SMFD	New (2023)	Cost: $25,000/year General Fund, HMPG, BRIC, FMA, CDAA Grant funded	Ongoing/ High	Provide residents in the community most at risk from the impacts of tsunamis and associated wildfires that could occur. Add additional signage in marinas and educate the public on quick and effective wildfire mitigation tactics.

Table 22: Southern Marin Fire Protection District Current Hazard Mitigation Actions

3.6 Progress in Local Mitigation Efforts

This plan has been created as a "living" document with input from the population and professionals within the Southern Marin Fire Protection District. The planning team for the Southern Marin Fire Protection District identified and prioritized the mitigation actions as detailed in Table 22, based on the risk assessment and in accordance with the process outline in Section 3, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this Southern Marin Fire Protection District Profile by all participating jurisdictions is included in Section 4.0: Plan Review, Evaluation, and Implementation.

3.7 Plan Integration

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

The planning team for the Southern Marin Fire Protection District will maintain this plan and will serve as a lead staff for grant project applications on District projects selected for application under the Hazard Mitigation Assistance grant programs.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into town plans and mechanisms. Where possible the Southern Marin Fire Protection District will use existing plans and/or programs to implement hazard mitigation actions both directly within the District and through the coordinated efforts with the Cities they serve.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, the Southern Marin Fire Protection District and the Cities they serve already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include Integration opportunities for the 2023 Marin County MJHMP:

District Master & Strategic Plans - Integrates hazard mitigation through the consideration of hazards most likely to impact the district.

District Emergency Operations Plans – Integrates hazard mitigation through the consideration of the Cities planned response to hazards most likely to impact the district.

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

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

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

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

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

3.8 Future Development Trends

Marin County and the Cities of Mill Valley and Sausalito have planning and community development departments, SMFD only is involved in providing fire services in new development approved by the County and Cities of Mill Valley and Sausalito. No other development projects are being considered by the Southern Marin Fire Protection District.

SECTION 4.0: PLAN REVIEW, EVALUATION, AND IMPLEMENTATION

The strategies presented are deemed appropriate and effective by recommendation of the Southern Marin Fire Protection District.

4.1 PLAN ADOPTION

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

4.2 PLAN MONITORING

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

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

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

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

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

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

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

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

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

4.3 Plan Evaluation

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

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

4.4 Plan Update

The Southern Marin Fire Protection District Fire Marshall will monitor and update the Southern Marin Fire Protection District Annex to the Marin County OA MJHMP. During the five-year update cycle, the Southern Marin Fire Protection District and the Marin County Office of Emergency Management will hold quarterly update meetings with the Marin Operational Area Hazard Mitigation Working Group and local stakeholders to discuss revisions to the plan and progress updates for the hazard mitigation actions. The Marin County Office of Emergency Management and all participating jurisdictions and special districts will continue to hold public meetings after the first quarter and third quarter update meetings annually and will continue to invite public participation in the update process via updated public surveys.

FIGURES AND TABLES

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ACRONYMS/ABBREVIATIONS

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

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

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

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

OWTA	On-Site Wastewater Treatment Systems
PD	Police Department
PG&E	Pacific Gas & Electric
PM10	Particulate Matter Less Than 10 Microns In Aerodynamic Diameter
PSPS	Public Safety Power shutoffs
PtH	Pass the hash
PUD	Public Utility District
PW	Public Works
RACES	Radio Amateur Civil Emergency Service
RAWS	Remote Automated Weather Stations
RCD	Resource Conservation District
RHNA	Regional Housing Needs Assessment
RTP	Regional Transportation Plan
SASM	Sewerage Agency of Southern Marin
SFBRA	San Francisco Bay Restoration Authority
SFHA	Special Flood Hazard Area
SFHA	Special Flood Hazard Areas - FEMA
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSGP	State Homeland Security Grant Program
SMART	Sonoma Marin Area Rail Transit
SMCSD	Sausalito Marin City Sanitary District
SMFD	Southern Marin Fire Protection District
SOD	Sudden Oak Death
SOX	Sulfur Oxides
SQL	Structured Query Language
SR	State Route
SRA	State Responsibility Areas
SSMP	Sewer System Management Plan
SVI	Social Vulnerability Index
TAM	Transportation Authority of Marin
TBD	To Be Determined
TENS	Telephone Emergency Notification System
UCERF2	Uniform California Earthquake Rupture Forecast, Version 2

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