2026 PALOS VERDES PENINSULA

Multi-Jurisdictional Hazard Mitigation Plan

Volume 1
Areawide Information

MUNICIPAL AND DISTRICT ADOPTION DRAFT
MARCH 2026

BLACK & VEATCH

CITY OF PALOS VERDES ESTATES
INCORPORATED 1939
CALIFORNIA

RPV

CITY OF ROLLING HILLS, CALIFORNIA

CITY OF ROLLING HILLS ESTATES
1957

ACLAD
ABALONE COVE LANDSLIDE ABATEMENT DISTRICT

Klondike Canyon
Geologic Hazard Abatement District

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS AND ACRONYMS

1-percent annual chance flood—The flood that has a 1 percent chance of being equaled or exceeded in any given year; often referred to as the 100-year flood.

asset—Any man-made or natural feature that has value, including people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

base flood—The flood having a 1-percent chance of being equaled or exceeded in any given year, also known as the "100-year" or "1-percent annual chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree against flooding.

basin—The area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds."

benefit/cost —A systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

benefit—A net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit/cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

CAL FIRE—California Department of Forestry and Fire Protection

Cal OES—California Governor's Office of Emergency Services

capability assessment—An analysis of a jurisdiction's capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out.

CFR—Code of Federal Regulations

Community Lifeline—As defined by FEMA, a community lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security.

debris flow—Dense mixtures of water-saturated debris that move down-valley, looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

DFIRM—Digital Flood Insurance Rate Map

Disaster Mitigation Act (DMA; Public Law 106-390)—The latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving certain federal financial assistance.

DMA—Disaster Mitigation Act

drought—The cumulative impacts of long periods of dry weather. These can include deficiencies in surface and subsurface water supplies and general impacts on health, well-being, and quality of life.

DWR—Department of Water Resources (California)

earthquake—The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

epicenter—The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the

geographic position of its epicenter and by its focal depth.

equity priority community—Community members who may be more vulnerable to hazard events are prioritized to ensure equitable mitigation initiatives.

exposure—Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

extent—The extent is the range of anticipated intensities of the identified hazards. Extent is most expressed using various scientific scales. For this panning effort, the extent of each hazard of concern is profiled by discussing intensity, warning times and the worst-case scenarios for the hazard. .

fault—A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

federal disaster declaration—Declarations for events that cause more damage than state and local governments and resources can handle without federal government assistance. A federal disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, to help disaster victims, businesses, and public entities.

FEMA—Federal Emergency Management Agency

fire behavior—Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

FIRM—Flood Insurance Rate Map

flash flood—A flood that occurs with little or no warning when water levels rise at an extremely fast rate.

Flood Insurance Rate Map (FIRM)—The official maps on which the Federal Emergency Management Agency delineate the Special Flood Hazard Area.

floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

floodway—Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

frequency—How often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1-percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

geographic information system (GIS)—A computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

goal—A general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met.

greenhouse gases—Methane, nitrous oxide and other gases that trap heat and warm the Earth, as a greenhouse traps heat from the sun.

ground shaking—The result of rapid ground acceleration caused by seismic waves passing beneath buildings, roads, and other structures.

Hazard Mitigation Grant Program (HMGP)—Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance

Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

hazard—A source of potential danger or adverse condition that could harm people and/or cause property damage.

hazardous material—A substance or combination of substances (biological, chemical, radiological, and/or physical) that, because of its quantity, concentration, or physical, chemical or infectious characteristics, has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

HMA—Hazard Mitigation Assistance

HMP—Hazard Mitigation Plan

hypocenter—The region underground where an earthquake's energy originates.

intensity—The measure of the effects of a hazard.

inventory—The assets identified in a study region. Inventories include assets that could be lost when a disaster occurs, and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

landslide—The movement of masses of rock and soil down a hillside or slope. Slope failures occur when the strength of the soils forming the slope is exceeded by the pressure, such as weight or saturation, acting upon them.

liquefaction—Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

LOMR—Letter of Map Revision. An official document issued by FEMA that revises the information shown on an existing FIRM.

magnitude—The measure of the strength of an earthquake.

mass movement—A collective term for landslides, debris flows, and lahars.

mitigation actions—Specific actions to achieve goals that minimize the effects from a disaster and reduce the loss of life and property.

mitigation—A preventive action taken in advance of an event to reduce or eliminate risk to life or property.

Mw—Moment Magnitude Scale

NCEI—National Centers for Environmental Information

NFIP—National Flood Insurance Program

NRI—National Risk Index

NOAA—National Oceanic and Atmospheric Administration

NWS—National Weather Service

pandemic—An epidemic of infectious disease that has spread through human populations across a large region, multiple continents, or worldwide.

peak ground acceleration (PGA)—A measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

PGA—Peak Ground Acceleration

presidential disaster declaration (same as federal disaster declaration)—These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A presidential disaster declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

probability of occurrence—A statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

public safety power shutoff (PSPS)—An event in which a major electric power provider temporarily shuts off electrical power to a selected area to prevent power lines from sparking wildfires.

PVE—Palos Verdes Estates

RPV—Rancho Palos Verdes

residual risk—The risk that remains after controls are accounted for.

RH—Rolling Hills

RHE—Rolling Hills Estates

risk assessment—The process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards

risk ranking—Process to score and rank hazards based on the probability that they will occur and the impact they will have if they do.

riverine—Of or produced by a river. Riverine floodplains have readily identifiable channels.

Robert T. Stafford Act—The statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs (Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107). Signed into law November 23, 1988; amended by the Disaster Relief Act of 1974 (Public Law 93-288).

SFHA—Special Flood Hazard Area

special flood hazard area—The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations.

stakeholder—Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

USACE—U.S. Army Corps of Engineers

USDA—U.S. Department of Agriculture

USGS—U.S. Geological Survey

vulnerability—Assessment of how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions.

watershed—An area that drains downgradient from areas of higher land to areas of lower land to the lowest point.

wildland-urban interface area (WUI)—An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together.

EXECUTIVE SUMMARY

Point Vicente Lighthouse (Photo Credit: Adobe Stock)

Hazard mitigation involves implementing cost-effective and sustainable measures to minimize the risk to human life, property, and infrastructure from potential hazards. Through mitigation planning, the participating jurisdictions of the Palos Verdes Peninsula Multi-Jurisdictional Hazard Mitigation Plan can develop a framework to lessen the impacts of natural disasters and create a more resilient community.

HAZARD MITIGATION OVERVIEW

The Palos Verde Peninsula cities and two special purpose districts developed a hazard mitigation plan (HMP) to continue its commitment to reducing risk of natural hazards for the residents, assets, and community lifelines within Palos Verde Peninsula. This planning effort aims to safeguard the people and essential services provided throughout the Planning Area.

This plan is a multi-jurisdictional hazard mitigation plan (MJHMP) that includes annexes for jurisdictions throughout the Palos Verdes Peninsula to address the Planning Area's specific capabilities, vulnerabilities, and mitigation opportunities. The Palos Verdes Peninsula MJHMP forms the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction,

and repetitive damage. This plan aligns with federal and state hazard mitigation planning regulations and requirements to ensure eligibility for pre- and post-disaster mitigation funding through the Federal Emergency Management Agency (FEMA) for all jurisdictions that participated as Planning Partners:

- City of Palos Verdes Estates
- City of Rancho Palos Verdes
- City of Rolling Hills
- City of Rolling Hills Estates
- Klondike Canyon Geologic Hazard Abatement District
- Abalone Cove Landslide Abatement District

BUILDING THE PLANNING TEAMS

The Palos Verdes Peninsula cities and special purpose districts brought together a diverse and inclusive group of individuals to participate, develop, and implement the MJHMP. A Core Planning Team, Planning Committee, and Planning Partnership oversaw the planning process and were responsible for coordinating, overseeing, and executing the planning process.

CORE PLANNING TEAM

The Core Planning Team was made up of key personnel from the cities and discipline leads from the City of Rolling Hills Estate's contract consultant, Black & Veatch.

HAZARD MITIGATION PLANNING COMMITTEE

The Planning Committee consisted of a variety of personnel from Palos Verdes Peninsula city departments and agencies, local jurisdictions, and stakeholders that guided the cities and participating jurisdictions through the process of updating the MJHMP.

PLANNING PARTNERSHIP

The Planning Partnership included jurisdictional representatives seeking DMA 2000 compliance. They participated throughout the process, reviewed information, provided input, informed the risk assessment, developed mitigation strategies, and adopted the MJHMP.

OUTREACH STRATEGY

The Core Planning Team (CPT) implemented a multimedia public involvement strategy that was approved by the Hazard Mitigation Planning Committee (HMPC). The strategy included a community hazard mitigation awareness survey; a project web page; and multiple in-person events promoting hazard awareness. Additionally, the HMPC helped amplify public outreach efforts to their networks.

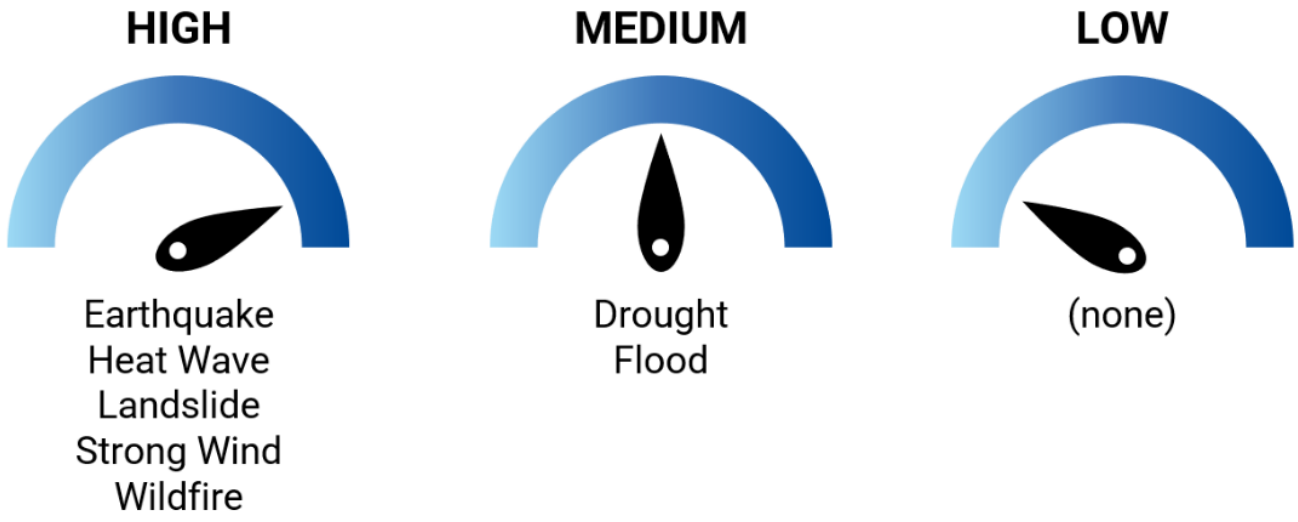
RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, property damage, and environmental damage. The assessment determines a community's overall vulnerability to hazard events. The HMPC used the risk assessment to gauge the potential impacts of natural hazards identified as "hazards of concern" for this plan.

Risk assessment models for hazards of concern were based on current data and technologies. The assessment of each hazard of concern includes discussion of the following:

- Hazard identification and profile.
- The exposure of population, property, and the environment to the hazards.
- The estimated cost of potential damage, where applicable.

Based on the risk assessment, the hazards of concern were ranked for the risk they pose to the Planning Area. Palos Verde Peninsula-wide results are as follows:



In addition to assessing the hazards of concern, this plan provides a review of "hazards of interest." The HMPC determined that these other hazards, though not required to be evaluated under federal guidelines for hazard mitigation plans, are important to recognize qualitatively in this plan. Hazard profiles, without quantitative risk assessments, are provided for the following hazards of interest:

- Groundwater Seepage
- Human-Caused
- Hazardous Materials
- Utility Related

CAPABILITY ASSESSMENT

A robust assessment of mitigation capabilities was completed by each participating jurisdiction to identify gaps that may need to be addressed so mitigation actions can be successfully implemented. The following capability types were analyzed:

- Planning and Regulatory
- Development and Permitting
- Administrative and Technical
- National Flood Insurance Program (NFIP) Compliance
- Public Outreach
- Fiscal
- Participation in Other Programs
- Adaptive Capacity

MITIGATION STRATEGY

The HMPC developed mitigation goals to reflect the current focus of Palos Verde Peninsula and its participating jurisdictions. The HMPC determined the following goals for this MJHMP:

- **Goal 1.** Reduce risk to life, property, community lifelines, the environment, and infrastructure from natural hazards and climate change.
- **Goal 2.** Expand and improve public awareness of hazards, risk, and mitigation strategies.
- **Goal 3.** Strengthen partnerships and communication among government agencies, private sector businesses, community-based, and nonprofit organizations.
- **Goal 4.** Integrate mitigation principles into regulations, policies, programs, and guidance to support equitable outcomes to benefit the whole community.
- **Goal 5.** Conserve, enhance, rehabilitate, and protect natural and cultural resources from hazards to provide a more resilient and sustainable community.

Mitigation actions presented in this plan are designed to reduce or eliminate losses resulting from natural hazard events. The development process resulted in the identification of nearly 200 mitigation actions for implementation by individual Planning Partners, as presented in the jurisdictional annexes in Volume 2 of this MJHMP. Several of these actions are within the current capabilities of each jurisdiction, resulting in a high priority for implementation over the next 5 years.

IMPLEMENTING, ADOPTING, AND MAINTAINING THE PLAN

Implementing the mitigation actions in this MJHMP will take time and resources over its 5-year performance period. The CPT developed an implementation and maintenance strategy that includes the following:

- Monitoring mitigation action implementation.
- Progress reporting.
- A strategy for continued public involvement.
- Plan integration with other relevant plans and programs.

This MJHMP is designed with an adaptive management approach that can evolve along with funding sources and state and federal mandates. The Palos Verde Peninsula Planning Partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan will enable the Planning Partnership to pursue FEMA Hazard Mitigation Assistance (HMA) grant funding for feasible, eligible, cost-effective actions. The Planning Partnership developed this plan with extensive opportunities for public involvement and input. Public support of the mitigation actions identified in this MJHMP will ensure its success.

Part 1
Introduction and Planning Process

Paddock in Rancho Palos Verdes (Photo Credit: Megan Brotherton)

1. INTRODUCTION

1.1 WHY PREPARE THIS PLAN?

Palos Verdes Peninsula Bluffs (Photo Credit: Adobe Stock)

The Palos Verdes Peninsula cities and two special purpose districts, the Planning Partnership, prepared this MJHMP update to better protect the residents, property, and assets throughout the Palos Verdes Peninsula from the effects of natural hazards.

Hazard mitigation plays a crucial role in emergency management by working to reduce the impacts of disasters on individuals, communities, and important assets. By implementing mitigation measures, we can help prevent the same areas from being repeatedly impacted by disasters. Mitigation is part of the emergency management cycle, which is divided into the following four phases:

- **Preparedness** is when we develop or update activities, programs, and systems before an event happens. These activities are often tested (or exercised) in non-emergency situations. This tests their effectiveness. Emergency managers also assess potential risks, hazards, and vulnerabilities in this phase.

- **Response** focuses on the immediate and short-term effects of a disaster. It is usually focused on life safety and preventing immediate damage.
- **Recovery** is a long-term phase that looks to return a community to normal, or to a more resilient state, after a disaster.
- **Mitigation** focuses on building (or rebuilding) in ways that reduce the risk more permanently. It is an activity that can occur at any point in the emergency management cycle. For example, communities can undertake mitigation actions before a disaster (the preparedness phase) or while rebuilding after a disaster (the recovery phase) (FEMA, 2023).

This multi-jurisdictional hazard mitigation plan (MJHMP) update highlights the dedication of the Palos Verdes Peninsula Planning Partnership to reducing risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations.

1.1.1 Federal Eligibility

Disaster Mitigation Act

In an effort to reduce the nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state and local government entities to closely coordinate on mitigation planning activities and requires an HMP for any local government applying for federal mitigation grant funds. These funds primary fall under the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) program. Grant programs under HMA include the following:

- Flood Mitigation Assistance
- Hazard Mitigation Grant Program (HMGP)

Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from hazards.

FEMA defines a **Hazard Mitigation Plan** as a community-driven process to help state, local, tribal, and territorial governments plan for hazard risk. By planning for risk and setting a strategy for action, governments can reduce the negative impacts of future disasters.

Entities with an adopted and federally-approved HMP are pre-positioned to receive available mitigation funds before and after the next disaster strikes. The plan was developed to make the Planning Partnership eligible for pre- and post-disaster FEMA grants.

1.1.2 Purposes for Planning

This MJHMP update highlights the Palos Verdes Peninsula Planning Partnership's dedication to reducing risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations. The Planning Partnership prepared this DMA-compliant MJHMP to identify resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and the intent of the Palos Verdes Peninsula and its residents to mitigate hazards. The plan will help guide mitigation activities throughout the Planning Area. It was developed to meet the following needs:

- Meet or exceed program requirements specified under DMA;
- Enable the Palos Verdes Peninsula Planning Partnership to apply for federal grant funding to reduce hazard risk through mitigation;
- Fulfill state and federal requirements for hazard mitigation planning;
- Create a risk assessment that focuses on the hazards of concern in the Palos Verdes Peninsula Planning Partnership's Planning Area; and
- Coordinate existing plans and programs so high-priority projects to mitigate potential disaster impacts are funded and implemented.

An HMP is a living document that jurisdictions use to reduce vulnerability to natural hazards. It serves as the groundwork for a jurisdiction's long-term plan to lessen disaster impacts and establishes a framework for decision-making to mitigate harm to individuals, assets, and the economy from future natural disasters. Mitigation projects include a broad range of actions to help reduce vulnerability, allowing Palos Verdes Peninsula to bounce back more quickly from disasters. This ongoing effort ensures that the Palos Verdes Peninsula Planning Partnership has the necessary information to create and implement a successful mitigation strategy, reduce the impacts of natural disasters, and enhance overall resilience.

1.2 PLAN UPDATES

1.2.1 Previous Plans

The Palos Verdes Peninsula cities have shown dedication to reducing disaster impacts by adopting the following local hazard mitigation plans:

- City of Palos Verdes Estates Local Hazard Mitigation Plan, 2018
- City of Rolling Hills Hazard Mitigation Plan, 2019
- Rancho Palos Verdes and Rolling Hills Estates Multi-Jurisdictional Hazard Mitigation Plan, 2020

1.2.2 Why Update

The prior plans needed to be updated for funding eligibility and to encompass a diverse Planning Partnership that included a unified plan for all the cities on the Peninsula and two special purpose districts. Throughout the planning process, the plan was developed with a focus on assessing changes in vulnerability caused by hazard events, evaluating capabilities and their utilization in implementing hazard mitigation measures, reviewing the prior mitigation strategies, and identifying new initiatives to enhance overall resilience across the Planning Area.

Federal and State Requirements

In response to the requirements of the DMA 2000, which requires local governmental agencies to develop and update its hazard mitigation plan every 5 years, this plan serves as the 2026 update to the prior Local Hazard Mitigation Plans developed by the Planning Partners. The Palos Verdes Peninsula MJHMP update is in alignment with FEMA's Local Mitigation Planning Policy Guide (April 2025), FEMA's Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements.

Changes in Hazards

The 2026 Palos Verdes Peninsula MJHMP update includes the previously identified hazards in the respective plans developed by the Planning Partners, along with one additional hazard of concern (italicized), as follows:

- Drought
- Earthquake
- Flood
- *Heat Wave*
- Landslide
- Strong Wind
- Wildfire

Changes in Development and Population

Local Plan Requirement E1—44 CFR Part 201.6(d)(3)

A local jurisdiction must review and revise its plan to reflect changes in development.

Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to hazards within a community. This requirement ensures that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

As of January 2025, the reported population for the Planning Area was 63,948, representing a slight decrease of 2.3 percent from the 2020 reported population (California Department of Finance, 2025).

Based on development permit data provided by the municipal Planning Partners (refer to Volume 2), permits were issued for the construction of new structures over the past 5 years.

This plan assumes that some of this new development occurred in hazard areas. All such new development would have been regulated pursuant to local programs and codes, such as the International Building Code and flood damage prevention requirements of the National Flood Insurance Program (NFIP). Therefore, it is assumed that hazard vulnerability did not measurably increase, even if exposure did. Palos Verdes Peninsula municipalities have general plans that govern land-use decisions and policymaking, as well as building codes and flood-management regulations based on state and federal mandates.

1.2.3 The Updated Plan - What Has Changed?

The overall planning process and the 2012 HMP have been improved and revised for this 2025 MJHMP in response to changes in planning requirements and overall improvements. Key changes are outlined as follows:

- **Plan Integration** – Goals and objectives have been established for the updated MJHMP to align with current Planning Partner initiatives and programs, as well as to meet identified state priorities.
- **Updated Hazards of Concern** – The list of assessed hazards was updated to reflect the most current community experience and concerns.
- **Socially Vulnerable Populations** – The 2026 MJHMP update defines vulnerable populations based on the Planning Area's demographic and geographic characteristics and includes a dedicated subsection for each identified hazard of concern.
- **Climate Change Impacts** – The 2026 MJHMP update dedicates a subsection for each hazard of concern to the issue of climate change and its effects on state-identified climate-related hazards.

1.3 HOW TO USE THIS PLAN

The 2026 Palos Verdes Peninsula MJHMP was prepared to align with FEMA's Local Mitigation Planning Policy Guide (April 2025), FEMA's Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements. The MJHMP is organized into two volumes as follows:

1.3.1 Volume 1

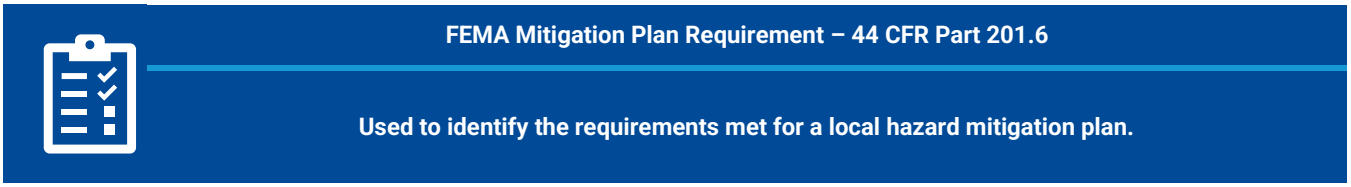
- Executive Summary
- Part 1 - Introduction and Planning Process
- Part 2 - Risk Assessment
- Part 3 - Mitigation Strategy
- Part 4 - Maintaining the Plan
- Appendix A – Public Outreach
- Appendix B – Hazard Selection
- Appendix C – Meeting Documentation
- Appendix D – Risk Assessment Methodology
- Appendix E – Federal and State Agencies, Programs, and Regulations
- Appendix F – Plan Maintenance Agendas
- Appendix G – FEMA Approval and Planning Partner Adoption

1.3.2 Volume 2

- Federally required jurisdiction-specific elements, in annexes for each participating jurisdiction.
- Description of the participation requirements confirmed by the CPT and HMPC.

1.3.3 Planning Requirement Icons

Throughout this plan, FEMA's local hazard mitigation planning requirements and state-specific compliance are identified using the icons below. These provide a pathway to show where the MJHMP meets each requirement.



2. PLANNING PROCESS

Local Plan Requirement A1 – 44 CFR Part 201.6(c)(1)

The plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

2.1 INTRODUCTION

The following section describes the overall process for the MJHMP, including how it was prepared, who was involved, and how stakeholders and the public participated. To adhere to the requirements of the DMA 2000 and ensure that the planning process received wide and robust support from the participating jurisdictions, regional and local stakeholders, and the public, the approach to the planning process and plan documentation included the following:

- The Palos Verde Peninsula MJHMP considers all natural hazards that pose a threat to the Planning Area. This satisfies the natural hazards requirements specified in DMA 2000 and Element B of FEMA's Local Mitigation Planning Policy Guide (April 2025).
- The City of Rolling Hills Estates served as the lead agency for the Palos Verde Peninsula MJHMP and selected a contract consultant, Black & Veatch, to assist with the development and implementation of the plan.
- A Core Planning Team (CPT) was formed to lead the planning effort, as shown in Table 2-1.
- The City of Rolling Hills Estates invited all jurisdictions located within the Planning Area to participate in the MJHMP update. The four cities of the Palos Verde Peninsula and two special districts agreed to participate and meet participation expectations, where appropriate, as shown in Table 2-1.
- This MJHMP was developed and updated following the process outlined by DMA 2000, FEMA's Local Mitigation Planning Handbook (June 2025), FEMA's Local Mitigation Planning Policy Guide (April 2025), and the State of California planning requirements. Following these processes ensures that all requirements have been met and supports state and federal reviews of the MJHMP.

The planning process for this MJHMP update consisted of the following six steps:

1. Organize Resources.
2. Assess Risk.
3. Engage the Public.
4. Plan Mitigation Strategy.
5. Plan Maintenance Strategy.
6. Assemble and Adopt the Plan.

2.2 DEFINING THE PLANNING AREA

The Planning Area consists of the Palos Verde Peninsula which includes the City of Palos Verdes Estates, City of Rancho Palos Verdes, City of Rolling Hills, and City of Rolling Hills Estates (Figure 2-1). Relevant Planning Area characteristics are described in Chapter 3 (Palos Verdes Peninsula Profile) and in each jurisdictional annex in Volume 2. The risk assessment for this MJHMP is performed for the entire Planning Area.

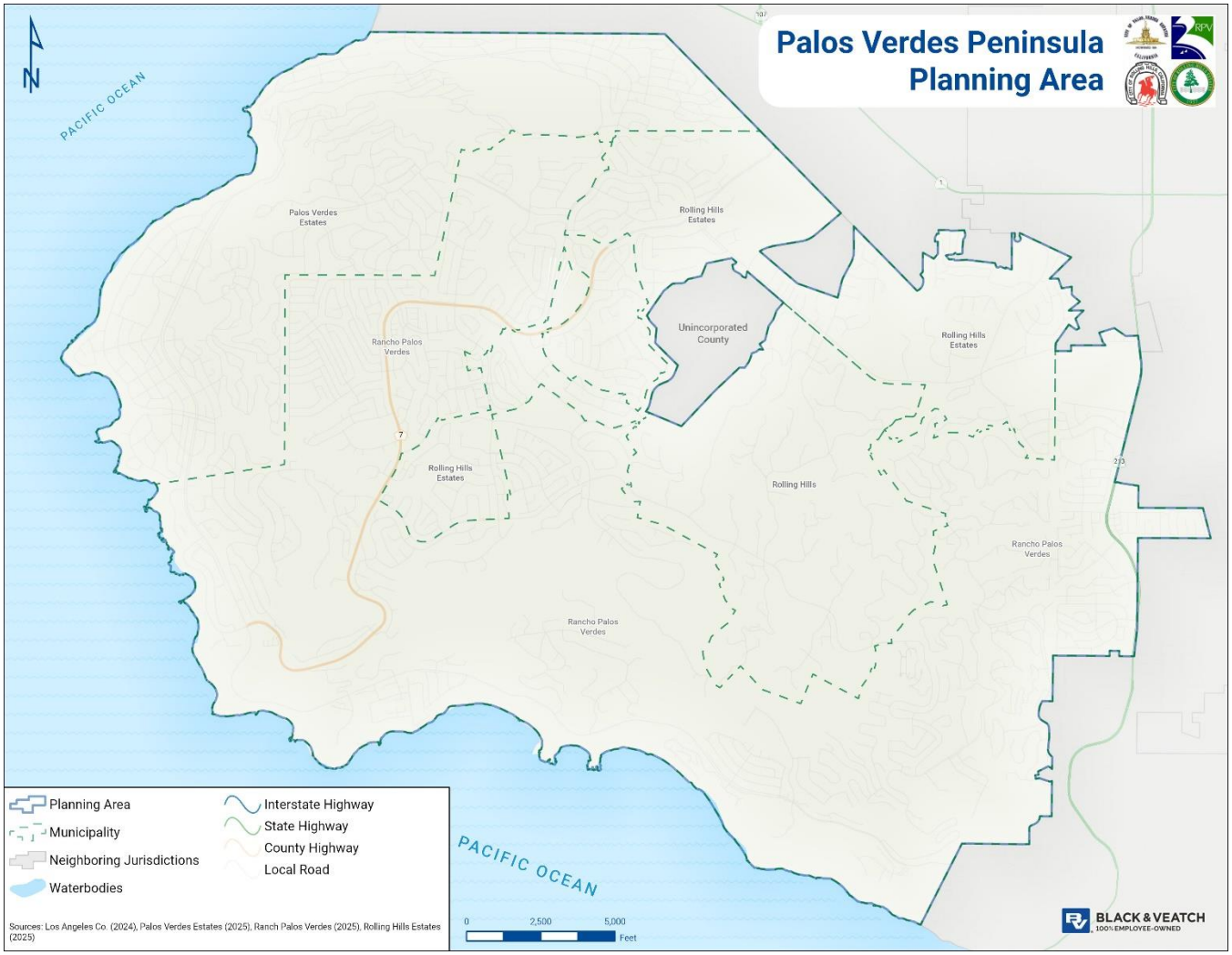


Figure 2-1. Palose Verdes Peninsula Planning Area

2.3 FUNDING

Funding for this MJHMP was fully funded through Cal OES HMGP DR-4683 with a local match.

2.4 FORMATION OF THE PLANNING TEAMS

A successful planning effort includes active participation and buy-in from the whole community – individuals and communities, all levels of government, private and nonprofit sectors, non-governmental establishments, community lifelines, and members of the public.

CORE PLANNING TEAM

The Core Planning Team was made up of key personnel from the cities and discipline leads from the City of Rolling Hills Estate's contract consultant, Black & Veatch.

HAZARD MITIGATION PLANNING COMMITTEE

The Planning Committee consisted of a variety of personnel from Palos Verdes Peninsula city departments and agencies, local jurisdictions, and stakeholders that guided the cities and participating jurisdictions through the process of updating the MJHMP.

PLANNING PARTNERSHIP

The Planning Partnership included jurisdictional representatives seeking DMA 2000 compliance. They participated throughout the process, reviewed information, provided input, informed the risk assessment, developed mitigation strategies, and adopted the MJHMP.

2.4.1 Core Planning Team

The **Core Planning Team** was made up of discipline leads from the City of Rolling Hills Estate's contract consultant, Black & Veatch, and key personnel from each of the cities.

Table 2-1 lists the cities' Core Planning Team members. They were responsible for monitoring plan progress milestones and identifying input need for the Planning Committee and Planning Partnership.

2.4.2 Planning Committee

The **Planning Committee** consisted of a variety of personnel from City departments and agencies, local jurisdictions, and stakeholders that guided the Planning Partnership through the process of updating the MJHMP.

Table 2-1 lists the Planning Committee members. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

2.4.3 Planning Partnership

The **Planning Partnership** was made up of jurisdictional representatives seeking DMA 2000 compliance. They were responsible for participating throughout the process, reviewing information and providing input, informing the risk assessment, developing mitigation strategies, and adopting the HMP.

The City of Rolling Hills Estates notified Planning Area municipalities and special districts of the planning process and invited them to participate. They were asked to formally notify the City by letter of intent to participate and to identify points of contact to represent the jurisdiction and participate throughout the planning process. The contacts each jurisdiction identified in the letter of intent to participate were informed of the planning process, attended meetings, provided direct input, and reviewed plan documents.

Table 2-1 lists the Planning Partnership members and Appendix C (Meeting Documentation) identifies the individuals who represented their jurisdictions during the planning effort. Members of the Planning Partnership were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

Jurisdictional involvement is demonstrated through the completion of an annex in Volume 2 of this plan. Each annex was developed with input gathered during the planning process and includes points of contact, risk assessments for relevant hazards, evaluation of capabilities for mitigation, identification and prioritization of mitigation measures, and ultimately, adoption of the updated plan through a resolution.

Table 2-1. Palos Verde Peninsula Hazard Mitigation Planning Participation

Jurisdiction / Organization	Name	Core Planning Team Member	Planning Committee Member	Planning Committee Member (Alternate)	Ad Hoc Committee	Planning Partnership Member
City of Palos Verdes Estates	Kristen Jo, Emergency Preparedness & Community Outreach Coordinator	■	■		■	■
City of Palos Verdes Estates	George Gabriel, Deputy City Manager			■		■
City of Rancho Palos Verdes	Luna Mohammad, Emergency Management Coordinator	■	■		■	■
City of Rolling Hills	Samantha Crew, Management Analyst	■	■		■	■
City of Rolling Hills Estates	Jessica Slawson, Assistant to the City Manager	■	■		■	■

Jurisdiction / Organization	Name	Core Planning Team Member	Planning Committee Member	Planning Committee Member (Alternate)	Ad Hoc Committee	Planning Partnership Member
Abalone Cove Landslide Abatement District	Jim Knight, Retired, Former Mayor		■			■
Abalone Cove Landslide Abatement District	Gordon Leon, Board Member		■			■
City of Rancho Palos Verdes	Deanna Fraley, Principal Engineer		■			
City of Rancho Palos Verdes	Megan Barnes, Senior Administrative Analyst (PIO)		■			
City of Rolling Hills Estates	Gabby Swain, Administrative Aide (PIO)		■			
City of Rolling Hills Estates	Whitney Berry, Senior Planner		■			
Palos Verdes Peninsula Land Conservancy	Cris Sarabia, Conservation Director		■			
Palos Verdes Peninsula Unified School District	Cheryl Dawson, Emergency Preparedness Consultant		■			
Palos Verdes Peninsula Unified School District	Brenna Terrones, Assistant Superintendent		■			
PVPCERT, NART	Georgiann Keller (Chair)		■			
Rolling Hills Community Association	Kathryn Bishop		■			
Southern California Edison	Connie Turner, Regional Manager – Public Affairs		■			
Southern California Edison	David Meza, Government Relations Manager			■		
Southern California Edison	Celina Luna, Government Relations			■		
Southern California Gas Co.	Ben Steinberger, Public Affairs Advisor		■			
California Water Service Company	Tracy Maestro, Superintendent		■			
City of Rancho Palos Verdes	Ara Mihranian, City Manager				■	
City of Rancho Palos Verdes	Paul Seo, Mayor				■	

Jurisdiction / Organization	Name	Core Planning Team Member	Planning Committee Member	Planning Committee Member (Alternate)	Ad Hoc Committee	Planning Partnership Member
City of Rolling Hills Estates	Greg Grammer, City Manager				■	
City of Rolling Hills	Karina Banales, City Manager				■	
City of Rolling Hills	Leah Mirsch, City Council Member				■	
City of Palos Verdes Estates	David McGowan, City Council Member				■	
City of Palos Verdes Estates	Kerry Kallman, City Manager				■	
City of Rolling Hills Estates	Velveth Schmitz, City Council Member				■	
Rolling Hills Community Association	Kristen Raig, Manager				■	
Black & Veatch	Rob Flaner, Project Manager	■				
Black & Veatch	Megan Brotherton, Lead Planner	■				
Black & Veatch	Carol Baumann, Risk Assessment Lead	■				
Black & Veatch	Erin Schanen, Planner	■				

2.5 STAKEHOLDER COORDINATION AND INVOLVEMENT

Local Plan Requirement A2 – 44 CFR Part 201.6(b)(2)

The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other nonprofit interests to be involved in the planning process.

Outreach to stakeholders was conducted in a timely manner and maintained throughout the planning process. Stakeholders were invited to participate in the planning process with relevance to the entire planning partnership and to all jurisdictional annexes in Volume 2 of this plan. This section outlines the stakeholders who were involved in the creation of this MJHMP and outlines their participation.

2.5.1 Types of Stakeholders

Stakeholders consist of individuals and groups that mitigation actions or policies affect. For this MJHMP, businesses, private organizations, public entities, and neighboring communities were identified and invited to participate. The Planning Partnership made conscientious efforts to ensure diverse regional, County, and local representation in the planning process.

2.5.2 Stakeholder Participation

Throughout the entire planning process, stakeholders were invited to participate via email notifications informing them of the planning effort and giving them an opportunity to get involved. Stakeholders were invited to participate as follows:

- Participate as a member of the Planning Committee and/or as a Planning Partner.
- Take a Public Hazard Awareness Survey.
- Attend Planning Committee meetings.
- Share public outreach information within their organization.
- Comment on the draft plan.

Below is a summary of the stakeholders' involvement in the planning process, demonstrating the extensive outreach efforts made by the Planning Partnership. Key elements of stakeholder outreach include the following:

- Seven stakeholders agreed to serve as members of the Planning Committee.
- The web link to the draft plan was emailed to all stakeholders and neighboring communities, inviting them to comment on the draft plan.

Federal and State Agencies

The following section lists the government agencies that were involved during the planning process.

Table 2-2 describes how federal and state agencies participated in the Palos Verdes Peninsula MJHMP update. Those listed in the table below were directly or indirectly involved in the process and provided crucial information to update the plan.

Table 2-2. Federal and State Agencies

Agency/Department	Federal	State	Participation
FEMA Region 9	■		FEMA provided updated planning guidance; provided summary and detailed NFIP data for the Planning Area; presented preliminary regulatory flood products to municipalities and the public; and conducted plan review.

Agency/Department	Federal	State	Participation
FEMA National Risk Index (NRI)	■		FEMA's NRI was used as a baseline for natural hazard selection for this MJHMP.
National Centers for Environmental Information (NCEI)	■		NCEI's online tools were accessed to obtain information regarding hazard identification, hazard details, and risk assessments to incorporate into the MJHMP update.
CAL FIRE		■	Provided updated maps for Local Responsibility Areas that were used in the wildfire risk assessment.
Cal OES – Mitigation Planning Division		■	Oversaw the planning process; reviewed the draft plan.

Local Stakeholders and Neighboring Communities

Area stakeholders and neighboring communities were invited to participate in the MJHMP update process. Agencies and organizations provided input in a variety of ways. Those that served on the HMPC and as a Planning Partner are noted in Table 2-1.

Local stakeholders who were invited to participate in the planning process through outreach via email messaging, meeting invitations, and in-person outreach events are included in Table 2-3.

Table 2-3. Local Stakeholders and Neighboring Communities

Stakeholder Category	Agency or Organization Name
Agencies Involved in Hazard Mitigation	Peninsula Public Safety Committee Rolling Hills Block Captains
Community-Based Organizations/Non-Profits	Peninsula Seniors Rancho Palos Verdes Council of Homeowners Associations (CHOA) Rotary Foundation Salvation Army
Emergency Services	American Red Cross CERT Disaster Management Area G Coordinator Los Angeles County Fire Department Los Angeles County Sheriff's Office Palos Verdes Police Department
Local Businesses and Academia	Palos Verdes Chamber of Commerce Terranea Resort University of California – Los Angeles
Natural Resource Protection	Palos Verdes Land Conservancy
Neighboring Communities	City of Gardena City of Hawthorne City of Inglewood City of Lawndale City of Lomita City of Redondo Beach

Stakeholder Category	Agency or Organization Name
	City of Torrance
Planning and Zoning	Rancho Palos Verdes Planning Director
Transportation	Rancho Palos Verdes Public Works
Utilities	California Water Service Company COX Cable Metropolitan Water District Republic Services Southern California Edison Southern California Gas Co.

2.5.3 Draft Plan Review

All the entities listed above were provided an opportunity to review and comment on the draft plan during the public comment period, primarily through the link on the MJHMP web page. Each entity was sent an email informing them that the draft plan was available for comment and included a link to the web page and online comment tool. Additional invitations to review the draft plan were released through social media posts.

The public draft review period extended from February 12–25, 2026. One comment was received on the draft plan.

Upon completion of a public comment period, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region 9 for a review to ensure program compliance.

2.6 PUBLIC PARTICIPATION

Local Plan Requirement A3 – 44 CFR Part 201.6(b)(1)

The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

An important component of the mitigation planning process involved public participation, so the outreach efforts described in this section were done on behalf of the entire planning partnership who developed jurisdictional annexes in Volume 2 of this plan. This coordinated approach was valuable to all planning partners, but especially to the two small special-purpose districts with limited resources for individual outreach.. Input from the public provides the Planning Partnership with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of Planning Area officials. Public awareness is a key component of a successful mitigation strategy and is aimed at making the community safer from the potential effects of hazards.

Public involvement during the development of the Palos Verdes Peninsula MJHMP was sought using a public survey, which permitted open comment; and a digital copy of the draft plan was made available on the project web page and advertised for public review and comment. Comments received were incorporated in the draft plan as applicable.

2.6.1 Hazard Mitigation Plan Web Page

At the beginning of the planning process, a hazard mitigation web page was established on PVPReady.gov to provide information about the process. The web page was used to keep the public informed about milestones and public participation opportunities and to solicit input.

Figure 2-2. Hazard Mitigation Web Page

2.6.2 Public Meetings

Each of the Hazard Mitigation Planning Committee meetings was open and advertised for public attendance (Figure 2-3). Refer to Section 2.9, Plan Development Milestones, for descriptions and details of the Hazard Mitigation Planning Committee meetings.

2.6.3 Public Events

Peninsula-wide public events promoted the MJHMP planning process including the Prepared Peninsula Expo in October 2025, with hundreds of community members in attendance. Additionally, the local station RPVtv broadcasted interviews on the planning process (Figure 2-4).

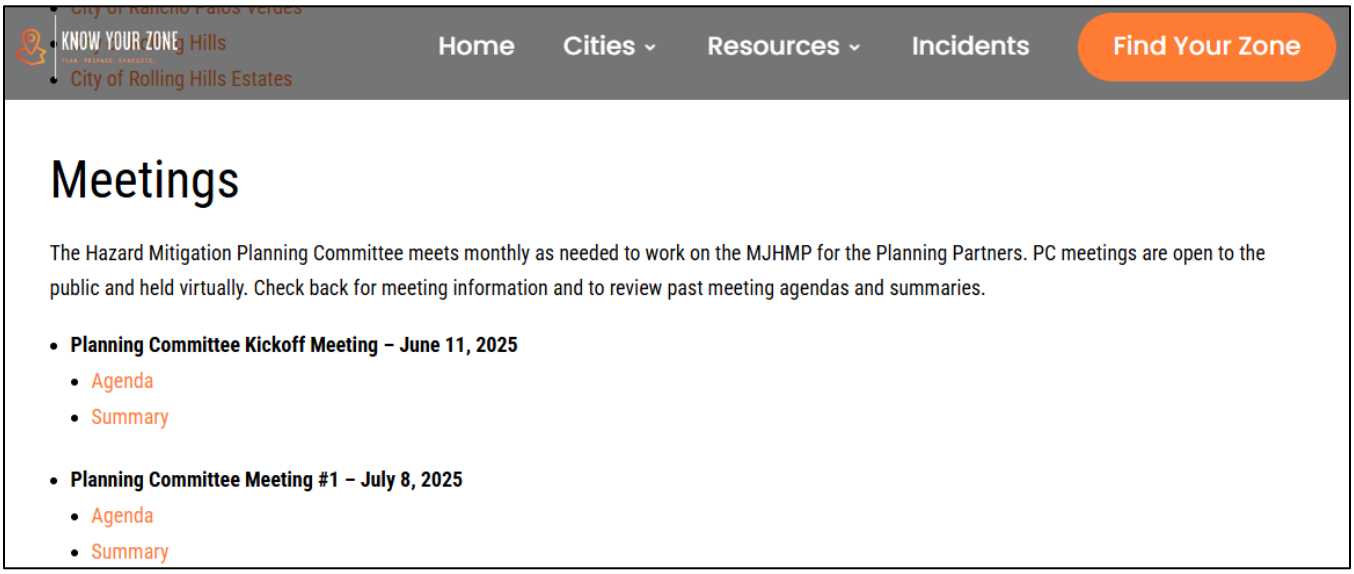


Figure 2-3. Public Meeting Participation

Photo Credit: Megan Brotherton

Figure 2-4. Prepared Peninsula Expo Featuring Coverage by RPVtv

2.6.4 Public Survey

The CPT developed and posted a public survey early in the planning process. The survey was designed to capture information from members of the public. The survey was posted from August 2025 through January 2026. A link to the survey was posted on the planning web page and distributed through multiple social media platforms. A link to the electronic public survey was also shared with Planning Committee members, Planning Partners, and Stakeholders. Rolling Hills block captains were engaged via email to promote the survey and participate in the planning process. RPVtv broadcast a public service announcement informing community members of the opportunity to provide input (RPVtv Public Service Announcement - "Palos Verdes Peninsula Hazard Mitigation Survey").

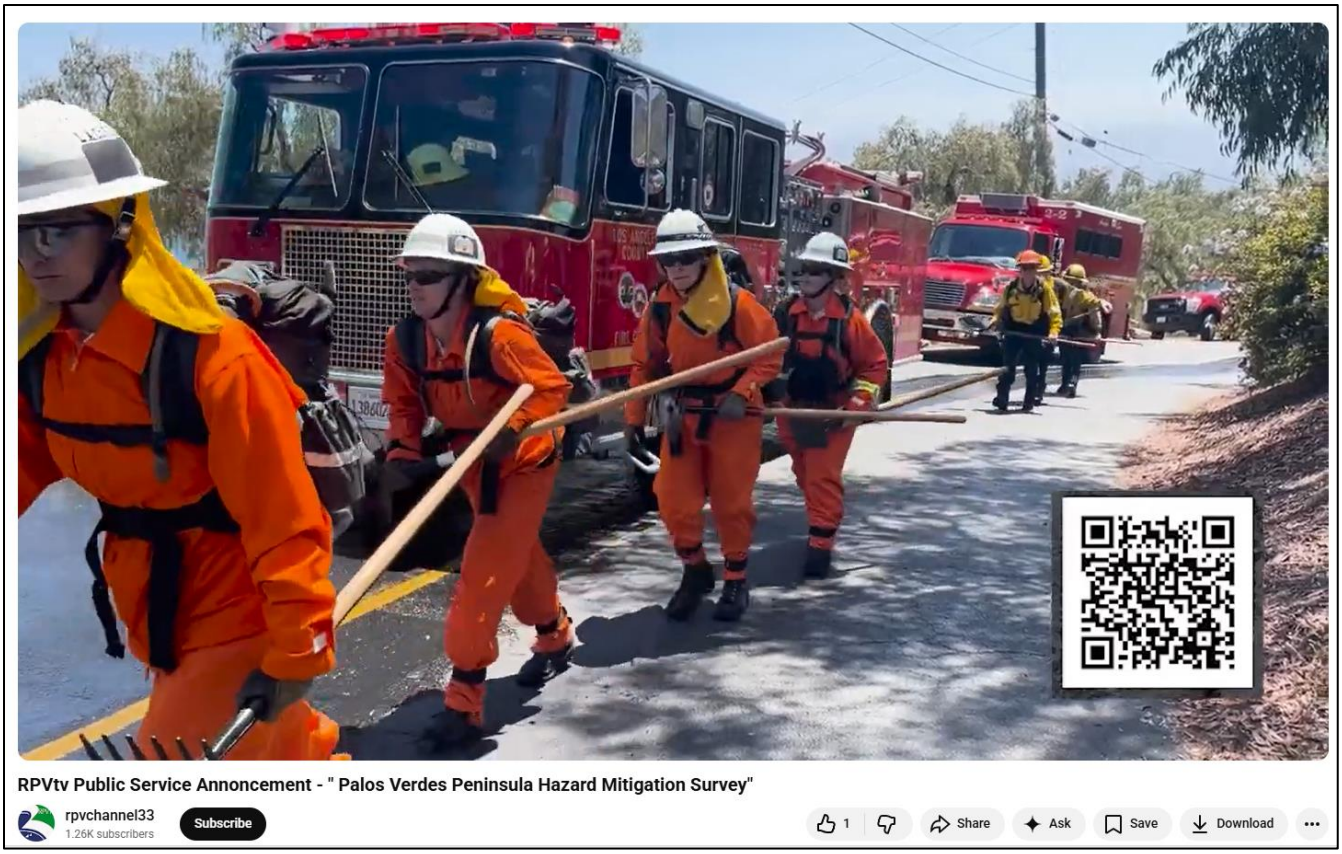


Figure 2-5. Survey Promotion on RPVtv

Summary of Survey Results

During the 6-month period that the survey was open, 431 members of the public completed the public survey. The survey and detailed results are included in Appendix A (Public Outreach).

Incorporation of the Public Survey Into the Hazard Mitigation Plan

Survey participants, including those from equity priority communities, suggested actions the Planning Partners should continue to do or should start doing to reduce or eliminate risk of future hazard events. Of those suggestions, all are included in the mitigation action plan, or are existing core capabilities that the Planning Partners will continue to carry out. Refer to Table 2-4 for examples of the suggestions and how they were incorporated in the MJHMP update.

Table 2-4. Public Survey Comment Examples and MJHMP Incorporation

Public Comment	2026 MJHMP Incorporation
Lack of emergency backup power for essential services	Jurisdictions included a mitigation action to acquire emergency backup power for city- and district-owned facilities that are not currently covered.
Flammable grasses, bushes, trees in open spaces need to be taken care of to reduce wildfire risk	Jurisdictions included mitigation actions to address wildfire fuel concerns
Evacuation concerns, not knowing where to go, or unsure which direction to go	Cities included a mitigation action to develop a Mass Care and Evacuation Playbook

2.6.5 Public Review Period

Members of the public were provided an opportunity to comment on the draft plan for 2 weeks in February 2026. The PVPReady.gov web page included a link to the draft plan and an online tool that allowed community members to submit comments. In addition to the website, the public comment period was promoted on social media and at publicly-facing meetings for the Rolling Hills Planning Commission and the Peninsula Public Safety Committee (PPSC) meeting.

2.7 IDENTIFICATION AND OUTREACH TO EQUITY PRIORITY COMMUNITIES

Due to the demographic and geographic composition of the Palos Verdes Peninsula, the HMPC determined that those who may be more vulnerable to hazards include residents 65+ years of age, those with access and functional needs, and those who live in neighborhoods with only one point of evacuation.

These community members were included in the planning process through digital, social media, in-person, and broadcast outreach.

2.8 REVIEW AND INCORPORATION OF EXISTING PROGRAMS

Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

The Planning Partnership utilized the most current technical information, plans, studies, and reports during the planning process to assist in hazard profiling, risk and vulnerability assessment, reviewing mitigation capabilities, and identifying, developing, and prioritizing mitigation strategies at the local levels.

- **Overall Planning Process** – The 2025 FEMA Local Mitigation Planning Policy Guide and Handbook were reviewed and used to develop this MJHMP. The 2023 California State HMP was reviewed for alignment with mitigation goals, identified hazards, risk assessments, and mitigation actions. In addition, neighboring jurisdiction mitigation plans were reviewed for alignment with identified hazards and mitigation actions.
- **Risk Assessment** – Asset and inventory data collected was used to complete the risk assessment of the MJHMP. This included local, state, and federal hazard technical information (e.g., US Geological Survey [USGS] earthquake data, CAL FIRE wildfire data, FEMA disaster declarations). Details of the data used, along with how the data was used, is presented in Chapter 1 and throughout the hazard profiles (Chapters 6 through 0).
- **Capability Assessment** – Numerous plans, reports, regulations, codes, and technical information were obtained from the HMPC, and stakeholders involved in the planning process, as well as through independent research conducted by the planning consultant. The Planning Partners were responsible for providing the inventory of their Planning and Regulatory capabilities in each jurisdictional annex in Volume 2, and noted relevant planning and regulatory documents as needed.

- **Mitigation Strategy** – The Planning Partnership developed nearly 200 mitigation actions to address the results of the risk assessment and input received from the public and local stakeholders. These actions considered the current capabilities of the Planning Partners to implement each strategy.

2.9 PLAN DEVELOPMENT MILESTONES

Table 2-5 summarizes the planning process activities, efforts, and key milestones conducted to prepare the MJHMP. Meeting documentation (e.g., presentations, agendas, meeting minutes) are located in Appendix C (Meeting Documentation). The table only identifies formal meetings held during the plan update; it does not reflect all planning activities conducted by individuals and groups throughout the planning process.

Table 2-5. Plan Development Milestones

Date	Event	Description	Attendance
	Support Contractor Secured		N/A
	Organize Resources	CPT formed	N/A
April 17, 2025	Project Kickoff Meeting	• Introductions • HMP Overview • Scope & Schedule • Core Planning Team • Planning Committee • Risk Assessment • Planning Partnership • County Department • Responsibilities • Communication Protocols	
June 3, 2025	CPT Meeting #1	• HMPC Membership and Coordination • HMPC Kickoff Meeting • GIS/Hazard Selection • File Sharing Access	8
June 11, 2025	HMPC Meeting #1	• Welcome & Introductions • Hazard Mitigation Planning Overview • Role of the Planning Committee • Meeting Ground Rules • Participating Planning Partners • Confirm Hazards • Public Outreach Strategy	23
July 1, 2025	CPT Meeting #2	• GIS • Landslide Methodology • Public Outreach Strategy • Community Lifelines • Mitigation Goals • HMPC Meeting Agenda	9
July 8, 2025	HMPC Meeting #2	• Welcome • Approve June Meeting Summary	20

Date	Event	Description	Attendance
		• Confirm Community Outreach Strategy • Define Equity Priority Communities • Approve Community Lifelines Recommendations • Discuss Mitigation Goals	
July 15, 2025	CPT Meeting #3	• Jurisdictional Annex Overview • Landslide Subcommittee • Public Outreach • GIS/Equity Priority Communities	9
July 29, 2025	CPT Meeting #4	• Finalize Landslide Subcommittee Membership • Public Outreach • Hazard Mitigation Goals	7
August 2025	Public Outreach	• Public Survey Opens	
August 12, 2025	Landslide Subcommittee #1	• Introductions • Landslide Risk Assessment Methodology • GIS/Data Request	9
August 26, 2025	CPT Meeting #5	• Landslide Subcommittee Meeting Takeaways • Public Outreach Update • SWOO Strategy & Mitigation Catalog for Planning Committee Input • Annex Development Needs	7
September 9, 2025	CPT Meeting #6	• Planning Committee Meeting Agenda • SWOO Exercise	7
September 10, 2025	HMPC Meeting #3	• Approve July Meeting Summary • Community Outreach Strategy Updates • Landslide Subcommittee Update • Planning Partner Update • Confirm Mitigation Goals	17
September 27, 2025	Public Outreach	Rancho Palos Verdes “Wildfire Home Hardening Expo”	N/A
October 7, 2025	CPT Meeting #7	• Public Outreach Coordination • Landslide Analysis Overview • Landslide Subcommittee Meeting Schedule • SWOO Updates	6
October 15, 2025	Landslide Subcommittee #2	• Landslide Approach • Landslide Risk Assessment Results	9
October 26, 2025	Public Outreach	Palos Verde Peninsula “Prepared Peninsula Expo – Learn How to be Disaster Ready”	300

Date	Event	Description	Attendance
October 21, 2025	CPT Meeting #8	• Hazard Map Review and Approval • Landslide Subcommittee Takeaways • Draft Natural Hazard Risk Assessment Results • November Planning Committee Meeting • Phase 2 Planning Partner Annex Workshop • Ad Hoc Committee Meeting Coordination	7
November 4, 2025	CPT Meeting #9	• Community Outreach Summary • HMPC Meeting Coordination • Ad Hoc Committee Meeting Coordination	6
November 18, 2025	CPT Meeting #10	• Ad Hoc Committee Meeting Coordination • Public Survey • HMPC Meeting Coordination	6
November 20, 2025	HMPC Meeting #4	• Approve September Meeting Summary • Community Outreach Updates • Schedule and Milestones • Risk Assessment Results • Mitigation Action Ideas	6
December 2, 2025	Mitigation Action Workshop	• Purpose of the Mitigation Strategy • Connecting to the Mitigation Strategy • Where to Focus • Mitigation Actions to Consider • Mitigation Action Worksheet and Online Form • Examples	7
December 3, 2025	Ad Hoc Committee Meeting	• HMP Planning Process Overview • Project Schedule and Milestones • Community Outreach Initiatives • Hazard Scenarios and Risk Assessment Results	13
December 16, 2025	CPT Meeting #11	• Upcoming Schedule and Milestone Coordination • Action Plan Development	7
January 2026	Public Outreach	• Public Survey Closes	431
January 27, 2026	CPT Meeting #12	• Landslide Chapter Feedback • Public Survey Results Overview • Plan Maintenance Strategy	7
February 10, 2026	CPT Meeting #14	• Review Planning Partner Comments on the Draft Plan	7

Date	Event	Description	Attendance
		• Peninsula Public Safety Committee Coordination • Planning Committee Meeting Coordination	
February 11, 2026	HMPC Meeting #5	• Approve September & November Meeting Summaries • Final MJHMP Input Opportunity • Public Comment Period • Next Steps and Milestones to Plan Approval • Concluding Comments and Appreciations	19
February 12-25, 2026	Public Outreach	Public Comment Period	N/A
February 19, 2026	Public Outreach	Peninsula Public Safety Committee Meeting	N/A
February 24, 2026	CPT Meeting #15	• Review and incorporate comments from the public comment period • Adoption support coordination • Review AB 2140 compliance	6
March 10, 2026	CPT Meeting #16	• Adoption schedules • Safety Element Coordination	6
February - March 2026	Adoption	City Council and District Board adoption of draft plan	N/A
Month day, 2026	Plan Submittal to Cal OES	Submittal of draft plan and plan review tool to Cal OES for review and approval	N/A
Month day, 2026	Plan Submittal to FEMA Region 9	Submittal of draft plan to FEMA Region 9 by Cal OES with proof of adoption documentation	N/A
Month day, 2026	Approval	Final approval of the plan by FEMA Region 9	N/A

3. PALOS VERDES PENINSULA PROFILE

This section provides general information about the Planning Area, including its historical information, physical setting, general building stock, land use, population, demographics, population trends, and community lifelines. Analyzing this information leads to an understanding of the study area, including economic, structural, and population assets at risk, and of concerns that could be related to hazards analyzed in this plan (e.g., low-lying areas prone to flooding, high percentage of vulnerable persons in an area).

3.1 OVERVIEW

3.1.1 Historical Overview

The Palos Verdes Peninsula was inhabited by the Tongva people for thousands of years prior to European settlement. In subsequent centuries, the land was used for farming and mining and passed through the ownership of the Sepulveda family and various mortgage holders. In 1913, Frank A. Vanderlip acquired the entire 16,000-acre peninsula with the desire to develop an exclusive residential community. Although progress was slowed by the Great Depression and World War II, development advanced rapidly during the 1950s and 1960s.

On December 20, 1939, the City of Palos Verdes Estates was the first of the four cities in the Planning Area to become incorporated. In 1957, the Cities of Rolling Hills Estates and Rolling Hills became incorporated. Rancho Palos Verdes was the last City to become incorporated in 1973.

Development in the Planning Area is notably mostly residential with large lots, equestrian trails, and abundant open space. The Planning Area is known for its coastal views, rolling hills, and steep slopes. The western and southern part of the Palos Verdes Peninsula is characterized by coastal bluffs and sea cliffs that range from approximately 100 to 300 feet high.

3.1.2 Jurisdictions

The Planning Area is made up of the Cities of Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, and Rolling Hills Estates. The Planning Area is bounded by the City of Torrance to the north and the San Pedro neighborhood of the City of Los Angeles to the southeast. The central portion of the Planning Area includes the unincorporated community known as Westfield/Academy Hills.

3.1.3 Government

The Planning Area is governed by five separate bodies: Los Angeles County which provides police and fire services and the general law Cities of Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, and Rolling Hills Estates which all have council-manager government structures. Palos Verdes Estates has its own police department.

3.2 PHYSICAL SETTING

This section describes the geography, land use, and land cover of the Planning Area.

3.2.1 Location

The Palos Verdes Peninsula is located in southwestern Los Angeles County and is bordered by the City of Torrance to the north, the San Pedro neighborhood of the City of Los Angeles to the east, and the Pacific Ocean to the south and west. The Peninsula forms a distinct geographic subregion within the South Bay area of Los Angeles County, characterized by elevated coastal hills and steep bluffs overlooking the Pacific Ocean. The Peninsula was once part of the Southern Channel Islands before becoming part of the California mainland. The 80-kilometer Palos Verdes Fault Line runs along the meeting place of the San Pedro Shelf and the San Pedro Basin and roughly forms the peninsula boundary.

3.2.2 Geography and Topography

The Palos Verdes Peninsula is situated south of the Pacific Coast Highway and west of Western Avenue (Highway 213). The landscape varies widely from the sandy beaches on the southern coast to the miniature Coast Range mountainous area of the Palos Verdes Hills on the northwestern side of the Planning Area, which peaks at 1,457 feet. The steep sea cliffs of this area form coastal bluffs and tidepools. The eastern part of the Planning Area features semi-rural rolling hills and scenic canyons.

The Palos Verdes Peninsula Land Conservancy manages over 1,700 acres of natural lands and 42 miles of public hiking trails. The Planning Area is also home to many beaches, coves, and City parks. The City of Rolling Hills Estates maintains over 20 miles of equestrian trails, and the Planning Area is renowned for its stables and equestrian opportunities.

The Palos Verdes Peninsula supports a mix of native and non-native vegetation shaped by its Mediterranean climate and unique geological history. Native vegetation includes coastal sage scrub, chaparral, and remnant grasslands, with species such as California Sagebrush, California Buckwheat, Toyon, and Coyote Brush. These plants help control erosion, limit wildfire, and lessen the impacts of drought. The coastal bluffs are home to salt-tolerant plants such as coastal sage scrub that provide habitat for the endangered Palos Verdes blue butterfly. While non-native grasses and ornamental trees like eucalyptus have altered portions of the landscape, ongoing restoration efforts led by local conservancies focus on rebuilding habitats for native fauna, reducing the presences of invasive species, and preserving the Peninsula's ecological diversity.

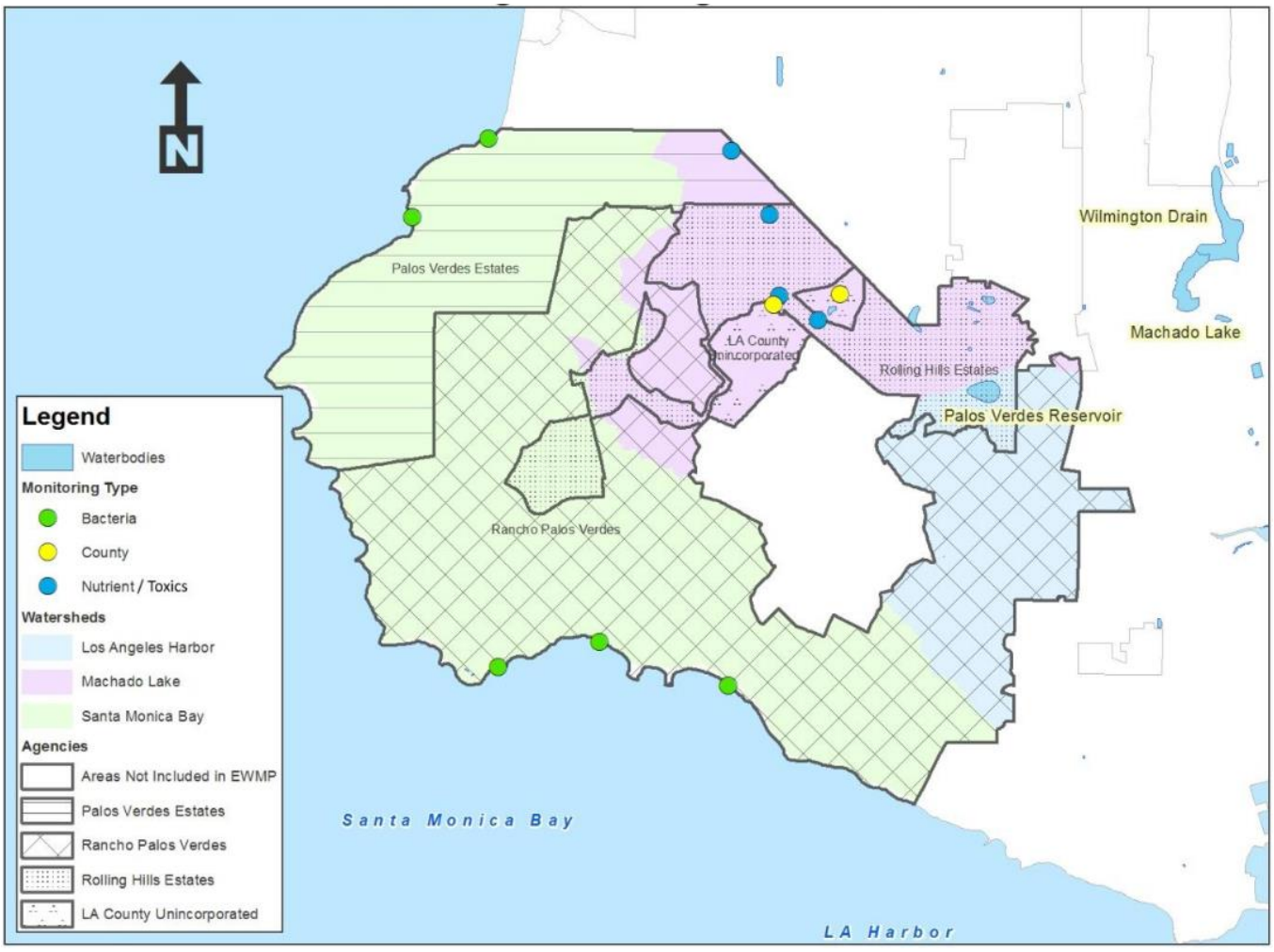
3.2.3 Watersheds and Surface Waters

A watershed is a geographical area that directs precipitation and snowmelt towards creeks, streams, rivers, and ultimately outflow locations such as reservoirs, bays, and the ocean. Watersheds vary in size and configuration, encompassing anything from a small body of water or County to vast regions covering thousands of square miles with numerous waterways (National Ocean Service, 2024).

The Palos Verdes Peninsula forms a distinct coastal watershed region within southwestern Los Angeles County. Because of its elevated topography and peninsular landform, most surface runoff drains directly to the Pacific Ocean through a series of short, steep coastal watersheds. The Peninsula is generally

divided into two HUC-12 equivalent watersheds the Santa Monica Bay Watershed and the Greater Dominguez Channel Watershed Management Area that is subdivided into Los Angeles Harbor Watershed and Machado Lake watershed (Peninsula WMG, 2019).

Watershed management on the Peninsula is coordinated through the Palos Verdes Peninsula Watershed Management Group (WMG) under the Regional MS4 Permit program. The Palos Verdes Peninsula WMG consists of the City of Rancho Palos Verdes, which serves as the coordinating agency for the Enhanced Watershed Management Program (EWMP) and Coordinated Integrated Monitoring Program (CIMP) Plan development, Los Angeles County Flood Control District, the County of Los Angeles and the cities of Palos Verdes Estates and Rolling Hills Estates (Los Angeles Regional Water Board, 2026). The City of Rolling Hills does not participate in the Peninsula EWMP; however, it does participate in the Peninsula CIMP (Los Angeles Regional Water Board, 2026). Figure 3-1 presents the watersheds found within the EWMP Watersheds with existing water quality monitoring sites.



Source: (Peninsula WMG, 2019)

Figure 3-1. Palos Verdes Peninsula EWMP Watersheds

3.2.4 Climate

The Palos Verdes Peninsula is a mild Mediterranean climate characterized by warm, dry summers and cool, wetter winters. Average annual temperatures are approximately 63° F, and average annual precipitation ranges from 12 to 15 inches, with most rainfall occurring during the winter months (NOAA NCEI, 2025). Summers are generally warm and dry, with the highest monthly average being 85° F. The coolest month of the year is December, with an average high of 68° F and an average low of 49° F.

3.3 POPULATION AND DEMOGRAPHICS

Those who live in the Planning Area are the most important asset, and this MJHMP will assess risk to people and identify mitigation strategies to protect them, including underserved and socially vulnerable populations.

3.3.1 General Population

As of January 2025, the State of California Department of Finance reported the following population estimates for each of the cities:

- Rancho Palos Verdes: 40,727
- Palos Verdes Estates: 12,999
- Rolling Hills Estates: 8,545
- Rolling Hills: 1,677

Current and Historical Population

Table 3-1 shows past population estimates for the municipalities in the Planning Area from 2000 to 2024. Over that time, California's population grew by 17.4 percent (California Department of Finance, 2025). The Planning Area's population overall has experienced a decline since 2020, though the City of Rolling Hills Estates stands as an exception to this.

Table 3-1. Recent Population by Jurisdiction

Jurisdiction	2000 Population	2010 Population	2020 Population	2024 Population
City of Palos Verdes Estates	13,317	13,444	13,328	13,014
City of Rolling Hills Estates	7,657	8,064	8,232	8,557
City of Rancho Palos Verdes	41,043	41,654	42,150	40,831
City of Rolling Hills	1,867	1,867	1,735	1,673
Total	63,884	65,029	65,445	64,075

Source: (California Department of Finance, 2025)

Future Population Projections

According to the Southern California Association of Governments (SCAG) Connect SOCAL 2024 Report, The SCAG region's annual growth has decreased every decade since the 1980s. The region is still adding new residents, but growth is expected to continue to slow. Los Angeles County is projected to grow 7.8 percent between 2019 and 2050.

3.3.2 Equity Priority Communities

Equity priority communities may be more at-risk during hazard events due to a variety of factors, such as their physical capacity to react or respond effectively, as well as their location and lack of access to emergency services. Those with greater vulnerability may experience more severe impacts during emergencies or disasters.

The identification of socially vulnerable populations and underserved communities within the Planning Area was emphasized throughout the planning process. Refer to Section 2.7 for more information on how vulnerable communities were identified and included in the planning process.

The Planning Partnership identified the following socially vulnerable populations and underserved communities:

- **Demographic Vulnerability** – Residents who are 65+ years of age and/or have access and functional needs.
- **Evacuation Vulnerability** – Residents who live in neighborhoods with only one point of access to an evacuation route.

Table 3-2. Vulnerable Populations Exposed to Hazard of Concern

City	Total Population	Demographic Vulnerability Population	Demographic Vulnerability % of Total Population	Evacuation Vulnerability Population	Evacuation Vulnerability % of Total Population
Palos Verdes Estates*	12,999	3,792	29.2%	0	0.0%
Rancho Palos Verdes	40,727	10,339	25.4%	5,723	14.1%
Rolling Hills	1,677	1,677	100.0%	1,677	100.0%
Rolling Hills Estates	8,545	3,811	44.6%	2,840	33.2%
Total	**63,948**	**19,620**	**30.7%**	**10,240**	**16.0%**

**See Appendix D for evacuation vulnerability methodology. The threshold for this analysis does not indicate evacuation vulnerability in PVE. However, some evacuation vulnerability does exist in PVE.*

3.4 DEVELOPMENT PROFILE

Local Plan Requirement B2— 44 CFR Part 201.6(c)(2)(ii)(C)	Local Plan Requirement E1— 44 CFR Part 201.6(d)(3)
The plan should describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	A local jurisdiction must review and revise its plan to reflect changes in development.

3.4.1 Land Use

Land use describes the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place.

Public and private lands frequently represent very different uses (U.S. EPA 2024). Land cover describes how much of an area is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Water types include wetlands or open water (National Ocean Service 2024).

Land use varies from land cover in that certain uses may not always be immediately apparent (e.g., land utilized for timber production without harvest for an extended period and wooded areas designated as wilderness may both appear as forested areas but serve different purposes) (U.S. EPA 2024).

Peninsula-side land use is shown in Figure 3-2. Additional detail on land use and development trends for each of the municipal jurisdictions can be found in Volume 2 of this MJHMP.

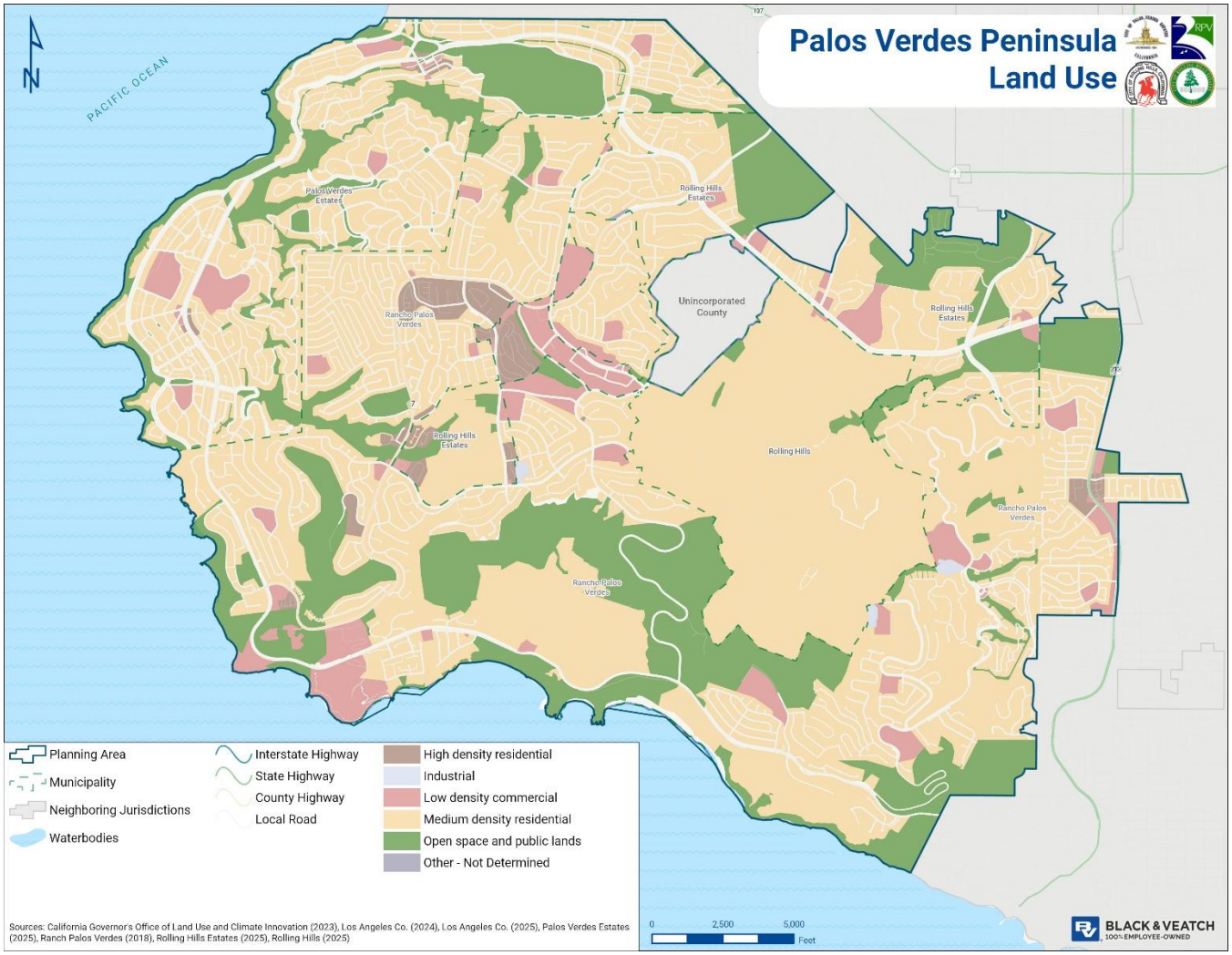


Figure 3-2. Palos Verdes Peninsula Land Use

Palos Verdes Estates

According to the City of Palos Verdes Estates General Plan (1973), the majority of land in the City is dedicated to single-family residential uses. Because commercial development within City limits is limited, residents rely on neighboring communities for most commercial services. According to the Palos Verdes Estates General Plan (2013-2021), at the time of the report, none of the vacant lots were suitable

for multi-family development. The small number of vacant lots pose various constraints such as very high land costs, topographical challenges, and potential investment needed for grading or other modifications.

Rancho Palos Verdes

According to the City of Rancho Palos Verdes General Plan Land Use Element (2018), development is constrained by designated hazard areas. Residential uses represent the City's predominant land use, followed by Open Space Preserve as the second most common. The City is the largest on the peninsula and houses many of the schools and other institutional land uses in the Planning Area. There are 18 public parks contributing to the second highest land use, Open Space Preserve.

There are several commercial centers in the City, though few opportunities for new commercial development exist. In recent years, planning efforts have increasingly emphasized open-space preservation, hazard avoidance (particularly landslide areas), and infrastructure maintenance.

Rolling Hills

According to the City of Rolling Hills' General Plan Land Use Element (1990), the City's land is predominately used for low-density or very low density, single-family development. According to the Rolling Hills Housing Element (2021-2029), the City has vacancies rates of 5 percent (rental) and 9 percent (homeowner). The City does not have any commercial land use. At the time of this MJHMP development, the City was planning for residential development.

Rolling Hills Estates

According to the Rolling Hills Estates General Plan 2040, residential development is the City's dominant land use, covering almost 60 percent of its total land area. Parks and recreation make up the second highest land use with nearly one-quarter of the land dedicated for open space and golf courses. Commercial development makes up less than 5 percent of City land and is primarily concentrated along Silver Spur Road. This commercial area is home to the most commercial activity in the Planning Area.

At the time of the land use element update, new developments consisted of residential care facilities for seniors, mixed-use condominiums, and single-family homes, reflecting the City's predominantly residential character.

3.4.2 General Building Stock

Current Building Stock

According to Los Angeles County Assessor records, 22,474 buildings are in the Planning Area, with a total replacement value of $24.1 billion. Table 3-3 shows the distribution of buildings by type of use within each of the Cities.

Table 3-3. Building Count by Occupancy Class

City	Building Count by Occupancy Class							
	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Palos Verde Estates	5,001	38	0	1	10	5	8	5,063
Rancho Palos Verdes	13,216	112	0	2	29	8	32	13,399
Rolling Hills	703	5	0	0	0	2	0	710
Rolling Hills Estates	3,132	122	0	14	18	1	15	3,302
Total	**22,052**	**277**	**0**	**17**	**57**	**16**	**55**	**22,474**

3.5 COMMUNITY LIFELINES

FEMA released initial guidance on the community lifelines concept in 2019 to describe the assets that enable the continuous operation of critical government and business functions and are essential to human health and safety or economic security. Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required (FEMA, 2023a).

The Planning Partnership identified lifelines that support the Paolos Verde Peninsula before, during, and after hazard events. A summary of the critical facilities or lifelines located within the Planning Area is listed in Table 3-4 and shown on Figure 3-3.

Table 3-4. Community Lifelines in the Planning Area

City	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
Palos Verdes Estates	11	1	0	0	1	11	1	4	29
Rolling Hills Estates	174	3	0	0	7	34	0	13	231
Rancho Palos Verdes	1	0	0	0	0	4	0	1	6
Rolling Hills	12	2	0	0	8	24	0	6	52
Total	198	6	0	0	16	73	1	24	318

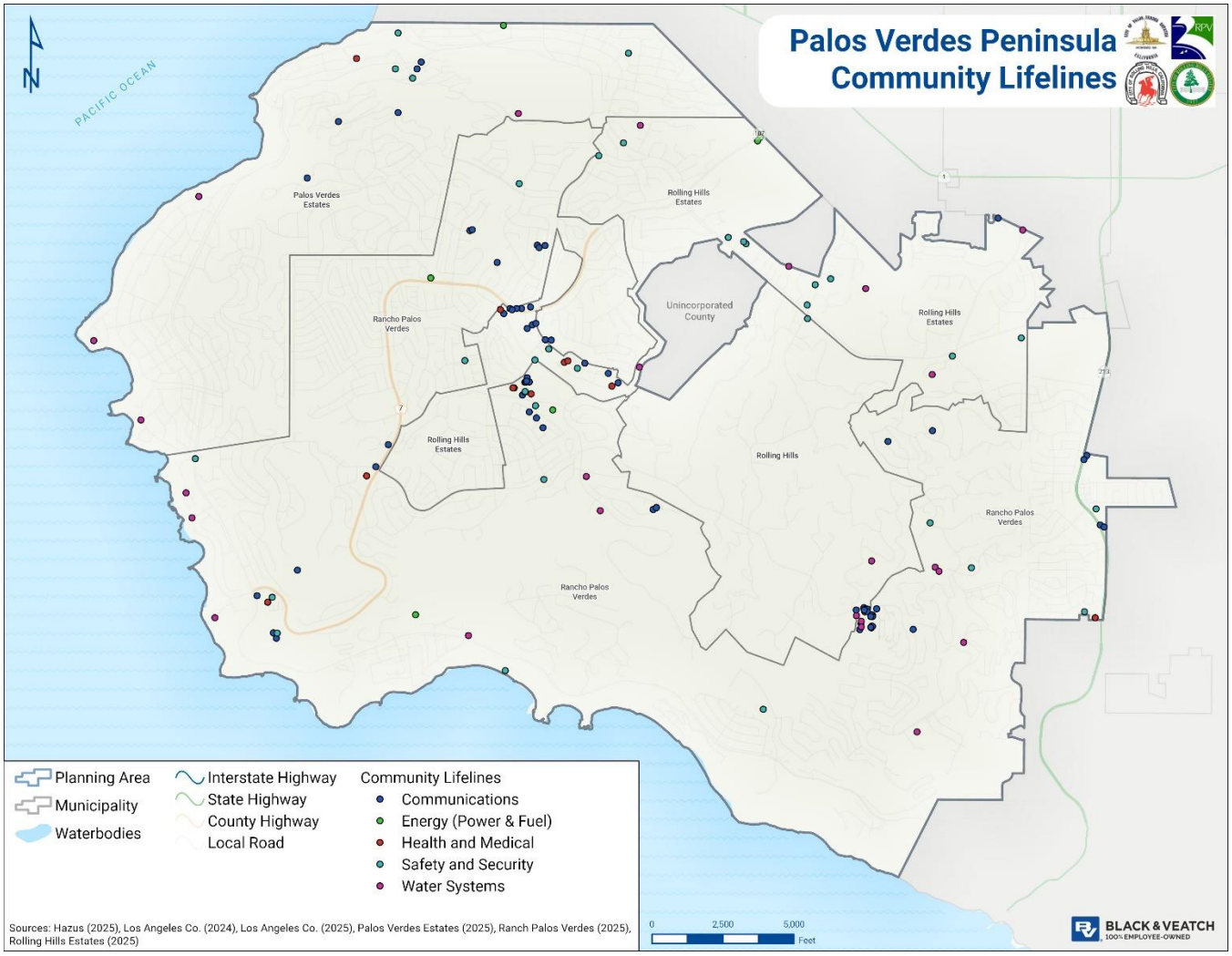


Figure 3-3. Planning Area Community Lifelines

3.5.1 Safety and Security

Safety and security lifelines include law enforcement/security (e.g., police stations, correctional facilities, site security), fire service, search and rescue, government service (e.g., emergency operation centers, government offices, schools), and community safety (e.g., flood control, protective actions).

3.5.2 Food, Hydration, Shelter

Food, hydration, and shelter lifelines include food (e.g., grocery stores, food banks), hydration (e.g., water supply chain, bottled water distribution), shelter, and agriculture. These lifelines exist within the Planning Area, but GIS data was not available for a spatial analysis or mapping. Many of these facilities, including grocery stores, are part of the general building stock analysis. Shelters, food distribution centers, and cooling centers are included in the safety and security lifeline category (e.g., library, religious institution).

3.5.3 Health and Medical

Health and medical lifelines include medical care (e.g., hospitals, pharmacies, long-term care), public health (e.g., health surveillance, behavioral health, labs), patient movement (e.g., emergency medical service), fatality movement, and medical supply chain.

3.5.4 Energy

Energy lifelines include power grid (e.g., generation systems, transmission systems, distribution systems) and fuel (e.g., refineries, fuel storage, pipelines, gas stations).

3.5.5 Communication

Communication lifelines include infrastructure (e.g., wireless, cable systems, television/radio, internet), alerts/warnings/messages, 911 and dispatch, responder communications, and finance (e.g., banks and electronic payment processing).

3.5.6 Transportation

Transportation lifelines include highway/roadway/motor vehicle (e.g., roads, bridges), mass transit, railway (e.g., freight, passenger), aviation, and maritime.

3.5.7 Hazardous Materials

Hazardous materials lifelines include facilities and HAZMAT, pollutants, or contaminants.

3.5.8 Water Systems

Water systems lifelines include potable water infrastructure (e.g., intake, treatment, storage, distribution) and wastewater management (e.g., collection, storage, treatment, discharge).

3.6 ECONOMY

3.6.1 Industry, Businesses, and Institutions

The Planning Area is largely residential, with most residents either commuting elsewhere for work, working from home, or retired. Because affordable housing options are scarce, many people employed on the peninsula live in surrounding communities.

Educational services, health care and social assistance, and professional, scientific, and management, and administrative and waste management services are the two largest industries in the Planning Area.

Table 3-5. Principal Employers in the Planning Area

Principal Employer	Industry	Location
UCLA	Education	Rancho Palos Verdes
Palos Verdes Peninsula High School	Education	Rolling Hills Estates
Academy of Foreign Languages	Education	Rolling Hills Estates
Rancho Vista Elementary School	Education	Rolling Hills Estates

Principal Employer	Industry	Location
Ridgecrest Intermediate School	Education	Rancho Palos Verdes
Point Vicente Elementary School	Education	Rancho Palos Verdes
Miraleste Intermediate School	Education	Rancho Palos Verdes
Soleado Elementary School	Education	Rancho Palos Verdes
Vista Grande Elementary	Education	Rancho Palos Verdes
Dodson Middle School	Education	Rancho Palos Verdes
School of Skills Corp	Education	Rancho Palos Verdes
Montemalaga Elementary School	Education	Palos Verdes Estates
Palos Verdes High School	Education	Palos Verdes Estates
Valmonte Elementary School	Education	Palos Verdes Estates
Palos Verdes Peninsula Unified School District Office	Education	Palos Verdes Estates
Institute of Internal Auditors	Offices of Physicians	Palos Verdes Estates

Table 3-6 summarizes the breakdown of industry types in the Planning Area according to the US Census 5-year American Community Survey (2019-2023).

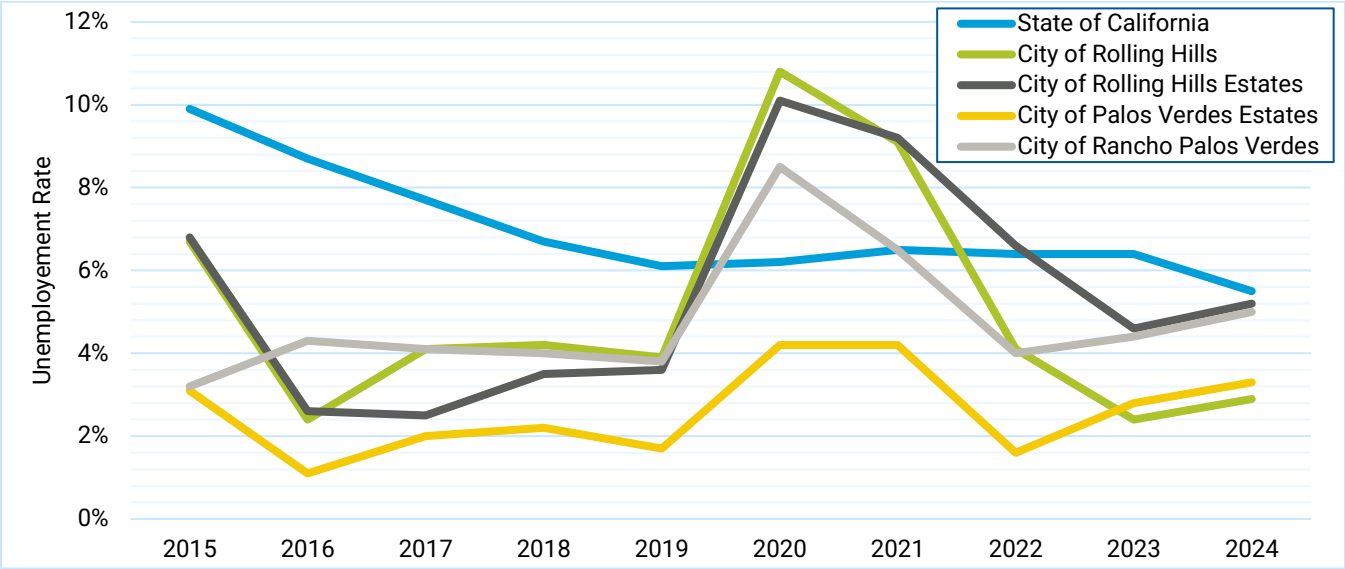
Table 3-6. Employment in Planning Area by Industry Sector Percentages

Jurisdiction	Agriculture, Forestry, Fishing and Hunting, Mining	Construction	Manufacturing	Retail Trade	Transportation and Warehousing, Utilities	Finance and Insurance, Real Estate, Rental and Leasing	Professional, Scientific, Management and Administrative, Waste Management Services	Educational Services, Health Care and Social Assistance	Arts, Entertainment, Recreation, Accommodation and Food Services	Other Services (except Public Administration)	Public Administration
Palos Verdes Estates	0.4%	3.9%	11.7%	5.7%	1.8%	17.7%	23.4%	17.4%	3.4%	1.5%	2.9%
Rancho Palos Verdes	0.4%	2.7%	11.5%	6.6%	9.0%	8.8%	19.3%	20.9%	4.2%	2.8%	4.6%
Rolling Hills	0.5%	0.5%	7.5%	7.3%	1.5%	15.7%	23.2%	26.7%	5.8%	3.0%	0%
Rolling Hill Estates	0.4%	3.2%	11.0%	2.2%	3.4%	10.5%	14.7%	27.3%	9.8%	9.9%	1.7%

Source: US Census 5-year American Community Survey (2019-2023).

Based on the State of California Employment Development Department, California's 2024 unemployment rate was 5.5 percent. All four municipalities in the Planning Area reported lower unemployment rates.

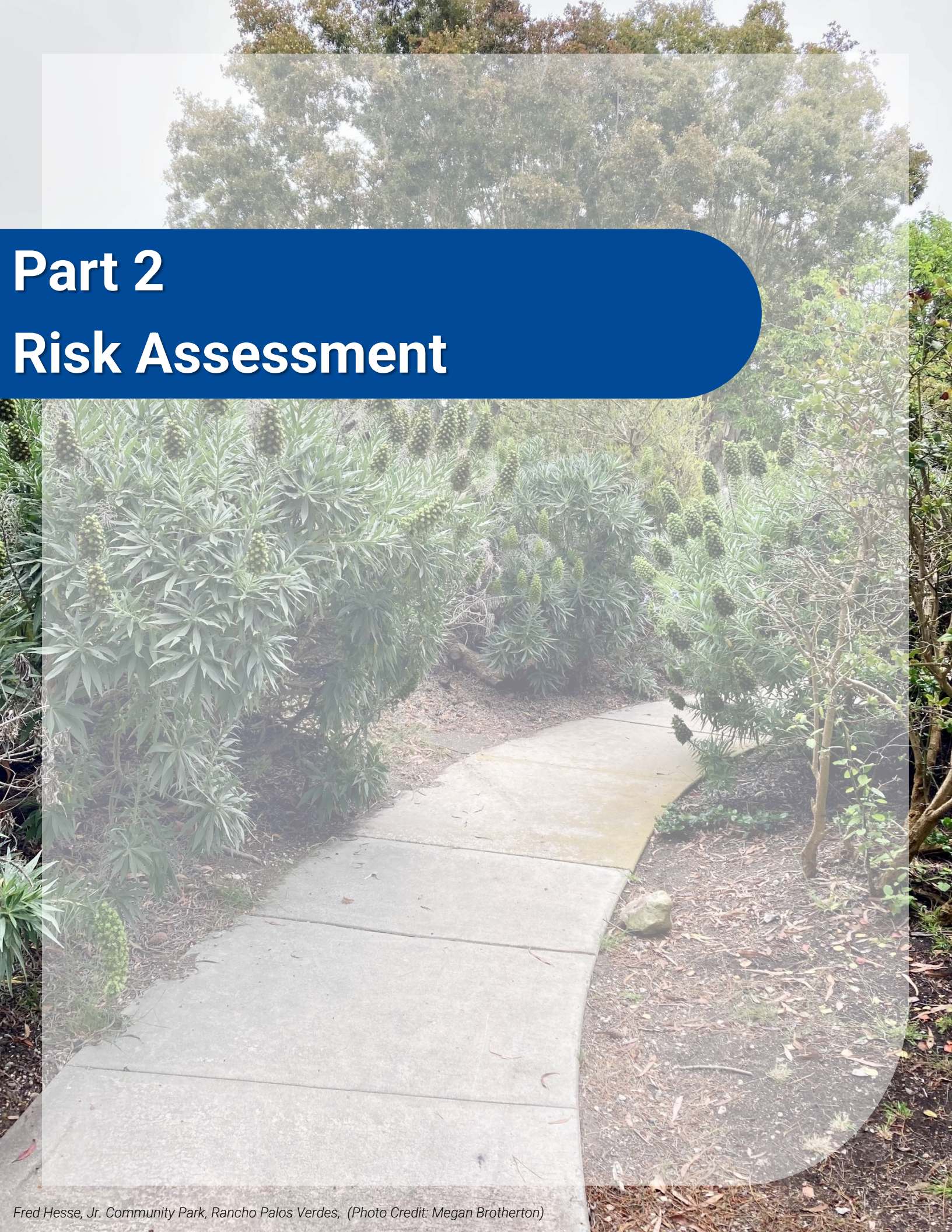
The local economic conditions during the COVID pandemic may contribute to fluctuations in employment within 2020 through 2022.



Source: (U.S. Census, 2025)

Figure 3-4. Recent Unemployment Rates for California and the Planning Area

Part 2
Risk Assessment



Fred Hesse, Jr. Community Park, Rancho Palos Verdes, (Photo Credit: Megan Brotherton)

4. HAZARDS OF CONCERN

4.1 WHAT IS A HAZARD OF CONCERN?

Defining the hazards that present the greatest risk to the Planning Area is the first step in assessing overall risk to the community. The CPT and PC reviewed available information to determine what types of hazards may affect the Planning Area, how often they can occur, and their potential severity.

Natural hazards are eligible for FEMA HMA grant funding and generally occur because of natural processes. Some natural hazards may also be caused by humans, such as wildfire. Human-caused hazards are not reviewed by FEMA for plan approval and are not eligible for FEMA HMA grant funding. The CPT and PC chose to add them in the MJHMP because of their current and potential impact on the Planning Area and to align with other local plans and programs.

4.2 FEDERAL DISASTER DECLARATIONS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Federal disaster declarations, authorized by the Stafford Act, include the following three main types:

- DR (Major Disaster) for large-scale events needing extensive aid.
- EM (Emergency) for supplemental assistance to save lives and property.
- FM (Fire Management) for fires threatening destruction.

Table 4-1 summarizes the Los Angeles County federal disaster declarations between 2019 and 2025.

Table 4-1. Federal Disaster Declarations in Los Angeles County

Disaster Number	Event Date Start Date	Incident Type	Title
FM-5293-CA	October 10, 2019	Fire	Saddleridge Fire
FM-5296-CA	October 24, 2019	Fire	Tick Fire
FM-5297-CA	October 28, 2019	Fire	Getty Fire
DR-4482-CA	January 20, 2020	Biological	COVID-19 Pandemic
EM-3428-CA	January 20, 2020	Biological	COVID-19
DR-4569-CA	September 4, 2020	Fire	Wildfires
FM-5374-CA	September 13, 2020	Fire	Bobcat Fire
DR-4683-CA	December 27, 2022	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3591-CA	January 8, 2023	Flood	Severe Winter Storms, Flooding, and Mudslides

Disaster Number	Event Date Start Date	Incident Type	Title
DR-4699-CA	February 21, 2023	Severe Storm	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
EM-3592-CA	March 9, 2023	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31, 2024	Severe Storm	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides
FM-5537-CA	September 10, 2024	Fire	Bridge Fire
FM-5548-CA	December 10, 2024	Fire	Franklin Fire
FM-5551-CA	January 7, 2025	Fire	Hurst Fire
FM-5550-CA	January 7, 2025	Fire	Eaton Fire
FM-5549-CA	January 7, 2025	Fire	Palisades Fire
DR-4856-CA	January 7, 2025	Fire	Wildfires and Straight-Line Winds
FM-5605-CA	August 7, 2025	Fire	Canyon Fire

Source: (FEMA, 2025)

4.3 NATURAL HAZARDS OF CONCERN AND HAZARDS OF INTEREST

Based on a review of the 2023 California State Hazard Mitigation Plan, the National Risk Index, prior hazard mitigation plans among the Planning Partnership, and input from the Planning Committee, seven hazards, listed alphabetically, were identified as natural hazards of concern affecting the Palos Verdes Peninsula and will be addressed in this plan update:


Drought


Heat Wave


Strong Wind


Earthquake


Landslide


Wildfire


Flood

Four hazards of interest listed below are discussed in a narrative but not fully assessed in the plan.


Groundwater Seepage


Human-Caused


Hazardous Materials


Utility Related

Please refer to Appendix B for a complete comparison of hazards included in the 2023 California State Hazard Mitigation Plan, the prior hazard mitigation plans from Planning Partnership, and this plan update.

5. RISK ASSESSMENT METHODOLOGY AND TOOLS

5.1 ASSESSING RISK

In hazard mitigation planning, risk is the potential for damage or loss when natural hazards interact with people or assets, such as buildings, infrastructure, and resources. A risk assessment is a process used to identify potential hazards and analyze what could happen if a disaster or hazard occurs. It involves a data-driven analysis to identify potential hazards, what could happen if hazards occur, and determine vulnerabilities to hazards (FEMA, 2023).

The risk assessment process focuses on three main elements – hazard identification, exposure identification, and vulnerability identification and loss estimation.

5.2 RISK ASSESSMENT TOOLS

Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

For this MJHMP, geographic information system (GIS) and FEMA's Hazus software were used to conduct the risk assessment.

5.2.1 Mapping

GIS tools provide a mechanism to perform quantitative analysis. Hazards that have specified geographic boundaries permit analysis using GIS. These hazards include the following:

- Earthquake
- Flood (including sea level rise and tsunami)
- Landslide
- Wildfire

5.2.2 Modeling

FEMA's Hazus Model 6.1 was used to evaluate the following hazards:

- **Earthquake**—A Level 2 analysis was performed to assess earthquake exposure and vulnerability for four scenarios: Compton M7.45, Palos Verdes M7.38, Redondo Canyon alt 2 M6.65, and the 100-yr probabilistic. The Hazus methodology uses ground motion and ground failure fragility curves to estimate damage state probabilities which are then used to estimate losses at the structure level.
- **Flood**—A Level 2 user-defined analysis was performed for general building stock and critical facilities and infrastructure in flood zones. The effective FEMA flood mapping for the Planning Area was used

to delineate flood hazard areas and estimate potential losses from the 1 percent annual chance flood event. To estimate damage that would result from a flood, Hazus uses predefined relationships between flood depth at a structure and resulting damage, with damage given as a percent of total replacement value. Curves defining these relationships have been developed for damage to structures and for damage to typical contents within a structure. By inputting flood depth data, estimated first floor elevations, and known property replacement cost values, dollar-value estimates of damage were generated.

- **Landslide**—Hazus does not model landslide, however, a Level 3 approach using Hazus protocols for a user-defined analysis was performed for general building stock in the deep-seated landslide hazard areas to estimate loss. Refer to Appendix D for a detailed description of the landslide hazard analysis methodology.

Overview

FEMA developed the Hazards U.S., or Hazus, model in 1997 to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology with new models for estimating potential losses from hurricanes and floods. The use of Hazus for hazard mitigation planning offers the following numerous advantages:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a HMP throughout its implementation.

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, community lifelines, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program can be used to map hazard data and the results of damage and economic loss estimates for buildings and infrastructure.

Level of Detail for Evaluation

Hazus provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out the following three levels of analysis, depending on the format and level of detail of information about the Planning Area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the Planning Area.

- **Level 2**—More accurate estimates of losses require more detailed information about the Planning Area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the Planning Area.

5.3 RISK ASSESSMENT APPROACH

This plan evaluated risks associated with each identified hazard for the Planning Area. Each hazard was profiled using the following steps:

- **Identify and profile each hazard** – The following information is given for each hazard of concern:
  - *Description of the Hazard:* Defining the hazard and a discussion of potential impacts.
  - *Location:* Geographic areas most affected by the hazard.
  - *Extent:* Measuring the intensity of the hazard, warning time for preparations, and the reasonable worst-case scenario.
  - *Previous Occurrences:* Summary of past events that have impacted the Planning Area.
  - *Future Occurrences:* Probability estimates, including potential frequency and intensity shifts caused by climate change and population and development trends.
- **Determine exposure to each hazard** – One of the following assessment approaches was used, depending on the type of information available for the hazard:
  - *Quantitative assessment*—Performed when numerical data are available to define risk. Available numerical hazard data may include financial impact and probability.
  - *Qualitative assessment*—Uses words to describe and categorize the likelihood and consequences of a risk when numerical data are unavailable.
- **Assess the vulnerability of exposed facilities** – Vulnerability of exposed structures and infrastructure was evaluated by estimating the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard
  - Impact on Life, Health, and Safety
  - Impact on General Building Stock
  - Impact on Community Lifelines
  - Impact on the Economy
  - Impact on Historic and Cultural Resources
  - Impact on Natural Resources
  - Change in Vulnerability Since the Previous HMPs
- **Identify potential mitigation opportunities** – A range of potential opportunities for mitigating each hazard is included for jurisdictions to consider during the development of their mitigation strategies.
  - Community: Mitigation actions that can be implemented by the general public.
  - Organizational: Mitigation actions that can be implemented by businesses and nonprofits.
  - Government: Mitigation actions that can be implemented by local governments.

5.4 SOURCES OF DATA USED IN RISK ASSESSMENT

Hazard information and data were collected for all hazards from a variety of sources, described in the sections below.

5.4.1 Building and Cost Data

Parcel and building information from the Los Angeles County Assessor were used to compile a detailed, Planning Area-wide structure inventory including replacement costs. Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in RS Means Square Foot Costs. It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. The construction class and number of stories for single-family residential structures also factor into determining the square foot costs.

5.4.2 Community Lifelines

An inventory of critical facilities and infrastructure was compiled from city, county, state, and national datasets. The facilities were categorized by FEMA's Community Lifelines: Safety and Security; Food, Hydration, Shelter; Health and Medical; Energy; Communications; Transportation; Hazardous Material; and Water Systems. To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

5.4.3 Population

2020 Census block-level data, provided with Hazus, was used to estimate the total population in each Planning Area. This data was also used to calculate the exposed population, displaced population and shelter needs for each hazard scenario.

Equity Priority Communities

Vulnerable communities for mitigation planning are defined through three categories: 65+ years of age, access and functional needs, and residents who live in neighborhoods with only one point of access to an evacuation route. In preparation for spatial overlays with the hazard data, the Planning Area was divided into three city boundaries for each member of the Planning Partnership.

Refer to Appendix D for a detailed description of the equity priority community methodology.

5.4.4 Hazus Data Inputs

The following hazard datasets were used for the Hazus analyses conducted for the risk assessment:

- Earthquake—ShakeMap data from the USGS Building Seismic Safety Council 2014 Event Set were used for the analysis of this hazard. This set of ShakeMap earthquake scenarios is the authoritative USGS collection for the continental United States. The scenario fault ruptures are derived from the latest National Seismic Hazard Model. Liquefaction zones and landslide susceptibility data from the California Geological Survey (CGS) was also incorporated into the Hazus model to replace the default data.

- Flood—A flood depth grid generated using the effective FEMA Digital Flood Insurance Rate Map (DFIRM), and USGS digital elevation model (DEM) data, was incorporated into the Hazus model.

5.4.5 Other Local Hazard Data

Local sources used in the risk and vulnerability assessment include the following:

- Landslide—Please refer to Appendix D for a full description of the data and methodology.
- Sea Level Rise— Sea-level rises of 25 cm and 200 cm with 100-year storm surge data were obtained from the Our Coast Our Future website. These data were developed using USGS' Coastal Storm Modeling System (CoSMoS) approach which projects coastal flooding due to both sea level rise and coastal storms driven by climate change.
- Tsunami—An exposure analysis was conducted using tsunami hazard area data provided by the California Department of Conservation.
- Wildfire—An exposure analysis was conducted using fire hazard severity zones data from CAL FIRE. These zones were mapped based on fuel loading, slope, fire weather, and other relevant factors including winds. The zones are classified as Moderate, High, or Very High fire hazard.

5.4.6 Data Source Summary

Table 5-1 describes the data used for spatially-based exposure and vulnerability assessments.

Table 5-1. Data Source Summary

Data	Source	Date(s)	Format(s)
City and Unincorporated Boundaries (Legal)	Los Angeles Co.	2024	Digital (GIS) format
Countywide Building Outlines	Los Angeles Co.	2025	Digital (GIS) format
Los Angeles County Parcels	Los Angeles Co.	2025	Digital (GIS) format
Building replacement costs	RS Means	2024	Digital (tabular) format
American Community Survey			
Evacuation routes			
Compton M7.45 ShakeMap	USGS	2017	Digital (GIS) format
Palos Verdes M7.38 ShakeMap	USGS	2017	Digital (GIS) format
Redondo Canyon alt 2 M6.65 ShakeMap	USGS	2017	Digital (GIS) format
CGS Map Sheet 48: Shear-wave Velocity in Upper 30m of Surficial Geology (Vs30)/NEHRP Soils	CGS	2015	Digital (GIS) format
Liquefaction Zones	CGS	2021	Digital (GIS) format
Digital Flood Insurance Rate Map (effective 6/2/2021; last LOMR 12/27/2024)	FEMA	2024	Digital (GIS) format
Projected flood exposure data from the USGS Coastal	Our Coast Our Future	2018	Digital (GIS) format

Data	Source	Date(s)	Format(s)
Storm Modeling System (CoSMoS v3.0) – 25cm with 100-year storm surge			
Projected flood exposure data from the USGS Coastal Storm Modeling System (CoSMoS v3.0) – 200cm with 100-year storm surge	Our Coast Our Future	2018	Digital (GIS) format
Tsunami Hazard Area Map, Los Angeles County	CA Dept of Conservation	2021	Digital (GIS) format
Landslide Catalog	NASA	2019	Digital (GIS) format
CA Landslide Inventory	CGS	2022	Digital (GIS) format
Redondo Beach Study	CGS	1999	PDF format
San Pedro Study	CGS	1999	PDF format
Torrance Study	CGS	1999	PDF format
Percent Change in Displacement Rate Map	Cotton, Shires and Associates, Inc.	2024-2025	PDF format
CGS Landslide Zones	CGS	Downloaded 2025	Digital (GIS) format
Fire Hazard Severity Zones in Local Responsibility Areas	CAL FIRE	2025	Digital (GIS) format
Police Stations	Hazus v6.1	Downloaded 2025	Digital (GIS) format
Fire Stations	Hazus v6.1	Downloaded 2025	Digital (GIS) format
Emergency Centers	Hazus v6.1	Downloaded 2025	Digital (GIS) format
Municipal Services	Los Angeles Co.	Downloaded 2025	
Schools, Colleges & Universities	Los Angeles Co.	Downloaded 2025	Digital (GIS) format
Schools	Hazus V6.1	Downloaded 2025	Digital (GIS) format
Electric Power Facilities	Los Angeles County		Digital (GIS) format
Highway Bridges	Hazus v6.1	Downloaded 2025	Digital (GIS) format
Sewer Pump Stations	Los Angeles Co.	Downloaded 2025	Digital (GIS) format

5.5 DATA LIMITATIONS

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment.

Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study.
- Incomplete or dated inventory, demographic, or economic parameter data.
- The unique nature, geographic extent, and severity of each hazard.

- Mitigation measures already employed by the participating municipalities.
- The amount of advance notice residents have to prepare for a specific hazard event.
- Uncertainty of climate change projections.

Hazus currently represents the industry best management practice for assessing risk in support of hazard mitigation planning. However, the Hazus model is limited by the availability of data to support its working components. The model makes assumptions where firm data are not available. Assumptions are used, for example, to estimate ground deformation caused by liquefaction. These model limitations can lead to an understatement or overstatement of risk.

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, the Planning Partnership will collect additional data to update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock utilizing best available data. The Planning Partnership acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.

6. DROUGHT

6.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

6.1.1 Description of the Hazard

Defining the Hazard

Drought is defined as a deficiency in precipitation over an extended period that results in a water shortage (National Integrated Drought Information System, n.d.). It is a gradual phenomenon and occurs slowly over a period of time (California Governor's Office of Emergency Services, 2024). Drought can have devastating impacts on communities due to its cascading impacts, including but not limited to negative impacts on public health, tree mortality, water quality, and energy as well as increased wildfire risk.

The occurrence of drought is a normal phase in the climate cycle of most regions, originating from a deficiency of precipitation over an extended period, usually a season or more. This leads to a water shortage for some activity, group, or environmental sector. Drought can be characterized based on the following (National Integrated Drought Information System, n.d.):

- **Meteorological Drought** – When dry weather patterns dominate an area.
- **Hydrological Drought** – When low water supply becomes evident in the water system.
- **Agricultural Drought** – When crops become affected by drought.
- **Socioeconomic Drought** – When the supply and demand of various commodities is affected by drought.
- **Ecological Drought** – When natural ecosystems are affected by drought.

Cause of the Hazard

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered long-term. It is possible for a region to experience a long-term pattern that produces drought, and to have short-term changes that result in wet spells within the long-term pattern. Likewise, it is possible for a long-term wet pattern to be interrupted by weather spells that result in short-term drought (National Integrated Drought Information System, n.d.).

Drought can be caused by various atmospheric conditions such as climate change, ocean temperatures, changes in the jet stream, and changes in the local landscape (National Aeronautics and Space Administration, n.d.). Droughts are long-term climatic patterns that emerge from complex interactions among global weather patterns. Persistent, upper-level high-pressure systems along the West Coast

result in warm, dry air and reduced precipitation. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of global weather systems.

Summary of Potential Impacts

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters.

The National Drought Mitigation Center uses three categories to describe likely drought impacts (National Integrated Drought Information System, n.d.):

- **Economic Impacts**—These impacts of drought cost people (or businesses) money. Farmers' crops are destroyed; low water supply necessitates spending on irrigation or drilling of new wells; water-related businesses (such as sales of boats and fishing equipment) may experience reduced revenue.
- **Environmental Impacts**—Plants and animals depend on water. When a drought occurs, their food supply can shrink, and their habitat can be damaged.
- **Social Impacts**—Social impacts include public safety, health, conflicts between people when there is not enough water to go around, and changes in lifestyle.

The demand that society places on water systems and supplies—such as expanding populations, irrigation, and environmental needs—contributes to drought impacts. Drought can lead to difficult decisions regarding the allocation of water, as well as stringent water use restrictions, water quality problems, and inadequate water supplies for fire suppression. There are also issues such as growing conflicts between agricultural uses of surface water and in-stream uses, surface water and groundwater interrelationships, and the effects of growing water demand on uses of water.

Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand. The impacts of drought vary between sectors of the community in both timing and severity (National Integrated Drought Information System, n.d.):

- **Water supply**—The water supply sector encompasses drinking water systems that are affected when a drought depletes groundwater supplies due to reduced recharge from rainfall.
- **Agriculture and commerce**—Impacts on the agriculture and commerce sectors include the reduction of crop yield and livestock sizes due to insufficient water supply for crop irrigation and maintenance of ground cover for grazing. In areas that depend on goods from agriculture and livestock, impacts may include increased prices for these commodities.
- **Environment, public health, and safety**—The environmental, public health, and safety sector focuses on wildfires that are both detrimental to the ecosystem and hazardous to the public. It also includes the impact of desiccating streams, such as the reduction of in-stream habitats for native species.

Cascading Hazard Impacts

The cascading impact most associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends.

Drought is also often accompanied by extreme heat, exposing people to the risk of sunstroke, heat cramps, and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries.

6.1.2 Location

A drought is a regional event that is not confined to geographic boundaries; it can affect several areas at once and range in severity across those areas. Drought that affects the Planning Area would affect the entirety of the area simultaneously and has the potential to impact every person, directly or indirectly, as well as adversely affect the local economy. A drought's impact can depend on climate zone, type of water supply available, and water users' ability to manage drought impacts. Los Angeles County depends on local and imported water in highly drought sensitive areas such as the Sierras, Los Angeles River, San Gabriel River, and Colorado River for its water supply (Los Angeles County Public Works, n.d.).

In California, one dry year does not normally constitute a drought. The State's extensive system of water supply infrastructure, which includes reservoirs, groundwater basins, and interregional conveyance facilities, are designed to mitigate the effects of short-term dry periods for most water users (DWR, n.d.). However, prolonged dry periods still lead to water shortage emergencies.

6.1.3 Extent

Measuring Intensity

Several quantitative methods exist for measuring drought in the United States. How these indices measure drought depends on the drought classification and the region being considered. Droughts are dynamic, and locations of the State susceptible to drought can change monthly.

U.S. Drought Monitor

The U.S. Drought Monitor assesses multiple numeric measures of drought to depict the drought conditions and locations across the United States. The U.S. Drought Monitor uses five drought intensity categories, D0 through D4, to identify areas of drought. These categories are shown on Figure 6-1.

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

Source: (U.S. Drought Monitor, 2025)

Figure 6-1. U.S. Drought Monitor Categories

National Oceanic and Atmospheric Administration Drought Indices

National Oceanic and Atmospheric Administration (NOAA) has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The ***Crop Moisture Index*** measures short-term drought weekly to assess impacts on agriculture.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale.
- The ***Palmer Drought Severity Index*** is based on long-term weather patterns. The intensity of drought in a given month is dependent on current weather plus the cumulative patterns of previous months. Weather patterns can change quickly, and the Palmer Drought Severity Index can respond fairly rapidly.
- The ***Palmer Hydrological Drought Index*** quantifies hydrological effects (reservoir levels, groundwater levels, etc.), which take longer to develop and last longer. This index responds more slowly to changing conditions than the Palmer Drought Index.
- The ***Standardized Precipitation Index*** considers only precipitation. A value of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. The Standardized Precipitation Index is computed for time scales ranging from 1 month to 24 months.

Maps of these indices show drought at a given point in time and are not necessarily indicators of the Planning Area's long-term susceptibility to drought (U.S. Drought Monitor, 2025) (NOAA, 2025).

Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.

At this time, scientists do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades

The El Niño-Southern Oscillation—a periodic shifting of ocean atmosphere conditions in the tropical Pacific that ranges from El Niño (warm phase) to neutral to La Niña (cold phase)—offers only limited predictive capability for precipitation in California. La Niña conditions tend to favor a drier outlook for Southern California. Seasonal precipitation forecasting is an important drought response tool and a research area requiring focused investment to develop the predictive ability needed to support water management. Dry conditions become a drought when the impacts of prolonged dry conditions create problems (California Governor's Office of Emergency Services, 2024).

Worst-Case Scenario

An extreme multi-year drought can impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out throughout Los Angeles County, as seen in 2025 with the Palisades and Eaton Fires, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon in the Peninsula, causing social and political conflicts. If such conditions persisted for several years, the economy of Los Angeles County and the Palos Verdes Peninsula could experience setbacks, especially in water dependent industries.

6.1.4 Previous Occurrences

The following sections provide a review of previous drought occurrences in Los Angeles County.

Declarations

Federal Declarations

There have been no federal declarations for drought for Los Angeles County (FEMA, 2025).

State Proclamations

In 1976, 2014, and 2015, California proclaimed drought disasters for Los Angeles County, but no proclamations have been made in the past 5 years since the last mitigation plan updates for Palos Verdes Peninsula communities (Cal OES, 2025).

USDA Declarations

Between 2019 and 2025, the USDA declared that Los Angeles County experienced seven disasters relating to drought.

Table 6-1. USDA Drought Disaster Declarations

Designation Number	Event Begin Date	Description
S4647	10/1/2019	Drought-Fast Track
S4916	10/1/2020	Drought-Fast Track
S4945	4/20/2021	Drought-Fast Track
S4979	4/6/2021	Drought-Fast Track
S5146	10/1/2021	Drought-Fast Track
S5371	10/1/2022	Drought-Fast Track
S5943	10/1/2024	Drought-Fast Track

Source: (U.S. Department of Agriculture, 2025)

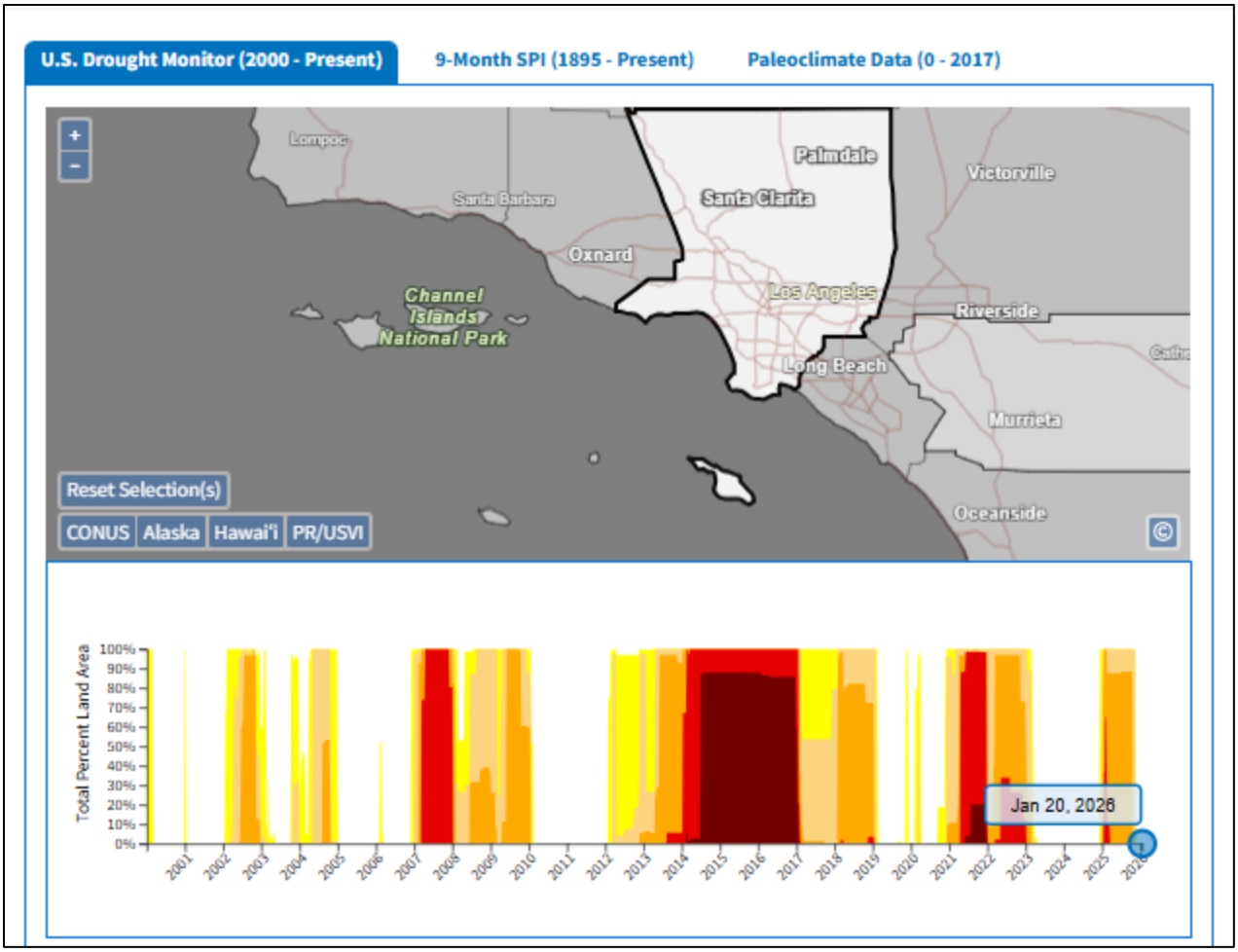
Summary of Significant Events

Drought is an ongoing hazard that has shaped California's history. In the mid-1800s, the Great Drought contributed to the demise of the cattle rancho system. In the 1920s and 1930s, dry conditions were prevalent in California and throughout the nation during the Great Depression and Dust Bowl. Later in the 20th century, significant droughts impacting water supplies occurred in the mid-1970s and mid- to early-1990s. Recent multi-year droughts occurred in 2007 to 2009, 2012 to 2016, and 2020 to early 2023. At the time of writing, the two watersheds encompassing the Peninsula, San Gabriel Watershed and Santa Monica Bay Watershed are not experiencing drought conditions.

Recent Events

Recent drought periods are described as follows:

- 2020 to 2023 Drought – A new record was set during this multi-year drought, with 2022 becoming the driest year in California since official drought records began in 1895. All 58 counties in California were impacted as USDA disaster-designated areas. This included residents in Los Angeles County.
- 2012 to 2016 Drought - The driest 3 consecutive years for statewide precipitation were between 2012 to 2014. Calendar year 2013 set minimum annual precipitation records for many communities.
- 2007 to 2009 Drought—This was California's first statewide proclamation of drought emergency, and the first drought in more than 70 years where water shortage was directly linked to social services impacts (California Department of Water Resources, 2010). Several California counties were also included in a state disaster proclamation, but Los Angeles County was only included in the emergency proclamation.



Source: (National Intigrated Drought Information System, 2026)

Figure 6-2. Percent of Los Angeles County Affected by Drought Conditions 2000 to January 2026

6.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, are discussed in the sections below.

Probability

Drought has a high probability of occurrence in Los Angeles County, including the Palos Verdes Peninsula. From January 2000 to December 2025, some part of Los Angeles County experienced a USDM rating of D0 or higher in 899 out of 1,360 weeks—two-thirds of the weeks. The Planning Area has also been included in USDA drought disaster declarations in 5 of the last 7 years. Historical drought data for the Planning Area indicate there have been four significant multi-year droughts in the last 38 years (1987 to 2025), amounting to a severe drought every 9 years on average.

Climate Change

Future impacts of climate change are expected to influence future drought occurrences for the Planning Area.

With a warmer climate, droughts could become more frequent, more severe, and longer lasting. The Fourth National Climate Assessment Report for the United States indicates that "rising air and water temperatures and changes in precipitation are intensifying droughts. Changes in the relative amounts and timing of snow and rainfall are leading to mismatches between water availability and needs in some regions. Groundwater depletion is exacerbating drought risk." (USGCRP, 2018).

Because changes in precipitation patterns are still uncertain, the potential impacts and likelihood of drought are uncertain. Department of Water Resources (DWR) has noted impacts of climate change on statewide water resources by charting changes in snowpack, sea level, and river flow. As temperatures rise and more precipitation comes in the form of rain instead of snow, these changes will likely continue or grow even more significant. DWR estimates that parts of the state will experience a 48 to 65 percent loss in snowpack by the end of the century compared to historical averages (DWR, 2021). Increasing temperatures may also increase net evaporation from reservoirs. The Planning Area's water supply is derived from groundwater.

Potential Future Impacts

Even though the population of the Palos Verdes Peninsula is expected to continue slowly declining, its location in California's most populous County exposes it to significant risk of heightened water consumption and devastating drought consequences. Even modest population growth or shifts in development patterns can place significant strain on the Planning Area's limited water resources. Additionally, any increase in development, particularly in wildland-urban interface areas, can elevate both water demand and wildfire risk. These changes may lead to water shortages, reduced water quality, and heightened public health risks, especially for vulnerable populations. A growing population could complicate emergency response efforts during drought-related events like wildfires, which are intensified by prolonged dry conditions. Economic impacts may also arise, including reduced tourism and increased utility costs, all of which could further challenge the Planning Area's resilience to future droughts.

6.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

6.2.1 Summary of Vulnerability

The entire Planning Area is exposed to the drought hazard, with the potential to affect the entire population.

Drought can affect a wide range of economic, environmental, and social activities. Its impacts can span many sectors of the economy because water is integral to the ability to produce goods and provide services. The impacts can reach well beyond the area undergoing physical drought. Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand.

6.2.2 Impact on Life, Health, and Safety

Drought can affect people's health and safety, including health problems related to low water flows, poor water quality, or dust and pollution (National Drought Mitigation Center, 2025). Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and hygiene; compromised food and nutrition; and increased incidence of illness and disease (U.S. Centers for Disease Control and Prevention, 2024). Droughts can also lead to reduced local firefighting capabilities.

The entire population of the Palos Verdes Peninsula is vulnerable to droughts.

Equity Priority Communities

In addition to water scarcity, drought conditions can also lead to power outages. Reduced water availability can limit hydroelectric power generation, while extreme heat and wildfire threats can strain the electrical grid or necessitate public safety power shutoffs. These outages can severely impact individuals with disabilities, older adults, and those with access and functional needs who rely on powered medical devices, refrigerated medications, or climate control for health and safety.

6.2.3 Impact on General Building Stock

The general building stock will not be directly affected by drought conditions. Droughts can have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

6.2.4 Impact on Community Lifelines

While community lifelines as defined for this plan will continue to be operational during a drought, instances of drought can put a significant amount of strain on water utilities services. This, in addition to a drought's ability to naturally worsen wildfires through cascading effects, can impede firefighting capabilities for both wildfires and smaller house fires (NOAA NIDIS, 2025).

Beyond fires, the cost of potable water may increase, but the community lifeline that includes hydration will still function. Landscaping at community lifeline facilities may not be maintained because of limited resources, but the risk to those areas will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas may not be watered frequently and may die. These aesthetic impacts are not considered significant.

6.2.5 Impact on the Economy

A prolonged drought can have a serious economic impact for all communities. As drought conditions persist, the availability of water for both residential and business use becomes increasingly limited. Local and state agencies may impose water restrictions. These restrictions may include placing limitations on watering lawns, car washing services, or any other recreational/commercial outdoor use of water supplies. Cost of accessing and transporting water may rise, placing further strain on household budgets and business operations. Industries that rely on water, such as nurseries, landscaping services, and tourism, may experience reduced demand or be forced to scale back.

6.2.6 Impact on Historic and Cultural Resources

The increase in wildfire risk due to drought would be the primary impact on historic and cultural assets.

6.2.7 Impact on Ecosystems and Natural Resources

Drought increases wildfire risk, and wildfires in turn increase demand for water. Prolonged periods of drought can result in detrimental changes in the vegetative structure, weakening trees which are more vulnerable to wildfire or insect outbreaks (EPA, 2025). The loss of trees due to distressed health, pests, or fire can produce increased risk of other hazards due to reduced ability to retain runoff during heavy rainfall events (Hoegh-Guldberg, et al., 2018).

The impact to ecosystems, even in suburban areas, can be profound during a drought. Surface water and waterways are reduced or dry up completely which impacts the habitat for surrounding flora and fauna reliant on those resources.

6.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

The Planning Area's vulnerability to drought may have increased because of prolonged dry periods and climate variability, not because of population or development. The Palos Verdes Peninsula's population has declined since the prior Planning Area HMPs. Los Angeles County's reliance on limited water resources, however, continues to make it sensitive to drought conditions.

6.3 MITIGATION OPPORTUNITIES

Table 6-2 presents a range of potential opportunities considered by the Planning Partnership for mitigating the drought hazard.

Table 6-2. Potential Opportunities to Mitigate the Drought Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• Stormwater management • Identify alternative water sources
Reduce Exposure and Vulnerability		
• Drought-resistant landscapes • Reduce water system losses • Modify plumbing systems (through water saving kits)	• Drought-resistant landscapes • Reduce private water system losses	• Water use conflict regulations • Reduce water system losses • Distribute water saving kits • Implement/expand water reuse projects

Community Scale	Organizational Scale	Government Scale
Build Local Capacity		
• Practice active water conservation	• Practice active water conservation	• Public education on drought resistance • Develop or expand recycled water network • Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers • Develop drought contingency plan • Develop criteria "triggers" for drought-related actions • Improve accuracy of water supply forecasts • Modify rate structure to influence active water conservation techniques • Increase emergency storage capacity
Nature-based Opportunities		
• Promote and use reclaimed water supplies • Increase capacity for stored surface water to create habitats and ecosystems for aquatic species • Promote and use active groundwater recharge		

7. EARTHQUAKE

7.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

7.1.1 Description of the Hazard

Defining the Hazard

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter.

Cause of the Hazard

In California, the Pacific and North American plates slide past each other in opposing directions at a rate of about 1.5 inches per year. Friction between the plates can cause sections to stick. When they break free sudden movements, the movements release energy that travels through the ground as waves, causing shaking at the surface in the form of earthquakes (California Governor's Office of Emergency Services, 2024).

Tectonic Plates

The Earth's crust, which is the rigid outermost shell of the planet, is broken into seven or eight major tectonic plates (depending on how they are defined) and many minor plates. Where the plates meet, they move in one of three ways along their mutual boundary: convergent (two plates moving together), divergent (two plates moving apart), or transform (two plates moving parallel to one another). Earthquakes, volcanic activity, mountain-building, and oceanic trench formation occur along these plate boundaries. Subduction is a geological process that takes place at convergent boundaries of tectonic plate, in which one plate moves under another. Regions where this process occurs are known as subduction zones, and they have the potential to generate highly damaging earthquakes.

California is seismically active because of movement of the North American Plate, east of the San Andreas Fault, and the Pacific Plate to the west, which includes the state's coastal communities. The

transform (parallel) movement of these tectonic plates against one another creates stresses that build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes.

Seismic Fault Lines

Geologists have found that earthquakes reoccur along faults, which are zones of weakness in the earth's crust. When a fault experiences an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake can still occur. In fact, relieving stress along one part of a fault may increase it in another part.

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. "Active" faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). "Potentially active" faults are those that have moved in the past 1.6 million years (USGS, 2025).

Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. The majority of the seismic hazards are on well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future. An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

Summary of Potential Impacts

According to the USGS Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect people's normal activities. This includes the following:

- **Surface Faulting**—Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground Motion** (shaking)—The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslide**—A movement of surface material down a slope.
- **Liquefaction**—A process by which water-saturated sediment temporarily loses strength and acts as a fluid. Earthquake shaking can cause this effect.
- **Tectonic Deformation**—A change in the original shape of a material due to strain.

Earthquakes can directly cause buildings and bridges to collapse; disrupt utility services; and trigger landslides, avalanches, flash floods, fires, and tsunamis. Infrastructure collapses during earthquakes produced eight of California's 10 costliest disasters in the last 100 years (California Governor's Office of Emergency Services, 2024).

Cascading Hazard Impacts

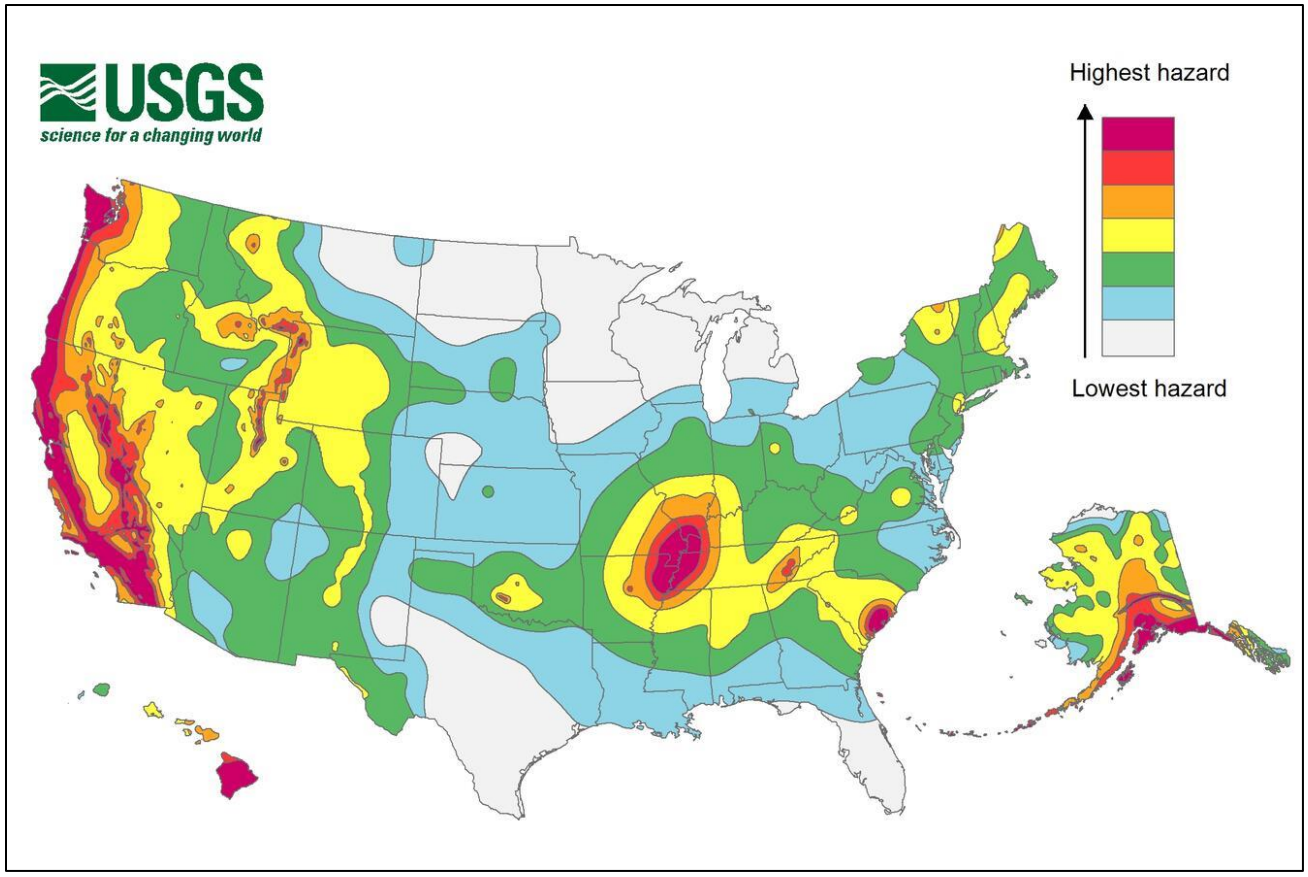
Cascading impacts result when one hazard event triggers one or more other hazard events that may still trigger others. The following cascading impacts associated with earthquakes are relevant to the Planning Area (California Governor's Office of Emergency Services, 2024):

- **Surface Fault Rupture**—When a fault rupture extends to the earth's surface, the displacement can catastrophically damage structures or utilities. Fissuring, settlement, and permanent horizontal and vertical ground shifting often accompany large earthquakes. Such displacement can significantly increase damage.
- **Fires**—Fires following earthquakes may result from multiple causes, including overturned burning candles, sparking from downed power lines, and broken gas pipelines. Additionally, fire departments may be severely stained after earthquakes. Impaired communications, water supply, transportation, and other resources affect fire department response. Several computer programs, such as Hazus, URAMP, SERA, and RiskLink provide ways to assess the fire-following-earthquake vulnerability of a community in future earthquakes.
- **Liquefaction**—Ground settlement during liquefaction can cause damage when the settlement varies significantly across the length of a structure. Liquefaction can occur in susceptible soils such as NEHRP Types D, E, and F. This can severely damage structures and infrastructure.
- **Landslides**—Landslides caused by earthquakes can be widespread over the immediate area and at greater distances where hillsides are susceptible. These landslides can significantly damage structures and transportation and utility lifelines.
- **Power Outages**—Earthquakes of all magnitudes can damage power lines and electrical facilities, impacting community lifelines that rely on power.
- **Hazardous Materials Release**—Earthquakes can lead to the release of hazardous materials from collapsed buildings and severed pipelines. This may include chemical accidents, oil spills, the release of gases, and runoff of hazardous materials.

7.1.2 Location

Faults

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the western states, including California. Figure 7-1 shows relative seismic risk for the United States.



Source: (USGS, 2018)

Figure 7-1. USGS National Seismic Hazard Map

A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. Small, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant in areas close to the fault. Large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area. The Palos Verdes Peninsula is in a region of High seismicity. According to the USGS, Southern California has the highest level of earthquake risk in the United States, with half of the expected financial losses from earthquakes in the Nation expected to occur in Southern California. Sitting astride the Pacific-North American plate boundary at the Big Bend of the San Andreas Fault, Southern California has over 300 faults capable of producing magnitude 6.0 and larger earthquakes. Affecting the more than 20 million inhabitants of the Los Angeles and San Diego metropolitan areas, this complex set of faults presents the greatest urban risk in the United States. Figure 7-2 shows the known faults within close proximity to the Planning Area.

Source: (California Geological Survey, 2015)

Figure 7-2. Fault Activity Map

National Earthquake Hazards Reduction Program Soils

National Earthquake Hazards Reduction Program (NEHRP) soil types define locations that will be significantly impacted by an earthquake. NEHRP Soils B and C typically can sustain low-magnitude ground shaking without much effect. Areas with NEHRP Soils D, E, and F are most commonly affected by ground shaking. NEHRP soils are described as follows:

- Site Class A: Hard rock
- Site Class B: Rock
- Site Class C: Very dense soil and soft rock
- Site Class D: Stiff soil
- Site Class E: Soft soil
- Site Class F: Soils requiring site-specific evaluation, like liquefiable soils, peat, or thick soft clays.

Figure 7-3 shows that NEHRP soil classifications within the Planning Area include C and D soils.

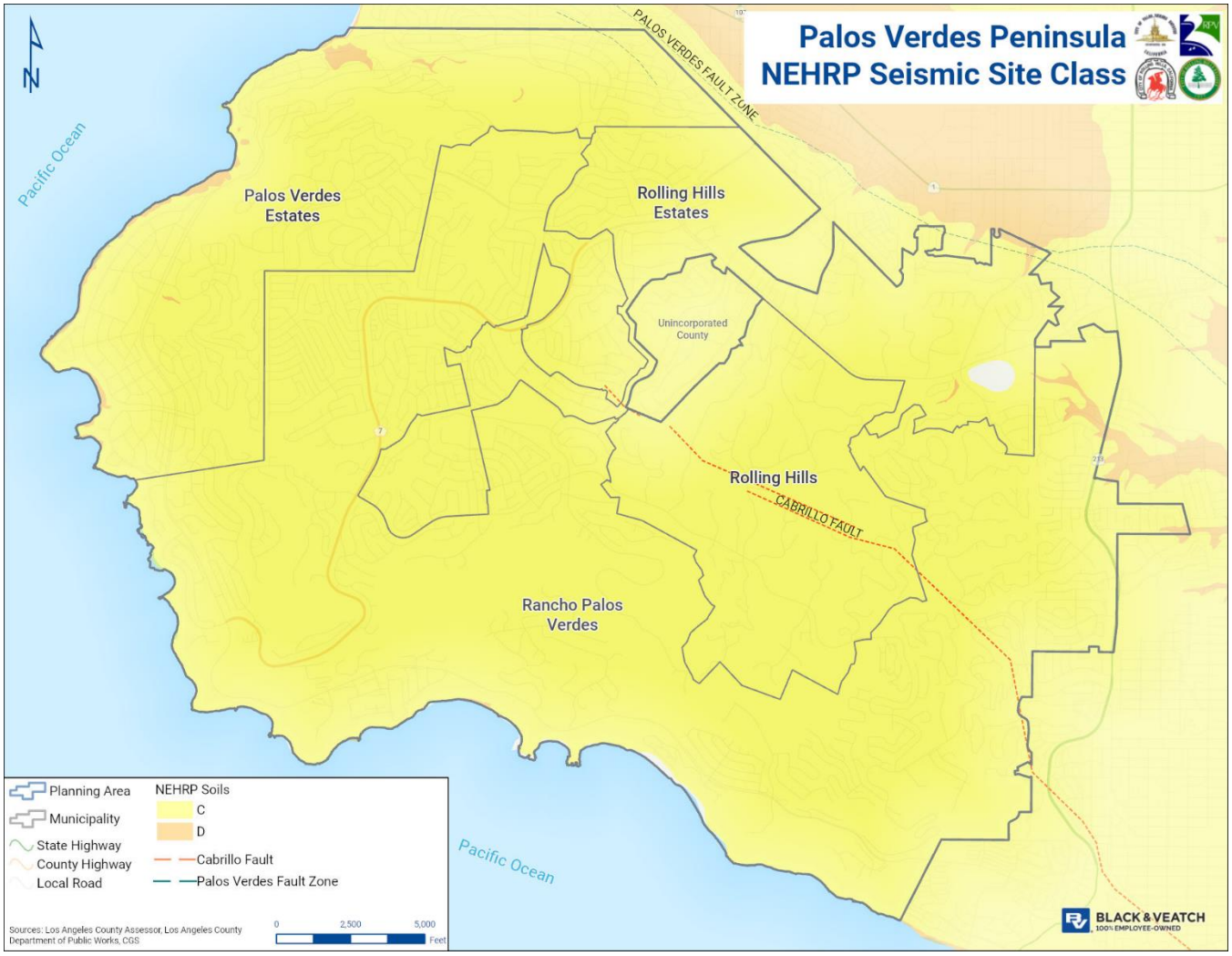


Figure 7-3. Palos Verdes Peninsula NEHRP Seismic Site Class

7.1.3 Extent

Measuring Intensity

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity.

Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude is commonly expressed by ratings on the moment magnitude scale (Mw), the most common scale used today (USGS n.d.). This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows:

Great—Mw > 8
Major—Mw = 7.0 – 7.9
Strong—Mw = 6.0 – 6.9
Moderate—Mw = 5.0 – 5.9
Light—Mw = 4.0 – 4.9
Minor—Mw = 3.0 – 3.9
Micro—w < 3

Intensity

An earthquake's intensity is a measure of how strong an earthquake feels at any one location. It can vary widely across the range where an earthquake is experienced. The modified Mercalli intensity scale is most commonly used. The modified Mercalli intensity scale is generally represented visually using USGS ShakeMaps, which show the expected ground shaking produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust (California Governor's Office of Emergency Services, 2024).

Table 7-1. Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA a (%)
		Resident Buildings	Vulnerable Buildings	
I	Not felt	None	None	<0.17%
II	Weak	None	None	0.17%-1.4%
IV	Light	None	None	1.4%-3.9%
V	Moderate	Very Light	Light	3.9%-9.2%
VI	Strong	Light	Moderate	9.2%-18%
VII	Very Strong	Moderate	Moderate/Heavy	18%-34%
VIII	Severe	Moderate/Heavy	Heavy	34%-65%
IX	Violent	Heavy	Very Heavy	65%-124%
X-XII	Extreme	Very Heavy	Very Heavy	>124%

[a] PGA measure in percent of g, where g is the acceleration of gravity

Source: (USGS, 2011) (USGS, 2025)

Ground Motion

Earthquake hazard assessment is based on expected ground motion. During an earthquake when the ground is shaking, it also experiences acceleration. The peak acceleration is the largest increase in velocity recorded by a particular station during an earthquake. Estimates are developed of the annual probability that certain ground motion accelerations will be exceeded; the annual probabilities can then be summed over a time period of interest.

The most commonly mapped ground motion parameters are horizontal and vertical peak ground accelerations (PGA) for a given soil type. PGA is a measure of how hard the earth shakes, or accelerates, in a given geographic area. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. PGA is measured in g (the acceleration due to gravity) or expressed as a percent acceleration force of gravity (%g). These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal

force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g., single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges).

ShakeMaps

The USGS Earthquake Hazards Program produces maps called ShakeMaps that map ground motion and shaking intensity following significant earthquakes. ShakeMaps focus on the ground shaking caused by the earthquake, rather than on characteristics of the earthquake source, such as magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust.

A ShakeMap shows the extent and variation of ground shaking immediately across the surrounding region following significant earthquakes. Such mapping is derived from peak ground motion amplitudes recorded on seismic sensors, with interpolation where data are lacking based on estimated amplitudes. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. In addition to the maps of recorded events, the USGS creates the following:

- **Scenario ShakeMaps** of hypothetical earthquakes of an assumed magnitude on known faults.
- **Probabilistic ShakeMaps**, based on predicted shaking from all possible earthquakes over a 10,000-year period. In a probabilistic map, information from millions of scenario maps is combined to make a forecast for the future. The maps indicate the ground motion at any given point that has a given probability of being exceeded in a given timeframe, such as a 100-year (1 percent annual chance) event.

The earthquake scenarios modeled for the risk assessment are shown on the following figures:

- Figure 7-5. Compton M7.45 Scenario – Planning area approximately 15 miles from scenario epicenter
- Figure 7-6. Palos Verdes M7.38 Scenario – Planning area approximately 14 miles from scenario epicenter
- Figure 7-7. Redondo Canyon M6.65 Scenario – Planning area approximately 11 miles from scenario epicenter
- Figure 7-8. 100-Year Probabilistic Earthquake Scenario

National Seismic Hazard Map

National maps of earthquake shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown, et al., 2001). The USGS updated the National Seismic Hazard Maps in 2018. New seismic,

geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps (Figure 7-1).

Liquefaction and Soil Types

Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into the ground.

The NEHRP creates maps based on soil characteristics to help identify locations subject to liquefaction. NEHRP soil types define the locations that will be significantly impacted by an earthquake. Table 7-2 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E, and F. In general, these areas are also most susceptible to liquefaction. Figure 7-4 shows liquefaction susceptibility in the Planning Area.

Table 7-2. NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	<180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays > 36 m thick)	-

Warning Time

There is no current reliable way to predict the day or month that an earthquake will occur at any given location. Researchers are studying potential earthquake warning systems to give notice before damaging earthquake events. The warning time could allow someone to take preventative measures such as to get under a desk, step away from a hazardous material, or shut down a computer system (California Governor's Office of Emergency Services, 2024).

Cal OES's Earthquake Early Warning California (MyShake), developed in partnership with UC Berkeley and USGS ShakeAlert, is a statewide, publicly available warning system that provides seconds or tens of seconds to take cover before shaking occurs, depending on the location of the event. The system uses data from motion sensors and Global Navigation Satellite System to detect earthquakes and notify Californians of an earthquake in advance. Individuals can download the MyShake App on their mobile devices for earthquake warnings (California Governor's Office of Emergency Services, 2024).

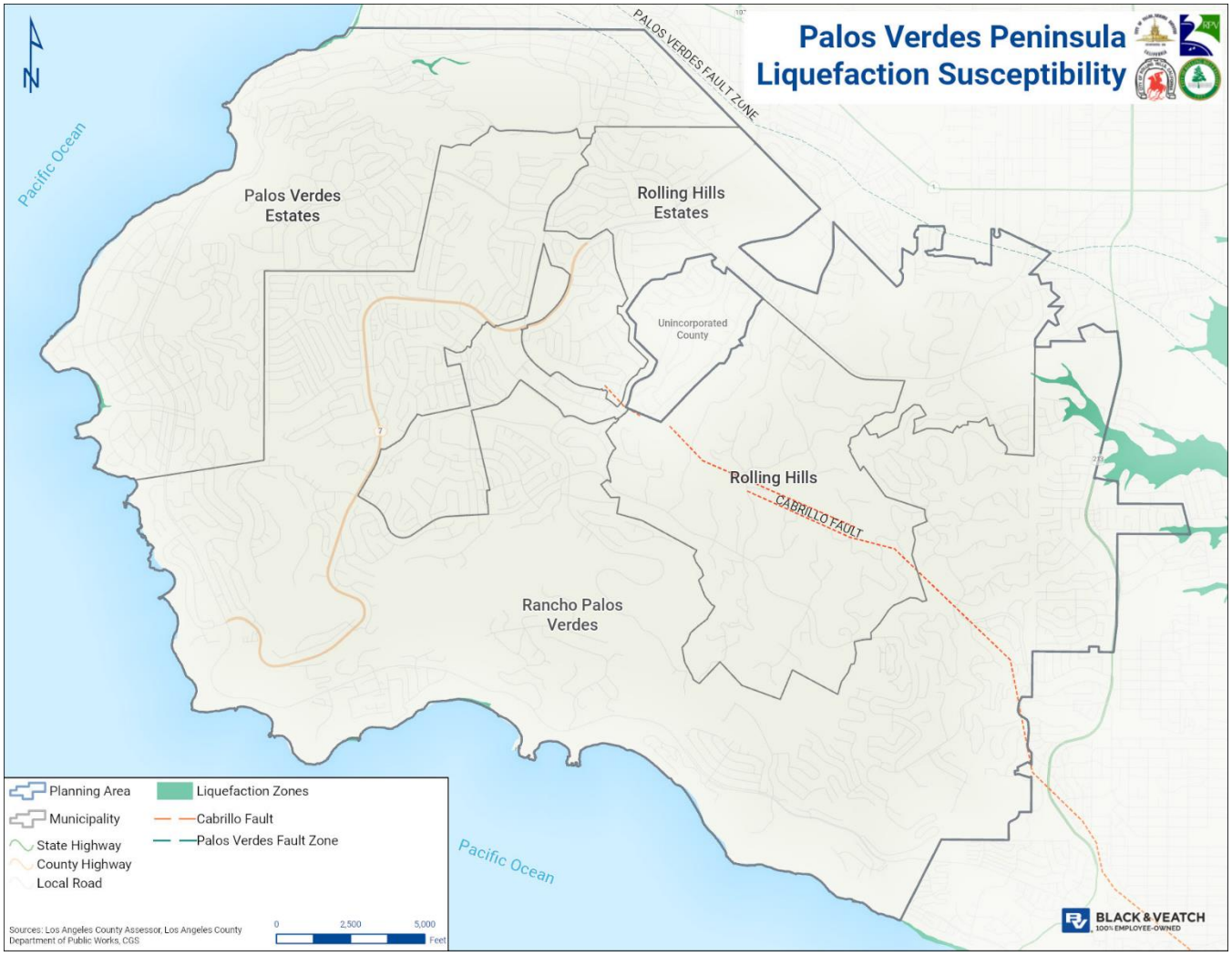


Figure 7-4. Palos Verdes Peninsula Liquefaction Susceptibility

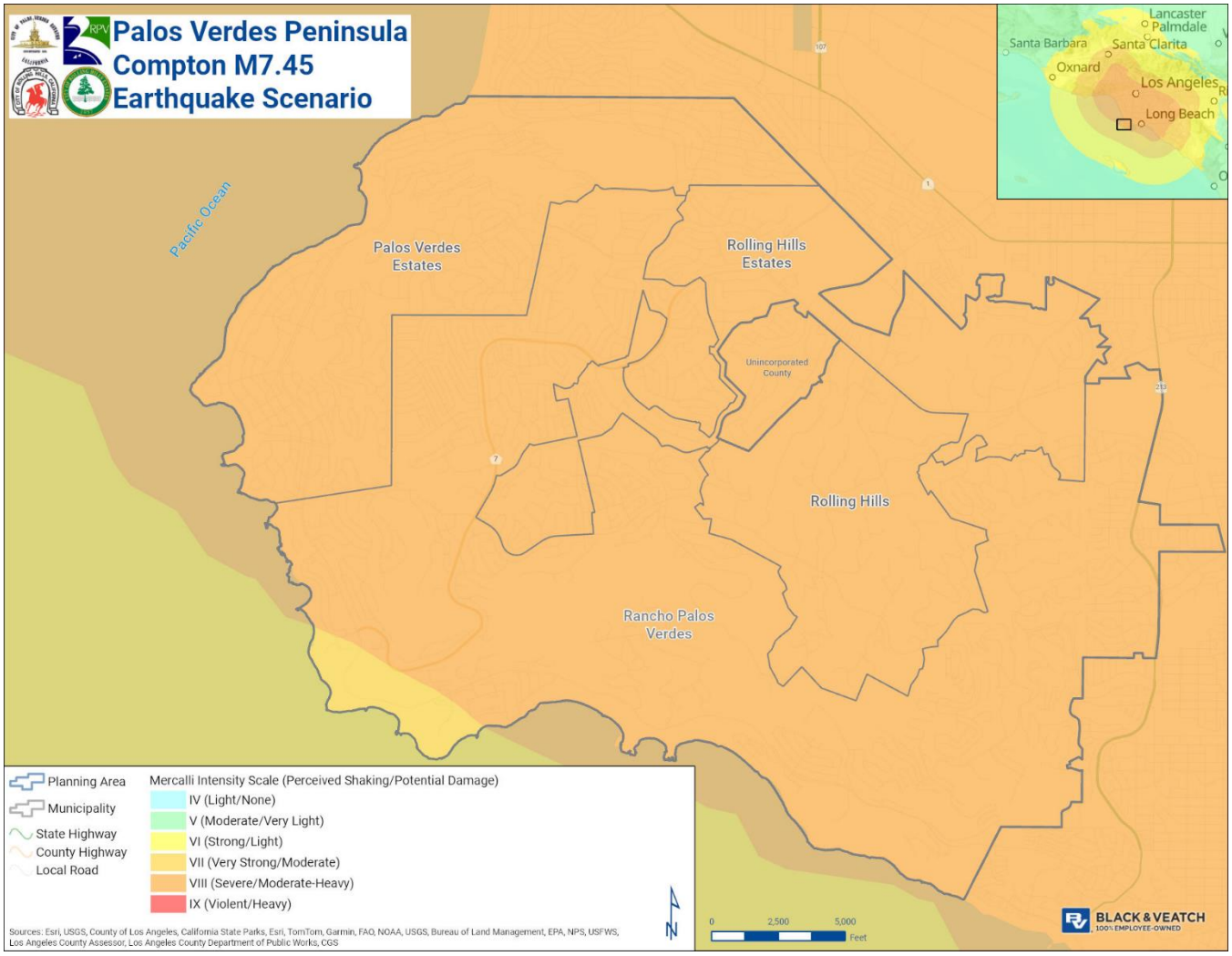


Figure 7-5. Compton M7.45 Scenario

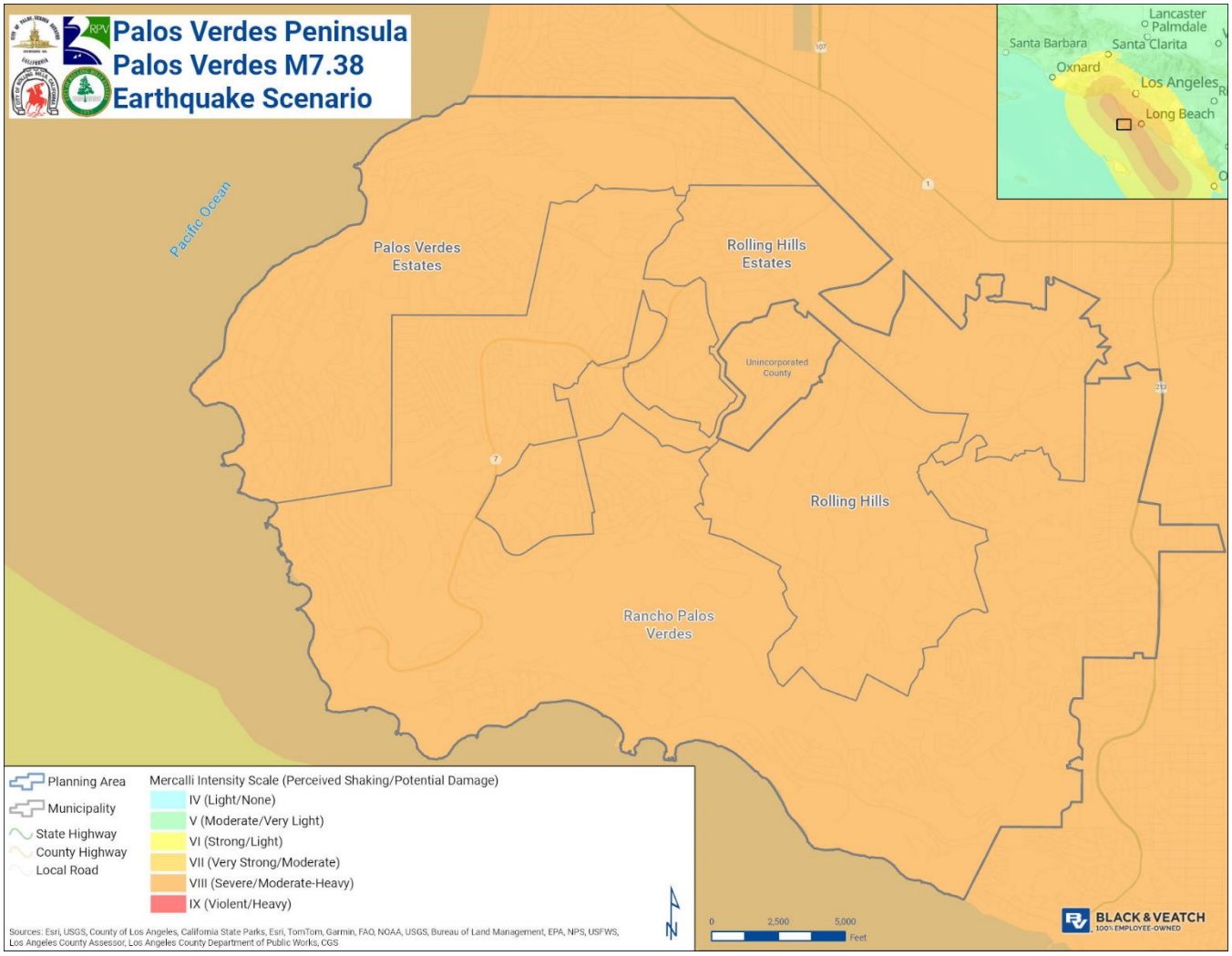


Figure 7-6. Palos Verdes M7.38 Scenario

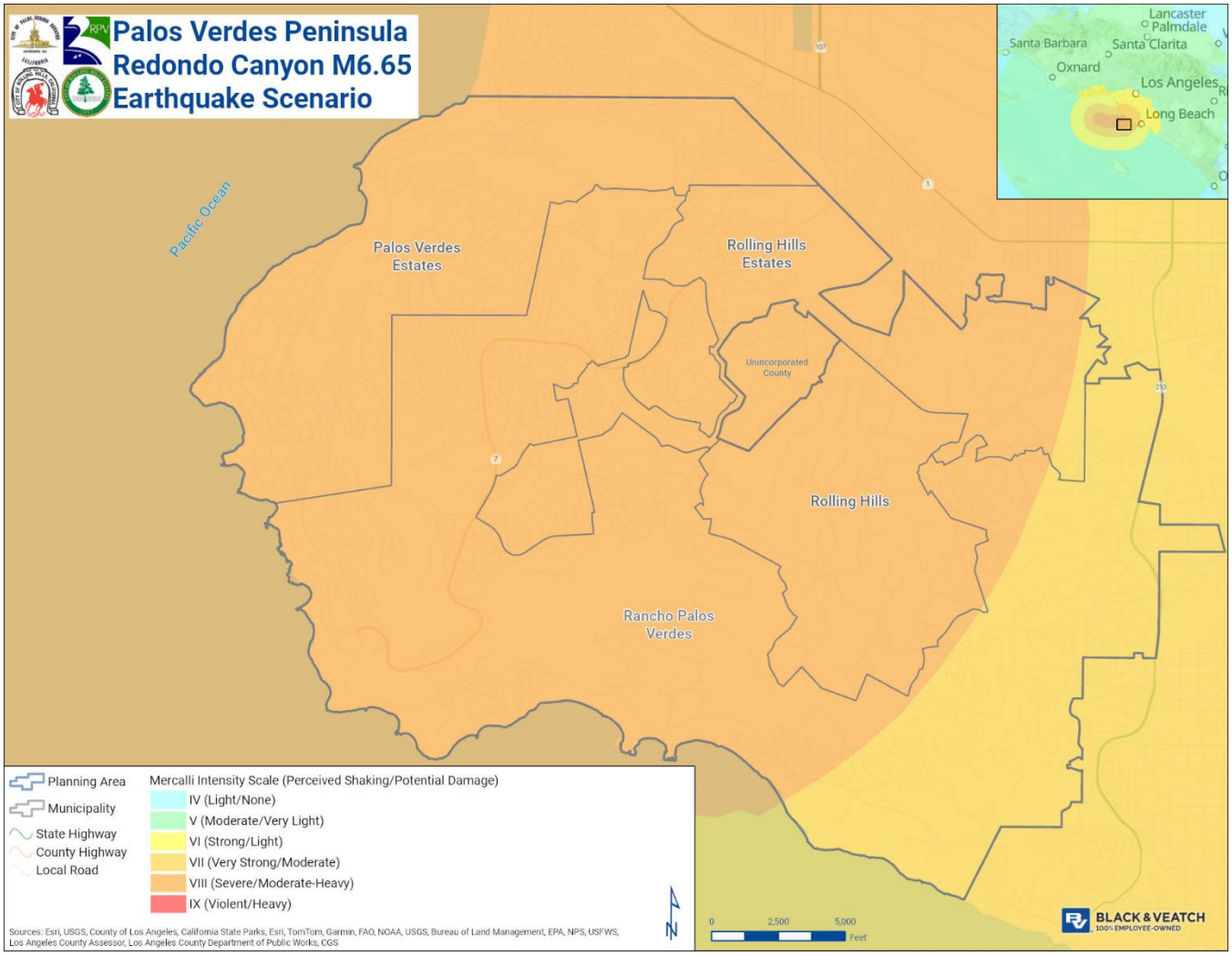


Figure 7-7. Redondo Canyon M6.65 Scenario

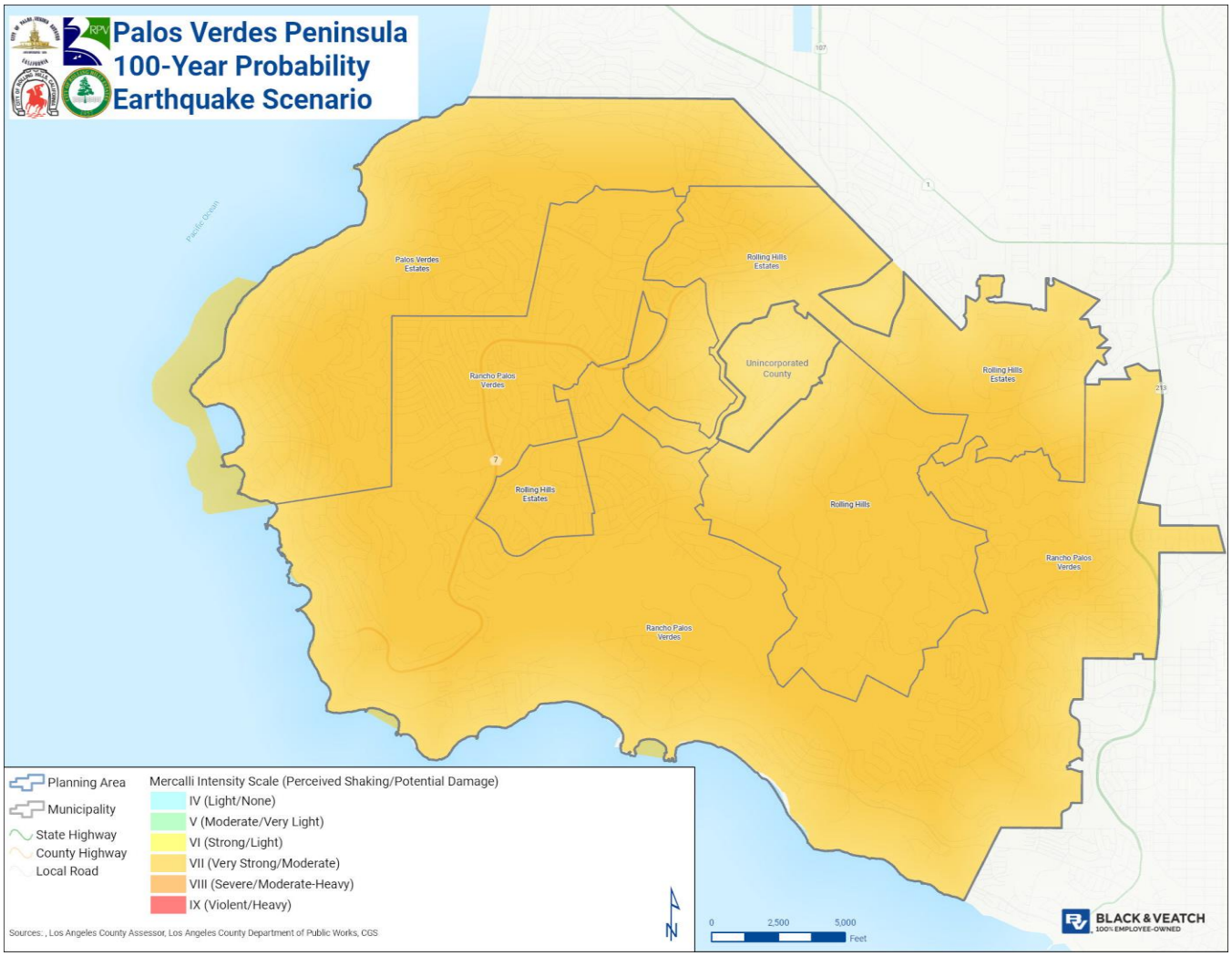


Figure 7-8. 100-Year Probabilistic Earthquake Scenario

Worst-Case Scenario

With the abundance of fault exposure in southern California, the potential scenarios for earthquake activity are many. Any earthquake above a magnitude of 5.0 or greater on faults near the Planning Area would result in significant structural damage, particularly to older, unreinforced masonry buildings and infrastructure not built to modern seismic standards. Followed by earthquakes, secondary hazards such as severe landslides could worsen the situation. Ground shaking could trigger slope failures, blocking transportation and isolating neighborhoods. In dry and peak wildfire conditions, the combination of damaged infrastructure and power lines along with dry vegetation could ignite wildfires.

Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur but would not provide enough warning other than to duck, cover and hold on for personal safety.

7.1.4 Previous Occurrences

The following sections provide a review of previous earthquake occurrences in Los Angeles County.

Declarations

Federal Declarations

Past federal disaster declarations for earthquakes in Los Angeles County have included the 1994 Northridge Earthquake (DR-1008), the 1987 Whittier Narrows Earthquake (DR-799), and the 1971 San Fernando Earthquake (DR-299, but no declarations have been made in the past 5 years since the last mitigation plan updates for Palos Verdes Peninsula communities (FEMA, 2025).

State Proclamations

In the past 5 years, California has not declared disasters related to earthquakes in Los Angeles County (Cal OES, 2025).

USDA Declarations

Between 2019 and 2025, the USDA has not declared disasters related to earthquakes in Los Angeles County (U.S. Department of Agriculture, 2025).

Summary of Significant Events

2024 Earthquake Near Highland Park

An unnamed 4.4 magnitude earthquake along the Puente Hills fault shook the greater Los Angeles area on August 12, 2024. Community members reportedly felt the quake as far north as Porterville and south to Chula Vista.

2010 Pico Rivera Earthquake

Pico Rivera was the epicenter of a magnitude 4.4 earthquake on March 16, 2010. The earthquake struck about 1.5 miles northeast of Pico Rivera at a depth of 11.7 miles, which is considered shallow. The USGS stated that the quake was likely from the Puente Hills' thrust fault. The epicenter was about 4.5 miles south of the epicenter of the 1987 Whittier Narrows earthquake. Both earthquakes exhibited thrust faulting. However, the 2010 earthquake strike rotated clockwise, suggesting that a different thrust system was activated. There were no injuries or major damage, but plenty of people felt the shaking. It was reported to have been felt from San Bernardino County to Santa Monica, and as far south as San Diego.

1994 Northridge Earthquake

The 1994 Northridge Earthquake was the costliest seismic event in California since the 1906 San Francisco Earthquake. The infrastructure of the metropolitan area was severely disrupted. Freeways collapsed, power systems for the city and linked communities as far away as Oregon were temporarily blacked out, and communications were disrupted. The California State HMP reports the Northridge Earthquake caused over $40 billion of disaster losses, 57 deaths, and 11,846 injuries (Cal OES, 2018).

Officially lasting approximately 30 seconds, and with a magnitude of 6.7, this earthquake caused significant damage to buildings. Of 57 fatalities attributed to this quake, 16 were a result of the collapse

of a single structure—the Northridge Meadows apartment building. The ground motion was measured throughout Southern California, including intensity readings of 1.82 g near the Ventura Freeway in the Tarzana area. Ground motions as strong as 1.21 g were measured as far away as Inglewood (approximately 25 miles from Northridge). One "g" of ground motion is enough to make unsecured buildings move off their foundations.

According to the USGS and the Southern California Earthquake Center, the Northridge Earthquake raised nearby mountains by as much as 70 centimeters. The fault, which was previously unknown, appears to be truncated by the fault that broke in the similarly sized 1971 San Fernando Earthquake, the two faults abutting at a depth of 5 miles. The Northridge Earthquake caused many times more damage than the 1971 event, primarily because its fault is directly under the densely populated valley, whereas the 1971 fault lies under the mountains.

The 1971 San Fernando Earthquake

The 1971 San Fernando earthquake (also known as the 1971 Sylmar earthquake) occurred in the early morning of February 9 in the foothills of the San Gabriel Mountains in Southern California. The origin of faulting was located 5 miles north of the San Fernando Valley. The unanticipated thrust earthquake had a magnitude of 6.5 on the Ms scale and 6.6 on the Mw scale, and a maximum Mercalli intensity of XI. Damage was locally severe in the northern San Fernando Valley and surface faulting was extensive to the south of the epicenter in the mountains, as well as urban settings along city streets and neighborhoods. Uplift and other effects affected private homes and businesses. The shaking surpassed building code requirements and exceeded what engineers had prepared for, and although most dwellings in the valley had been built in the prior two decades, even modern earthquake-resistant structures sustained serious damage.

Recent Events

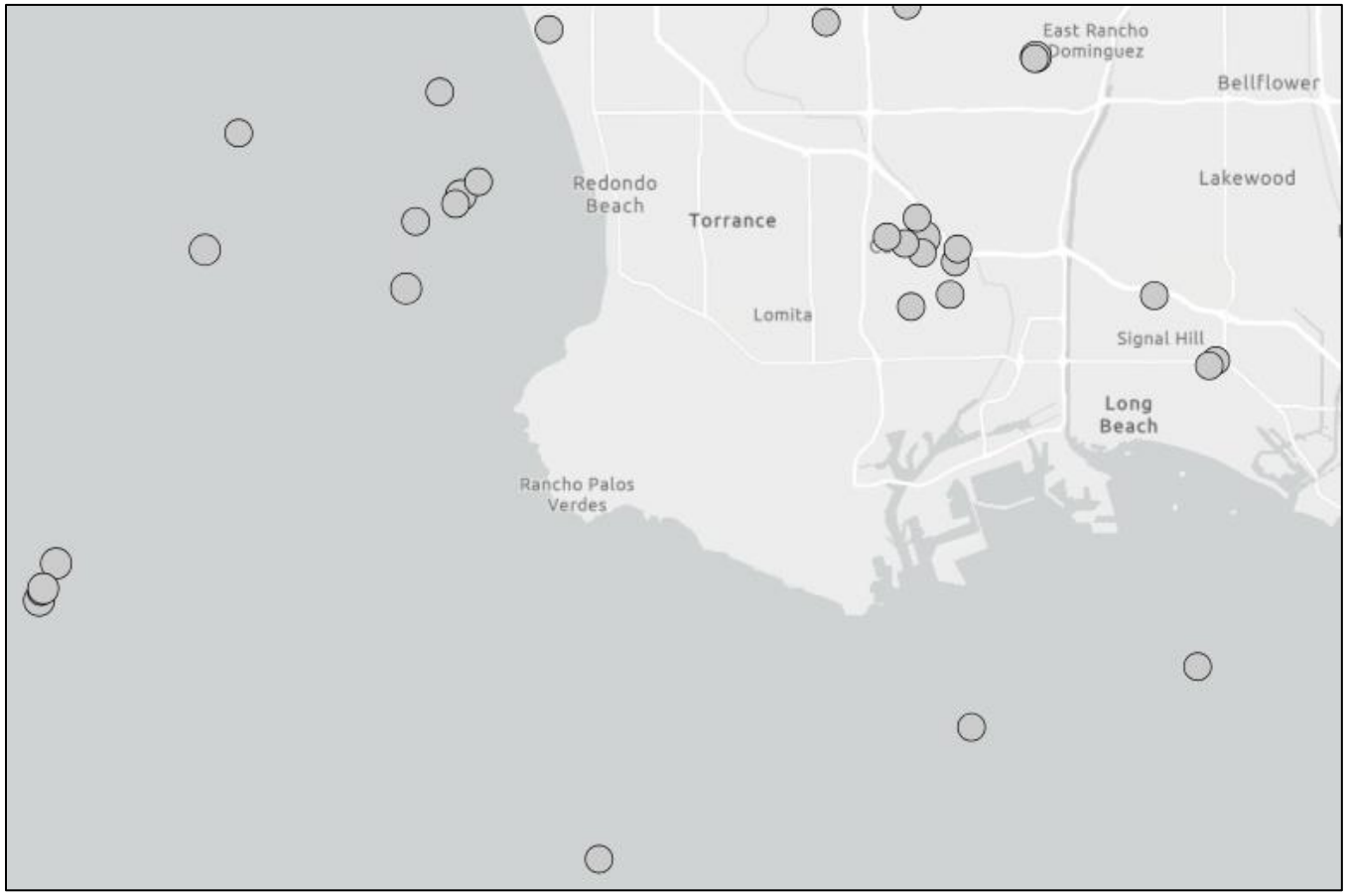
According to the USGS Search Earthquake Catalog, there have been no earthquakes in the Palos Verdes Peninsula in the 4.5+ Richter magnitude since January 2019. Earthquakes near the vicinity of the Palos Verdes Peninsula in the 2.5 – 4.5 Richter magnitude since January 2019 are listed in Table 7-3. None of these events resulted in notable impacts to the Planning Area. Locations of recent events are shown on Figure 7-9.

Table 7-3. USGS Earthquake Reports

Incident Period	Magnitude	Location
May 4, 2019	M 2.6	7 km WSW of Hermosa Beach
May 5, 2019	M 2.5	5 km WSW of Hermosa Beach
December 24, 2019	M 2.7	16 km S of Rancho Palos Verdes
December 24, 2019	M 2.7	16 km S of Rancho Palos Verdes
February 13, 2021	M 2.6	17km S of San Pedro
May 4, 2021	M 2.6	7km WSW of Hermosa Beach
May 9, 2021	M 2.5 - 3.5	5km WSW of Hermosa Beach
June 18, 2021	M 2.8	4 km WSW of Hermosa Beach
September 18, 2021	M 2.8	Carson, CA
September 24, 2021	M 2.6	Carson, CA

Incident Period	Magnitude	Location
January 11, 2022	M 2.8	Carson, CA
January 11, 2022	M 2.5	Carson, CA
October 12, 2022	M 2.5	Carson, CA
November 5, 2022	M 2.7;	Carson, CA
June 8, 2023	M 2.5	Carson, CA
August 25, 2023	M 2.7	Carson, CA
January 1, 2024	M 4.1	18 km S of Rancho Palos Verdes
April 17, 2024	M 2.6	13 km S of Rancho Palos Verdes
July 21, 2024	M 3.6	8km WNW of Palos Verdes Estates
September 2, 2024	M 3.1	22 km W of Rancho Palos Verdes;
September 7, 2024	M 2.8 – 3.2	22 km W of Rancho Palos Verdes
April 26, 2025	M 2.7	7 km W of Seal Beach
July 4, 2025	M2.5	9 km SSE of San Pedro

Source: (USGS, 2025)



Source: (USGS, 2025)

Figure 7-9. USGS Earthquake Catalog 2019 – 2025

7.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, are discussed in the sections following.

Probability

California experiences hundreds of earthquakes each year, most with magnitudes below 3.0 and minimal damage. Earthquakes that cause moderate damage to structures occur several times a year. According to the USGS, a strong earthquake measuring greater than Magnitude 5.0 occurs statewide every 2 to 3 years, and major earthquakes of more than Magnitude 7.0 occur once a decade. The San Andreas Fault has the potential for experiencing major to great events.

Based on the most recent earthquake forecast model for California, scientists estimate that in the next 30 years the Los Angeles region has a 60 percent probability of an earthquake of Magnitude 6.7 or greater, a 46 percent probability of an earthquake of Magnitude 7 or greater, and a 31 percent probability of an earthquake of Magnitude 7.5 (USGS, 2025).

Fault rupture is the sliding movement of rock on either side of a fault. This phenomenon is responsible for causing the resulting shaking. The Third Uniform California Earthquake Rupture Forecast (UCERF3) is a comprehensive model of earthquake occurrence for California. It represents the best available science for authoritative estimates of the magnitude, location, and likelihood of potentially damaging earthquakes (SCEC, 2023). The UCERF3 predicts the probability of an earthquake of Magnitude 6.7 or greater over the next 30 years as shown on Figure 7-10. The UCERF3 also defined the following estimated 30-year probability for the deterministic earthquake scenarios used for the risk assessment in this LHMP:

- Compton M7.45 Scenario = 0.26 percent estimate 30-year probability
- Palos Verdes M7.38 Scenario = 2.73 percent estimate 30-year probability
- Redondo Canyon M6.65 Scenario = 0.20 percent estimate 30-year probability

Source: (Southern California Earthquake Center, 2025)

Figure 7-10. UCERF3 Earthquake Probability

Climate Change

It is unknown whether climate change has a direct impact on earthquake probability or severity. However, cascading hazards related to earthquakes are exacerbated by climate change. Increasing air temperatures and extreme weather events can affect soil integrity and affect erosion, sedimentation, and landslide occurrence associated with earthquakes.

Potential Future Impacts

Since all of the Planning Area is located within earthquake hazard zones, all future development will, to some extent, be exposed to the earthquake hazard. The municipal Planning Partners will strictly enforce all seismic building codes and design standards to prevent loss of life and property from earthquakes. Public education, cooperation with the development community, and individual preparedness are essential.

7.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

7.2.1 Summary of Vulnerability

The entire Planning Area is exposed to the earthquake hazard, so an earthquake has the potential to affect the entire population, and all buildings in the Planning Area, all of the Planning Area's identified critical facilities, and the entire environment of the Planning Area.

7.2.2 Impact on Life, Health, and Safety

Depending on the severity of the earthquake some people may be directly injured or killed. In addition, homes and businesses may be damaged, resources and supplies may be scarce, business interruptions may keep people from working, utilities may have outages, schools may be temporarily closed, and road closures may cause extra time and travel. All of these indirect effects could impact people who suffered no direct harm from the earthquake. Thus, the entire population must deal with the consequences of earthquakes to some degree.

Impacts on persons and households in the Planning Area were estimated for the scenario events assessed through the Level 2 Hazus analysis. Table 7-4 summarizes the results.

Table 7-4. Estimated Earthquake Impact on Persons and Households

City	Compton M7.45		Palos Verdes M7.38		Redondo Canyon M6.65		100-Year Probabilistic	
	Displaced Households	Short-Term Shelter	Displaced Households	Short-Term Shelter	Displaced Households	Short-Term Shelter	Displaced Households	Short-Term Shelter
Palos Verdes Estates	51	22	110	47	81	35	6	2
Rancho Palos Verdes	364	161	873	386	568	257	48	21
Rolling Hills	1	0	2	1	0	0	0	0
Rolling Hills Estates	3	1	10	4	8	3	3	1
Totals	**419**	**185**	**995**	**438**	**657**	**296**	**57**	**25**

Equity Priority Communities

While all people in the Planning Area are considered exposed and potentially vulnerable, those who may live in structures that do not conform to seismic building codes; and therefore, sustain more damage during an event, are more vulnerable. Those organizations with physical structures that provide care, services, and shelter may be impacted as a result of an earthquake. Loss of water, power, roads, phones,

and transportation due to earthquake events can be particularly dangerous for those with certain access and functional needs. Residents who live in neighborhoods with one point of egress may also be more vulnerable if the evacuation route is impacted.

7.2.3 Impact on General Building Stock

Building Age

Table 7-5 identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development. Using these time periods, the planning team used Hazus to identify the number of structures in the Planning Area by date of construction.

Table 7-5. Age of Structures in the Palos Verdes Peninsula

Time Period	Number of Current Structures Built in Period by City		Total	Significance of General Time Frame for Building Requirements
Pre-1933	Palos Verdes Estates	52	66	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
	Rancho Palos Verdes	12		
	Rolling Hills	0		
	Rolling Hills Estates	2		
1933 to 1940	Palos Verdes Estates	71	102	In 1940, the first strong motion recording was made.
	Rancho Palos Verdes	27		
	Rolling Hills	3		
	Rolling Hills Estates	1		
1941 to 1960	Palos Verdes Estates	1,582	5,127	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
	Rancho Palos Verdes	2,686		
	Rolling Hills	160		
	Rolling Hills Estates	699		
1961 to 1975	Palos Verdes Estates	1,595	11,081	In 1975, significant improvements were made to lateral force requirements.
	Rancho Palos Verdes	7,793		
	Rolling Hills	242		
	Rolling Hills Estates	1,451		
1976 to 1993	Palos Verdes Estates	1,047	3,973	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
	Rancho Palos Verdes	2,033		
	Rolling Hills	188		
	Rolling Hills Estates	705		
1994 to Present	Palos Verdes Estates	716	2,125	Seismic code is currently enforced.
	Rancho Palos Verdes	848		
	Rolling Hills	117		
	Rolling Hills Estates	444		

The number of structures does not reflect the number of total housing units, as many multi-family units and attached housing units are reported as one structure. About 9 percent of the Planning Area's structures were constructed after the Uniform Building Code was amended in 1994 to include seismic

safety provisions. Less than 1 percent of the structures were built before 1933 when there were no building permits or seismic standards.

Loss Potential

Property losses were estimated through the Level 2 Hazus analysis for the assessed earthquake fault scenarios. Table 7-6 shows the estimates for damage to structures and building contents with the percent of total replacement value. The Hazus analysis also estimated the amount of earthquake-caused debris in the Planning Area for the assessed events, as summarized in Table 7-7.

Table 7-6. Loss Estimates for Fault Scenarios

City	Estimated Loss Associated with Earthquake			% of Total Replacement Value
	Structure	Contents	Total	
Compton M7.45				
Palos Verdes Estates	$446,647,695	$146,765,435	$593,413,130	10.3%
Rancho Palos Verdes	$1,043,271,733	$348,773,413	$1,392,045,146	10.8%
Rolling Hills	$99,677,745	$30,707,295	$130,385,040	12.2%
Rolling Hills Estates	$468,250,162	$160,116,003	$628,366,164	14.4%
Total	**$2,057,847,334**	**$686,362,146**	**2,744,209,480**	**11.4%**
Palos Verdes M7.38				
Palos Verdes Estates	$538,584,168	$183,729,347	$722,313,516	12.5%
Rancho Palos Verdes	$1,281,027,168	$437,494,870	$1,718,522,038	13.3%
Rolling Hills	$112,505,474	$34,967,268	$147,472,741	13.8%
Rolling Hills Estates	$670,754,311	$230,028,018	$900,782,328	20.6%
Total	**$2,602,871,121**	**$886,219,503**	**3,489,090,624**	**14.5%**
Redondo Canyon M6.65				
Palos Verdes Estates	$531,917,704	$179,507,789	$711,425,492	12.3%
Rancho Palos Verdes	$1,075,689,302	$361,305,822	$1,436,995,124	11.2%
Rolling Hills	$94,397,701	$29,210,738	$123,608,439	11.5%
Rolling Hills Estates	$451,096,021	$156,780,926	$607,876,947	13.9%
Total	**$2,153,100,728**	**$726,805,274**	**2,879,906,001**	**11.9%**
100-Year Probabilistic				
Palos Verdes Estates	$170,510,108	$54,802,670	$225,312,778	3.9%
Rancho Palos Verdes	$402,630,021	$133,417,897	$536,047,918	4.2%
Rolling Hills	$52,876,343	$15,955,268	$68,831,611	6.4%
Rolling Hills Estates	$98,305,937	$43,482,788	$141,788,725	3.2%
Total	**$724,322,409**	**$247,658,623**	**971,981,032**	**4.0%**

Table 7-7. Estimated Earthquake-Caused Debris

City	Debris to Be Removed (tons)x 1000			
	Compton M7.45	Palos Verdes M7.38	Redondo Canyon M6.65	100-Year Probabilistic
Palos Verdes Estates	19.59	27.65	25.40	6.27
Rancho Palos Verdes	43.78	69.42	47.23	14.27
Rolling Hills	3.34	5.28	2.81	1.05
Rolling Hills Estates	20.38	31.88	20.78	6.08
Total	**87.09**	**134.23**	**96.22**	**27.67**

7.2.4 Impact on Community Lifelines

The entire Planning Area is vulnerable to earthquakes, including all community lifelines. Functional downtime is the most significant earthquake impact on critical facilities and community lifelines. The severity of this impact is based on the amount of time it takes to restore damaged facilities to operational status. Hazus estimates damage and functional downtime for earthquake scenarios. Refer to Table 7-8 for a summary of community lifelines in the earthquake hazard areas.

Table 7-8. Community Lifelines in Earthquake Hazard Area

City	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
Palos Verdes Estates	11	1	0	0	1	11	1	4	29
Rancho Palos Verdes	174	3	0	0	7	34	0	13	231
Rolling Hills	1	0	0	0	0	4	0	1	6
Rolling Hills Estates	12	2	0	0	8	24	0	6	52
Total	198	6	0	0	16	73	1	24	318

7.2.5 Impact on the Economy

In the Planning Area, loss of employment and lost property tax basis would be an economic impact. A major earthquake could disrupt, damage, or destroy computer facilities, which could curtail the operations of banks, insurance companies, and other elements of the financial community for a period of time. This may affect local government, businesses, and residents' ability to make payments and purchases.

7.2.6 Impact on Historic and Cultural Resources

Several sites of the Planning Area, such as the Point Vicente Interpretive Center and the Palos Verdes Library District, feature historic and cultural content dating back over a century. In the event of an earthquake, these sites face a heightened risk of severe damage or total collapse. The loss would not only be structural but also cultural, erasing irreplaceable links to the region's past.

7.2.7 Impact on Ecosystems and Natural Resources

Earthquakes can cause a range of environmental impacts. Earthquake-induced landslides may severely damage surrounding habitats, while shifts in the earth's structure can reroute streams, altering water quality and disrupting ecosystems. Groundwater-fed streams or springs may dry up because of changes in underlying geology. Additionally, earthquakes pose a significant risk of hazardous material release through various mechanisms, including the following:

- The toppling of elevated tanks or overturning of horizontal tanks
- Structural failures

- Dislodging of asbestos
- Sloshing from open-topped containers
- Storage container failures
- Under- or above-ground pipeline breaks

7.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

There has been little change in earthquake vulnerability in the Planning Area since the prior Planning Area HMPs. The population remains small, and there has been minimal new construction that would alter the Planning Area's exposure. While seismic risk is inherent because of regional fault lines, the lack of significant development means that overall vulnerability has not increased meaningfully.

7.3 MITIGATION OPPORTUNITIES

Table 7-9 presents a range of potential opportunities considered by the Planning Partnership for mitigating the earthquake hazard.

Table 7-9. Potential Opportunities to Mitigate the Earthquake Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• None
Reduce Exposure and Vulnerability		
• Locate outside of hazard area (off soft soils) • Retrofit structure (anchor house structure to foundation) • Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances) • Build to higher design	• Locate or relocate critical functions outside hazard area where possible • Build redundancy for critical functions and facilities • Retrofit critical buildings and areas housing critical functions	• Locate critical facilities or functions outside hazard area where possible • Harden infrastructure • Provide redundancy for critical functions • Adopt higher regulatory standards • Perform seismic retrofits for vulnerable critical buildings and areas
Build Local Capacity		
• Practice "drop, cover, and hold" • Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-	• Adopt higher standard for new construction; consider "performance-based design" when building new structures • Keep cash reserves for reconstruction	• Provide better hazard maps • Provide technical information and guidance • Enact tools to help manage development in hazard areas (e.g., tax incentives, information) • Include retrofitting and replacement of critical system elements in capital improvement plan • Develop strategies to take advantage of post-disaster opportunities

Community Scale	Organizational Scale	Government Scale
sufficiency during an event • Keep cash reserves for reconstruction • Become informed on the hazard and risk reduction alternatives available • Develop a post-disaster action plan for your household • Sign up for early warning systems • Sign up for MyShake	• Inform your employees on the possible impacts of earthquakes and how to deal with them at your work facility. • Develop a continuity of operations plan	• Warehouse critical infrastructure components such as pipe fittings, valves, pumps, power line, and road repair materials • Solidify supplemental power supply to tanks and pump stations (generator program) • Develop and adopt a continuity of operations plan • Initiate triggers guiding improvements (such as <50% substantial damage or improvements) • Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities • Develop a post-disaster action plan that includes grant funding and debris removal components
Nature-based Opportunities		
• None identified		

8. FLOOD

8.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

8.1.1 Description of the Hazard

Defining the Hazard

Flooding is any overflowing of water onto land that is normally dry, due to rain, ocean waves, or the failure of a dam or levee (NOAA National Severe Storms Laboratory, 2023). Floods are the most common of all weather-related natural disasters. In urban areas, where buildings, highways, driveways, and parking lots reduce the ground's ability to absorb rainfall, the resulting increase in runoff can overwhelm constructed storm drain systems, resulting in flooding on nearby roads and buildings. The Palos Verdes Peninsula is typically exposed to the following flood types, with each further described below:

- **Inland flooding** which includes riverine flooding, flash flooding, and urban flooding.
- **Coastal flooding** which includes flood impact from long-term inundation from sea-level rise, tsunami, and coastal erosion.

Inland Flooding

Inland flooding can include riverine flooding, flash flooding, and localized flooding.

Riverine Flooding

Riverine flooding, or fluvial flooding, is when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land. This occurs when the flow of a river exceeds the bank sides and causes damage or obstruction to a nearby floodplain. Riverine flooding can turn into a flash flood if the river is at or above its flood stage and if the soil is saturated (FEMA, 2025).

Flash Flooding

A flash flood is a rapid inundation of low-lying areas caused by heavy rain associated with severe thunderstorms, tropical systems, or melting water from ice or snow. Flash flooding also occurs far away from water bodies when a large volume of water cannot be absorbed by the soil or storm water systems and travels overland unimpeded (NWS, 2019).

Urban Flooding

Urban (stormwater) flooding occurs in developed areas when heavy rainfall runoff overwhelms the local stormwater drainage systems (NOAA, 2025). Water that does not evaporate or infiltrate into the ground is carried by conduits to waterways such as creeks, rivers, or the ocean. These drainage systems have two purposes: 1) to control storm water runoff during periods of heavy rainfall; and 2) to minimize disruption of activity from more frequently occurring, less significant storms. Urban flooding occurs when runoff exceeds system capacity, or because systems are blocked from lack of maintenance or other obstruction (NOAA NWS, 2025).

Coastal Flooding

Coastal areas can experience various kinds of flooding related hazards including storm surge, sea level rise, erosion, and tsunami. The combination of these events can result in the total perceived coastal flooding event. Coastal flooding can be caused by a combination of inputs including astronomical tides, El Niño, and storm surge from coastal storms.

Storm Surge

Storm surge is the abnormal rise in seawater level during a storm, measured as the height of the water above the normal predicted astronomical tide. The surge is caused primarily by a storm's winds pushing water onshore. The amplitude of the storm surge at any given location depends on the orientation of the coastline with the storm track; the intensity, size, and speed of the storm; and the local bathymetry (NOAA, n.d.).

Storm tide is the total observed seawater level during a storm, resulting from the combination of storm surge and the astronomical tide. Astronomical tides are caused by the gravitational pull of the sun and the moon and have their greatest effects on seawater level during new and full moons—when the sun, the moon, and the Earth are in alignment. As a result, the highest storm tides are often observed during storms that coincide with a new or full moon (NOAA, n.d.).

Sea Level Rise

Relative or local sea levels are affected by global sea level fluctuations, changes in land elevation, winds, and ocean circulation. It refers to the height of the water as measured along the coast relative to a specific point on land. Tide stations measure local sea level rise. Water measurements at the tide stations are referenced to stable vertical points on the land, and a known relationship is established. As the temperature of the Earth changes, so does sea level. Temperature and sea level are linked for the following two main reasons (USEPA, 2025):

- Land ice melt: Changes in the volume of water and ice on land (namely glaciers and ice sheets) can increase or decrease the volume of water in the ocean.
- Thermal expansion: As water warms, it expands slightly—an effect that is cumulative over the entire depth of the oceans.

Rising sea level inundates low-lying wetlands and dry land, erodes shorelines, contributes to coastal flooding, and increases the flow of salt water into estuaries and nearby groundwater aquifers. Higher sea level also makes coastal infrastructure more vulnerable to damage from storms (USEPA, 2025).

Tsunami

A tsunami is a series of ocean waves that sends surges of water (potentially reaching heights of over 100 feet) onto land. Tsunamis are primarily caused by underwater earthquakes. The earthquake's impact displaces the body of water above it, causing a tsunami. They can be unpredictable, continue for hours and cause severe damage along coastal communities. Most of the damage found in the aftermath of a tsunami is due to the surge of water, wave impacts, strong currents, erosion, and debris. This leads to the destruction or damage of structures; disruption of transportation, power and communications; and more (FEMA, 2023a).

Coastal Erosion

Coastal erosion is the loss of sediment along coastal waterways due to waves and currents. Loss of sediment along beaches can lead to a greater risk of collapse of coastal bluffs. Erosional events can occur rapidly from a single storm event or take place gradually with incremental losses taking place over weeks, months, and years.

Some methods used in the past to stop or reduce coastal erosion actually exacerbated the problem. Shore protection structures such as seawalls and revetments often are built to stabilize the upland property, but they can subject down-drift beaches to increased erosion. Typically, they eliminate natural wave run-up and sand deposition processes and can increase reflected wave action and currents at the waterline. Increased wave action can cause localized scour in front of structures and prevent settlement of suspended sediment (FEMA, 1996).

Cause of the Hazard

Inland flooding typically occurs when prolonged rain falls over several days, when intense rain falls over a short period of time, or when a debris jam causes a river or stream to overflow onto the surrounding area. The most common cause of flooding is water due to rain that accumulates faster than soils can absorb it or rivers can carry it away (NWS, n.d.).

The California DWR defines the following causes of inland and coastal flood hazards (DWR, 2019):

- **Riverine Flooding** occurs when rivers, streams, and lakes overflow their banks. This includes flooding caused by levee failure and channel erosion. Areas adjacent to local streams and creeks can also experience flooding as a result of excessive runoff from heavy rainfall and accumulation of water flowing over broad flat areas
- **Flash Flooding** is a sudden, rapid flooding of low-lying areas typically caused by intense rainfall. Flash floods can also occur from the collapse of a manmade structure. Rapidly rising water can reach heights of 30 feet or more.
- **Urban Flooding** occurs in both urban and non-urban areas during or after a storm. Any storm, particularly slow-moving, steady rainstorms, can overwhelm drainage systems. When the system backs up, pooling water can flood streets, yards, and even the lower floors of homes and

businesses. Even less intense storms can cause this type of flooding when leaves, sediment, and debris plug storm drains.

- **Coastal Flooding** happens through a process known as "storm surges," when ocean waves are significantly larger than normal. If a storm event corresponds with a higher than normal tide, extensive flooding can occur. Winds blowing in an onshore direction (from the sea toward the land) can cause the water to "pile up" against the coast, overtopping natural and manmade flood protection structures like sea walls. Coastal communities, especially in low-lying areas, are highly susceptible to this hazard (DWR 2019).

Tsunamis are primarily caused by underwater earthquakes. The earthquake's impact displaces the body of water above it, causing a tsunami. Other causes of tsunamis include landslides, volcanic activity, certain types of severe weather and—potentially—near-Earth objects like asteroids or comets that collide with or explode above the ocean (FEMA, 2023a).

Summary of Potential Impacts

Flooding in the Palos Verdes Peninsula can have significant impacts on the people, structures, infrastructure, and natural environment. Roads, bridges, and buildings can be severely damaged or destroyed, making transportation difficult and disrupting daily life and emergency response efforts. Hydrostatic pressures and flowing floodwaters can easily cause structures to collapse or float away. This can lead to costly repairs and loss of property value, impacting homeowners and businesses. Floodwaters can contaminate drinking water and lead to the spread of contaminants and diseases. During severe flood events, residents may need to evacuate their homes, which can lead to displaced residents and the potential increased risk of drowning during evacuation efforts. Flooding can result in scouring and erosion of sediment in areas with flow or wave action.

Cascading Hazard Impacts

Flooding often initiates a series of cascading hazards that extend beyond direct inundation caused by a flood event. One of the most significant secondary impacts is bank and bluff erosion. In many cases, the threat and effects of erosion are worse than actual flooding. This is particularly evident along steep river reaches, canyons, and coastal bluffs, where fast-moving floodwaters may recede quickly but aggressively scour banks and slopes, destabilizing land and progressively encroaching on adjacent properties.

Flood impacts can be further amplified when precipitation-driven riverine or urban flooding coincides with coastal flooding, resulting in elevated total water levels and more widespread or prolonged flooding than would occur from a single source alone. Prolonged soil saturation from high flows can also trigger landslides and slope failures, especially in areas with steep terrain or pre-existing instability. In addition, floodwaters can mobilize hazardous materials when storage tanks or containment systems fail, allowing pollutants to enter waterways or drainage systems.

Along coastal areas, flood events intensify erosion through increased storm-driven wave energy, coastal inundation, and surface runoff that undercut bluffs and destabilize slopes within active landslide complexes. Heavy rainfall combined with elevated ocean conditions has been shown to accelerate bluff retreat and landslide movement, increasing risks to coastal infrastructure, roadways, and residential development (NASA, 2025).

8.1.2 National Flood Insurance Program Participation

Properties constructed after adoption of a FIRM or DFIRM are considered less vulnerable to flooding because they were constructed after adoption of regulations and codes to decrease vulnerability. Properties built before adoption of a FIRM or DFIRM are more vulnerable to flooding because either they do not meet code or are within hazardous areas.

Table 8-2 lists flood insurance statistics for the cities of the Palos Verde Peninsula, the Planning Area municipalities that participate in the NFIP. As of December 31, 2025, 133 policies were in force for the Planning Area, providing more than $43.6 million in insurance. There were two repetitive loss (RL) properties in the City of Palos Verde Estates jurisdiction.

Table 8-1. Riverine Flooding Sources in the Palos Verde Peninsula

City	Date of Entry	Current FIRM Date	Flood Insurance Policies	Insurance in Force	Annual Premiums	Claims	RL or SRL Properties	Value of Claims
Palos Verdes Estates	November 21, 2001	April 21, 2021	49	$15,976,000	$42,514	15	2	$39,750
Rancho Palos Verdes	September 26, 2008	April 21, 2021	51	$16,218,000	$35,640	8	-	$261,095
Rolling Hills	September 26, 2008	NSFHA	19	$6,650,000	$11,000	1	-	-
Rolling Hills Estates	September 26, 2008	NSFHA	14	$4,727,000	$9,074	9	-	$12,344
Total			**133**	**$43,571,000**	**$98,228**	**33**	**2**	**$313,189**

Source: (FEMA, 2025)

To be eligible to participate in the NFIP, a local government must possess the authority to adopt codes and standards to regulate development in the Special Flood Hazard Area. The special purpose district planning partners do not possess these authorities and are therefore not listed in this section.

8.1.3 Location

Inland Flooding

Riverine and flash flooding occurs along rivers and streams in the Palos Verdes Peninsula. Table 8-2 identifies the potential riverine flooding sources for the Planning Area.

Table 8-2. Riverine Flooding Sources in the Palos Verde Peninsula

Flooding Source	Community	HUC-8 Subbasin(s)
Agua Amarge Canyon Creek	City of Palos Verdes Estates	18070104
Malaga Canyon Creek	City of Palos Verdes Estates	18070104
Unnamed Stream Main Reach	City of Palos Verdes Estates	18070104

Flooding Source	Community	HUC-8 Subbasin(s)
Unnamed Stream Tributary 1	City of Palos Verdes Estates	18070104
Unnamed Stream Tributary 2	City of Palos Verdes Estates	18070104
UNKNOWN 1 to Malaga Canyon Creek	City of Palos Verdes Estates	18070104
UNKNOWN 2 to Malaga Canyon Creek	City of Palos Verdes Estates	18070104

Source: (FEMA, 2021)

Floodplains

The land area susceptible to being inundated or flooded by water from any source (e.g., river, stream, lake, estuary) is referred to as a floodplain. The floodplain includes the floodway and the floodway fringe to convey the flood event and provide flood water storage. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. However, not all flooding occurs in such areas. Flash and urban flooding often occur outside of designated floodplain areas.

Flood hazard areas are identified as **Special Flood Hazard Area (SFHA)**. SFHAs are defined as the area that will be inundated by the flood event having a 1 percent chance of being equaled to or exceeded in any given year. The 1 percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements. The following are additional definitions relating to flood maps (FEMA 2025):

- Flood hazard areas identified on the Flood Insurance Rate Map (FIRM) are identified as a SFHA.
- SFHA is the area that will be inundated by the flood event having a 1 percent chance of being equaled or exceeded in any given year.
- SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2 percent annual chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2 percent annual chance flood, are labeled.

The 1-percent annual chance flood is also referred to as the base flood or **100-year flood**. The 1-percent annual chance floodplain is also commonly referred to as the **100-year floodplain**.

A 100-year flood is *not* a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur

In the Planning Area, FEMA has designated several areas along canyons and creeks, such as the Malaga Creek and Margate Canyon Creek, as SFHAs due to their susceptibility to seasonal flooding and runoff from steep terrain. These mapped areas are subject to federal floodplain management regulations under the NFIP, and property owners in these zones may be required to carry flood insurance if they have federally backed mortgages.

Figure 8-1 displays the FEMA 1 percent annual chance flood zone for the Palos Verde Peninsula.

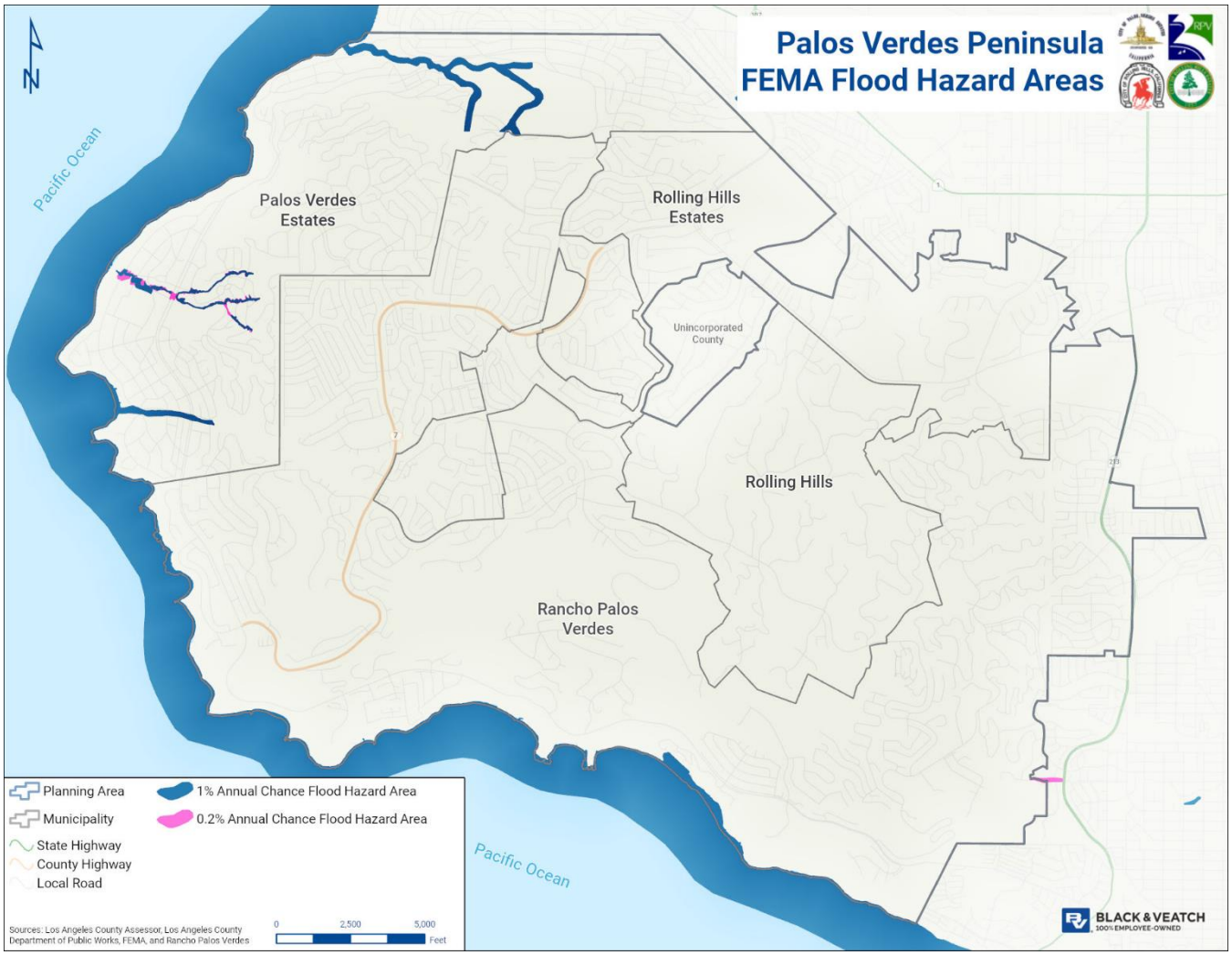


Figure 8-1. FEMA 1 Percent Annual Chance Flood Zone

Table 8-3 summarizes the number of acres in Planning Area in the mapped FEMA floodplain.

Table 8-3. Acres of Floodplain in FEMA 1 Percent Annual Chance Flood Zones

City	Acres of Floodplain
Palos Verdes Estates	111
Rancho Palos Verdes	70
Rolling Hills	0
Rolling Hills Estates	0
Total	**180**

Coastal Flooding

Storm Surge

The Southern California coastline is exposed to waves generated by winter and summer storms originating in the Pacific Ocean. It is not uncommon for these storms to cause 15-foot breakers. The occurrence of such a storm event in combination with high astronomical tides and strong winds can cause a significant wave runup and allow storm waves to attack higher than normal elevations along the coastline. When this occurs, shoreline erosion and coastal flooding frequently results in damage to inadequately protected structures and facilities located along low-lying portions of the shoreline.

Sea Level Rise

The potential for sea level rise flooding is confined to very limited Planning Areas along the coast because of the topography of the region, defined primarily by coastal bluffs.

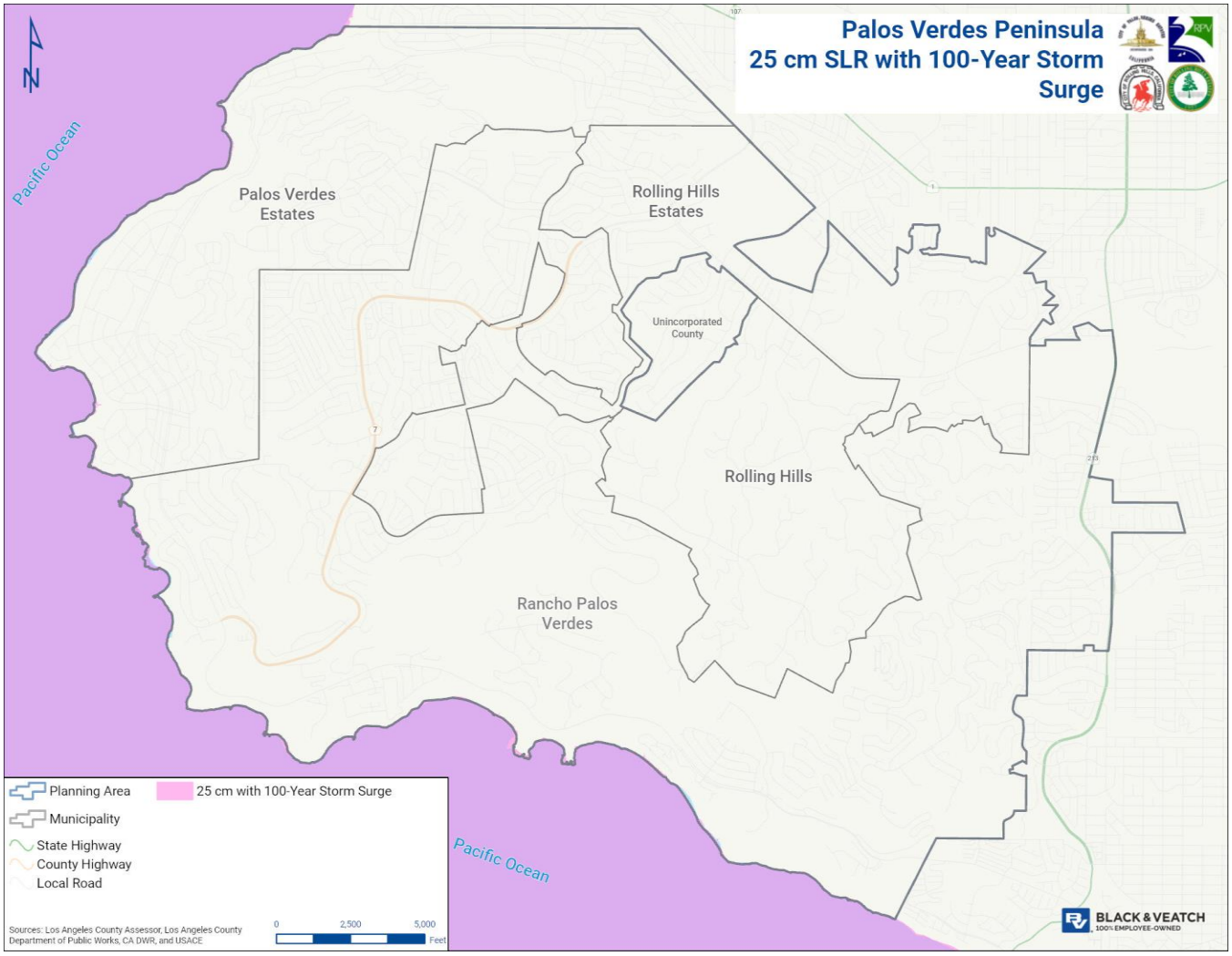


Figure 8-2. 25 cm Sea Level Rise with 100-Year Storm Surge

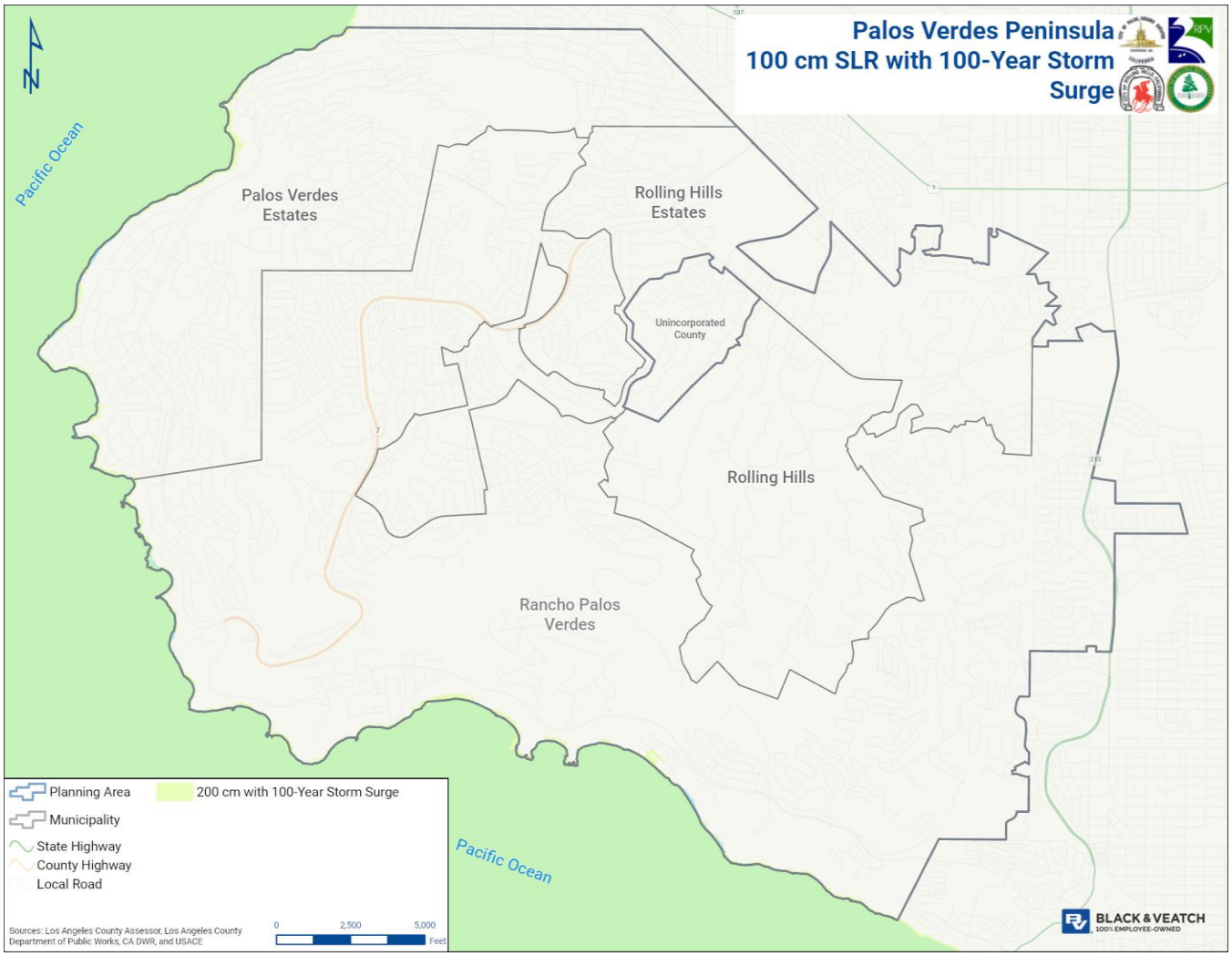


Figure 8-3. 100 cm Sea Level Rise with 100-Year Storm Surge

Tsunami

Areas prone to flooding from a tsunami include low-lying coastal areas. These are very limited in the Planning Area due to the topography of the region, defined primarily by coastal bluffs. Figure 8-4 displays the tsunami inundation area for the Planning Area.

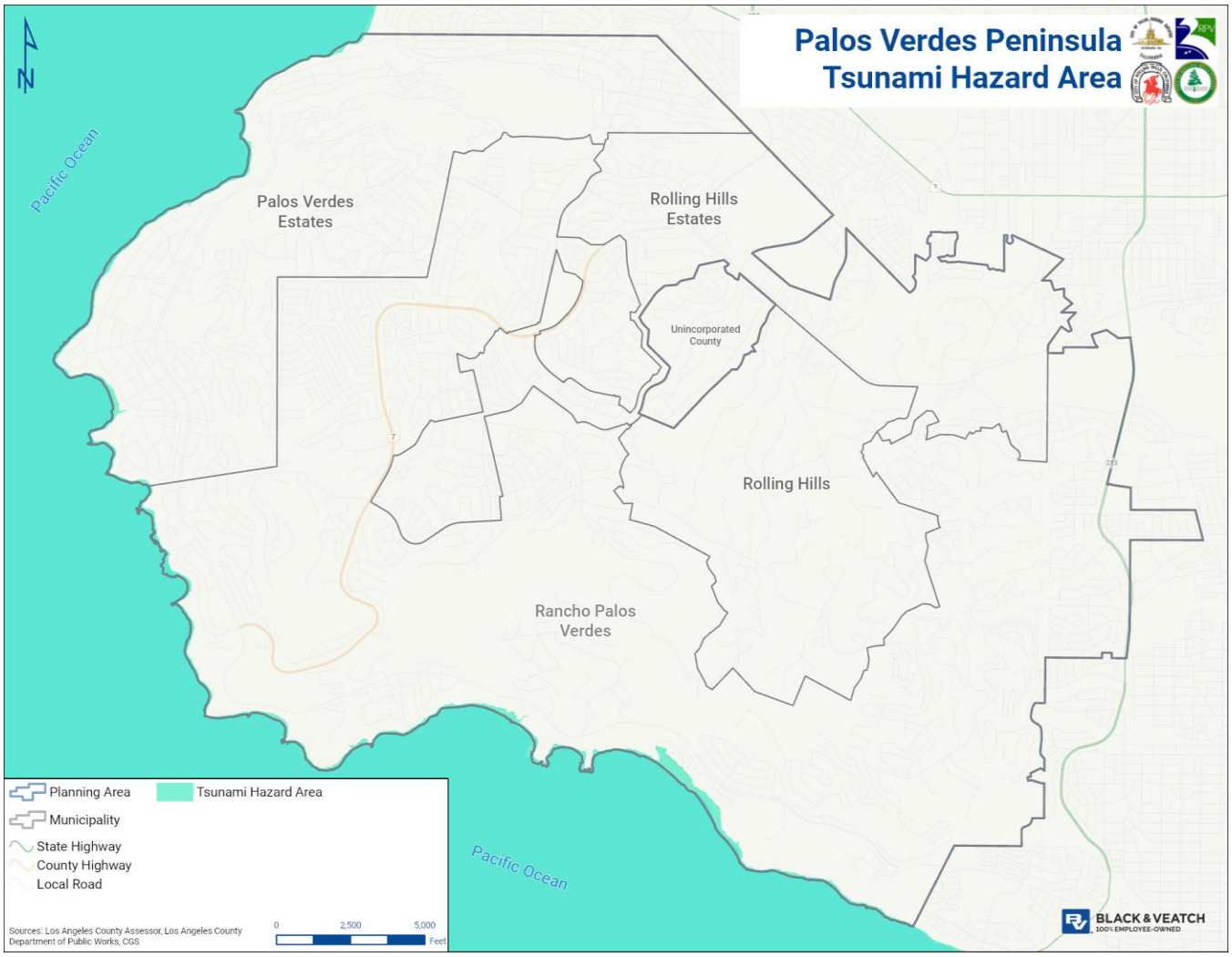


Figure 8-4 Tsunami Hazard Area

8.1.4 Extent

Measuring Intensity

Flood categories are defined for each gage location that describe or categorize the observed or expected severity of flood impacts in the corresponding stream segment or nearby stream. The severity of flooding at a given stage is not necessarily the same at all locations along a stream because of varying channel/bank characteristics on portions of the stream. Therefore, the stage for a given flood category is usually associated with lowest water level corresponding to the most significant flood impacts

somewhere in the reach. The flood categories used in the NWS are the following (NWS, High Water Level Terminology, n.d.):

- **Minor Flooding**—Minimal or no property damage, but possibly some public threat. A Flood Advisory product is issued to advise the public of events that are expected not to exceed the minor flood category.
- **Moderate Flooding**—Some inundation of structures and roads near streams. Some evacuations of people or transfer of property to higher elevations are necessary. A Flood Warning should be issued if moderate flooding is expected during the event.
- **Major Flooding**—Extensive inundation of structures and roads. Significant evacuations of people or transfer of property to higher elevations. A Flood Warning should be issued if major flooding is expected during the event.

The three flood categories do not necessarily exist for each gage location. Most commonly, gages in remote areas may not have a major flood stage assigned. Record flooding is flooding that equals or exceeds the highest stage or discharge at a given site during the period of recordkeeping.

The NWS also categorizes coastal flooding into three levels of severity: minor, moderate, and major. The classifications measure how much water levels exceed average astronomical high tide for that location (NOAA NOS, n.d.):

- **Minor High Tide Flooding**—water levels reach 0.55 meters (1.8 feet) above average high tide. This minor flooding is mostly disruptive, causing stormwater backups and road closures.
- **Moderate High Tide Flooding**—0.85 meters (2.8 feet) above average high tide. This can cause more disruption and damage homes and businesses.
- **Major Flooding**—1.20 meters (3.9 feet) above average high tide. Floods of this severity are destructive, may lead to evacuations, and often require repairs to infrastructure and property.

Warning Time

Because of the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

Each watershed has unique qualities that affect its response to rainfall. A hydrograph, which is a graph showing stream flow in relation to time, is a useful tool for examining a stream's response to rainfall. Once rainfall starts falling over a watershed, runoff begins, and the stream begins to rise. Water depth in the stream channel (stage of flow) will continue to rise in response to runoff even after rainfall ends. Eventually, the runoff will reach a peak and the stage of flow will crest. It is at this point that the stream stage will remain the most stable, exhibiting little change over time until it begins to fall and eventually subside to a level below flooding stage.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time to the time that a community has to take actions to protect

lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage.

The NWS issues warnings or advisories when confidence is greater than 80 percent that an event will occur. Depending on the type of event, these may be issued anywhere from hours before an event to days in advance of an event. Warnings include the following (NWS, Flood Related Products, n.d.):

- **Flash Flood Warning**: A Flash Flood Warning is issued to inform the public, emergency management and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. Flash Flood Warnings are urgent messages as dangerous flooding can develop very rapidly, with a serious threat to life and/or property. Flash Flood Warnings are usually issued minutes to hours in advance of the onset of flooding.
- **Flash Flood Watch**: A Flash Flood Watch is issued to indicate current or developing conditions that are favorable for flash flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flash flooding.
- **Flood Warning**: A Flood Warning is issued to inform the public of flooding that poses a serious threat to life and/or property. A Flood Warning may be issued hours to days in advance of the onset of flooding based on forecast conditions. Floods occurring along a river usually contain river stage (level) forecasts.
- **Flood Watch**: A Flood Watch is issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flooding. In situations where a river or stream is expected to be the main source of the flooding, forecast confidence may allow for a Flood Watch to be issued several days in advance.
- **Flood Advisory**: A Flood Advisory is issued when a flood event warrants notification but is less urgent than a warning. Advisories are issued for conditions that could cause a significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.

A Flood Advisory product is issued to advise the public of events that are expected not to exceed the minor flood category. A Flood Warning should be issued if moderate or major flooding is expected during the event.

Worst-Case Scenario

The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This would overwhelm local response and floodplain management departments. Major roads would be blocked, preventing access for many residents and critical functions. High runoff flows could cause rivers to scour, possibly washing out roads and creating more isolation problems.

A worst-case scenario occurred in 2005. Several roads in the Portuguese Bend area of Rancho Palos Verdes were flooded and blocked. In several cases flooding was so high along residential driveways that they could not use their cars. This flooding was ultimately caused by the landslide changing the elevation of the roads, which in turn disrupted the storm drain system and was not an overflow of Altamira Canyon.

8.1.5 Previous Occurrences

The following sections provide a review of previous flood occurrences in the Planning Area.

Declarations

Federal Declarations

Between 2019 and 2025, the Planning Area experienced five major disaster (DR) or emergency declarations (EM) related to a flood hazard.

Table 8-4. Federal Flood Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-4683-CA	December 27, 2022 – January 31, 2023	January 14, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3591-CA	January 8 – January 31, 2023	January 9, 2023	Severe Winter Storms, Flooding, and Mudslides
DR-4699-CA	February 21 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
EM-3592-CA	March 9 – July 10, 2023	March 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31– February 9, 2024	April 13, 2024	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslides

Source: OpenFEMA Datasets (OpenFEMA Data Sets | FEMA.gov)

State Proclamations

Between 2019 and 2025, California included Los Angeles County in 10 state-proclaimed flood disasters.

Table 8-5. State Landslide Disaster Declarations

Disaster Number	Declaration Date	Description
-	November 17, 2021	January 2021 Winter Storms
-	September 16, 2022	Tropical Storm Kay
N-1-23, N-2-23, N-10-23	January 4, 2023	December 2022 to January 2023 Storms
CA23-1	January 4, 2023	Late December 2022 Storms
CA23-3	March 1, 2023	Late February-Early March 2023 Winter Storms
CA23-3	June 16, 2023	February 2023 Winter Storms
-	August 19, 2023	Tropical Storm Hilary
-	February 4, 2024	Early February 2024 Storms
-	March 3, 2024	March 2024 Storms
-	June 21, 2024	January 2024 Winter Storms

Source: (Cal OES, 2025)

USDA Declarations

Between 2019 and 2025, the USDA declared that Los Angeles County experienced one disaster relating to flood.

Table 8-6. USDA Drought Disaster Declarations

Designation Number	Event Begin Date	Description
S5658	August 9, 2023	Tropical Storm Hillary

Source: (U.S. Department of Agriculture, 2025)

Summary of Significant Events

Significant and damaging atmospheric river flood event that occurred in the winters of 2022-2023 which caused and resulted in land movement in the fall of 2023 and early 2024 in the Planning Area.

Recent Events

The NOAA NCEI Storm Events Database reported 75 flood events impacting Los Angeles County forecast zones from 2019 through 2025, three of which impacted areas adjacent to the Planning Area (NOAA NCEI, 2025). The Planning Area experienced the atmospheric river that occurred in the winter of 2023-2024, delivering short-duration rainfall events that resulted in flash flooding warnings from February 1 – February 5, 2024. Table 8-7 shows a summary of significant flood events impacting the Planning Area (NOAA NCEI, 2025).

Table 8-7. Recent Flood Hazard Events

Date (s) of Event	Event Type	FEMA / State Declaration Number (if applicable)	Los Angeles County included in declaration?	Description
January 9 – January 14, 2023	Flood/Severe Winter Storm	DR-4683-CA	Yes	Heavy rainfall across Los Angeles County resulting in flash flooding, landslides, and impact to transportation.
January 9, 2023	Flood/Severe Winter Storm	EM-3591-CA	Yes	Heavy rainfall generated flash flooding and significant mud and debris flows.
April 3, 2023	Flood/Severe Winter Storm	DR-4699-CA	Yes	Heavy rainfall generated flash flooding and significant mud and debris flows across Los Angeles County.
March 10, 2023	Flood/Severe Winter Storm	EM-3592-CA	Yes	Winter storm conditions developed across the mountains of Los Angeles County with heavy precipitation and resulting landslides.

Date (s) of Event	Event Type	FEMA / State Declaration Number (if applicable)	Los Angeles County included in declaration?	Description
August 9, 2023	Tropical Storm	NA	NA	Tropical Storm Hilary delivered record August rainfall for Los Angeles County and widespread flooding/debris flows across Southern California.
February 1 – February 5, 2024	Flood/Flash Flood	NA	NA	Flash Flood Warning covering Rancho Palos Verdes, Long Beach, Lomita, and Carson on February 1, 2024. Palos Verdes Drive South was temporarily closed because of mud and rock slides that morning.
April 13, 2024	Flood/Severe Winter Storm	DR-4769-CA	Yes	A powerful winter storm impacted all of Southwestern California including tornadoes, flooding, landslides, and mudslides.

Source: (NOAA NCEI, 2025); (FEMA, 2025)

8.1.6 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

The chance of heavy flooding and flash flooding is greatest during California's rainy season from November to April. However, the diversity of climate patterns in California makes flooding more than a seasonal risk. The following are some of the weather and climate conditions that have a significant impact on the occurrence of flooding (Cal OES, 2023):

- El Niño conditions
- La Niña conditions
- Desert monsoons
- Tropical storms
- Gulf of Alaska storms
- Atmospheric river patterns

The number of years between floods of any given size varies because of the natural variations in climate and weather events. FEMA conducts flood studies that use historical records to determine the probability of occurrence for different flood levels in a community. FEMA FIRMs identify the flood hazard area as the area that would be inundated by a flood with a 1 percent chance of occurring in any given year (the

1-percent annual chance flood). FIRMs also typically show the extent of the flood with a 0.2 percent chance of occurring in any given year (0.2 percent annual chance flood). These measurements reflect statistical averages only, and it is possible for two or more floods with a 1 percent annual chance to occur in a short time period (USGS, n.d.). Table 8-8summarizes the concept of recurrence intervals and probabilities.

Table 8-8. Recurrence Intervals and Probabilities of Occurrence

Recurrence Interval (in years)	Probability of Being Equaled or	Recurrence Interval (in years)
100	1 in 100	1%
50	1 in 50	2%
25	1 in 25	4%
10	1 in 10	10%
5	1 in 5	20%
2	1 in 2	50%

Source: (USGS, n.d.)

Flooding is common in California and can take place any time of the year. Based on historical flood events, the State has a high probability of future riverine, flash, localized, and alluvial fan flood events. The frequency and severity of fluvial flooding for river systems are based on “discharge probability.” The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1 percent annual chance flood) to occur in a short time period. A single flood event can have flows at different points on a river or stream that correspond to different probabilities of occurrence.

Climate Change

Climate change plays a significant role in the increasing frequency and intensity of extreme weather events, particularly floods. According to scientific reports, as global temperatures rise, the hydrological cycle becomes more dynamic and unpredictable. Warmer air holds more moisture, which often leads to heavier and more intense rainfall. This accelerates the risk of flooding, as seen in numerous impactful events around the world. Additionally, the shift in weather patterns caused by climate change contributes to prolonged periods of drought in some regions, further exacerbating water-related challenges.

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Scientists project greater storm intensity with climate change, resulting in more direct runoff and flooding. High frequency flood events in particular will likely increase with a changing climate. What is currently considered a 1 percent annual chance also may strike more often, leaving many communities at greater risk. Going forward, model calibration must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.

Climate change will also increase other hazards that contribute to flood risk, most notably wildfires. According to California's Fourth Climate Change Assessment, continued increases in greenhouse gas emissions are expected to drive a substantial rise in large wildfires, with a projected 50 percent increase in fires over 25,000 acres and a 77 percent increase in average area burned by 2100. Post-fire landscapes are highly vulnerable: vegetation loss and soil damage make it easier for rain to trigger destructive debris flows and mudflows. When storms pass over recently burned areas, runoff can carry ash, sediment, and debris downslope, dramatically intensifying flood impacts and causing significant damage (Refer to Figure 8-5) (Cal OES, 2023).

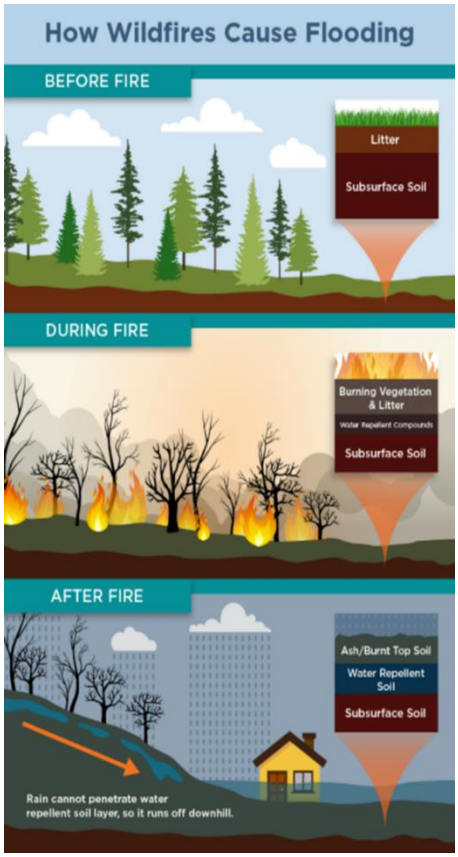


Figure 8-5. How Wildfires Cause Flooding

Potential Future Impacts

The Planning Area is well-equipped to manage growth in floodplains with flood damage prevention ordinances, its building codes, and the Safety Element of the municipal General Plans. Collectively, these tools help limit exposure to flood hazards by regulating development in floodplains, requiring flood-resistant construction standards, and guiding land-use decisions away from the highest-risk areas. Continued enforcement and periodic updates to these regulatory frameworks will be critical to maintaining community resilience, minimizing property damage, and protecting public safety over the long term.

8.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

8.2.1 Summary of Vulnerability

Flood vulnerability in the Planning Area is focused within the floodplain; however, flooding also takes place outside the floodplain during severe rainfall events and in areas of urban flooding. A Hazus Level 2 user-defined analysis was performed for general building stock, critical facilities and infrastructure in the flood zones.

8.2.2 Impact on Life, Health, and Safety

Floods present threats to public health and safety. Floodwater is generally contaminated by pollutants such as sewage, human and animal feces, pesticides and insecticides, fertilizers, oil, asbestos, and rusting building materials. The following health and safety risks are commonly associated with flood events:

- **Unsafe food**—Floodwaters contain disease-causing bacteria, dirt, oil, human and animal wastes, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and thus must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.
- **Contaminated drinking/washing water and poor sanitation**—Flooding impairs clean water sources with pollutants and affects sanitary toilets. Direct and indirect contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne infectious disease. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection and illnesses if they are broken or overflow. Unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks, including life-threatening cholera, typhoid, dysentery, and some forms of hepatitis.
- **Mosquitoes and animals**—Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of

mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities.

- **Molds and mildews**—Excessive exposure to molds and mildews can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases and to trigger cold-like symptoms such as sore throat, watery eyes, wheezing and dizziness. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets, and bathrooms. Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people and pregnant women are considered most vulnerable to mold-induced health problems.
- **Carbon monoxide poisoning**—Carbon monoxide poisoning is a potential hazard after major floods. Carbon monoxide can be found in combustion fumes, such as those generated by small gasoline engines, stoves, generators, lanterns and gas ranges, or by burning charcoal or wood. In the event of power outages following floods, flood victims tend to use alternative sources of fuels for heating, cooling, or cooking inside enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation. Carbon monoxide builds up from these sources and poisons the people and animals inside.
- **Hazards when reentering and cleaning flooded homes and buildings**—Flooded buildings can pose health hazards after floodwaters recede. Electrical power systems can become hazardous. People should avoid turning on or off the main power while standing in floodwater. Gas leaks from pipelines or propane tanks can trigger explosion when entering and cleaning damaged buildings or working to restore utility service. Flood debris—such as broken bottles, wood, stones, and walls—may cause wounds and injuries when cleaning damaged buildings. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks and other industrial chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup.
- **Mental stress and fatigue**—Exposure to extreme disaster events can cause psychological distress. Having experienced a devastating flood, seen loved ones lost or injured, and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Post-flood recovery—especially when prolonged—can cause anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Behavior changes may also occur in children. There is also a long-term concern among the affected that their homes can be flooded again in the future.

Equity Priority Communities

Vulnerable populations are defined as individuals with physical or mobility limitations, cognitive impairments, and economic constraints that may hinder their ability to prepare for, respond to, or recover from flood hazard events. Within the Planning Area, these populations may reside in locations served by

a single means of ingress and egress, which can significantly increase their risk during flood events. High floodwaters, roadway washouts, or other flood-related infrastructure damage can delay or prevent evacuation, limit access for emergency responders, and isolate residents for extended periods. These conditions heighten the potential for injury, health complications, and delayed assistance, particularly for individuals who require mobility aids, medical support, or external assistance during emergencies.

8.2.3 Impact on General Building Stock

Many buildings, especially in older or rural communities, were constructed before modern floodplain management standards were adopted, making them more susceptible to water damage. Flooding can lead to significant structural damage, mold growth, and long-term deterioration of foundations and materials, especially in homes and public buildings not elevated above base flood elevations. These impacts not only threaten the physical integrity of the building stock but also strain local resources for repair and recovery.

Property exposure and losses were estimated through the Level 2 Hazus analysis for the assessed flood zones. Table 8-9 and Table 8-10 show the estimates for the flood exposure and damage to structures and building contents with the percent of total replacement value. Table 8-11 summarizes the number of structures and type of occupancy in the mapped flood risk areas.

Table 8-9. Exposure Estimates for Flood Hazard Areas

City	No. of Buildings Exposed	Value of Buildings Exposed	Value of Contents Exposed	Total Replacement Cost Value	% of Total Replacement Value
100-year Flood					
Palos Verdes Estates	4	$4,467,630	$2,233,815	$6,701,445	0.1%
Rancho Palos Verdes	3	$572,625	$286,312	$858,937	0.0%
Rolling Hills	0	$0	$0	$0	0.0%
Rolling Hills Estates	0	$0	$0	$0	0.0%
Total	7	$5,040,255	$2,520,127	$7,560,382	0.0%
Sea Level Rise					
Palos Verdes Estates	0	$0	$0	$0	0.0%
Rancho Palos Verdes	0	$0	$0	$0	0.0%
Rolling Hills	0	$0	$0	$0	0.0%
Rolling Hills Estates	0	$0	$0	$0	0.0%
Total	0	$0	$0	$0	0.0%
Tsunami					
Palos Verdes Estates	1	$678,902	$678,902	$1,357,804	0.0%
Rancho Palos Verdes	10	$2,119,499	$1,059,749	$3,179,248	0.0%
Rolling Hills	0	$0	$0	$0	0.0%
Rolling Hills Estates	0	$0	$0	$0	0.0%
Total	11	$2,798,401	$1,738,651	$4,537,052	0.0%

Table 8-10. Loss Estimates for 100-year Flood Hazard Areas

City	Structure Debris (Tons)	Buildings Impacted	Total Value Damaged (Structure & Contents)	% of Total Value
Palos Verdes Estates	193	2	$449,110	0.0%
Rancho Palos Verdes	140	2	$129,534	0.0%
Rolling Hills	0	0	$0	0.0%
Rolling Hills Estates	0	0	$0	0.0%
Total	334	4	$578,644	0.0%

Table 8-11. Estimated Number of Buildings by Type, Located in the Flood Hazard Areas

City	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
100-year Flood								
Palos Verdes Estates	4	0	0	0	0	0	0	4
Rancho Palos Verdes	3	0	0	0	0	0	0	3
Rolling Hills	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0
Total	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**7**
Sea Level Rise								
Palos Verdes Estates	0	0	0	0	0	0	0	0
Rancho Palos Verdes	0	0	0	0	0	0	0	0
Rolling Hills	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tsunami								
Palos Verdes Estates	1	0	0	0	0	0	0	1
Rancho Palos Verdes	10	0	0	0	0	0	0	10
Rolling Hills	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0
Total	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**11**

8.2.4 Impact on Community Lifelines

As most flooding in the Planning Area are riverine, stream and waterway overflow and drainage events, these types of flooding often result in property damage, road washouts, and transportation disruptions. General impacts of these events may include commercial and residential structural damage. Loss of water, power, roads, phones, and transportation may occur, which can be particularly dangerous for those with certain medical conditions. Critical facilities and community lifelines exposed to the riverine flood hazard are likely to experience functional downtime following a flood event, which could increase the net impact of the event. Refer to Table 8-12 for a summary of community lifelines in the flood hazard areas.

Table 8-12. Community Lifelines in Flood Hazard Areas

City	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
100-year Flood									
Palos Verdes Estates	0	0	0	0	0	0	0	0	0
Rancho Palos Verdes	0	0	0	0	0	0	0	0	0
Rolling Hills	0	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Sea Level Rise									
Palos Verdes Estates	0	0	0	0	0	0	0	0	0
Rancho Palos Verdes	0	0	0	0	0	0	0	0	0
Rolling Hills	0	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Tsunami									
Palos Verdes Estates	0	0	0	0	0	0	0	0	0
Rancho Palos Verdes	0	0	0	0	0	1	0	0	1
Rolling Hills	0	0	0	0	0	0	0	0	0
Rolling Hills Estates	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**

8.2.5 Impact on the Economy

Flooding can lead to significant economic impacts, including damage to infrastructure, businesses, and property, as well as disruptions to transportation and supply chains.

8.2.6 Impact on Historic and Cultural Resources

Historic structures were not constructed to the modern building code and are less likely to be able to withstand the forces of flooding events. This may result in structures being pushed off their foundations, collapses, and other structural failures. Intense rainfall and runoff can also increase moisture intrusion, sediment deposition, and access limitations, complicating preservation efforts and potentially resulting in the loss of irreplaceable cultural resources over time.

8.2.7 Impact on Ecosystems and Natural Resources

Floods can have both beneficial and detrimental effects on ecosystems and natural resources, including habitat destruction, erosion, water contamination, and changes to soil fertility, while also potentially recharging groundwater and creating new habitats. Seasonal floods can renew ecosystems, providing

life-giving waters in more ways than one. Floods transport vital nutrients, such as nitrogen, phosphorus, and organic material, to the surrounding land. When the water recedes, it leaves behind nutrient-rich sediment on the floodplains, enhancing soil fertility and promoting biodiversity. Floods can also help recharge groundwater supplies and create new aquatic habitats that support a variety of species.

However, floods can also cause significant ecological disruption. Rapid or severe flooding may lead to habitat destruction, increased erosion, water contamination, and the displacement of wildlife. Heavy rainfall can quickly overwhelm river systems, leading to flash floods that threaten both natural environments and human infrastructure. Silt is deposited in tidepools when flooding occurs in the canyons. This silt accumulation in the protected tidepools has a detrimental impact on the fragile ecosystem.

8.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

California Senate Bill 79 has overruled the local Peninsula City's General Plans and zoning codes and now mandates an increase of density in communities. Increased density can result in increased vulnerability from the flood hazard with more impervious surfaces which can lead to more severe urban flooding during extreme precipitation events.

8.3 MITIGATION OPPORTUNITIES

Table 8-13 presents a range of potential opportunities considered by the Planning Partnership for mitigating the flood hazard.

Table 8-13. Potential Opportunities to Mitigate the Flood Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Clear storm drains and culverts • Use low-impact development techniques	• Clear storm drains and culverts • Use low-impact development techniques	• Maintain drainage systems • Institute low-impact development techniques on property • Structural flood control, levees, channelization, or revetments • Stormwater management regulations and master planning • Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff
Reduce Exposure and Vulnerability		
• Locate outside of hazard area • Elevate utilities above base flood elevation • Use low-impact development techniques	• Locate outside of hazard area • Use low-impact development techniques • Build critical function redundancy or retrofit critical buildings	• Locate or relocate critical facilities outside of hazard area • Acquire or relocate identified repetitive loss properties • Promote open space uses in identified high hazard areas via techniques such as planned unit developments, easements, setbacks, greenways, sensitive area tracks

Community Scale	Organizational Scale	Government Scale
• Raise structures above base flood elevation • Elevate items within house above base flood elevation • Build new homes above base flood elevation • Flood-proof structures	• Provide floodproofing when new critical infrastructure must be located in floodplains	• Adopt land development criteria such as planned unit developments, density transfers, clustering Institute low impact development techniques on property • Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff • Harden infrastructure, bridge replacement program • Provide redundancy for critical functions and infrastructure • Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold, compensatory storage, non-conversion deed restrictions • Stormwater management regulations and master planning • Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities • Improve unpaved roads to reduce their likelihood to fail due to flooding
Build Local Capacity		
• Buy flood insurance • Develop household plan, such as retrofit savings, communication with outside, 72 hour self-sufficiency during and after an event	• Keep cash reserves for reconstruction • Support and implement hazard disclosure for sale of property in risk zones • Solicit cost-sharing through partnerships on projects with multiple benefits	• Produce better hazard maps • Provide technical information and guidance • Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) • Incorporate retrofitting or replacement of critical system elements in capital improvement plan • Develop strategy to take advantage of post-disaster opportunities • Warehouse critical infrastructure components • Develop and adopt a continuity of operations plan • Consider participation in the Community Rating System • Maintain and collect data to define risks and vulnerability • Train emergency responders • Create an elevation inventory of structures in the floodplain

Community Scale	Organizational Scale	Government Scale
		• Develop and implement a public information strategy • Charge a hazard mitigation fee • Integrate floodplain management policies into other planning mechanisms within the Planning Area. • Consider impacts of climate change on the risk associated with the flood hazard • Consider the residual risk associated with structural flood control in future land use decisions • Enforce National Flood Insurance Program • Adopt a Stormwater Management Master Plan
Nature-based Opportunities		
• Restore and reconnect floodplains that have been degraded by development and structural flood control • Use soft approaches for stream bank restoration and hardening • Set back levees on systems that rely on levee protection to allow the channel to meander, which reduces erosion and scour potential • Preserve floodplain storage capacity by limiting or prohibiting the use of fill in the floodplain • Incorporated green infrastructure into stormwater management facilities • Protect and/or restore riparian buffers		

9. HEAT WAVE

9.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

9.1.1 Description of the Hazard

Defining the Hazard

In California, a heat wave, or extreme heat event, is defined as 3 days over 100 degrees Fahrenheit (° F) (FEMA National Risk Index, n.d.). Extreme heat overall is defined as temperatures that hover 10° F or more above the average high temperatures for a region for several days or weeks. Heat waves can lead to an increase in heat-related illnesses and deaths, worsen drought, and impact water supplies and other industries such as transportation, agriculture, and energy (California Office of Environmental Health Hazard Assessment, 2022).

Cause of the Hazard

Heat waves are usually a result of both high temperatures and high relative humidity. The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures, posing significant risk to human health. Anthropogenic climate change is fueling an increase in frequency of extreme heat days in California (California Office of Environmental Health Hazard Assessment, 2022).

The severity of heat waves can be amplified by the "urban heat island effect" which is the phenomena defined by the National Integrated Heat Health Information System in which cities experience more intense warming than their surrounding rural landscapes, particularly during the summer. This temperature difference occurs when cities' unshaded roads and buildings absorb heat during the day and release this heat slowly (California Office of Environmental Health Hazard Assessment, 2022). As a result, highly developed urban areas can experience mid-afternoon temperatures that are 15° F to 20° F warmer than surrounding, vegetated areas (California Office of Environmental Health Hazard Assessment, 2022).

Summary of Potential Impacts

Heat waves have significant impacts on human health and infrastructure. Extreme heat is the primary weather-related cause of death in the United States. In a 10-year record of weather fatalities across the nation (2015-2024), excessive heat claimed more lives each year than floods, tornadoes, and hurricanes (NOAA, n.d.). According to the *California Climate Adaptation Strategy*, heat waves have claimed more lives in California than all other declared disaster events combined.

Heat-related illness includes a spectrum of illnesses ranging from heat cramps to severe heat exhaustion and life-threatening heat stroke Those who work outside are at risk for heat stroke or sun stroke, heat

exhaustion, fatigue, and dehydration (California Office of Environmental Health Hazard Assessment, 2022). Elevated nighttime temperatures are likely key ingredients in causing heat-related illness and mortality. Heat-related illness includes a spectrum of illnesses ranging from heat cramps to severe heat exhaustion and life-threatening heat stroke Those who work outside are at risk for heat stroke or sun stroke, heat exhaustion, fatigue, and dehydration (California Office of Environmental Health Hazard Assessment, 2022). Elevated nighttime temperatures are likely key ingredients in causing heat-related illness and mortality. Heat impacts infrastructure safety and agencies' ability to provide timely and efficient services to their customers.

Cascading Hazard Impacts

Heat waves can lead to the cascading hazard of drought and wildfire, depending on the severity and length of the event. Existing drought and wildfire conditions can be severely exacerbated by extreme heat events, further drying out soil and vegetation and increasing electricity demand. These hazards are covered in Sections 6 and 0.

Extreme heat can also impact infrastructure and economies. Urban infrastructure is especially threatened by cascading effects of extreme heat stress on interdependent water, power, and transportation systems. High heat can deteriorate pavement, buckle railway tracks, and restrict aircraft operations. During hot weather, increased use of air conditioning and refrigeration increases electricity usage, thus straining the electrical grid (California Department of Water Resources, 2025).

9.1.2 Location

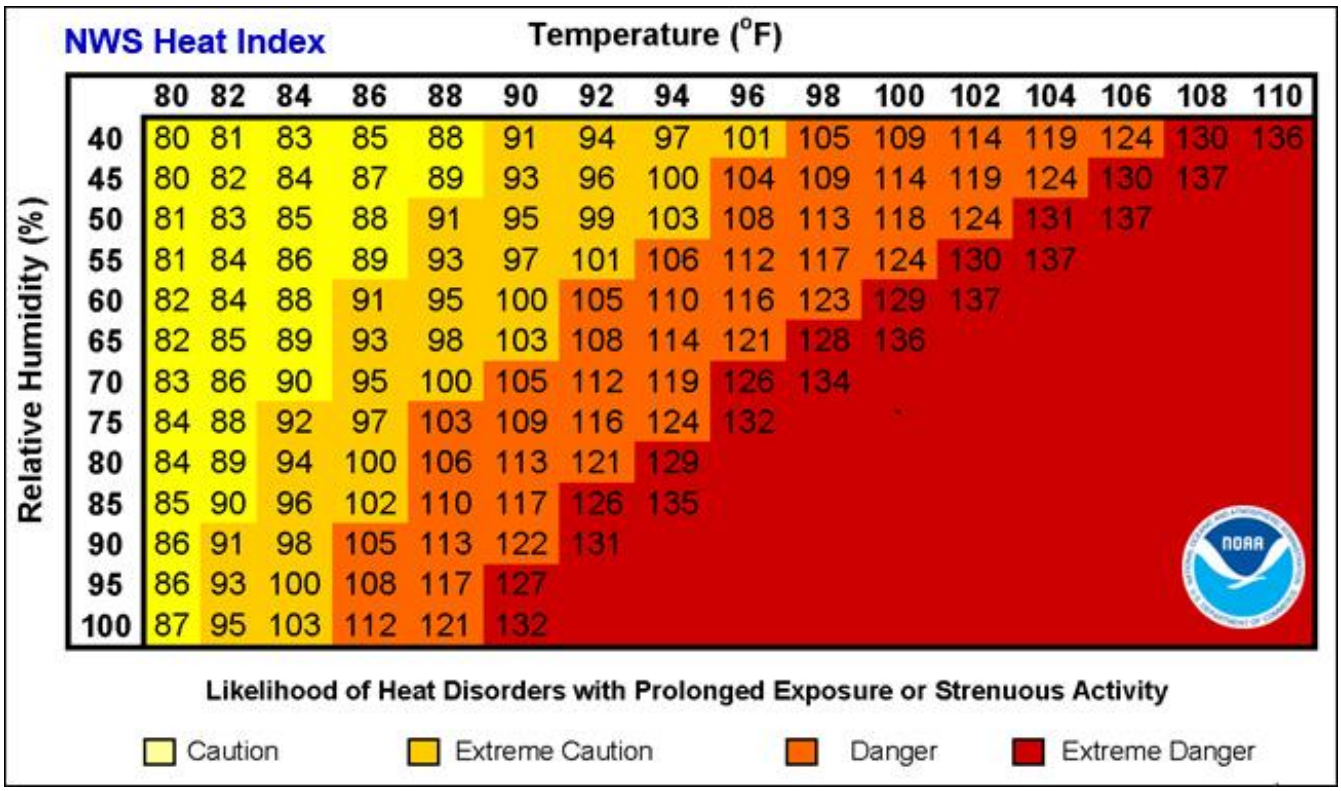
Extreme heat has not historically been a hazard of main concern for the Palos Verdes Peninsula. This is due to the Planning Area's coastal location and exposure to cooling winds from the sea (National Oceanic and Atmospheric Administration, n.d.). However, future projections indicate that the Planning Area could experience more frequent and intense episodes of extreme heat, which will impact the entire Planning Area, especially those without air conditioning.

9.1.3 Extent

Heat emergencies are often slow to develop and usually hurt vulnerable populations and already aging and damaged infrastructure. It could take several days of oppressive heat for a heat wave to have a significant or quantifiable impact in the Planning Area.

Measuring Intensity

Heat wave extent can be defined by local record highs and the NWS Heat Index. The NOAA and NWS devised the "Heat Index" chart shown on Figure 9-1, which uses air temperature and humidity to determine the heat index or apparent temperature. In addition, information regarding the likelihood of health dangers by temperature range is presented (National Weather Service & National Oceanic and Atmospheric Administration, 2024).



Source: NWS Heat Index (Heat Index)

Figure 9-1. NWS Heat Index

Warning Time

The NWS is producing experimental forecasts called HeatRisk to assess the heat risk to local thresholds in California, Nevada, Utah, and Arizona. The NWS issues excessive heat watches, excessive heat warnings, and heat advisories to warn of an extreme heat event (a "heat wave") within 36 hours of the predicted event (National Weather Service, 2023).

The NWS will use the HeatRisk Index (Table 9-1) to determine if an excessive heat watch/warning or heat advisory is warranted. The NWS issues the following types of heat-related advisories:

- **Heat Advisory**—HeatRisk Index category is on the orange/red that includes the Level 2 and Level 3 thresholds
- **Excessive Heat Watch/Warning**—HeatRisk Index category is on the red/magenta that includes the Level 3 and Level 4 thresholds

An Excessive Heat Watch is a way to give the public and emergency officials a warning that extreme temperatures are expected. If high temperatures remain forecasted for 24 to 28 hours, the excessive heat *watch* will be upgraded to an excessive heat *warning* (National Weather Service, 2023).

Table 9-1. NWS HeatRisk Index

Category	Risk of Heat-Related Impacts
Green 0	Little to no risk from expected heat.
Yellow 1	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
Red 3	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.
Magenta 4	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure.

Source: NWS HeatRisk (NWS HeatRisk)

Worst-Case Scenario

The worst-case scenario for an extreme heat wave in the Palos Verdes Peninsula would be a heat wave lasting longer than 3 days with an Excessive Heat Warning Level 4. This heat wave would have temperatures near or above 100° F with no overnight cooling, especially in densely developed areas. A heat wave of this magnitude would impact a broad swath of the population, including those with air conditioning.

Prolonged heat would put a strain on the Planning Area's energy grid, health system, and cause widespread damage to infrastructure. A prolonged heat wave can occur with cascading hazards, most importantly drought and wildfire. California's current projections indicate an increase in extreme heat days, which increase the likelihood of drought conditions in the Planning Area. Rising temperatures and a lack of precipitation can lead to ideal conditions for wildfires, which could impact all residents in the Planning Area. The destruction caused by these wildfires, including denuding vegetation and burn scars, increases the risk of mudslides and flooding when heavy rain occurs (NOAA NCEI, 2021).

9.1.4 Previous Occurrences

The following sections provide a review of previous heat wave occurrences in the Planning Area.

Declarations

Historically, FEMA has denied requests and subsequent appeals for federal disaster declarations related to extreme heat events, stating that the cascading impacts of heat-related events, such as wildfires, cause the damage for which states seek assistance (Congressional Research Service, 2024).

Federal Declarations

There have been no federal declarations for heat waves for Los Angeles County (FEMA, 2025).This is because of limitations in the Stafford Act, which allocates funds to states for natural disasters. While no recorded heat wave has occurred in the Planning Area since 2019, members of Congress have introduced legislation to include extreme heat in the Stafford Act (Congressional Research Service, 2024).

State Proclamations

There have been no state proclamations related to heat waves for Los Angeles County (Cal OES, 2025).

USDA Declarations

There have been no USDA declarations related to heat waves for Los Angeles County (U.S. Department of Agriculture, 2025).

Summary of Significant Events

Los Angeles County has 13 events listed in their record of extreme heat history. Of this, the all-time record occurred in 1955 when Los Angeles hit 110° F on September 1 of that year. The most recent extreme heat events are summarized below:

- **July/August 2023** – between July 11 and August 2, daytime temperatures only dipped below 90° F on 1 day.
- **August 2023** – Two multi-day heat events occurred with temperatures over 90° F, peaking at 102° F.
- **July 2024** – A weeklong extreme heat event occurred with temperatures between 90° F to 97° F.
- **September 2024** – An extreme heat wave impacted southern California the first week of the month, with daytime temperatures 10° to 20° above normal for that time of year. Persistent triple-digit temperatures drove a spike in emergency room visits for heat-related illnesses. Three fires burning in the eastern part of Los Angeles County exploded in intensity during this time period, impacting communities with smoke and short-notice evacuations (NOAA, 2024).
- **August/September 2025** – County-wide heat advisories, warm nights, and regional wildfire and air-quality impacts.

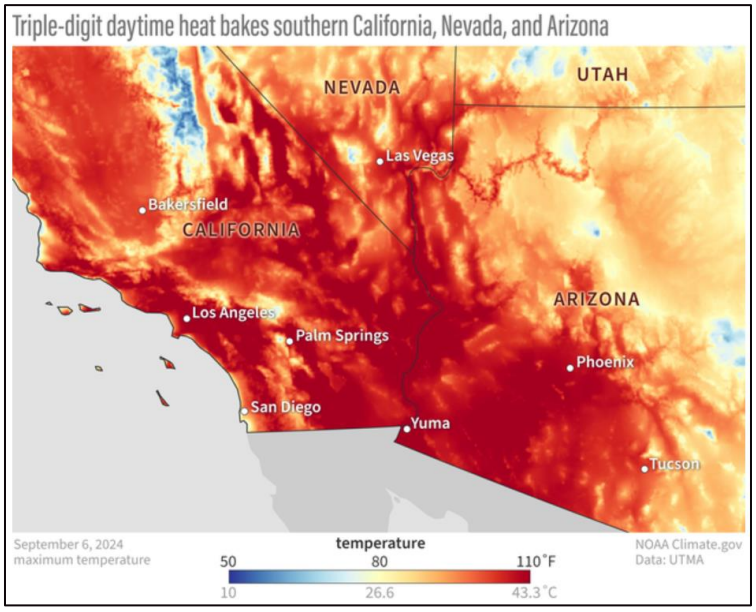


Figure 9-2. September 2024 Extreme Heat Map
Source: (NOAA , 2024)

Recent Events

The NOAA NCEI Storm Events Database have not reported any excessive or extreme heat events impacting the Planning Area's forecast zones from 2019 to 2025 (NOAA NCEI, 2025).

9.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, are discussed in the sections below.

Probability

Extreme heat has become more frequent in California since 1950, especially at night. Heat waves – two or more consecutive heat events – vary from year to year but have become more frequent in the past decade (California Office of Environmental Health Hazard Assessment, 2022). Based on historical events in Los Angeles County, there is a probability of at least one heat wave each year in the County. The Planning Area is not as susceptible to extreme heat events as other parts of the County due to the coastal influence and large areas of open space. As noted in the climate change discussion below, extreme heat events are expected to increase. The probability of one heat wave each year is likely.

Climate Change

Projected warming temperatures will influence runoff, evaporation, and evapotranspiration, as well as drought and overall ecological health in the region. This includes longer growing seasons, shifts in vegetative populations, and invasive species encroachment.

Data projections from Cal-Adapt, a tool provided by the California Energy Commission, were utilized to obtain localized climate change projections as it relates to the hazard of extreme temperature (Cal Adapt, 2025). Data suggests that climatic changes may intensify the severity and frequency of extreme heat events in the Planning Area. The increase in average surface temperatures can also lead to more intense heat waves that can be exacerbated in the Planning Area.

According to the California HPI: Extreme Heat Edition, the Palos Verdes Peninsula is expected to experience 10.2 days over 90° F during years 2035 to 2064. While this number is lower than much of California, putting it at a Healthy Places Index rating of 98/100, this figure is expected to increase during years 2077 to 2099 (California Healthy Places Index, 2022).

Potential Future Impacts

Grid vulnerabilities to potential future heat waves described by climate change projections were assessed throughout Los Angeles County. Heat waves have posed serious challenges to power infrastructure in Southern California, including a major blackout in 2011 and emergency curtailment in 2014, and understanding how future temperature change might impact the power system is critically important for its continued reliable operation. Potential increases in peak demand, resource adequacy requirements, and component over-loadings were forecast for ranges of scenarios from 2021 to 2060.

9.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

9.2.1 Summary of Vulnerability

The entire Planning Area is exposed to the extreme heat hazard, so an event has the potential to affect the entire population. Extreme heat generally does not impact buildings, but all buildings in the Planning Area will have an increased energy demand for cooling. All of the Planning Area's identified critical facilities and the entire environment of the Planning Area are vulnerable to the extreme heat hazard.

9.2.2 Impact on Life, Health, and Safety

Extreme heat can cause illness such as heat exhaustion and heat stroke, and can induce or exacerbate illnesses related to cardiovascular, respiratory, renal, and mental health (UCLA Luskin Center for Innovation & Public Health Alliance of Southern California, 2025). According to the California Healthy Places Index: Extreme Heat Edition tool, the Palos Verdes Peninsula is projected to experience 10.2 days per year with temperatures exceeding 90° F between 2035 and 2064. This is significantly lower than the statewide median value of 79.9 days (California Healthy Places Index, 2022).

Equity Priority Communities

Equity Priority Community populations that may be more at risk from heat waves include older individuals and those with access and functional needs. Power outages triggered by overburdened electrical grids can be life threatening to those dependent on electricity for medical devices. Members of these communities who do not have access to air conditioning would lack nighttime relief from the heat, elevating their risk of health complications.

9.2.3 Impact on General Building Stock

Extreme heat events can significantly impact the built environment by causing infrastructure damage, increasing energy demand, exacerbating urban heat island effects, and posing health risks to residents and workers, necessitating adaptation strategies like green infrastructure and heat-resilient design. All of the general building stock within the Palos Verdes Peninsula is considered to be exposed to the extreme heat hazard with varying degrees of vulnerability based on the age and condition of the structures.

9.2.4 Impact on Community Lifelines

Extreme heat events can severely impact community lifelines by straining infrastructure, increasing energy demand, and disrupting essential services like healthcare, transportation, and food security, potentially leading to power outages, heat-related illnesses, and economic damage.

9.2.5 Impact on the Economy

The economic and societal consequences of extreme heat are pervasive. Impacts encompass reductions in gross domestic product, as workers and infrastructure systems become less productive, as well as wider detrimental effects on well-being, as healthcare outcomes worsen, and people are unable to access outdoor space. Impacts include transitory ones, from people enduring uncomfortable conditions and workers taking sick leave, and enduring losses, for example, due to interruptions to education or property damage from wildfires which can be more severe due to extreme heat's effect on the environment. Tourism and other leisure activities are also affected as temperatures rise, making walking, shopping, and sightseeing uncomfortable and potentially dangerous.

According to the Atlantic Council's Adrienne Arsht Rockefeller Foundation Resilience Center, extreme heat-related labor productivity losses already affect all regions and sectors of the U.S. economy. Under baseline climate conditions, the United States could lose on average approximately $100 billion annually from heat-induced lost labor productivity.

9.2.6 Impact on Historic and Cultural Resources

Extreme heat events pose significant threats to historic and cultural resources, leading to accelerated deterioration of materials, damage to structures and artifacts, and disruption of ecosystems around these sites.

9.2.7 Impact on Ecosystems and Natural Resources

Rising temperatures affect all types of ecosystems through shifts in species distribution and population structure and increase the risk of species extinction. These changes can impact ecosystem services, such as carbon storage, and affect crop production. Higher temperatures also naturally increase the risk of arid conditions and droughts.

9.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

Extreme heat vulnerability may be increasing slightly, not due to population growth, but due to climate change and the aging population of the Palos Verdes Peninsula.

9.3 MITIGATION OPPORTUNITIES

Table 9-2 presents a range of potential opportunities considered by the Planning Partnership for mitigating the extreme heat hazard.

Table 9-2. Potential Opportunities to Mitigate the Heat Wave Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Plant trees to create shade in urban areas • Remove concrete and other hard surfaces and replace them with native vegetation	• Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage • Remove concrete and other hard surfaces and replace them with native vegetation	• Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage • Remove concrete and other hard surfaces and replace them with native vegetation
Reduce Exposure and Vulnerability		
• Insulate structures to provide greater thermal efficiency • Provide redundant power sources • Install air conditioning	• Relocate critical infrastructure underground • Provide cooling centers for employees • Install “cool roofs” and “green roofs”	• Relocate critical infrastructure underground • Trim trees away from power lines • Install “cool roofs” and “green roofs” • Establish and promote accessible cooling centers in the community • Use the best available technology to enhance the warning systems for extreme heat events
Build Local Capacity		
• Promote 72-hour self-sufficiency • Obtain a NOAA weather radio • Obtain an emergency generator	• Provide safety training and resources for employees that work primarily outside and at field locations • Create redundancy in power supply • Equip facilities with a NOAA weather radio • Equip vital facilities with emergency backup power	• Enhance public awareness and outreach to address actions to take during extreme heat events • Coordinate severe weather warning capabilities and the dissemination of warning among agencies with the highest degree of capability • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines

Community Scale	Organizational Scale	Government Scale
		• Provide NOAA weather radios to the public • Review and update heat response plan to account for climate change projections • Promote programs that support community-scale microgrids • Evaluate and revise building codes to address and mitigate extreme heat impacts on residents
Nature-based Opportunities		
• Manage invasive species that thrive in warmer temperatures • Incorporate nature-based heat-reduction measures with plantings in green spaces, trail areas, and community parks		

10. LANDSLIDE

10.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

10.1.1 Description of the Hazard

Defining the Hazard

A landslide is a mass of rock, earth or debris moving down a slope. Landslides may be minor or large and can move at slow to very high speeds. Mudslides are rivers of rock, earth, organic matter, and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall.

Mass Movement

Mass movement is the movement of rock and soil down slope under the influence of gravity. Landslides are the most commonly recognized type of mass movement. Other common mass movement types include the following:

- **Mudflows**, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry."
- **Slurry** can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing larger as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.
- **Creep** is the imperceptibly slow downward movement of slope forming rock or soil that can be accelerated during wet weather events or earthquakes. This slow-moving landslide is often only noticed through crooked trees and disturbed structures.
- **Coastal bluff erosion** is the collapse of coastal bluffs due to undercutting erosive forces of wave action.
- **Rock falls** are rapid movements of bedrock, which result in bouncing or rolling.
- **Rock topple** is a section or block of rock that rotates or tilts before falling to the slope below.
- **Block slides** are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material.
- **Earth flows** is the mass movement of fine-grained sediments that flow downhill and typically form a fan structure.

Deep-Seated Landslides

Deep-seated landslides (greater than 10 to 15 feet deep or below the rooting depth of vegetation) are typically triggered by prolonged ground saturation caused by deep infiltration of rainfall or other long-term hydrologic processes, earthquake shaking, or a combination of both rainfall and seismic activity. Some deep-seated landslides move very slowly, though others can move quickly and with little notice (California Governor's Office of Emergency Services, 2024).

Shallow Landslides

Shallow landslides typically originate in uppermost soil or rock layers (greater than 10 feet deep or in the rooting zone of vegetation) on steep slopes and often form slumps or fast-moving earth and debris flows (USGS, 2025). Shallow landslides can similarly be triggered by sustained rainfall or saturated soils.

Land Subsidence

Land subsidence is the gradual lowering of land-surface elevation due to changes in the soil or sediment. In California, subsidence has been documented for over a century and is a growing issue that impacts water infrastructure and communities (California Department of Water Resources, 2025).

Cause of the Hazard

Both natural and human-induced changes in the environment can trigger landslides and other forms of mass movement. Landslides are caused by a combination of geological and climate conditions and the influence of urbanization. They can be initiated by storms, earthquakes, fires, or human modification of the land or infrastructure. Vulnerable natural conditions are affected by human development and the infrastructure that supports it. The following factors can contribute to slide formation:

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations
- Change in water content
- Groundwater movement (watershed)
- Weathering of rocks
- Removing or changing the type of vegetation covering slopes

Areas that are generally prone to landslide hazards include previous landslide areas (i.e. active or inactive ancient landslides), the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes.

While small landslides are frequently a result of human activity, the largest landslides are often naturally occurring phenomena with little or no human contribution. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by significant precipitation or seismic events.

Summary of Potential Impacts

Landslides in hillside terrain can pose serious hazard to downslope property and structures. They can disrupt roadways which can adversely impact proper drainage of storm drain systems and cut off other infrastructure lifelines, destroy private property, and cause flooding, bank erosion, and rapid channel migration. A slide can move rapidly down slopes or through channels and can strike with little or no warning. It can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path. Although slides behave as fluids, they convey many times the hydraulic force of water due to the mass of material they carry.

Despite their destructive potential, landslides can serve beneficial functions to the natural environment. They supply sediment and large wood to the channel network and can contribute to complexity and dynamic channel behavior critical for aquatic and riparian ecological diversity.

Cascading Hazard Impacts

Landslides that block rivers or streams can form unstable natural dams, trapping water and creating temporary lakes. These impoundments pose a serious risk of sudden failure, which can create destructive flash flooding downstream. Saturated soils from these events can likely destabilize nearby slopes, triggering additional landslides and cause cascading effects such as damaged infrastructure and roads, isolating communities, disrupting emergency services, and contaminating water sources.

Landslides can also change the elevation of roadways and in turn, disrupt the storm drain system associated with those roadways. Unplanned diversion of stormwater into areas like Altamira Canyon causes erosion, leading to damage or collapse of structures in those areas.

10.1.2 Location

The analysis assumed, in general, that susceptibility to deep-seated landslides is low on very low slopes in all rock materials and increases with slope steepness and in weak rocks and soils. The analysis also factored in locations of past landslides. Figure 10-1 shows Californian Geological Survey (CGS) historic landslide occurrences for the Planning Area.

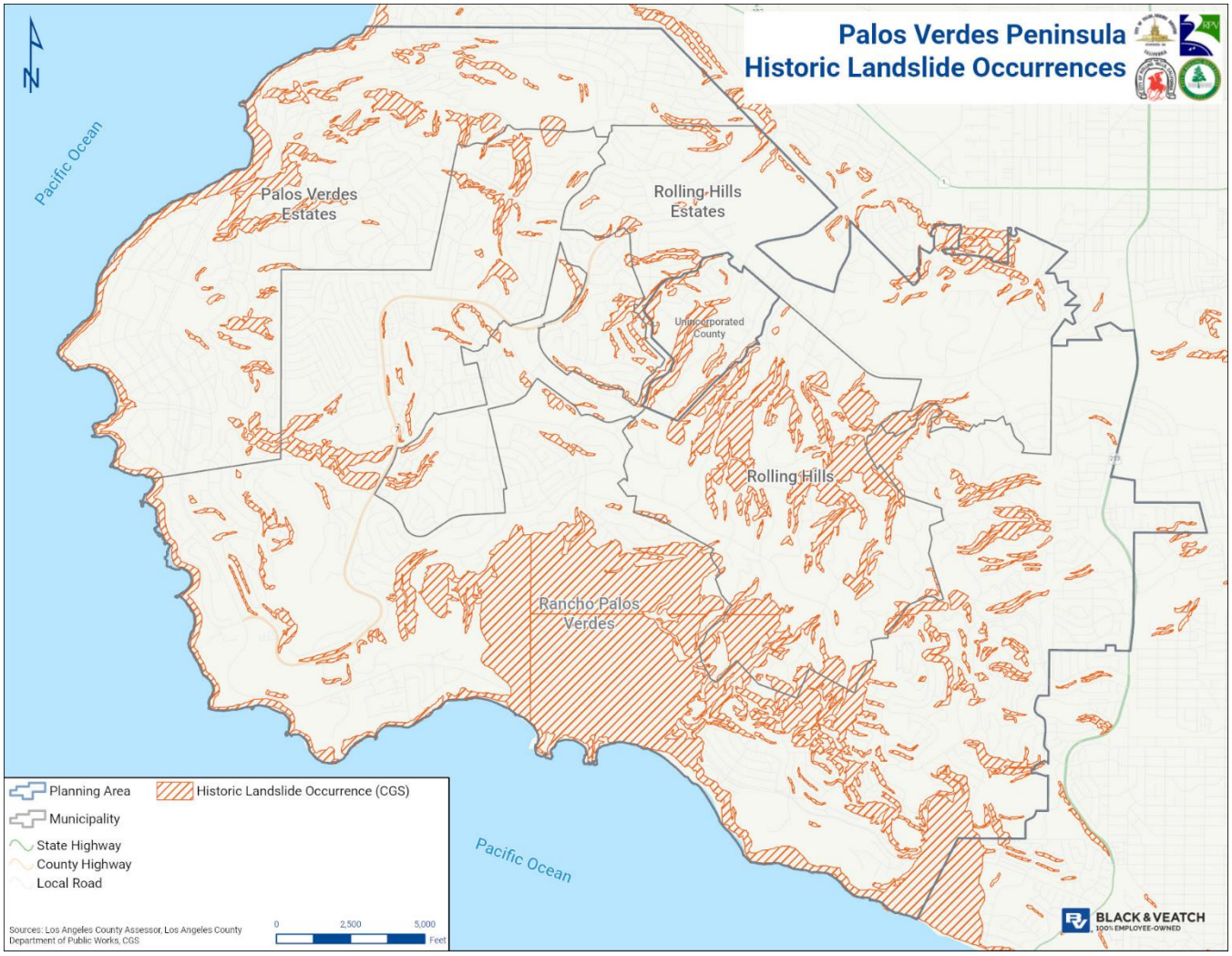


Figure 10-1. Historic Landslide Occurrences

10.1.3 Extent

Measuring Intensity

Landslides are typically a function of soil type and steepness of slope. Soil type is a key indicator for landslide potential and is used by geologists and geotechnical engineers to determine soil stability for construction standards. Figure 10-2 presents the steepness of slope and Figure 10-3 presents the soils map for the Planning Area. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33 percent
- Post-wildfire areas
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable

- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, mixed with granular soils, such as sand or gravel

The best predictor of where slides might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The recognition of ancient dormant landslide sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

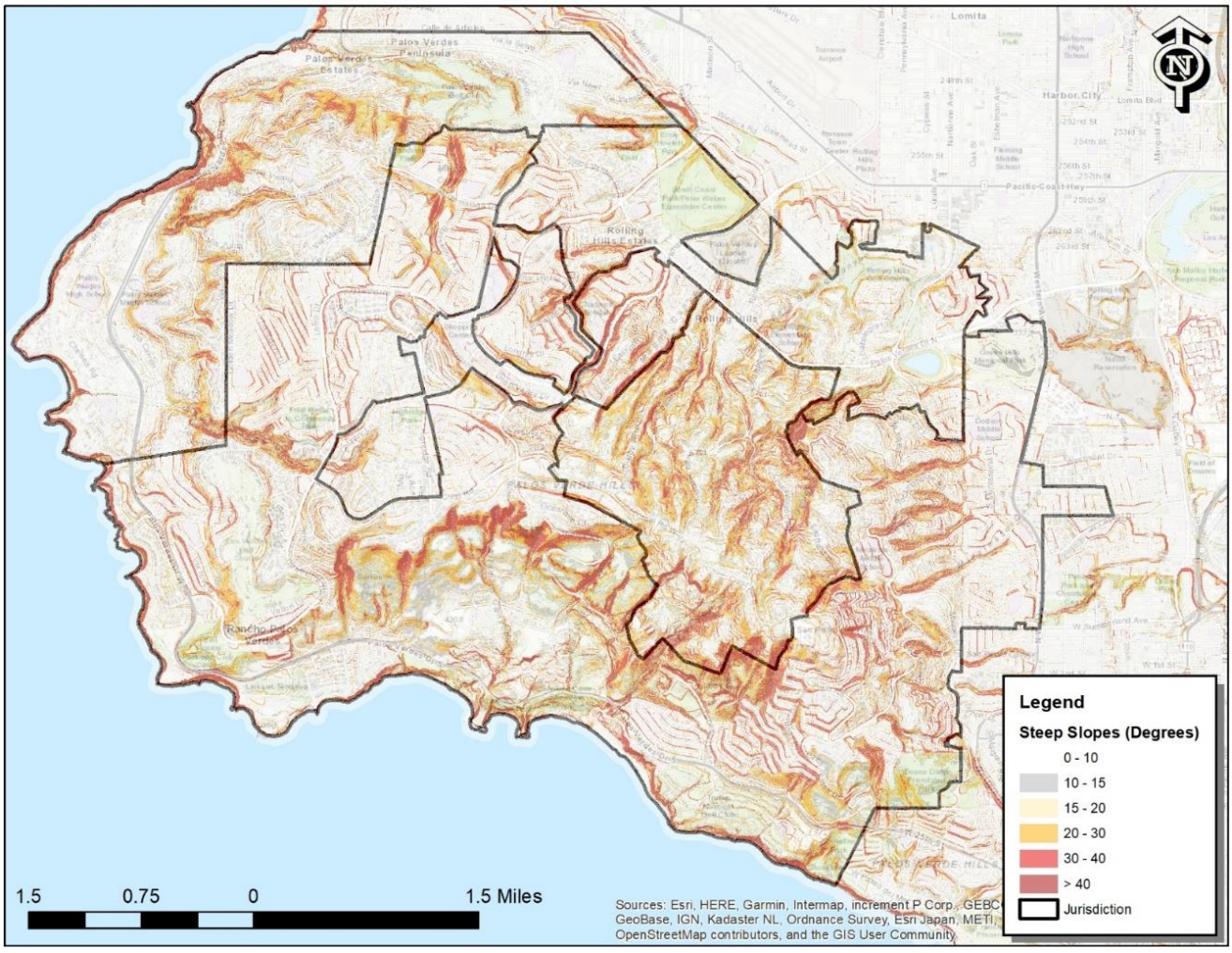


Figure 10-2. Steep Slope Map

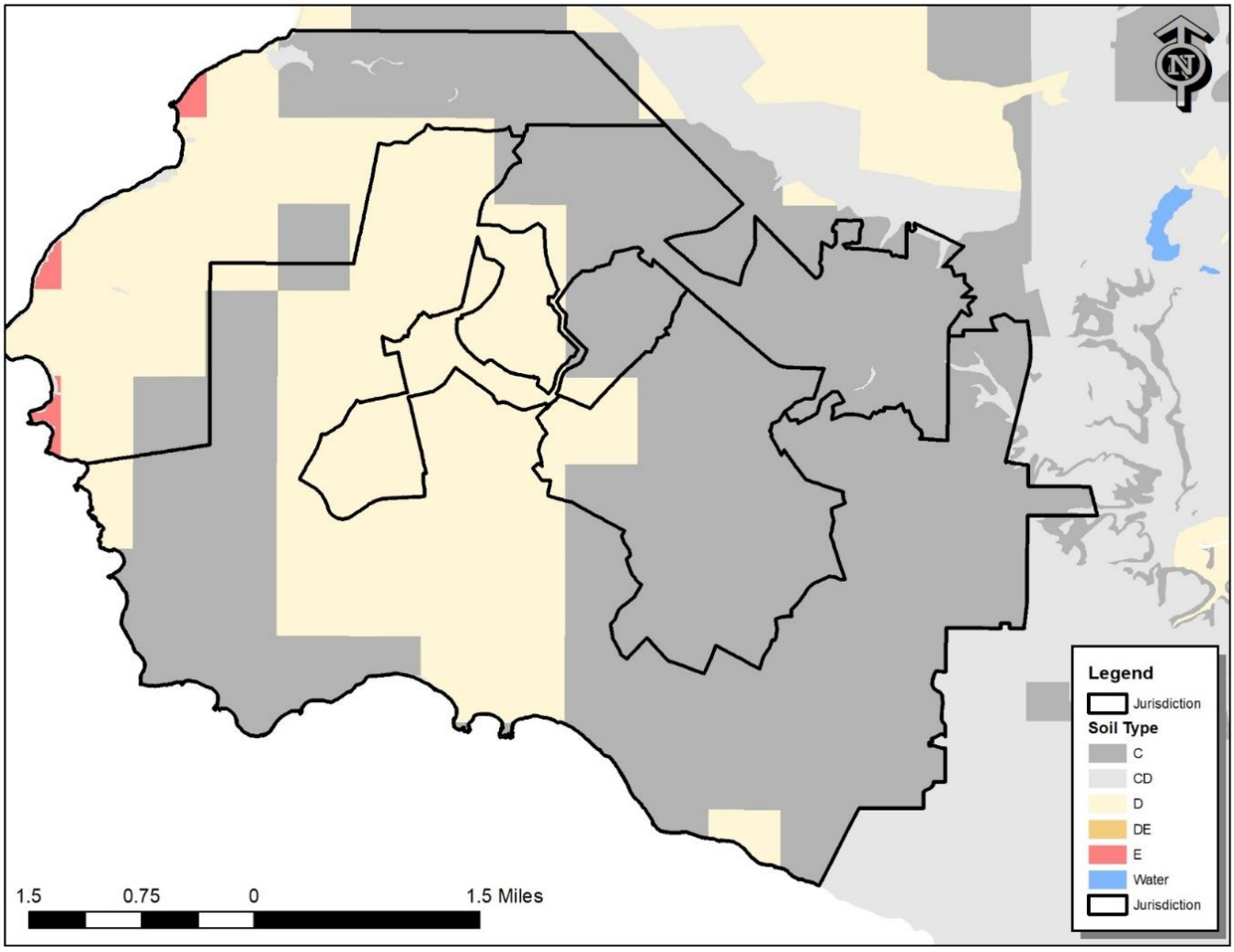


Figure 10-3. Soils Map

Warning Time

Landslides can occur suddenly or slowly. The velocity of slide may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting or moving relative to the main house
- Tilting or cracking of concrete floors and foundations (doors and windows are difficult to move)
- Broken waterlines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)

- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows and visible open spaces indicating frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together

Some methods used to monitor landslides can provide an idea of the type of slide and the amount of time prior to failure. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in predictions of what areas are at risk during general time periods. Currently, there is no practical warning system for individual landslides. The standard operating procedure is to monitor situations on a case-by-case basis and respond when an event occurs.

Worst-Case Scenario

The worst-case scenario for landslide hazards in the Planning Area would generally correspond to a severe storm with heavy rain that caused flooding in an area that had been burned by fire. Landslides are more likely during the late winter when the water table is high. After heavy rains, typically between November and March, soils become saturated with water. As water seeps downward through upper soils, it can weaken and destabilize the slope, especially in areas with weak, clay-rich soils. A short intense storm could cause saturated soil to move, resulting in landslides. As rainfall continues, ground water rising and increase of hydraulic pore pressure adds to the weakening of the slope. Gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

10.1.4 Previous Occurrences

The following sections provide a review of previous landslide/mass movement occurrences in the Palos Verdes Peninsula.

Declarations

Federal Declarations

Between 2019 and 2025, the Planning Area experienced five major disaster (DR) or emergency declarations (EM) associated with Landslides/mass movement.

Table 10-1. Federal Landslide Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-4683-CA	December 27, 2022 – January 31, 2023	January 14, 2023	California Severe Winter Storms, Flooding, Landslides, and Mudslides
EM-3591-CA	January 8 – January 31, 2023	January 9, 2023	California Severe Winter Storms, Flooding, and Mudslides
DR-4699-CA	February 21 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides

Disaster Number	Incident Period	Declaration Date	Description
EM-3592-CA	March 9 – July 10, 2023	March 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31– February 9, 2024	April 13, 2024	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslide

Source: (FEMA, 2025)

State Proclamations

Between 2019 and 2025, California declared one disaster related to landslide/mass movement in the Planning Area. This declaration was related to utility shutoffs caused by the winter storm induced landslides that began in 2023 and are still ongoing.

Table 10-2. State Landslide Disaster Declarations

Disaster Number	Declaration Date	Description
N/A	September 3, 2024	Rancho Palos Verdes Land Movement Impacts to Utility Services

Source: (Cal OES, 2025)

Local Proclamation

On October 3, 2023, the City of Rancho Palos Verdes proclaimed a local emergency due to the winter storm induced landslides, this emergency proclamation remains in effect as of the writing of this plan.

USDA Declarations

Between 2019 and 2025, the USDA declared no disasters related to landslide/mass movement in the Planning Area County (U.S. Department of Agriculture, 2025).

Summary of Significant Events

The Palos Verdes Peninsula has a long history of landslides, most notably the massive, ancient Greater Portuguese Bend Landslide Complex, first significantly activated by road construction in 1956, causing continuous movement and damaging hundreds of homes over decades.

A summary of significant events affecting the Planning Area is detailed below.

1956 Portuguese Bend Landslide

The largest landslide to occur in the Planning Area was the activation of the Portuguese Bend Landslide a subslide of the Greater Portuguese Bend Landslide Complex. The slide area encompasses approximately 270 acres. The weight of the moving material is estimated to be about 60 million tons, with a maximum thickness calculated to be 250 feet. The slide began in August 1956 in conjunction with a Los Angeles County roadway project to extend Crenshaw Boulevard from Crest Road to Palos Verdes Drive South. Initially, movement was 3 to 4 inches per day, quickly slowing to 1 inch per day a month later. The reactivation of this ancient landslide resulted in the loss of 134 residential dwellings, which were damaged beyond repair and razed. Relocation to safer ground saved a few homes (Reiter, 1984). The slide also destroyed the Portuguese Bend Beach Club a private recreational facility that included a large

clubhouse, saltwater pool, boating pier, tennis courts, and volleyball courts. Between 1962 and 1970, movement slowed to 1/2 inch per day (Reiter, 1984).

The Portuguese Bend Landslide movement can range from 12 inches per year to 12 inches per week, depending on the amount of rainfall the previous season. Nearly all of the remaining homes in the active slide area have been placed on elevated or so-called "floating" foundations that can be adjusted as the earth continues to slowly move and buckle beneath the homes. Refer to the summarized impacts of the 2023-2024 Atmospheric River Event for significant events impacting the Portuguese Bend Landslide.

1974 Abalone Cove Landslide

Activation of the 80-acre Abalone Cove Landslide a subslide of the Greater Portuguese Bend Landslide Complex was first noted at the shoreline in February 1974. Slow movement continued between the shoreline and Palos Verdes Drive South until 1978 but only impacted vacant land. In late April or early May 1978, following one of the rainiest seasons on record (29.61 inches fell during 1977-78 compared to an average annual rainfall of 11.38 inches), the slide began to accelerate, and cracking was seen in the roadway. The slide reached its maximum inland extent in February 1980, following 7.75 inches of rain during a 10-day period. Because the Abalone Cove Landslide started along the coastline and progressed landward, it was not triggered by drag from the abutting Portuguese Bend Landslide. The major factors attributed to reactivation of the slide appear to be rainfall and rising groundwater levels (Reiter, 1984). Some homes experienced damage but no homes were destroyed as a result of this slide. The visitor's center at the landmark Wayfarers Chapel was severely damaged and closed to the public in 1982. All but a small portion of the original structure was razed in 1995 and a new visitors center was constructed west of the slide scarp in 1999.

As a result of the Abalone Cove Landslide, the Abalone Cove Landslide Abatement District (ACLAD) was established as a geologic hazard abatement district. The ACLAD continues its mission of abating the Abalone Cove Landslide through the management of dewatering wells to remove ground water that fuels the Abalone Cove Landslide (RPV, 2025).

1979 Klondike Canyon Landslide

Activation of the Klondike Canyon Landslide, a subslide of the Greater Portuguese Bend Landslide Complex occurred in 1979 adjacent to the coastline and to the east of the much larger Portuguese Bend Landslide. Like the Portuguese Bend and the Abalone Cove Landslides, Woodring published the location of the ancient "Beach Club Landslide" in 1946. However, by that time, both Yacht Harbor Drive (in 1927) and Palos Verdes Drive South (in 1937) had been constructed across this landslide. Development of the two roadways was followed in the late 1940's by the construction of the Portuguese Bend Club and grading for the Seaview tract landward of Palos Verdes Drive South was completed in late 1956. Following record-breaking rainfall in 1977-1978, the first indications of movement of the Klondike Canyon Landslide were noted in September 1979 at the intersection of Dauntless Drive and Exultant Drive in the Seaview tract. Heavy rainfall continued during 1979-1980 and 1982-1983, accelerating land movement, which damaged local roads and eventually destroyed one home in the Seaview tract.

In 1981, the Klondike Canyon Landslide Geologic Abatement District (KCLAD) was established as a California State Geological Hazard Abatement District for the 50 acre Klondike Canyon Landslide. KCLAD

manages dewatering wells to lower the ground water table within the slide mass (RPV, 2025). The dewatering efforts have been successful in stabilizing the area and additional landslide abatement efforts have continued since that time, such as drainage improvements in Klondike Canyon and the installation of a private sewer system in the Portuguese Bend Beach Club.

1980 Flying Triangle Landslide

The Flying Triangle landslide, a subslide of the Greater Portuguese Bend Landslide Complex, occupies an area of approximately 70 acres on the south side of the crest of the Palos Verdes Hills overlooking Portuguese Bend. Movement was first formally observed in March 1980, though displacement may have begun as early as 1974. The landslide represents the reactivation of a relatively large, complex compound ancient landslide of probable Pleistocene age that is unrelated to the main Portuguese Bend landslide. The reactivation is directly attributed to a period of unusually heavy precipitation during the early 1980s. As ground movement intensified, residential structures within the affected area were threatened; some homes were demolished, while others were retrofitted and supported on steel I-beam systems to accommodate continued movement. During this period, gas and water utilities were relocated above ground to reduce the risk of rupture and to maintain service continuity.

1997 Indian Peak Road

The 1997 Indian Peak Road caused a considerable amount of property damage. In March 1997, two office buildings located in the 900 block of Indian Peak Road in Rolling Hills Estates toppled and slid down a hillside, causing damage to another building near Deep Valley Drive.

1999 Ocean Trails Golf Course

In June 1999, just 1 week before its scheduled grand opening, the entire 18th fairway of the former Ocean Trails Golf Course in Rancho Palos Verdes collapsed into the ocean, resulting in the loss of approximately 12 acres of land.

2005 Poppy Trail Landslide

On March 5, 2005, a 300-foot-long portion of a steep hillside at No. 1 Poppy Trail Road in Rolling Hills sheared off and slid downhill, terminating just below the roadway easement for Poppy Trail Road. The slide buried a portion of the road, temporarily eliminating ingress and egress for nine residential lots. In response, the affected area was stabilized through emergency grading and other temporary protective measures to reduce erosion and further movement. The slide mass was subsequently reshaped, the roadway was rebuilt, and full ingress and egress were restored to the impacted homes.

2023 Peartree Lane Landslide

The Peartree Lane Slope Failure in Rolling Hills Estates became apparent on July 8, 2023. The landslide moved laterally up to 45 feet into the adjacent canyon and destroyed and/or red-tagged five multi-family townhome structures containing 12 units. An additional five units were yellow-tagged due to utility damage (Rolling Hills Estates, n.d.). The City of Rolling Hills Estates and County of Los Angeles retained a consultant to investigate the Peartree Lane landslide event. The results of the investigation determined that record rainfall from atmospheric rivers in winter 2022–2023 caused a new

landslide in a developed area, with precipitation levels not seen since the 1980s and early 2000s. This event was determined to be a new failure, not a reactivation of a previous slide. Secondary factors included the reduction in vegetation due to residential development and localized surficial failures on the steep slope.

As a result of the Peartree Lane Landslide, Rolling Hills Estates City Council declared a local emergency on January 11, 2023.

2023-2024 Atmospheric River Event

The atmospheric river event that occurred in the winter of 2023-2024 caused land movement in the fall 2023 and early 2024. Flooding resulted in saturated soils and accelerated the Greater Portuguese Bend Landslide Complex including the subslides, impacting areas like Abalone Cove and Klondike Canyon. It also activated the deeper Altamira Landslide that encompasses the Portuguese Bend Landslide, the Abalone Cove Landslide, the Klondike Canyon Landslide, and the Beach Club Landslide.

Analysis completed by NASA's Jet Propulsion Laboratory determined that, during a four-week period in the fall of 2024, land in the residential area slid toward the ocean by as much as 4 inches (10 centimeters) per week (NASA, 2025). The motion accelerated, and the active area expanded following record-breaking rainfall in Southern California in 2023 and heavy precipitation in early 2024 (Jet Propulsion Laboratory , 2025).

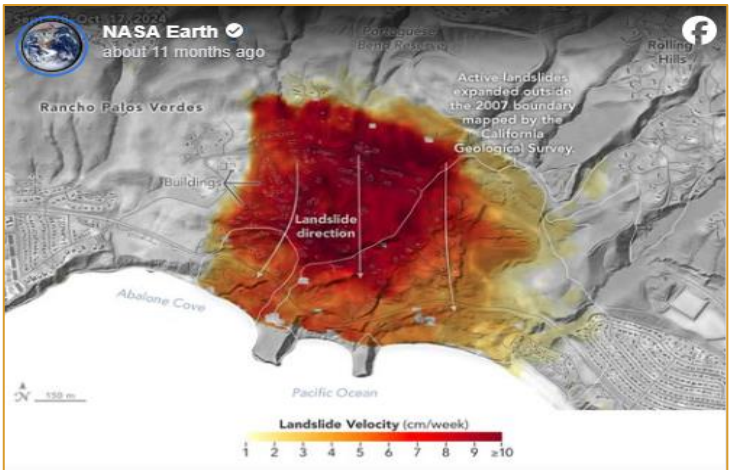


Figure 10-4. Fall 2024 Motion of Landslides on the Palos Verdes Peninsula
Source: (Jet Propulsion Laboratory , 2025)

Figure 10-4 presents a public engagement post by NASA, with the visualization characterizing the speed and direction of the landslide. The darkest reds indicating the highest speeds of earthen movement with the arrows represent the direction of horizontal motion.

Recent Events

The California Department of Conservation reports California landslides in an interactive map built on data provided by government agencies, media, and citizen scientists. Table 10-3 summarizes these events in addition to recent landslide events impacting the Planning Area.

Table 10-3. Recent Landslide Events

Disaster Date	Location	Description
December 9, 2022	Coastal bluff collapse impacting Rat Beach in Palos Verdes Estates.	A significant landslide in December 2022 in Palos Verdes Estates resulted in a massive cliff collapse that nearly destroyed a lifeguard tower and pushed a maintenance truck. The incident, which occurred along the coast near Rosita Place, led to immediate, indefinite closure of the beach due to dangerous, ongoing instability. Following the initial slide, a second, smaller slide occurred within hours. Geologists warned of further instability, leading to the closure of the beach from the southern part of Rat Beach to the northern part of Torrance Beach
July 8, 2023	Peartree Lane, Rolling Hills Estates	Multiple homes damaged or destroyed by a landslide on the slope of the canyon adjacent to Peartree Lane
February 1, 2024	North of Palos Verdes Drive across from entrance to parking lot for Pelican Cove Park in the City of Rancho Palos Verdes.	Mud and debris deposited on eastbound and westbound lanes
September 27, 2025	Coastal bluff off Marguerite Drive near Palos Verdes Drive West in the City of Rancho Palos Verdes.	According to the Los Angeles County Fire Department, approximately 300-400 linear feet of the slope sloughed off, dropping approximately 50-60 feet toward the coastline. There was no reported damage to public property, no injuries and no structural damage to the four homes affected. This landslide is not related to the Greater Portuguese Bend Landslide.

Source: (CA Department of Conservation, 2025)

10.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, as discussed in the sections below.

Probability

Mass movements are often triggered by other natural hazards such as earthquakes, heavy rain, floods, or wildfires, so their frequency is often related to the frequency of the precipitating hazards. Most weather-induced landslides occur in the winter after the water table has risen, but may also occur months following a wet season. Landslides that result from earthquakes can occur at any time. Landslides and land movement are an active hazard in the Planning Area. There is a high probability of landslide activity each year.

Climate Change

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Each these factors would increase the probability of landslides.

Potential Future Impacts

According to the California Department of Finance, the population of the greater Los Angeles County region is expected to increase over the next 45 years. Within the past 5 years, the population of the Palos Verdes Peninsula region has gradually declined. The Planning Area has limited potential for expansion through annexation, as it is surrounded by other incorporated cities and is for the most part built out.

As a result, continued growth would occur through redevelopment rather than outward expansion.

10.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

10.2.1 Summary of Vulnerability

Summary findings of the risk assessment for landslide are shown below. Landslide susceptibility and vulnerability are defined by ten levels of severity, with one being the least susceptible and ten being the most susceptible. Please refer to *Chapter 5. Risk Assessment Methodology and Tools* for the detailed methodology.

10.2.2 Impact on Life, Health, and Safety

All people exposed to the landslide hazard are potentially vulnerable.

Equity Priority Communities

Vulnerable populations may experience greater impacts from landslides and other earth movements due to a financial inability to react or respond to these events. Vulnerable populations may reside in areas with only one means of ingress and egress, making them more vulnerable in the event of an evacuation. Populations with access and functional needs as well as elderly populations are more vulnerable to the landslide hazards as they may not be able to evacuate quickly enough to avoid the impacts of a quick-moving landslide. The table below displays the number of vulnerable populations exposed to landslides.

Table 10-4. Vulnerable Populations Exposed to Landslides

City	Total Population	Demographic Vulnerability Population	Demographic Vulnerability % of Total Population	Evacuation Vulnerability Population	Evacuation Vulnerability % of Total Population
Palos Verdes Estates*	793	424	53.4%	0	0.0%
Rancho Palos Verdes	2,746	712	25.9%	438	15.9%
Rolling Hills	322	322	100.0%	322	100.0%

City	Total Population	Demographic Vulnerability Population	Demographic Vulnerability % of Total Population	Evacuation Vulnerability Population	Evacuation Vulnerability % of Total Population
Rolling Hills Estates	276	79	28.7%	55	19.8%
Total	**4,136**	**1,113**	**26.9%**	**814**	**19.7%**

**See Appendix D for evacuation vulnerability methodology. The threshold for this analysis does not indicate evacuation vulnerability in PVE. However, some evacuation vulnerability does exist in PVE.*

10.2.3 Impact on General Building Stock

Property exposure and losses were estimated through a Level 3 approach using Hazus protocols for a user-defined analysis for the landslide hazard areas. Table 10-5 shows the estimates for the exposure and damage to structures and building contents with the percent of total replacement value. Table 10-6 summarizes the number of structures and type of occupancy in the landslide risk areas.

Table 10-5. Exposure Estimates for Landslide Susceptibility Areas

City	No. of Buildings Exposed	Value of Buildings Exposed	Value of Contents Exposed	Total Replacement Cost Value	% of Total Replacement Value
Deep-Seated Landslide Loss					
Palos Verdes Estates	310	$266,036,027	$133,822,473	$399,858,500	6.9%
Rancho Palos Verdes	904	$575,221,081	$298,030,640	$873,251,721	6.8%
Rolling Hills	135	$132,731,604	$66,365,802	$199,097,406	18.6%
Rolling Hills Estates	103	$51,219,218	$26,879,904	$78,099,122	1.8%
Total	1,452	$1,025,207,930	$525,098,819	$1,550,306,749	6.4%

Table 10-6. Estimated Number of Buildings by Type, Located in the Landslide Susceptibility Areas

City	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Palos Verdes Estates	305	5	0	0	0	0	0	310
Rancho Palos Verdes	891	8	0	1	3	0	1	904
Rolling Hills	135	0	0	0	0	0	0	135
Rolling Hills Estates	101	0	0	1	0	0	1	103
Total	**1,432**	**13**	**0**	**2**	**3**	**0**	**2**	**1452**

10.2.4 Impact on Community Lifelines

Many types of infrastructure are exposed to impacts from landslides, including transportation, water, sewer, gas, power, and communication infrastructure. Highly susceptible areas of the Palos Verdes Peninsula include roads and utility infrastructure, including dewatering systems.

Access to major roads is crucial to life and safety, including evacuations. Landslides can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems and delays for public and private transportation. Many roads are also conduits for utilities that are vulnerable to landslides or land movement. Equestrian communities have the additional impact of evacuation of animals requiring additional time. In the past, large equestrian trailers have impaired residential egress and emergency responder ingress.

Power lines can be subjected to landslides. A landslide could trigger failure of soil underneath a power pole, causing it to collapse and rip down the lines which could lead to fires or wildfires in heavily vegetated areas. Power and communication failures due to landslides can create problems for vulnerable populations and businesses. Refer to Table 10-7 for a summary of community lifelines located in the Palos Verdes Peninsula that are in the moderate, high, and very high landslide hazard areas.

Landslide-induced deformation frequently ruptures buried water and sewer lines, leading to service outages, localized flooding, loss of sanitation, and potential contamination of surrounding soils and coastal waters. These failures disrupt essential community lifelines and can further destabilize slopes by increasing groundwater infiltration and erosion when pressurized pipes break.

Damage curves were not established for the slow-moving landslide hazard. However, the damage and loss associated with damage to the utilities, roads, buildings, and other infrastructure; and emergency spending primarily on dewatering is more than $10 million per year. Refer to Appendix D for more information.

Table 10-7. Community Lifelines in Deep-Seated Landslide Hazard Areas

City	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
Palos Verdes Estates	2	0	0	0	0	0	0	0	2
Rolling Hills Estates	21	1	0	0	0	1	0	2	25
Rancho Palos Verdes	0	0	0	0	0	0	0	0	0
Rolling Hills	0	0	0	0	0	1	0	1	2
Total	23	1	0	0	0	2	0	3	29

10.2.5 Impact on the Economy

Large landslides can cause economic impacts, including losses from severely damaged or destroyed property and infrastructure, and indirect impacts like disruptions to businesses and supply chains (i.e. delivery of goods and services). Homes in the Planning Area that have been red- or yellow-tagged may impact finances of local jurisdictions with the reduction of property taxes.

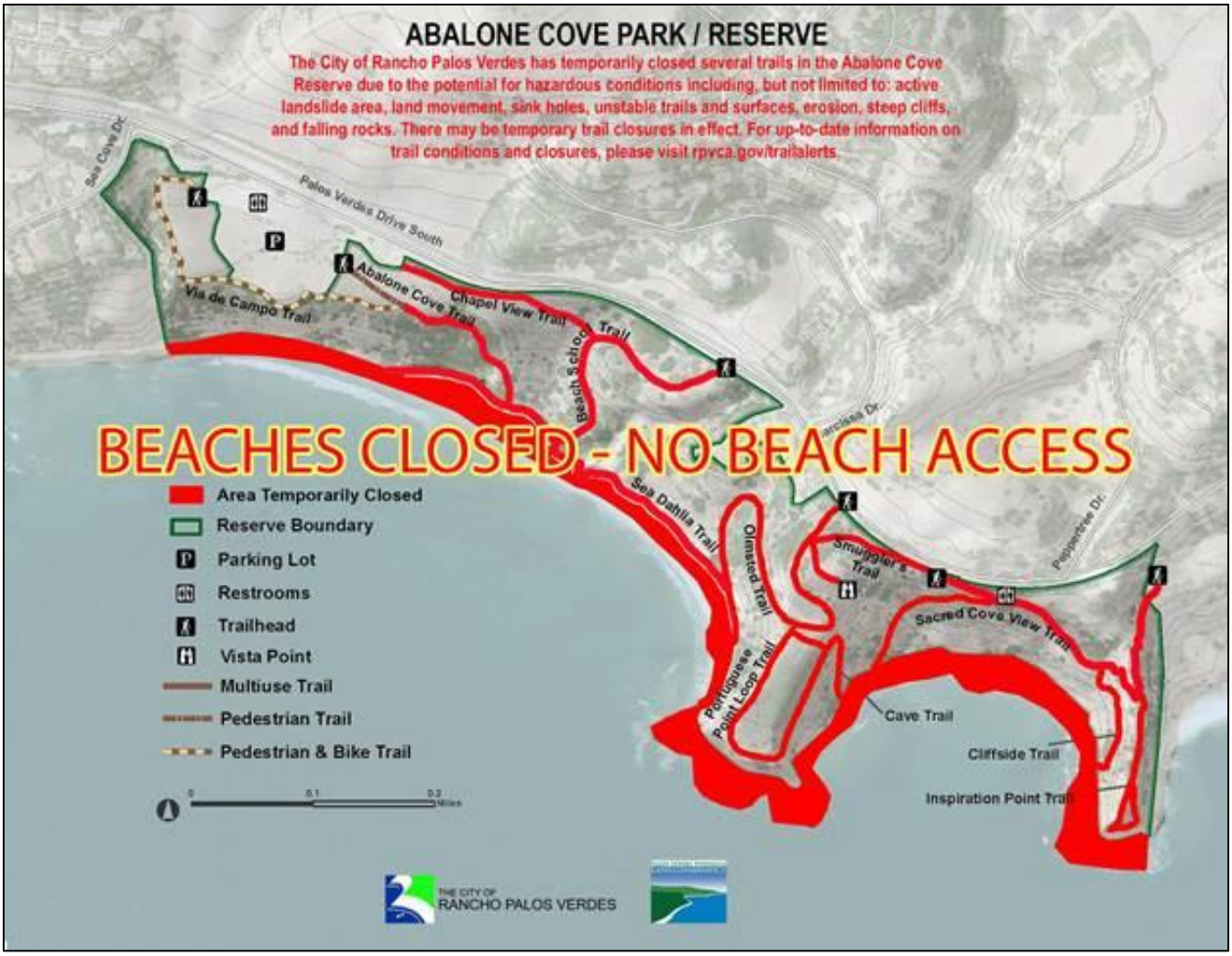
10.2.6 Impact on Historic and Cultural Resources

Landslides can cause damage to historical and cultural resources, ranging from structural damage to historic or protected buildings and monuments to the destruction of artifacts and archaeological sites, impacting cultural heritage.

10.2.7 Impact on Ecosystems and Natural Resources

Landslides can destroy natural resources valuable to the community. Landslides that fall into streams or the ocean may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost due to landslides. Sensitive habitats may be located in areas prone to landslides, increasing the risk to biodiversity.

Landslide movement has also forced the closure of key recreational amenities in the Planning Area, examples include beach access trails in the Abalone Cove Reserve and the full closure of Abalone Cove Beach and Sacred Cove Beach in 2024 due to unsafe ground conditions (RPV, 2025). An example of the Abalone Cove Reserve Closure is presented on Figure 10-5. Shifting terrain has also damaged and restricted access to hiking and equestrian trails within the Palos Verdes Nature Preserve, particularly in the Portuguese Bend Reserve, where rapid land deformation has rendered portions of the trail network unstable and unsafe for public use. These impacts not only limit public recreation but also affect protected habitat areas, where ongoing land movement disrupts vegetation communities and alters ecological corridors essential for native wildlife.



Source: (RPV, 2025)

Figure 10-5. Example of Beach and Trail Closure (Abalone Cove Reserve Closure)

10.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

The risk of landslides and mass movement continues to change as the Palos Verdes Peninsula is an active landslide area. Landslide mitigation activities such as drilling deep dewatering wells have reduced vulnerability in some areas.

Homes in the Planning Area that have been red or yellow tagged may be unoccupied due to landslide activity, therefore the decrease in residential population in those active landslide areas also reduces the population exposed to the hazard.

The changing climate may lead to increased and more frequent rainfall events, which may exacerbate slope instability and landslide hazards. Although population levels in landslide susceptible areas in the Planning Area have declined, the type and location of new or proposed development remain important factors to monitor. Since the prior mitigation planning efforts, areas within the Planning Area that were previously considered developable are now excluded from future development due to landslide activity.

10.3 MITIGATION OPPORTUNITIES

Table 10-8 presents a range of potential opportunities considered by the Planning Partnership for mitigating the landslide/mass movement hazard.

Table 10-8. Potential Opportunities to Mitigate the Landslide/Mass Movement Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Stabilize slope • Reduce weight on top of slope • Minimize vegetation removal and the addition of impervious surfaces	• Stabilize slope • Filling in fissures and lining canyons to minimize water infiltrating the ground and water table	• Stabilize slope • Filling in fissures and lining canyons to minimize water infiltrating the ground and water table • Reduce weight on top of slope
Reduce Exposure and Vulnerability		
• Locate structures outside of hazard area	• Locate structures outside of hazard area	• Armor/retrofit critical infrastructure against the impact of landslides • Support transition of high hazard areas to open space
Build Local Capacity		
• Subscribe to warning systems, and develop evacuation plan • Keep cash reserves for reconstruction • Educate yourself on risk reduction techniques for landslide hazards	• Institute warning system, and develop evacuation plan • Keep cash reserves for reconstruction • Develop a continuity of operations plan • Educate employees on the potential exposure to landslide hazards and emergency response protocol	• Provide public with information on landslide hazard and appropriate risk reduction alternatives
Nature-based Opportunities		
• Replace or restore native vegetation known to stabilize steep slopes • Hybrid solutions that combine engineering with a nature-based approach using appropriate vegetation		

11. STRONG WIND

11.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

11.1.1 Description of the Hazard

Defining the Hazard

Windstorms are generally short-duration events involving straight-line winds or gusts of over 50 miles per hour (mph), strong enough to cause property damage. Windstorms are especially dangerous in areas with significant tree stands and areas with exposed property, poorly constructed buildings, major infrastructure, and above-ground utility lines. A windstorm can topple trees and power lines, cause damage to residential, commercial, and critical facilities, and leave tons of debris in its wake. There are seven primary types of damaging winds (NOAA National Severe Storms Laboratory, n.d.):

- **Straight-line winds**—Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts**—A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts—**A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts**—A small, concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
- **Gust front**—A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho**—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area (National Weather Service, n.d.).

- **Bow echo**—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive damage at the ground (National Oceanic Atmospheric Association, 2023).

In addition to the seven primary types of damaging winds, Southern California also experiences a localized phenomenon known as Santa Ana winds. These strong, dry, gusty downslope winds known as Santa Ana winds form when air from a region of high pressure over the desert region of the southwestern United States flows westward toward low-pressure areas off the California coast (Figure 11-1) (Sosnowski, 2021). As the wind flows over the Sierra Nevada and Santa Ana mountains, it drops from high elevation to sea level. The air becomes compressed and heats up as it sinks, and its relative humidity drops. Gaps in mountains form wind tunnels that strengthen these winds as they pour warm air east to west through the canyons. These winds play a major role in increasing wildfire risk in the region because of the dryness of the winds and the speed with which they can cause a fire to spread, complicating containment efforts (National Weather Service, n.d.).

Source: (Sosnowski, 2021)

Figure 11-1. Santa Ana Winds

Cause of the Hazard

Longer-period windstorms have two main causes: (1) large differences in atmospheric pressure across a region and (2) strong jet stream winds overhead. Horizontal pressure differences may accelerate the surface winds substantially as air travels from a region of higher atmospheric pressure to one of lower (Pielke, 2025).

Santa Ana winds may occur year-round, but are most common during the cooler months, typically from September through March. A Santa Ana wind event can yield sustained winds of 40 mph; isolated wind gusts of over 90 mph have been recorded. Most Santa Ana wind events peak for a 12 to 24 hour period but can persist for a few days (National Weather Service, n.d.).

Summary of Potential Impacts

Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights and parks, and other damage. Wind speeds as low as 32 mph can cause structural damage, and winds of 100 mph can destroy wood-frame structures. High winds can also cause direct losses to buildings, people, and vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damage and interrupted services.

Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing winds can create lift and suction forces that act to pull building components and surfaces outward. As positive and negative forces impact a building's doors, windows, and walls, the result can be roof or building component failures and considerable structural damage. The effects of winds are magnified in the upper levels of multi-story structures.

Debris carried along by extreme winds can contribute directly to loss of life and indirectly to the failure of protective building envelopes. Falling trees and branches can damage buildings, power lines, and other property and infrastructure. Tree limbs breaking in winds of only 45 mph can be thrown over 75 feet, so overhead power lines can be damaged even in relatively minor windstorm events. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds. Utility lines brought down by summer thunderstorms have also been known to cause fires, which start in dry roadside vegetation. Electric power lines falling down to the pavement create the possibility of lethal electric shock.

Downed trees and power lines, and damaged property also can be major hindrances to emergency response and disaster recovery. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures.

Cascading Hazard Impacts

High winds can quickly cause or spread wildfires, inundating nearby areas with heavy smoke.

11.1.2 Location

Strong winds can impact the entirety of the Planning Area.

11.1.3 Extent

Measuring Intensity

Damage from such winds accounts for half of all severe weather reports in the lower 48 states. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. The Beaufort Wind Chart in Table 11-1 provides terminology and a description of potential wind impacts at different levels (California State Water Resources Control Board, n.d.).

Table 11-1. Land Based Beaufort Scale

Beaufort Number	Range (mph)	Terminology	Description
0	0	Calm	Clam. Smoke rises vertically.
1	1-3	Light Air	Wind motion visible with smoke.

Beaufort Number	Range (mph)	Terminology	Description
2	4-7	Light breeze	Wind felt on exposed skin. Leave rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	Fresh breeze	Smaller trees sway.
6	25-31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use is difficult.
7	32-38	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	Severe gale	Light structure damage
10	55-63	Storm	Trees uprooted. Considerable structural damage.
11	64-73	Violent Storm	Widespread structural damage.
12	74-95	Hurricane	Considerable and widespread damage.

Source: California State Water Resources Control Board (Beaufort Wind Force Scale)

Warning Time

NOAA issues watch, warning, and advisory information for high winds. Weather stations and media outlets warn residents of upcoming storms so they may prepare and plan accordingly.

Worst-Case Scenario

The worst-case scenario for strong wind recently occurred in Los Angeles County in January 2025 when wildfires spread rapidly due to strong winds. The Palisades Fire, driven by hurricane-force Santa Ana winds, it burned 23,707 homes, killed 12 people, and destroyed 6,837 structures.

The Eaton Fire began on the evening of January 7, 2025, in the Eaton Canyon in the San Gabriel Mountains, and was driven by powerful Santa Ana winds into foothill communities, particularly Altadena. The fire killed at least 17 people and destroyed more than 9,000 buildings.

These examples show how wildfires can spread by high velocity, warm winds. Wind-driven wildfire scenarios could occur within the Palos Verdes Peninsula.

11.1.4 Previous Occurrences

The following sections provide a review of previous strong wind occurrences in the Palos Verdes Peninsula.

Declarations

Federal Declarations

Between 2019 and 2025, the Palos Verdes Peninsula experienced three strong wind-related major disaster (DR) or emergency declarations (EM).

Table 11-2. Federal Strong Wind Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-4699-CA	February 21 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
DR-4769-CA	January 31– February 9, 2024	April 13, 2024	Severe Winter Storms, Tornadoes, Flooding, Landslides, and Mudslide
DR-4856-CA	January 7- January 31, 2025	January 8, 2025	Wildfires and Straight-Line Winds

Source: (FEMA, 2025)

State Proclamations

Between 2019 and 2025, California included Los Angeles County in seven state-proclaimed disasters relating to strong wind.

Table 11-3. State Strong Wind Disaster Proclamations

Disaster Name	Declaration Date	Disaster Number
Tropical Storm Kay	September 16, 2022	-
December 2022 to January 2023 Storms	January 4, 2023	N-1-23, N-2-23, N-10-23
February to March 2023 Storms	March 1, 2023	N-6-23, N-7-23, N-9-23, N-10-23
Tropical Storm Hilary	August 19, 2023	-
January 2024 Winter Storms	June 21, 2024	-
Early February 2024 Storms	February 4, 2024	-
Los Angeles County Fires and Windstorm Event	January 7, 2025	N-2-25 through N-24-25

Source: (Cal OES, 2025)

USDA Declarations

Between 2019 and 2025, there was one USDA declaration for Los Angeles County relating to strong wind.

Table 11-4. USDA Strong Wind Disaster Declarations

Disaster Number	Incident Period	Description
S5658	August 19 – August 21, 2023	Tropical Storm Hilary

Source: USDA Disaster Designation Information (https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index)

Summary of Significant Events

Due to its geographic conditions, southern California and Los Angeles County have an extensive history dealing with strong winds. California's all-time record for wind gusts was experienced in Los Angeles County on March 25, 1975, when wind gusts of 101 mph were recorded in the Community of Sandberg. (NWS, 2025). Beyond then, Santa Ana winds have seasonally affected Los Angeles County, especially in the San Gabriel and San Bernardino Mountain regions, often reaching above 60 mph (NWS, 2025).

The January 2025 high wind events throughout Los Angeles County ranked among the most damaging and deadliest wind-driven wildfire events in California history. Refer to Chapter 12 Wildfire for additional details.

Recent Events

Between 2019 and 2025, there were two NOAA NCEI Storm Events for Los Angeles County not included in disaster declarations, relating to strong wind.

Table 11-5. NOAA NCEI Storm Events

Disaster Number	Event Date	Description
1187889	February 20, 2024	A third, powerful, winter storm brought significant impacts to Southwestern California. Rainfall totals ranged between 2 and 12 inches. With the heavy rainfall, numerous reports of flooding and mud/debris flows were reported. Also, some gusty winds were reported.
1187947	March 7, 2024	A late-season storm brought significant rainfall to the area along with strong thunderstorms. Rainfall totals across the area ranged from 1 to 2 inches across Los Angeles County. Unstable air, associated with the storm, brought scattered strong thunderstorms to the area, producing gusty winds, large hail and even some flash flooding.

11.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, are discussed in the sections below.

Probability

The Palos Verdes Peninsula regularly experiences strong wind events, especially during the fall and winter months when the Santa Ana winds occur (National Weather Service, n.d.). Based on historic events and projected conditions, there is a high probability of occurrence of at least one strong wind event in the Planning Area every year.

Climate Change

It is uncertain whether strong wind events are becoming more or less frequent under a changing climate (CalOES, 2023). However, impacts from climate change are increasing the intensity and frequence of wildfires which spread quickly by strong winds (Lindsey, 2025).

Potential Future Impacts

The Palos Verdes Peninsula is located in California's most densely populated and developed County. It is surrounded by other incorporated cities so anticipated future growth will be managed through development, which creates an opportunity to build to current codes. The Planning Area will be well-equipped to manage development with its building codes, and the Safety Element of its cities' General Plans.

11.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

11.2.1 Summary of Vulnerability

The entire Planning Area may be impacted by the strong wind hazard.

11.2.2 Impact on Life, Health, and Safety

Damaging winds can cause injuries and fatalities. Downed trees may fall on homes or cars, killing or injuring those inside. Objects that are not secured can be picked up in wind events and become projectiles.

Equity Priority Communities

The entire population of the Planning Area is vulnerable to strong wind events. The elderly, residents with disabilities, and those with limited evacuation route access may be more vulnerable due to slower evacuation times. Residents who live in older homes that are not built in compliance with modern codes and standards may also be more vulnerable. Power outages from strong wind events can be life threatening to those dependent on electricity for medical devices.

11.2.3 Impact on General Building Stock

Loss estimates are represented by a percentage of the replacement cost value of structures in the Planning Area (Table 11-6).

Table 11-6. General Building Stock Replacement Cost Values

City	Total Building Value (Structure and contents)	10% of Total Building Value	30% of Total Building Value	50% of Total Building Value
Palos Verdes Estates	$5,778,400,360	$577,840,036	$1,733,520,108	$2,889,200,180
Rolling Hills Estates	$12,883,794,425	$1,288,379,443	$3,865,138,328	$6,441,897,213
Rancho Palos Verdes	$1,071,504,628	$107,150,463	$321,451,388	$535,752,314
Rolling Hills	$4,372,243,176	$437,224,318	$1,311,672,953	$2,186,121,588
Total	**$24,105,942,589**	**$2,410,594,259**	**$7,231,782,777**	**$12,052,971,294**

11.2.4 Impact on Community Lifelines

All community lifelines within the Palos Verdes Peninsula are vulnerable to direct and cascading impacts from strong wind events. Community lifelines that lack backup power generation capabilities are

especially vulnerable. Facilities located near trees or power lines that are likely to fall are vulnerable. Roads and other transportation infrastructure could be blocked by downed trees or other debris.

11.2.5 Impact on the Economy

Strong winds can cause damage to structure and infrastructure resulting in significant repair or construction costs. Businesses may temporarily close if power is lost due to a wind event.

11.2.6 Impact on Historic and Cultural Resources

Historic structures and those of cultural importance may not be built to standards to withstand strong winds. These historic and cultural resources may sustain damage, resulting in costly repairs or retrofits keeping in harmony with the original structure.

11.2.7 Impact on Ecosystems and Natural Resources

Natural resources are highly vulnerable to strong winds. Natural areas and parks may experience damage to trees and other plants.

11.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

Vulnerability remains consistent since the prior mitigation planning efforts. While strong wind events continue to pose challenges, the lack of significant development or demographic shifts means that overall vulnerability has not increased. While the population has decreased slightly, aging infrastructure and changing climate patterns, could slightly elevate vulnerability.

11.3 MITIGATION OPPORTUNITIES

Table 11-7 presents a range of potential opportunities considered by the Planning Partnership for mitigating the strong wind hazard.

Table 11-7. Potential Opportunities to Mitigate the Strong Wind Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• None
Reduce Exposure and Vulnerability		
• Provide redundant power • Plant appropriate trees near home and power lines (“Right tree, right place” National Arbor Day Foundation Program)	• Relocate critical infrastructure (such as power lines) underground • Reinforce or relocate critical infrastructure such as power lines to meet performance expectations • Install tree wire	• Harden infrastructure such as locating utilities underground • Trim trees back from power lines

Community Scale	Organizational Scale	Government Scale
Build Local Capacity		
• Trim or remove trees that could affect power lines • Promote 72 hour self-sufficiency • Obtain a NOAA weather radio • Obtain an emergency generator	• Trim or remove trees that could affect power lines • Create redundancy • Equip facilities with a NOAA weather radio • Equip vital facilities with emergency power sources	• Support programs such as “Tree Watch” that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. • Increase communication alternatives • Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. • Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines. • Provide NOAA weather radios to the public
Nature-based Opportunities		
• None identified		

12. WILDFIRE

12.1 HAZARD PROFILE

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.

12.1.1 Description of the Hazard

Defining the Hazard

The National Wildfire Coordination Group (NWCG) defines wildfire as a wildland fire originating from an unplanned ignition, such as lightning, unauthorized and accidental human caused fires, and prescribed fires that are declared wildfires (NWCG, 2025). Wildfire can also be ignited by the transport of burning embers by high winds miles away from the initial ignition source. The potential for significant damage to life and property exists in or close proximity to areas designated as "wildland/urban interface areas," where development is adjacent to densely vegetated areas.

The active spread phase is when the fire begins to grow rapidly, driven by dry vegetation, strong winds and terrain. Fires in California have been found to spread up to 14 times faster under high winds. High winds not only accelerate the fire's spread but also carry embers and firebrands over long distances, igniting new spot fires far ahead of the main fire. These flying embers can travel up to a mile or more, making it difficult to predict and contain the fire's advance. Firefighting and resource coordination during this phase is challenging as high winds can hinder the deployment of aerial resources, such as water-dropping helicopters and firefighting planes.

In the fully developed phase, the fire reaches its peak intensity, consuming significant fuel and spreading aggressively. Extreme heat from wildfires can create pyrocumulonimbus clouds, which can spark new fires miles away. These clouds can exacerbate fire spread by generating erratic winds and even sparking new fires through lightning strikes.

In the decay phase, fire intensity decreases as it runs out of fuel or is under control. However, lingering hotspots can reignite under the favoring conditions (Institute of Energy and the Environment, 2025).

Cause of the Hazard

One of the most significant factors is climate change. Warmer temperatures, reduced precipitation, or a changed rainfall season and longer fire seasons have dried out California's landscapes, increasing the potential for ignition and rapid fire spread. Extended periods of drought further exacerbate the issue. Dry vegetation becomes ready to ignite with the slightest spark.

While some fires are fuel-dominated due to century-long fire suppression and changes in land management, others are wind-dominated, particularly in southern California, like the recent Los Angeles wildfires. Winds like Santa Ana and Diablo winds act as accelerants for wildfires. These strong, dry gusts

push flames across vast distances, spreading fires at an alarming rate. Combined with already dry conditions, these winds make controlling wildfires exceptionally challenging.

Wildfire spreads include phases of ignition, active spread, fully developed and decay. During the ignition phase, wildfires can be sparked by natural causes, such as lightning, or human activities like power line failures or campfires. Approximately 84 percent of wildfires in the United States are caused by human activities. Early detection of ignition would be the most critical but challenging thing to minimize the fire's impact.

Summary of Potential Impacts

California wildfires have devastating impacts, including loss of life, homes, and livelihoods, along with significant environmental and economic consequences, including air and water quality issues, and increased mental health challenges.

Human Impacts

- **Loss of Life and Property** – Wildfires can cause fatalities and destroy homes, businesses, and infrastructure.
- **Displacement and Evacuation** – Hundreds to thousands of people are forced to evacuate their homes, leading to temporary or long-term displacement.
- **Air Quality Issues** – Wildfire smoke contains harmful pollutants that can exacerbate respiratory and cardiovascular conditions and even lead to premature death.
- **Mental Health Impacts** – The trauma and uncertainty associated with wildfires can lead to increased rates of depression, anxiety, and post-traumatic stress.
- **Economic Costs** – Wildfires cause significant economic losses, including property damage, business closures, and increased insurance premiums.

Environmental Impacts

- **Air Pollution** – Wildfire smoke releases pollutants into the atmosphere, impacting air quality and human health both locally and downwind.
- **Water Quality Issues** – Ash and debris from fires can contaminate water sources, and burned watersheds are prone to increased flooding and erosion.
- **Habitat Loss and Ecosystem Changes** – Wildfires can destroy forests and other habitats, leading to changes in vegetation and wildlife populations.
- **Marine Ecosystems** – Firefighting runoff and ash can enter coastal waters, potentially harming marine life and ecosystems.
- **Soil Erosion** – Burned areas are more vulnerable to erosion, which can lead to landslides and further damage to the environment.

Economic Impacts

- **Property and Capital Losses** – Wildfires can cause billions of dollars in property damage and economic losses.
- **Increased Insurance Premiums** – The cost of wildfires can lead to higher insurance premiums or even un-insurability for homeowners and businesses.

- **Tourism Impacts** – Wildfires can disrupt tourism and negatively impact local economies.
- **Supply Chain Disruptions** – Wildfires can disrupt transportation and supply chains, leading to shortages and price increases.

Cascading Hazard Impacts

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. A major fire can lead to ancillary effects such as landslides in steep ravine areas and flooding due to the effects of silt in local watersheds. The increased potential for flash flood impacts lasts until vegetation is restored, which can take up to a decade or longer. In these areas, flash flooding poses a threat not only from the massive force and amount of water, but also from debris and ash forming mudslides and debris flows (NOAA Physical Sciences Laboratory). Wildfires cause the contamination of reservoirs, destroy transmission lines and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Vegetation plays a vital role in stabilizing soil on slopes. When wildfires destroy this vegetation, the roots that bind the soil together decay, increasing the likelihood of landslides and debris flows, especially during subsequent rainstorms (USGS, 2025). Altering the soil structure can make the ground less permeable. This change increases stormwater runoff and raises the likelihood of flooding. Post-fire flooding tends to be more destructive due to the presence of sediment, ash, pollutants, and debris to surface water (USGS, 2023), which can mix with rainwater to form damaging mudflows that carry sediment and cause significant destruction.

Impacts from Smoke

Wildfires can have a significant effect on air quality, especially with prolonged periods of burning combined with climatic conditions. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather.

The danger of wildfire smoke comes primarily from particulate matter, consisting of fine particles that are 2.5 micrometers (about a ten-thousandth of an inch) or less in diameter ($PM_{2.5}$). On a given day, California wildfires can produce 10 times more $PM_{2.5}$ air pollution than is produced by all other pollution sources combined (Associated Press, 2020). The small particles in $PM_{2.5}$ pollution are capable of reaching deep into the lungs, causing a host of complications, including significantly increased risks of heart disease, respiratory disease, asthma, and premature mortality. Health problems related to wildfire smoke exposure can be as mild as eye and respiratory tract irritation and as serious as worsening of heart and lung disease, including asthma, and even death. Smoke from wildfires that burn homes and other structures can additionally contain toxic materials such as asbestos and heavy metals. Studies indicate that wildfire smoke is up to 10 times more harmful than other forms of $PM_{2.5}$ pollution (Aguilera, Corringham, Gershunov, & Benharhnia, 2021).

Not all individuals are equally exposed to the hazard of wildfire smoke, nor are they equally vulnerable. Outdoor workers and unhoused individuals have especially high exposure to outdoor air, and younger individuals are especially vulnerable to unhealthy air. On November 15, 2018, over 1 million California children had classes canceled due to wildfires and wildfire smoke (Holm, Miller, & Balmes, 2020).

Because $PM_{2.5}$ pollution affects the immune and cardiovascular systems, other vulnerable populations include people with medical conditions, including diabetes and heart and lung conditions. These vulnerable populations together represent a significant fraction of the California population and indicate inequity in impacts.

At least 95 percent of Californians suffered unhealthy levels of particle pollution due to wildfires in 2020 (Los Angeles Times, 2020). Worse air quality leads to illnesses, emergency room visits, and hospitalizations for chronic health conditions, including chronic obstructive pulmonary disease, asthma, chronic bronchitis, and other respiratory and cardiovascular conditions as well as increased risk for respiratory infections, which all result in greater health costs to the State (Romley, Hackbarth, & Goldman, 2010; Wang, Aaron, & Madrigano, 2019; Inserro, 2018).

12.1.2 Location

The entire Planning Area is susceptible to wildfire. California's seasonally dry climate lends itself to wildfires, and in an effort to better prepare, CAL FIRE is required to classify the severity of wildfire hazard in areas of California. The State Fire Marshal is mandated to classify lands within both State Responsibility Areas and Local Responsibility Areas into Fire Hazard Severity Zones (FHSZ). FHSZs fall into one of the Following Classifications:

- Moderate
- High
- Very High

The FHSZ maps are developed using a science-based and field-tested model that assigns a hazard score based on the factors that influence fire likelihood and fire behavior. Many factors are considered such as fire history, existing and potential fuel (natural vegetation), predicted flame length, blowing embers, terrain, and typical fire weather for the area. While these zones identify the wildfire hazard risk, they do not incorporate the impact of mitigation measures or lack thereof.

The California laws that require FHSZs include California Public Resources Code 4201-4204, California Code of Regulations Title 14, Section 1280 and California Government Code 51175-89. Figure 12-1 shows the FHSZ mapped by CAL FIRE within the Palos Verdes Peninsula.

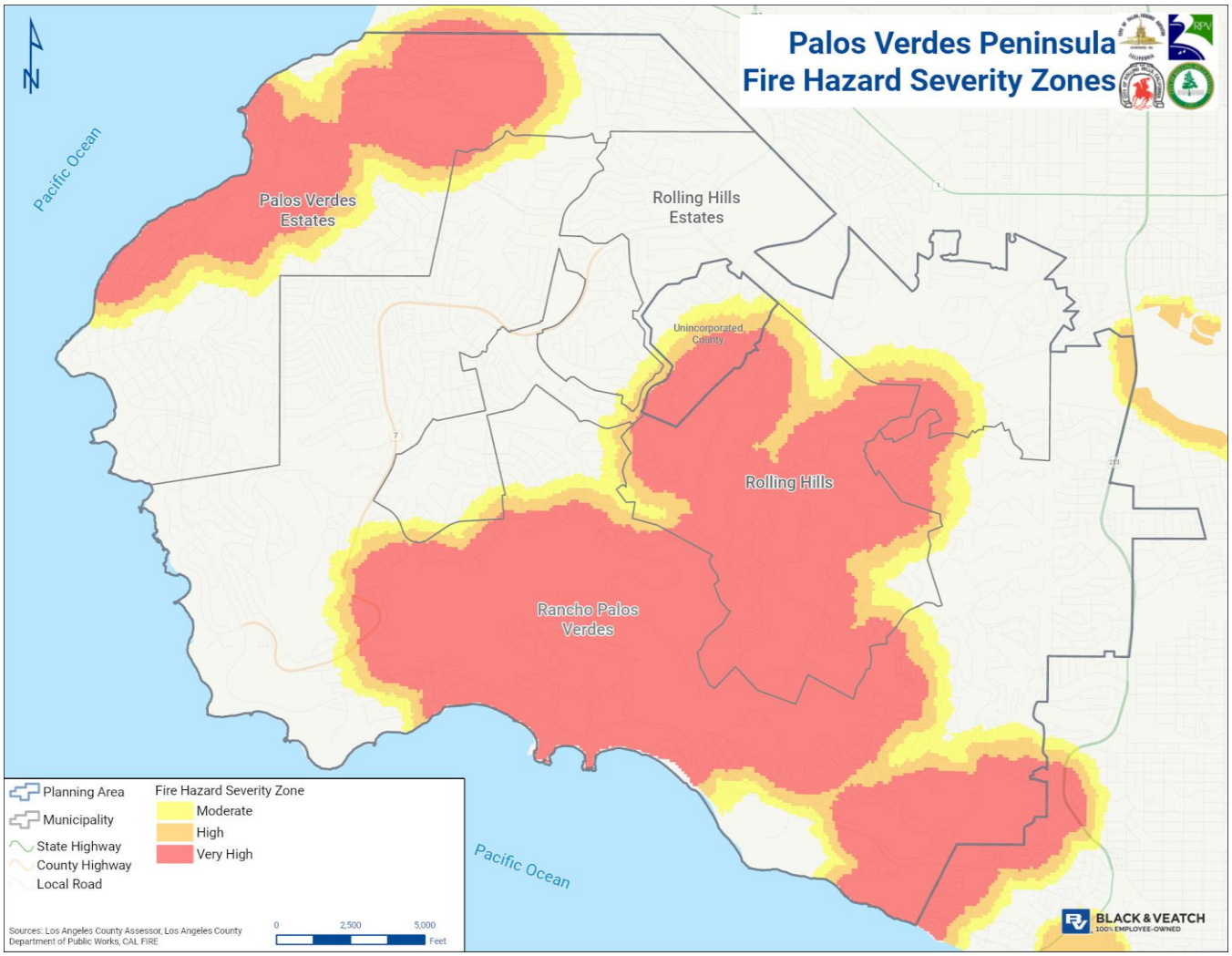


Figure 12-1. Palos Verdes Peninsula Fire Hazard Severity Zones

12.1.3 Extent

Measuring Intensity

The National Fire Danger Rating System is a system that allows fire managers to estimate today's or tomorrow's fire danger for a given area. It combines the effects of existing and expected states of selected fire danger factors into one or more qualitative or numeric indices that reflect an area's fire protection needs. Based on the fire danger, managers may impose restrictions or closures to public lands, plan for or pre-position staff and equipment to fight new fires and make decisions whether to suppress or allow fires to burn under prescribed conditions (National Park Service, 2023).

Five rating levels are used to describe danger levels in public information releases and fire prevention signing (USFS, n.d.):

- **Fire Danger Level: Low**—When the fire danger is "low," it means that fuels do not ignite easily from small embers, but a more intense heat source, such as lightning, may start fires in duff or dry

rotten wood. Fires in open, dry grasslands may burn easily a few hours after a rain, but most wood fires will spread slowly, creeping or smoldering. Control of fires is generally easy.

- **Fire Danger Level: Moderate**—When the fire danger is "moderate," it means that fires can start from most accidental causes, but the number of fire starts is usually pretty low. If a fire does start in an open, dry grassland, it will burn and spread quickly on windy days. Most wood fires will spread slowly to moderately. Average fire intensity will be moderate except in heavy concentrations of fuel, which may burn hot. Fires are still not likely to become serious and are often easy to control.
- **Fire Danger Level: High**—When the fire danger is "high," fires can start easily from most causes, and small fuels (such as grasses and needles) will ignite readily. Unattended campfires and brush fires are likely to escape. Fires will spread easily, with some areas of high-intensity burning on slopes or concentrated fuels. Fires can become serious and difficult to control unless they are put out while they are still small.
- **Fire Danger Level: Very High**—When the fire danger is "very high," fires will start easily from most causes. The fires will spread rapidly and have a quick increase in intensity, right after ignition. Small fires can quickly become large fires and exhibit extreme fire intensity, such as long-distance spotting and fire whirls. These fires can be difficult to control and will often become much larger and longer-lasting fires.
- **Fire Danger Level: Extreme**—When the fire danger is "extreme," fires of all types start quickly and burn intensely. All fires are potentially serious and can spread very quickly with intense burning. Small fires become big fires much faster than at the "very high" level. Spot fires are probable, with long-distance spotting likely. These fires are very difficult to fight and may become very dangerous and often last for several days.

A widely used measure of fire intensity is fire line intensity, which is the rate of heat transfer per unit length of the fire line (measured in kW m−1) and represents the radiant energy release in the flaming front. Fire line intensity is a good measure of how likely the fire is to propagate and how difficult it will be to stop, and thus, it is a critical component of fire behavior models used to inform fire suppression activities. Very seldom is fire line intensity actually measured, rather it is generally inferred based on flame length, which has been found to correlate with fire line intensity; however, this correlation has not been widely tested.

Factors that influence wildfire intensity include the following:

- Fuel: The type, amount, and moisture content of vegetation (fuel) significantly impact intensity.
- Topography: Steep slopes and canyons can concentrate wind and fuel, increasing intensity.
- Weather: Hot, dry, and windy conditions exacerbate fire intensity.

Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when a wildfire might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning and high winds that may spread

a wildfire. Reliable NWS lightning and wind warnings are available on average 24 to 48 hours prior to a significant storm.

The most common and effective methods used currently to detect wildfires in California are remote sensing and satellite monitoring. Satellites like NASA's MODIS and VIIRS provide real-time data on fire location, size, and intensity. These tools help identify new ignitions and monitor fire progression, even in remote areas. Thermal imaging from drones and ground-based radar complements satellite data, offering high-resolution insights for on-the-ground operations. California is also using an artificial intelligence (AI)-powered wildfire detection system using AI to train a forest-based camera network to recognize early signs of fire (https://alertcalifornia.org/).

There have been many controlled or prescribed burns implemented to reduce excess vegetation, like thinning dense forests and clearing underbrush, to mitigate fire severity. There have been robotics companies starting to try out these controlled burns with the help of robots, like the BurnBot. Autonomous helicopters have demonstrated the ability to detect and suppress fires independently.

Additionally, there are computational models, such as ELMFIRE with wildland-urban interface extensions, that simulate fire spread through communities. These tools incorporate data on vegetation, structure materials and fire dynamics to reconstruct past events and predict future risks.

Worst-Case Scenario

The worst-case scenario recently occurred in Los Angeles County in early 2025. For details, refer to *Summary of Significant Events* in this chapter.

12.1.4 Previous Occurrences

The following sections provide a review of previous wildfire occurrences in Los Angeles County.

Declarations

Federal Declarations

Between 2019 and 2025, Los Angeles County experienced 12 wildfire-related major disasters (DR) or emergency declarations (EM).

Table 12-1. Federal Wildfire Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
FM-5293-CA	October 10 – October 22, 2019	October 11, 2019	Saddleridge Fire
FM-5296-CA	October 24 – October 29, 2019	October 24, 2019	Tick Fire
FM-5297-CA	October 28 – November 2, 2019	October 28, 2019	Getty Fire
DR-4569-CA	September 4 – November 17, 2020	October 16, 2020	Wildfires
FM-5374-CA	September 13, 2020	September 13, 2020	Bobcat Fire
FM-5537-CA	September 10 – September 24, 2024	September 11, 2024	Bridge Fire

Disaster Number	Incident Period	Declaration Date	Description
FM-5548-CA	December 10 – December 18, 2024	December 10, 2024	Franklin Fire
FM-5551-CA	January 7, 2025	January 8, 2025	Hurst Fire
FM-5550-CA	January 7, 2025	January 8, 2025	Eaton Fire
FM-5549-CA	January 7, 2025	January 7, 2025	Palisades Fire
DR-4856-CA	January 7 – January 31, 2025	January 8, 2025	Wildfires And Straight-Line Winds
FM-5605-CA	August 7, 2025	August 8, 2025	Canyon Fire

Source: (FEMA, 2025)

State Proclamations

Between 2019 and 2025, California included Los Angeles County in four state-proclaimed wildfire disasters.

Table 12-2. State Wildfire Disaster Declarations

Disaster Number	Declaration Date	Description
N-22-21 (statewide)	August 18, 2020	Fires - River, Jones, LNU Lightning Complex, Weather Conditions
N-81-20	September 25, 2020	Fire - Slater, Bobcat, Oak
N-4-24	September 11, 2024	Airport and Bridge Fires
Multiple	January 7, 2025	Los Angeles County Fires and Windstorm Event

Source: (Cal OES, 2025)

USDA Declarations

Between 2019 and 2025, there were no USDA declarations for Los Angeles County relating to wildfire (U.S. Department of Agriculture, 2025).

Summary of Significant Events

The Palisades Fire

The Palisades Fire was a highly destructive wildfire that began burning in the Santa Monica Mountains of Los Angeles County on January 7, 2025, which grew to destroy large areas of Pacific Palisades, Topanga, and Malibu before it was fully contained after 24 days on January 31. One of a series of wildfires in Southern California driven by hurricane-force Santa Ana winds, it burned 23,707 acres (9,594 ha; 95.94 km2; 37.042 sq mi), killed 12 people, and destroyed 6,837 structures, making it the 10th deadliest and third-most destructive California wildfire on record and the most destructive to occur in the history of the city of Los Angeles.

The Eaton Fire

The Eaton Fire was a highly destructive wildfire in Los Angeles County, Southern California. The fire began on the evening of January 7, 2025, in the Eaton Canyon in the San Gabriel Mountains, and was driven by powerful Santa Ana winds into foothill communities, particularly Altadena. The fire killed at least 17 people and destroyed more than 9,000 buildings, becoming the fifth deadliest and the second

most destructive wildfire in California history. The cause of the fire is under investigation; news reports and lawsuits have focused on the possible involvement of power lines operated by electrical utility Southern California Edison. The fire was fully contained on January 31 after burning for 24 days.

Both fires are examples of how wildfires can spread into areas not to be considered at risk due to the transport of burning embers by high velocity, warm air winds. Even in parts of the Peninsula not included in the very high fire hazard zone, either of these scenarios could occur in any part of the Planning Area under specific circumstances.

Additionally, heavy rains following the fires could cause post-fire debris flow flooding and landslides in areas stripped of vegetation.

Recent Events

The NOAA NCEI Storm Events Database reported 14 wildfire events impacting Los Angeles County from 2019 through 2025. Countywide impacts include 18,724 structures damaged or destroyed, 30 deaths, 38 injuries, and nearly 276,000 acres burned. Wildfire smoke was the only direct impact to the Palos Verdes Peninsula from the fires.

12.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

Probability

With 56 presidential disaster declarations in 55 years (1970 to 2025) the annual probability for wildfire events in Los Angeles County would be one per year based on past events. It is important note that none of the fires noted above occurred within the Planning Area. However, it is likely that the Planning Area experienced impacts from most if not all fires noted to some degree, due to smoke impacts, power outages, transportation interruption of other associated economic impacts. Considering risk potential associated with ember-casting by high winds, the Palos Verdes Peninsula's exposure to annual wildfire risks would be considered to be high.

Climate Change

One of the most significant factors is climate change. Warmer temperatures, reduced precipitation or a changed rainfall season, and longer fire seasons have dried out California's landscapes, increasing the potential for ignition and rapid fire spread. According to California's Fourth Climate Change Assessment, if greenhouse gas emissions continue to rise, California is likely to see a 50 percent increase in fires larger than 25,000 acres as well as a 77 percent increase in average area burned by 2100. Numerous climactic drivers will influence wildfire risk differently between California regions (California Energy Commission, Governor's Office of Planning and Research, & California Natural Resources Agency, 2019):

- **Increasing Temperatures:** Wildfire risk in the Southern California region is rising in tandem with increasing temperatures.

- **Shifting Wind Patterns:** The Santa Ana winds will continue to shape wildfire activity across Southern California. Modelers are still working to determine how these wind events will be impacted by climate change.
- **Shifting Water Patterns:** Climate change will cause shifting water patterns that can impact wildfire risk across the state. In Southern California, changing precipitation will factor heavily into post-fire risk assessments since these landscapes are especially vulnerable to post-fire flooding and landslides (USGS, n.d.).
- **Shifting Insect Habitat:** Bark beetle infestations are rising in response to the changing climate, increasing tree mortality—particularly in the southern Sierra Nevada —and reducing carbon storage.
- **Human Impacts:** Across all of California's landscapes, human factors, such as development patterns and risk mitigation strategies, will have a direct impact on communities' ability to mitigate and adapt to the impacts of climate change. Local decisions are a large factor in determining the future health of a community.

Potential Future Impacts

The future impacts of wildfires in the Planning Area could be profound. Ecologically, more frequent fires threaten ecosystem health and stability. Economically, wildfires can devastate local industries such as tourism, while also increasing insurance costs and straining emergency services. Socially, communities may face displacement, health risks from smoke exposure, and long-term recovery challenges. If current trends continue, the Planning Area could see a wildfire season that starts earlier, lasts longer, and includes more extreme fire events, potentially overwhelming local resources and infrastructure.

As the population of Palos Verdes Peninsula changes, impacts will change accordingly.

12.2 VULNERABILITY ASSESSMENT

Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)

The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.

12.2.1 Summary of Vulnerability

For the vulnerability assessment of this hazard, the entire Planning Area has been considered to be exposed to wildfire impacts, either by direct impacts, or cascading impacts from wildfires within the region. There are currently no models available to measure direct impacts from wildfire risks, therefore, for this qualitative assessment on vulnerability has been associated with exposure to the mapped wildfire hazard severity zones.

12.2.2 Impact on Life, Health, and Safety

Larger and more intense wildfires are creating the potential for greater smoke production and chronic exposures in the United States, particularly in the West. Wildfires increase air pollution in surrounding areas and can affect regional air quality. The effects of smoke from wildfires can range from eye and respiratory tract irritation to more serious disorders, including reduced lung function, bronchitis, exacerbation of asthma and heart failure, and premature death. Children, pregnant women, and the elderly are especially vulnerable to smoke exposure. Emissions from wildfires are known to cause increased visits to hospitals and clinics by those exposed to smoke.

Within the Planning Area, an estimated 19,273 people are located in the FHSZs (Table 12-3).

Table 12-3. Estimated Number of People Living in the FHSZs

City	Total Population[1]	Population Exposed[2]	% Total
Moderate FHSZ			
Palos Verdes Estates	12,999	1,045	8.0%
Rancho Palos Verdes	40,727	2,619	6.4%
Rolling Hills	1,677	141	8.4%
Rolling Hills Estates	8,545	431	5.0%
Total	**63,948**	**4,236**	**6.6%**
High FHSZ			
Palos Verdes Estates	12,999	1,086	8.4%
Rancho Palos Verdes	40,727	2,487	6.1%
Rolling Hills	1,677	248	14.8%
Rolling Hills Estates	8,545	338	4.0%
Total	**63,948**	**4,160**	**6.5%**
Very High FHSZ			
Palos Verdes Estates	12,999	3,405	26.2%
Rancho Palos Verdes	40,727	6,142	15.1%
Rolling Hills	1,677	1,221	72.8%
Rolling Hills Estates	8,545	109	1.3%
Total	**63,948**	**10,877**	**17.0%**

Sources: (CAL FIRE, 2025a); (Hazus v6.1, 2023)

Notes: (1) Population calculated using 2020 Census data from Hazus v6.1.

(2) Percent of residential buildings exposed multiplied by the Estimated Population.

Equity Priority Communities

Equity Priority Community populations, including the elderly, people with disabilities, and those with limited evacuation access are disproportionately impacted by wildfires, facing greater risks due to the following:

- Elderly Populations—Physical difficulties and cognitive decline can hamper older adults' ability to keep their properties clear of flammable materials, such as dry shrubs and grasses, and can slow their ability to evacuate in an emergency. The fire that destroyed the town of Paradise, California, in 2018 was a tragic example. Of the 85 victims, 68 were 65 years or older.

- Disabled Populations—People with mobility or cognitive impairments may struggle to evacuate or cope with the aftermath of a wildfire.
- Evacuation Access—Residents who live in neighborhoods with only one way out are more vulnerable during an evacuation if their route is blocked or congested with traffic.

Table 12-4. Vulnerable Populations Exposed to FHSZs

City	Total Population	Demographic Vulnerability Population	Demographic Vulnerability % of Total Population	Evacuation Vulnerability Population	Evacuation Vulnerability % of Total Population
Moderate Fire Hazard Severity Zone					
Palos Verdes Estates*	1,045	569	54.5%	0	0.0%
Rancho Palos Verdes	2,619	1,276	48.7%	724	27.6%
Rolling Hills	141	141	100.0%	141	100.0%
Rolling Hills Estates	431	297	69.0%	210	48.7%
Total	**4,236**	**1,714**	**40.5%**	**1,075**	**25.4%**
High Fire Hazard Severity Zone					
Palos Verdes Estates*	1,086	530	48.8%	0	0.0%
Rancho Palos Verdes	2,487	860	34.6%	598	24.0%
Rolling Hills	248	239	96.2%	239	96.2%
Rolling Hills Estates	338	246	72.6%	183	54.0%
Total	**4,160**	**1,344**	**32.3%**	**1,019**	**24.5%**
Very High Fire Hazard Severity Zone					
Palos Verdes Estates*	3,405	1,417	41.6%	0	0.0%
Rancho Palos Verdes	6,142	1,183	19.3%	1,149	18.7%
Rolling Hills	1,221	1,221	100.0%	1,221	100.0%
Rolling Hills Estates	109	106	97.5%	95	87.5%
Total	**10,877**	**2,511**	**23.1%**	**2,466**	**22.7%**

**See Appendix D for evacuation vulnerability methodology. The threshold for this analysis does not indicate evacuation vulnerability in PVE. However, some evacuation vulnerability does exist in PVE.*

12.2.3 Impact on General Building Stock

Fire Hazard Severity Zone Exposure

CAL FIRE released updated FHSZ mapping for the California that included very high, high, and moderate severity zones within the Palos Verdes Peninsula. Table 12-5 presents the estimated number of buildings located in the FHSZs. Table 12-6 presents the number of buildings by structure type. Of the structures exposed, the majority are residential structures.

Table 12-5. Estimated Buildings Located in FHSZs

City	Total Buildings	Total Buildings Exposed	% Total
Moderate FHSZ			
Palos Verdes Estates	5,063	402	7.9%
Rancho Palos Verdes	13,399	856	6.4%
Rolling Hills	710	60	8.5%
Rolling Hills Estates	3,302	169	5.1%
Total	**22,474**	**1,487**	**6.6%**
High FHSZ			
Palos Verdes Estates	5,063	424	8.4%
Rancho Palos Verdes	13,399	813	6.1%
Rolling Hills	710	105	14.8%
Rolling Hills Estates	3,302	125	3.9%
Total	**22,474**	**1,467**	**6.5%**
Very High FHSZ			
Palos Verdes Estates	5,063	1,340	26.5%
Rancho Palos Verdes	13,399	2,019	15.1%
Rolling Hills	710	516	72.7%
Rolling Hills Estates	3,302	41	1.2%
Total	**22,474**	**3,916**	**17.4%**

Table 12-6. Estimated Number of Buildings, by Structure Type, Located in FHSZs

City	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Moderate FHSZ								
Palos Verdes Estates	402	0	0	0	0	0	0	402
Rancho Palos Verdes	850	0	0	0	6	0	0	856
Rolling Hills	59	1	0	0	0	0	0	60
Rolling Hills Estates	158	10	0	0	0	0	1	169
Total	**1,469**	**11**	**0**	**0**	**6**	**0**	**1**	**1,487**
High FHSZ								

City	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Palos Verdes Estates	418	0	0	0	2	1	3	424
Rancho Palos Verdes	807	4	0	0	0	0	2	813
Rolling Hills	104	1	0	0	0	0	0	105
Rolling Hills Estates	124	1	0	0	0	0	0	125
Total	**1,453**	**6**	**0**	**0**	**2**	**1**	**5**	**1,467**
Very High FHSZ								
Palos Verdes Estates	1,310	24	0	0	0	4	2	1,340
Rancho Palos Verdes	1,993	8	0	2	6	4	6	2,019
Rolling Hills	512	2	0	0	0	2	0	516
Rolling Hills Estates	40	1	0	0	0	0	0	41
Total	**3,855**	**35**	**0**	**2**	**6**	**10**	**8**	**3,916**

Building Codes and Associated Vulnerability

Modern building codes significantly reduce wildfire vulnerability by mandating fire-resistant materials, construction practices, and features like enclosed eaves and meshed vents, ultimately increasing the likelihood of home survival in high-risk areas. Every wildfire creates an opportunity to mitigate future wildfire risk through recovery with the application of strong codes and standards.

The State of California is a mandatory building code state. California first mandated building code adopted locally in 1978 with state legislation (SB 331, Robbins) requiring that building standards be unified in a single code within the California Code of Regulations, designated as Title 24, the California Building Standards Code. The basis for the California Building Code has always been the International Building Code (IBC), or its predecessor, the Uniform Building Code. The IBC has always included requirements for fire and smoke protection features, but the first edition of the IBC, which was adopted in 2000, was the first time these requirements were codified in a single, comprehensive building code. Chapter 7 of the IBC includes detailed requirements for fire and smoke protection features, including the following:

- Fire-resistance-rated construction: This includes requirements for the fire resistance of structural members, walls, partitions, and horizontal assemblies.
- Fire alarm systems: The IBC specifies requirements for the installation and maintenance of fire alarm systems.
- Fire suppression systems: The IBC includes requirements for fire suppression systems, such as sprinkler systems.
- Smoke control systems: The IBC includes requirements for smoke control systems, such as smoke vents and exhaust fans.

Working under the premise that any structure not built to Chapter 7 of the IBC standards would be more vulnerable to fire starts from ember transport by high winds, and that any structure not held to any codes

or standards would be the most vulnerable, an exposure analysis was performed using the date of construction as an identifier for potential vulnerability. Table 12-7 shows residential building counts in the following categories:

- Structures built before 1978, where codes and standards were not required by state mandate.
- Structures built between 1978 and 2000, where codes and standards applied to new construction, but not with specificity to smoke and fire protection.
- Structures built after 2000 where application of Chapter 7 of the IBC is applied.

Table 12-7. General Building Stock by Date of Construction

Building Code Milestone	Number of Current Residential Structures Built in Period by City		Total Residential (includes multi-family)
Built before 1978	Palos Verdes Estates	3,462	16,768
	Rancho Palos Verdes	10,740	
	Rolling Hills	425	
	Rolling Hills Estates	2,141	
Built between 1978 and 2000	Palos Verdes Estates	1,032	3,938
	Rancho Palos Verdes	1,986	
	Rolling Hills	200	
	Rolling Hills Estates	720	
Built after 2000	Palos Verdes Estates	507	1,346
	Rancho Palos Verdes	490	
	Rolling Hills	78	
	Rolling Hills Estates	271	

With well over 16,000 residential structures in the Planning Area built before 1978, there could be an assumed level of vulnerability to that building stock from wildfire risk, assuming exposure to ember casting from regional wildfires. The degree of vulnerability is uncertain, but any structure built before 1978, surrounded by tree canopy, would be considered to be the highest degree of risk.

12.2.4 Impact on Community Lifelines

All community lifelines located in the FHSZ are exposed and vulnerable to the wildfire hazard and are likely to experience functional downtime following wildfire events that could increase the overall impact of such events. Wildfires can have an impact on water supplies because of residual pollutants like char or debris landing in water resources which can clog wastewater pipes, culverts, etc. Wildfires may also impact transportation routes, blocking residents and commuters from getting in and out of the City during a wildfire event because of heavy smoke making it difficult to drive, or where the flames have close proximity to the roadways, making the route an unsafe passageway.

Refer to Table 12-8 for a summary of community lifelines located in the Palos Verdes Peninsula that are in the moderate, high, and very high fire severity zones.

Table 12-8. Community Lifelines in Wildfire Severity Zones

City	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
Moderate FHSZ									
Palos Verdes Estates	0	0	0	0	0	0	0	0	0
Rancho Palos Verdes	1	0	0	0	0	1	0	0	2
Rolling Hills	0	0	0	0	0	0	0	1	1
Rolling Hills Estates	1	0	0	0	1	1	0	0	3
Total	2	0	0	0	1	2	0	1	6
High FHSZ									
Palos Verdes Estates	0	0	0	0	1	2	0	1	4
Rancho Palos Verdes	3	0	0	0	0	1	0	0	4
Rolling Hills	0	0	0	0	0	1	0	0	1
Rolling Hills Estates	0	0	0	0	0	0	0	1	1
Total	3	0	0	0	1	4	0	2	10
Very High FHSZ									
Palos Verdes Estates	11	1	0	0	0	5	1	1	19
Rancho Palos Verdes	92	1	0	0	0	5	0	7	105
Rolling Hills	1	0	0	0	0	2	0	0	3
Rolling Hills Estates	0	0	0	0	0	0	0	1	1
Total	104	2	0	0	0	12	1	9	128

12.2.5 Impact on the Economy

Wildfires can have both positive and negative effects on local economies. Positive effects come from economic activity generated in the community during fire suppression and post-fire rebuilding. However, local economies only experience positive effects if fire suppression spending and contracting is done locally. In addition, future benefits are only possible if the fire stimulates, rather than stops, economic development efforts associated with recovery.

Factors that affect state and local budgets in the long-term include the following:

- Replacement of lost facilities and associated infrastructure,
- Watershed and water quality mitigation, and
- Sensitive species and habitat restoration.

Of the Planning Area's $24.1 billion in total replacement cost values of structures, 32.9 percent ($7.94 billion) are exposed to the FHSZs.

Table 12-9. Estimated Replacement Cost Value of Buildings Located in the FHSZs

City	Total Replacement Cost Value	Exposed Structure Value	Exposed Contents Value	Total Exposed	% Total Value Exposed
Moderate FHSZ					
Palos Verdes Estates	$5,778,400,360	$281,620,930	$140,810,465	$422,431,394	7.3%
Rancho Palos Verdes	$12,883,794,425	$552,700,048	$286,401,758	$839,101,806	6.5%
Rolling Hills	$1,071,504,628	$50,298,617	$25,175,614	$75,474,231	7.0%
Rolling Hills Estates	$4,372,243,176	$175,944,992	$127,639,484	$303,584,475	6.9%
Total	**24,105,942,589**	**$1,060,564,586**	**$580,027,321**	**$1,640,591,906**	**6.8%**
High FHSZ					
Palos Verdes Estates	$5,778,400,360	$397,943,708	$240,159,438	$638,103,145	11.0%
Rancho Palos Verdes	$12,883,794,425	$589,902,680	$313,194,403	$903,097,083	7.0%
Rolling Hills	$1,071,504,628	$109,085,109	$60,866,035	$169,951,144	15.9%
Rolling Hills Estates	$4,372,243,176	$83,180,192	$42,629,284	$125,809,476	2.9%
Total	**24,105,942,589**	**$1,180,111,689**	**$656,849,159**	**$1,836,960,848**	**7.6%**
Very High FHSZ					
Palos Verdes Estates	$5,778,400,360	$1,116,478,024	$582,412,258	$1,698,890,281	29.4%
Rancho Palos Verdes	$12,883,794,425	$1,288,574,053	$665,222,293	$1,953,796,347	15.2%
Rolling Hills	$1,071,504,628	$521,353,242	$261,527,690	$782,880,932	73.1%
Rolling Hills Estates	$4,372,243,176	$18,484,982	$9,276,891	$27,761,872	0.6%
Total	**24,105,942,589**	**$2,944,890,301**	**$1,518,439,131**	**$4,463,329,432**	**18.5%**

12.2.6 Impact on Historic and Cultural Resources

The impact to historic cultural resources from direct and indirect exposure to fire and fire-related activities may be swift and detrimental. Wildfires can rapidly engulf historic buildings, archaeological sites, and culturally significant landscapes, leading to irreversible loss of heritage. The loss of such historic and cultural resources would not only erase tangible connections to the past but also diminish the cultural richness and historical continuity of the Palos Verdes Peninsula.

12.2.7 Impact on Ecosystems and Natural Resources

Wildfires present a serious threat to the Palos Verdes Peninsula because of its dry grasslands, which become highly flammable during the hot, dry summer months. Watersheds are particularly vulnerable, with fires potentially reducing water supply reliability and compromising water quality through increased

sedimentation and runoff. Air quality also deteriorates significantly during and after fire events, affecting both human health and environmental conditions.

The aesthetic and recreational value of the Planning Area is another major concern. Large-scale fires can scar scenic landscapes and recreational areas, diminishing the visual appeal that draws tourists and outdoor enthusiasts. The loss of these resources would have profound ecological and economic consequences.

12.2.8 Change in Vulnerability Since the Prior Planning Area HMPs

Wildfire vulnerability may have increased slightly due to prolonged drought conditions and increased fuel loads, but not due to population or development changes. The Planning Area's population has decreased slightly. However, climate-driven changes in fire behavior could elevate risk despite the population change. Climate change has intensified wildfire behavior, with longer fire seasons and more extreme fire weather.

12.3 MITIGATION OPPORTUNITIES

Table 12-10 presents a range of potential opportunities considered by the Planning Partnership for mitigating the wildfire hazard.

Table 12-10. Potential Opportunities to Mitigate the Wildfire Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• Clear potential fuels on property such as dry overgrown underbrush and diseased trees	• Clear potential fuels on property such as dry overgrown underbrush and diseased trees	• Clear potential fuels on property such as dry overgrown underbrush and diseased trees • Implement best management practices on public lands
Reduce Exposure and Vulnerability		
• Create and maintain defensible space around structures and provide water on site • Locate outside of hazard area • Maintain trimmed trees and grass • Use fire-resistant building materials	• Create and maintain defensible space around structures and infrastructure and provide water on site • Locate outside of hazard area • Use fire-resistant building materials • Use fire-resistant plantings in buffer areas of high wildfire threat	• Create and maintain defensible space around structures and infrastructure • Locate outside of hazard area • Enhance building code to include use of fire-resistant materials in high hazard area • Use fire-resistant plantings in buffer areas of high wildfire threat • Consider higher regulatory standards (such as Class A roofing) • Establish biomass reclamation activities

Community Scale	Organizational Scale	Government Scale
		• In high-risk areas, use heat-resistant materials like welded steel, and avoid heat-susceptible materials like polyvinyl chloride and high-density polyethylene
Build Local Capacity		
• Employ techniques from the National Fire Protection Association's Firewise Communities program to safeguard home • Identify alternative water supplies for firefighting • Install/replace roofing material with non-combustible roofing materials	• Support Firewise community initiatives • Create/establish stored water supplies to be utilized for firefighting	• More public outreach and education efforts, including an active Firewise program • Identify fire response and alternative evacuation routes • Seek alternative water supplies • Become a Firewise community • Use academia to study impacts/solutions to wildfire risk • Establish/maintain mutual aid agreements between fire service agencies • Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development • Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions • Provide incentives for existing structures to be hardened against wildfire • Use tools to detect, forecast, and take action ahead of wildfire
Nature-based Opportunities		
• Manage invasive species that are susceptible to increased wildfire risk • Create riparian corridors in wildfire hazard areas as fire breaks • Incorporate nature-based wildfire risk reduction buffers into existing ecosystem-friendly land uses (e.g., green space, trains, or parks)		

13. OTHER HAZARDS OF INTEREST

After reviewing the previous plan and considering options for other hazards of interest to address, the HMPC selected a limited number of hazards of interest to include in the development of this Multi-Jurisdictional Hazard Mitigation Plan. The sections below provide short profiles of each hazard of interest, including a qualitative discussion of their potential impact in the Planning Area. No formal risk assessment was performed, no mitigation actions have been developed to address them, and the hazards are not included in the risk ranking. However, all Planning Partners for this plan should be aware of these hazards and take steps to reduce the risks they present whenever it is practical to do so.

13.1 GROUNDWATER SEEPAGE

13.1.1 Overview

Malaga Cove Plaza in Palos Verdes Estates has experienced persistent groundwater seepage since the early 1980s, causing building damage and operational difficulties for businesses as water infiltrates foundations and basements. Despite installing dewatering wells, sump pumps, and a subdrain in 1997, these measures have become costly and increasingly ineffective, leaving the area vulnerable to recurring water intrusion. Geophysical studies show that variable subsurface conditions such as sand layers of differing thickness interspersed with low permeability clay cause groundwater to accumulate and flow laterally along permeable zones, producing seepage along streets aligned with these pathways. Additionally, fractured rock associated with the Palos Verdes and Cabrillo fault zones provides further conduits for groundwater movement toward the plaza. Combined with steep local topography that channels surface and subsurface water northward, along with infiltration from rainfall and irrigation at higher elevations, these factors continuously drive groundwater toward Malaga Cove Plaza.

13.1.2 Identified Groundwater Seepage

Groundwater seepage is the slow movement of water through soil or rock until it reaches the ground surface or enters nearby structures. It occurs when water stored below the surface follows natural openings or permeable layers and moves in response to pressure or elevation differences. This process can lead to moisture intrusion, flooding, or structural impacts when the water emerges in developed areas.

13.1.3 Past Events

While groundwater seepage has been present in the Malaga Cove area for many years, in the spring of 1993, water seeping through foundations prompted the City to implement dewatering measures. These measures proved effective for the time being but gradually decreased in effectiveness. Water intrusion occurred again in September of 2023, prompting the City to begin investigating a new solution.

13.1.4 Location and Extent

Malaga Cove Plaza has experienced periodic groundwater seepage along Via Campesina and Via Chico since the 1980s. Seepage occurs where natural drainage paths direct water from higher elevations

toward the plaza. This site sits atop fine-grained lagoon, beach, and dune sands that facilitate groundwater movement. Rainfall and irrigation from higher ground increase the amount of water soaking into these sandy soils, leading to more water movement below the surface and visible seepage. Hydrogeological studies show that this issue is shaped by a mix of drainage patterns, the area's landscape, how easily water passes through the soil, and the presence of geological faults.

13.2 HAZARDOUS MATERIALS

13.2.1 Overview

Hazardous substances including chemicals, petroleum products, explosives, radiological materials are regularly used and transported within and through the Planning Area. As technology continues to advance, the processes involving these materials are becoming increasingly complex. Their movement by rail, highway, air, and pipeline introduces distinct challenges in the event of an accidental release.

Soils in the Portuguese Bend area have high naturally occurring Radon levels due to past volcanic activity in this area. It can be an issue if the radon gas becomes trapped inside a home with little ventilation.

13.2.2 Identified Hazardous Materials Hazards

The Palos Verdes Peninsula does not contain any sites currently designated under the U.S. Environmental Protection Agency's (EPA) Superfund program. The former Montrose Chemical Corporation facility, located in the adjacent City of Torrance, is listed on the EPA's National Priorities List (NPL). This facility manufactured dichlorodiphenyltrichloroethane (DDT) until operations ceased in 1982. DDT has since been prohibited in most countries due to its well-documented adverse environmental effects, including persistence in ecosystems, bioaccumulation within the tissues of organisms, and long-term ecological and toxicological impacts. Concerns include soil contamination, groundwater contamination, and the effects of contaminated wastewater discharge. Cleanup and containment efforts have been ongoing since the facility closed.

Located just over a mile from the Montrose Superfund site lies the Del Amo site, where synthetic rubber was manufactured between 1943 and 1972. The site was placed on the National Priorities List in 1997 after soil and groundwater contamination was discovered. Today, much of the property has been transformed into an industrial park, though environmental cleanup continues. Groundwater contamination remains a significant issue, though no drinking water sources have been found to be affected at present. The site overlaps with the Montrose Superfund site and contamination from both sites have comingled to create "dual-site groundwater."

13.2.3 Past Events

According to the California Office of Emergency Services, 593 reported spills have occurred between 2019 and 2024 on the peninsula and in neighboring municipalities (Torrance, Long Beach, Lomita, and Wilmington). These spills include but are not limited to vapor, chemical, petroleum, and sewer. Hazardous spills most commonly occur on waterways, roadways, and at residences. Impacts of hazardous spills may include the following:

- Potential for fires and explosions

- Disruption of transportation systems
- Destruction of utilities and other public services
- Damage to public infrastructure and facilities
- Residential displacement, including evacuations
- Individuals trapped and injured in unsafe conditions
- Health issues related to discharges or releases
- Need for emergency food, shelter, and medical care
- Economic impacts, both short- and long-term
- Water pollution and quality degradation

13.2.4 Location and Extent

The Planning Area does not have any heavy industry, which reduces the amount of hazardous materials in the area. The following locations, however, could subject the Planning Area to significant hazardous materials incidents:

1. Kaiser Medical Hospital – located along the Planning Area's northeastern boundary
2. Pacific Coast Highway – arterial highway; potential transportation incidents
3. Interstate 110 – located east of the Planning Area; potential transportation incidents
4. Ports – Port of Los Angeles and Port of Long Beach; potential hazardous materials/ terrorism/ transportation incidents
5. Oil Refineries – located on Lomita Boulevard and the Crenshaw Boulevard Torrance Refinery; potential hazardous materials incident; oil refineries located in north Torrance could present air quality issues in the event of an accident
6. LAX Airport – located north of the Planning Area; potential hazardous materials/ terrorism/ transportation incidents

The Planning Area generally experiences mild to warm temperatures throughout the year, with light winds most of the time. During the day, gentle offshore breezes usually blow in from the northwest. At times, these breezes are replaced by powerful Santa Ana winds coming from the northeast. Santa Ana winds are strongest in the fall and winter and can reach speeds of up to 70 mph.

The regular offshore breezes often help clear away airborne pollutants. However, during the summer, a layer of warm air can form above the area. This prevents pollutants from dispersing and traps them near the ground. When pollutants build up, air quality worsens, which can increase health risks for the community.

13.3 HUMAN-CAUSED

13.3.1 Overview

Human-caused events are potentially life-threatening incidents initiated by individuals or groups with the intent to disrupt the public. Although no significant human-caused events have been documented within the Planning Area to date, it remains essential for municipalities to be prepared for these occurrences. Examples include terrorism, cyberterrorism, civil disorder, and active shooter incidents. Notably, areas

immediately adjacent to the Planning Area have experienced such events, indicating that the peninsula should also be regarded as vulnerable to these potential threats.

13.3.2 Identified Human-Caused Hazards

Terrorism

Terrorism is defined as the unlawful use of force or violence against persons or property, carried out with the intent to intimidate, coerce, or extort. These acts are intending to instill fear within the public, sow doubt in governmental institutions, and generate publicity for political, ideological, or religious causes.

The Federal Bureau of Investigation recognizes two primary categories of terrorism within the United States:

- **Domestic Terrorism**: Activities perpetrated by individuals or groups whose operations are directed at elements of the U.S. government or civilian population without foreign influence.
- **International Terrorism**: Activities perpetrated by individuals or groups that are foreign based, directed by entities outside the United States, or that transcend national boundaries in scope, impact, or intent.

Terrorist incidents may take multiple forms, depending on the technological capabilities of the perpetrators, the motivations driving the act, and the vulnerabilities of the intended target. While bombings remain the most frequently employed method within the United States, other potential scenarios include attacks on transportation systems, utilities, public services, or the deployment of chemical, biological, radiological, or nuclear agents.

Cyberterrorism

Cyber terrorism refers to the deliberate use of digital technologies, computer systems, and networks to conduct terrorist activities. These intentional, large-scale disruptions of information systems and critical infrastructure are often carried out through malicious tools such as computer viruses or ransomware and may originate from anywhere in the world. Unlike conventional cybercrime, which is typically motivated by financial gain, cyber terrorism is distinguished by its intent to instill fear, cause widespread disruption, undermine public confidence, or advance political, ideological, or religious objectives. Potential impacts extend beyond individual users to include government operations, private-sector enterprises, and essential services that are part of the interconnected system.

Civil Disorder

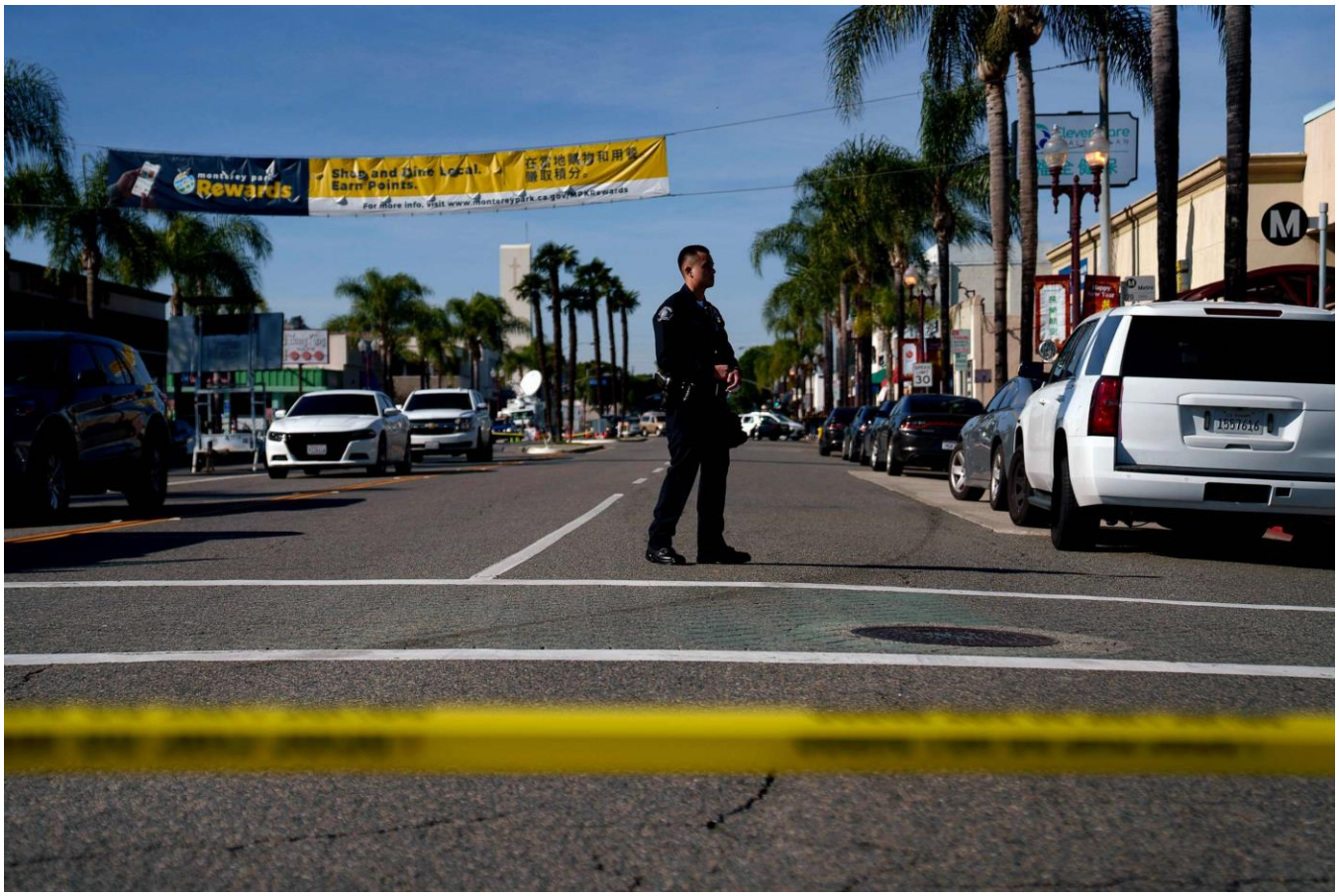
Civil disorder, also referred to as civil unrest or civil strife, is a broad term commonly used by law enforcement and emergency management agencies to describe disturbances involving groups of people. Such disturbances may arise as organized protests addressing significant socio-political issues, or they may manifest as expressions of antisocial behavior that disrupt public order and safety.

Civil disturbances can vary widely in scope and intent. While some events are peaceful demonstrations protected under constitutional rights, others may escalate into disruptive or violent activities that strain public safety resources, disrupt essential services, and create risks to both property and human life.

Active Shooter

To date, there have been no reported active shooter events within the Planning Area. However, active shooter incidents have tragically occurred in schools, workplaces, and public venues across the United States in recent years, underscoring the need for preparedness at the local level.

One of the most devastating examples occurred on February 14, 2018, when a gunman opened fire at Marjory Stoneman Douglas High School in Parkland, Florida, killing 17 students and staff members and injuring 17 others. This incident is recognized as one of the deadliest high school shootings in U.S. history. Similarly, on December 14, 2012, an active shooter at Sandy Hook Elementary School in Newtown, Connecticut, killed 20 children and six staff members, marking one of the most tragic school shootings in the nation. These events highlight the unpredictable nature of active shooter incidents, which can occur in any community, at any time.



A police officer stands outside the site of the deadly Monterey Park Shooting, the worst mass shooting in Los Angeles County History. Source: ABC News

13.3.3 Past Events

Over the past five years, Los Angeles County has experienced a number of human-driven crises. In 2023, a 72-year-old shooter killed 11 and injured 9 after opening fire on the Star Ballroom Dance Studio in Monterey Park. . In 2025, Immigration and Customs Enforcement (ICE) detentions and a sense of alarm over what many viewed as a weakening of democratic institutions caused civil unrest, as these

operations impacted communities' abilities to continue their daily routines, increasing community need for lifeline services and impacting the economy, as many workers were detained or feared going to work due to ICE operations. Between 2020-2024, 24 active shooter incidents occurred in California.

13.3.4 Location and Extent

Human-caused hazards can unfold anywhere, at any time. Within California and Los Angeles County, the spectrum of potential terrorist targets is extensive. These include government facilities, educational institutions, religious sites, public gathering venues (such as shopping centers and entertainment facilities), abortion clinics, energy and utility infrastructure, transportation networks, oil refineries, water storage facilities, financial institutions, and locations associated with high-profile individuals. Active shooter incidents likewise vary based on perpetrator target and can occur anywhere. Technological advancements have created opportunities for cybercriminals to launch attacks from any part of the world and impact any location.

13.4 UTILITY RELATED

13.4.1 Overview

Utility related events include power failure or stoppages, water stoppages, and natural gas stoppages. Utility service interruptions are usually initiated by providers in response to severe weather, necessary repairs, or safety concerns. Severe weather events such as high winds, wildfires, extreme heat and heavy rainfall can disrupt service delivery by placing strain on or damaging critical infrastructure. Restoring service after an outage can take anywhere from several hours to multiple days, depending on the severity of the damage. Repair crews are unable to begin restoration efforts until the immediate threat has subsided and preliminary cleanup is underway. Temporary interruptions in essential utilities may disproportionately harm vulnerable communities. When stoppages and outages coincide with severe weather, they can amplify already dire conditions in the community.

13.4.2 Identified Utility Related Hazards

Power Failure/Stoppages

Stoppages take place when electricity demand on the grid is set to exceed the available supply. Brownouts happen when utility companies intentionally lower the load to prevent full blackouts caused by system overload. These partial outages may involve rotating power outages across different parts of the service area or lowering the voltage being delivered. A power failure, by contrast, is an unplanned, complete loss of electricity that occurs when equipment in the grid breaks down or when severe weather damages power lines or transformers.

In 2012, the California Public Utilities Commission (CPUC) ruled that the California Public Utility Code gives electric utilities the authority to shut off electric power to protect public safety, since power supply systems have the potential to ignite wildfires. Electric utility infrastructure has historically been responsible for less than 10 percent of reported wildfires. However, fires attributed to power lines consist of roughly half of the most destructive fires in California history.

A public safety power shutoff (PSPS) is an event in which a major electric power provider temporarily shuts off electrical power to a selected area to prevent power lines from sparking wildfires and threatening lives. Utilities usually implement these during days with sustained winds or strong gusts, fire weather, or other factors. The duration of a shutoff event is tied directly to the weather that triggers it (Cal OES, 2023).

Water Stoppages

Although it is rare for water utilities to shut down during severe weather, service may be interrupted if water pressure falls below safe levels for public distribution. This can happen when extremely cold temperatures cause widespread pipe bursts, leading to significant water loss.

Natural Gas Stoppages

Stoppages are implemented by providers as a precaution against fires, explosions, and leaks, or as a direct response to these events. Landslides pose a massive threat to gas pipelines, as the ground movement may severely damage infrastructure. Gas lines are also often shut off in areas where there is a high risk of wildfire activity.

13.4.3 Past Events

Although the peninsula has not recently experienced a natural gas leak/spill, some residents have experienced prolonged periods of time without natural gas delivery due to land movement. Utilities shut off natural gas services in some areas and relocated pipelines in response to accelerating land movement in 2024. An example of a natural gas pipeline leak within Los Angeles County is outlined below.

Protesters sit outside of the Porter Ranch Neighborhood in response to the gas leak: LA Times

On October 23, 2015, a natural gas storage well in Porter Ranch failed, triggering a massive and uncontrolled leak. The incident forced 5,000 families to relocate, while more than 130,000 people lived within 5 miles of the site. The leak continued until February 12, 2016, releasing over 100,000 metric tons of methane and ethane into the atmosphere. Since then, many residents have reported ongoing health problems linked to the disaster. In December 2022, the University of California, Los Angeles launched a 5-year study to evaluate both the short- and long-term health impacts on those who lived near the affected area.

13.4.4 Location and Extent

Utility interruptions that affect residents on the peninsula may originate in the Planning Area, somewhere in Los Angeles County, or somewhere else in the state. Most natural gas is transported through pipelines, and pipelines can be found throughout the Planning Area.

14. HAZARD RANKING

The prioritization and categorization of identified hazards for the Planning Area is based on the Priority Risk Index (PRI), a tool used to measure the degree of risk for identified hazards in a particular Planning Area. The PRI was used to assist the Planning Partnership in identifying hazards that pose the most significant threat to the Peninsula.

The PRI results provide a numerical value for each hazard, allowing hazards to be ranked against one another (i.e., the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and climate change.

Each degree of risk has been assigned a value (1 to 4) and a weighting factor.

To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (CLIMATE CHANGE x .10)]

According to the weighting scheme applied, the highest possible PRI value is 4.0. Table 14-1 shows the weighting schemes for each category. The assigned weighting factors are typical for hazard mitigation planning efforts. The Planning Partners had the option to amend these values if desired if additional factors should be considered for their individual hazard rankings. The final rankings for each Planning Partner are included in the jurisdictional annexes in Volume 2. By determining a value for each hazard that can be compared to other hazards threatening the Planning Area, hazards can be ranked with greater ease.

Many of the PRI categories are described within the natural hazard profiles. A hazard risk ranking for each hazard of concern was assigned to the range of PRI values as follows:

- PRI Value 1 to 1.9 = Low Hazard Risk Ranking
- PRI Value 2.0 to 2.9 = Medium Hazard Risk Ranking
- PRI Value 3.0 to 4.0 = High Hazard Risk Ranking

The final PRI results, including the calculated values for each hazard in the Planning Area are found in Table 14-2.

Table 14-1. Priority Risk Index Scoring Criteria

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1% and 10% annual probability	2	
	Likely	Between 10% and 90% annual probability	3	
	Highly Likely	90%+ annual probability	4	
Impact	Minor	Only minor property damage and minimal disruption to government functions and services. No shutdown of critical facilities.	1	30%
	Limited	Minor injuries to the total and socially vulnerable population are possible, more than 10% of buildings damaged or destroyed, temporary shutdown of critical facilities (less than 1 week).	2	
	Critical	Multiple deaths/injuries to the total and socially vulnerable population are possible, more than 25% of buildings damaged or destroyed, complete shutdown of critical facilities for more than 1 week.	3	
	Catastrophic	High number of deaths/injuries to the total and socially vulnerable population are possible, more than 50% of buildings damaged or destroyed, complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Limited to one specific area.	1	20%
	Small	Small areas affected.	2	
	Moderate	Large areas affected.	3	
	Large	All areas affected.	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Climate Change	Decreasing Risk	Climate change is likely to result in a decrease in the frequency and/or severity of hazard events.	1	10%
	No Impact	Climate change is not expected to impact frequency and/or severity of hazard events.	2	
	Risk Unknown	Not enough data currently exists to make accurate projections on the impact of climate change on hazard events.	3	
	Increasing Risk	Climate change is likely to result in an increase in the frequency/severity of hazard events.	4	

Table 14-2. Priority Risk Index Scoring Criteria

Hazard	Probability	Impact	Spatial Extent	Warning Time	Climate Change	PRI	Risk Ranking
Drought	1.2	.30	.80	.10	.40	2.8	Medium
Earthquake	1.2	.60	.80	.40	.20	3.2	High
Flood	1.2	.30	.20	.10	.40	2.2	Medium
Heat Wave	1.2	.90	.80	.20	.40	3.5	High
Landslide	1.2	.90	.60	.40	.40	3.5	High
Strong Wind	1.2	.90	.80	.20	.40	3.5	High
Wildfire	.90	.90	.60	.40	.40	3.2	High

Part 3
Mitigation Strategy

Foxtail Agave, Palos Verdes Peninsula (Photo Credit: Megan Brotherton)

15. MITIGATION STRATEGY

15.1 REVIEW OF PREVIOUS MITIGATION ACTIONS

Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)

The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.

The prior individual Planning Partner mitigation plans identified recommended mitigation actions. For this MJHMP, the actions were reviewed by the Planning Partners, who provided a status update using the following guidance:

- No Progress – The mitigation action has not been completed.
- In Progress – Implementation of the mitigation action has begun but has not been completed.
- Ongoing Capability – The mitigation action has been implemented and will be completed on an annual or regular basis (for example, maintenance activities, annual outreach, etc.). These actions were removed from the updated mitigation strategy and included as jurisdictional capabilities in their respective annexes in Volume 2.
- Completed – The mitigation action has been fully implemented and was removed from the updated mitigation strategy.

Actions that were in progress or had no progress were evaluated to determine if they should be discontinued or included in this MJHMP. Reasons for discontinuing an action include that the action has been evaluated as being duplicative, impractical, unfeasible, or undesirable, or if the problem that the action was originally developed for is no longer present. Actions that were identified for inclusion in the updated mitigation strategy received additional evaluation to determine if the action should be revised to reflect any new information obtained as part of the plan update process (for example, changes in risk, capabilities, lead agency, or available funding sources).

15.1.1 Mitigation Accomplishments Since the Prior Mitigation Planning Efforts

- Dewatering wells – Installed and maintained as funds are available.
- Stabilization of the San Ramon Canyon and adjacent roadways; diverting runoff to minimize Tarapaca landslide movement, mudslides, and flooding on PVDS/25th Street.

15.2 MITIGATION GOALS

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(i)

The mitigation strategy must include a description of mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards.

Mitigation goals represent broad statements that are consistent with the hazards identified in the MJHMP and achieved through the implementation of specific mitigation actions. The HMPC developed mitigation goals to reflect the current focus of Palos Verde Peninsula and its participating jurisdictions. The HMPC determined the following goals for this MJHMP:

- **Goal 1.** Reduce risk to life, property, community lifelines, the environment, and infrastructure from natural hazards and climate change.
- **Goal 2.** Expand and improve public awareness of hazards, risk, and mitigation strategies.
- **Goal 3.** Strengthen partnerships and communication among government agencies, private sector businesses, community-based, and nonprofit organizations.
- **Goal 4.** Integrate mitigation principles into regulations, policies, programs, and guidance to support equitable outcomes to benefit the whole community.
- **Goal 5.** Conserve, enhance, rehabilitate, and protect natural and cultural resources from hazards to provide a more resilient and sustainable community.

Goals are directly linked to the mitigation actions identified in each jurisdictional annex in Volume 2.

15.3 MITIGATION ALTERNATIVES

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)

The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.

A range of potential mitigation opportunities is included in each hazard risk assessment in Chapter 6 through Chapter 0. The potential actions are categorized by the following:

- Who may implement the action:
  - Community scale (individuals or groups)
  - Organizational scale (businesses, nonprofits, community-based organizations)
  - Government scale (any government agency that has permit authorities and police powers within the Planning Area)

- What the alternative would do:
  - Manipulate the hazard (actions to prevent hazard events from occurring)
  - Reduce exposure and vulnerability (actions to safeguard people, property, and the environment from the impacts of the hazard)
  - Build local capacity (actions to improve abilities to mitigate and respond to hazard events)
  - Use nature-based solutions (actions that use green solutions to mitigate the hazard and provide additional environmental services)

15.4 DEVELOPING MITIGATION ACTIONS

Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)	Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(iii)
The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.	*The hazard mitigation strategy shall include an action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.*

Each jurisdiction reviewed the results of the risk and capability assessments, previous mitigation strategy, mitigation goals, catalogs of mitigation alternatives and selected actions to be included in their mitigation strategy in their jurisdictional annexes in Volume 2 of this plan.

15.5 PRIORITIZING MITIGATION ACTIONS

Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)	Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(iii)
The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.	*The hazard mitigation strategy shall include an action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction.*

A broad range of potential mitigation actions were considered in the prior mitigation plans for this Planning Partnership. Tables in each plan were developed to rank the mitigation projects based on the STAPLEE criteria or a series of 18 questions.

For this MJHMP, the Planning Partnership followed the same prioritization method used in the 2023 California State HMP.

15.6 MITIGATION ACTION CATEGORIZATION

The identified mitigation actions are classified by the following action types.

15.6.1 Local Plans and Regulations

These activities are intended to keep hazard problems from getting worse and are typically administered through programs or regulatory actions that influence the way land is developed and assets are built. In the context of this plan, these measures also include security initiatives. Planning and regulatory measures are particularly effective in reducing a jurisdiction's future vulnerability, especially in areas where development has not occurred, or capital improvements have not been substantial. Examples of these activities include the following:

- Planning and zoning
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvement programs
- Riverine / fault zone setbacks
- Security measures

15.6.2 Structure and Infrastructure Projects

These activities involve the modification of existing buildings, assets, and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include the following:

- Acquisition
- Relocation
- Asset and building elevation
- Structural retrofitting
- Safe rooms, shutters, shatter-resistant glass
- Road and bridge infrastructure improvements
- Reservoirs
- Dams, levees, dikes, and floodwalls
- Diversions, detention, retention
- Stormwater infrastructure expansion
- Water, sewer, or other utility infrastructure improvements

15.6.3 Education and Awareness Programs

Education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include the following:

- Outreach projects
- Speaker series and demonstration events
- Hazard map information
- Library materials
- School-age educational programs
- Hazard expositions
- Social media campaigns
- Warning and communication systems

15.6.4 Natural Systems Protection

Natural systems protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, and steep slopes, in addition to the following:

- Floodplain protection
- Watershed management
- Riparian buffers
- Habitat preservation
- Erosion and sediment control
- Wetland preservation and restoration
- Slope stabilization
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Green infrastructure

15.6.5 Climate Resiliency

Climate resiliency actions incorporate methods to mitigate or adapt to the impacts of the changing climate. Examples include the following:

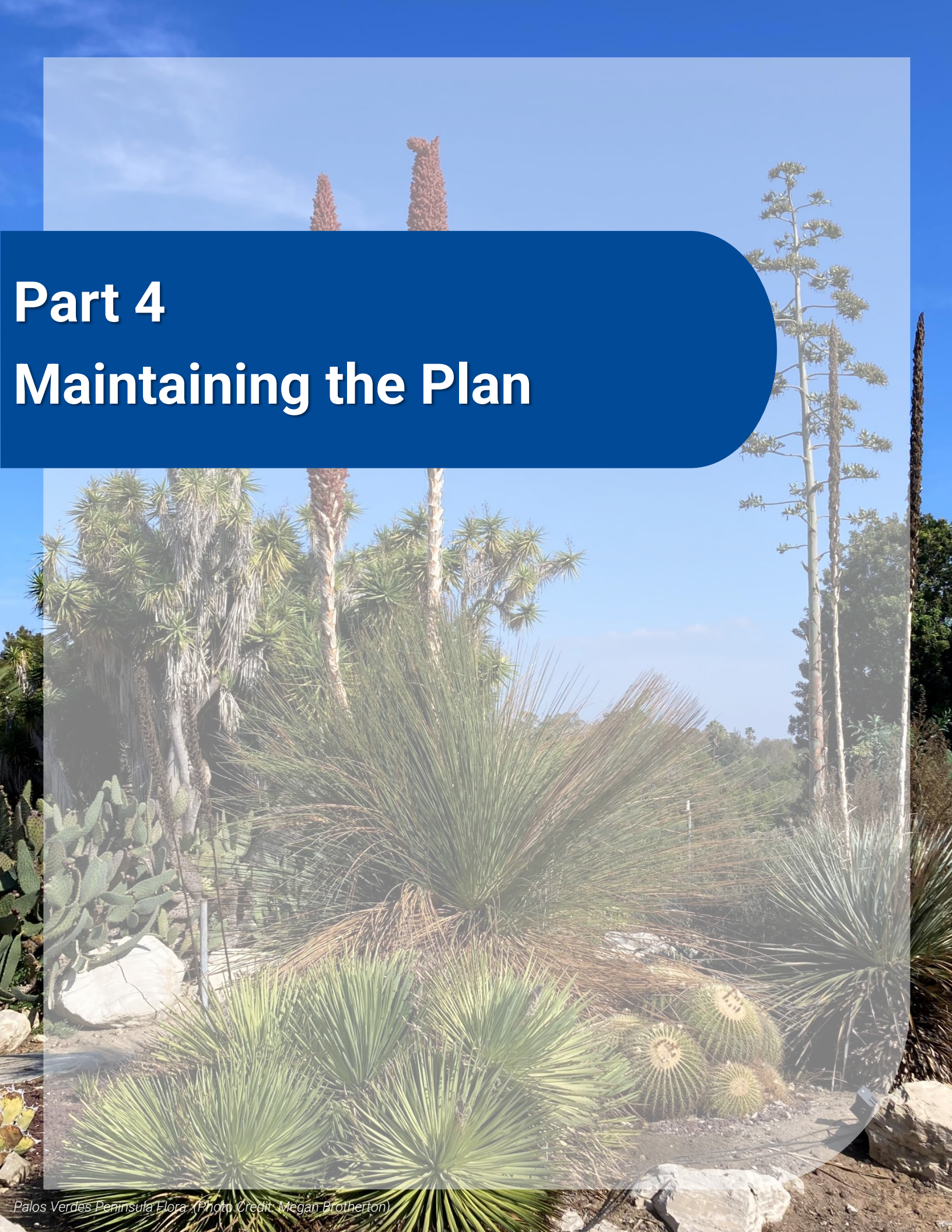
- Aquifer storage and recovery
- Incorporating future conditions projections in planning and project design
- Actions that specifically address climate change risks such as drought and extreme heat

15.6.6 Community Capacity Building

These actions increase local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences of hazards. Examples include the following:

- Staff training
- Memorandums of understanding
- Development of plans and studies
- Monitoring programs

Part 4
Maintaining the Plan



Palos Verdes Peninsula Flora. (Photo Credit: Megan Brotherton)

16. ADOPTING AND MAINTAINING THE MITIGATION PLAN

16.1 PLAN ADOPTION

Local Plan Requirement F1 – 44 CFR Part 201.6(c)(5)

The plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan.

DMA compliance and its benefits can only be achieved after the Plan is adopted. For multi-jurisdictional plans, each jurisdiction requesting approval must document that has been formally adopted. The Planning Partnership has chosen the option for pre-approval adoption. Each City Council and District Board will adopt this plan while it is being reviewed by Cal OES and FEMA Region 9. Copies of the FEMA approval and Planning Partner resolutions adopting this plan can be found in Appendix G of this volume.

16.2 PLAN MAINTENANCE

This section describes a formal plan maintenance process to ensure that the hazard mitigation plan remains an active and relevant document. The Assistant to the City Manager for Rolling Hills Estates will take the lead on monitoring, evaluating, and updating the MJHMP over the 5-year performance period, in coordination with all Planning Partners. This position will rotate among the participating cities for each subsequent update. Table 16-1 summarizes this plan maintenance strategy. The sections below further describe each element.

Table 16-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility
Plan Monitoring		
Track the implementation of plan actions	Continuous	All Planning Partners will report annually or in alignment with potential grant opportunities to Assistant to the City Manager for Rolling Hills Estates on action implementation. Points of contact are listed in Volume 2.
Plan Evaluation		
Review the status of previous actions; assess changes in risk; evaluate success of integration	Upon initiation of hazard mitigation plan update, comprehensive General Plan update, or major disaster	All Planning Partners
Grant Notification		

Approach	Timeline	Lead Responsibility
Assistant to the City Manager for Rolling Hills Estates will notify Planning Partners of grant funding opportunities to fund actions identified in this plan	Continuous, as grants become available	Assistant to the City Manager for Rolling Hills Estates
Plan Update		
Initiate the process to comprehensively update the plan at least every 5 years.	At the end of year 3, coordinate with the Planning Partners, and work to identify grant funding opportunity for update. Obtain grant funding by the end of year 4.	Assistant to the City Manager for Rolling Hills Estates will lead the plan update. All Planning Partners will support the effort.
Integration into Other Planning Mechanisms		
Create a linkage between the hazard mitigation plan and individual jurisdictions' general plans the Community Wildfire Protection Plan or similar plans identified in the core capability assessments	Continuous	All Planning Partners
Continuing Public Involvement		
Maintain and update the website with relevant hazard mitigation information and public participation opportunities.	Continuous	Assistant to the City Manager for Rolling Hills Estates will lead continuing public participation. All Planning Partners will support the effort.

16.2.1 Integrating the Plan

Local Plan Requirement D3 – 44 CFR Part 201.6(c)(4)(ii)

The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

The Planning Partners will integrate this MJHMP into relevant decision-making processes, plans, or mechanisms, where feasible. This includes integrating the requirements of the MJHMP into other planning documents, processes, or mechanisms, such as strategic planning initiatives, general plans, local capital improvement plans, stormwater plans, emergency plans, and other future plans. Opportunities to integrate the requirements of this plan into other planning mechanisms shall continue to be identified through future planning efforts. The Planning Partnership outlined the following mechanisms underway and under consideration:

- Ensuring that the goals and mitigation actions of new and updated local planning documents are consistent, or do not conflict with the goals and actions of the HMP and will not contribute to increased hazard vulnerability in the Planning Area.

- Integration of the HMP will be considered on a case-by-case basis and identified at the onset of plan development.
- Integration of the HMP into the capital improvement program scoring criteria (e.g., does the project advance mitigation) will be implemented if deemed feasible.

16.2.2 Implementing the Hazard Mitigation Plan Through Existing Programs

To successfully reduce future losses, implementing the actions within this plan is highly recommended. The Planning Partners involved a wide range of staff in the plan development process and many departments, divisions, or other partners participating in the Plan are responsible for implementing specific mitigation actions identified by each jurisdiction. Every proposed action listed in the mitigation action plan is assigned to a specific "lead" department or partner in order to assign responsibility and accountability and increase the likelihood of implementation.

In addition to the assignment of a local lead department or partner, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. The Planning Partners will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, specific potential funding sources have been identified for proposed actions listed in the mitigation action plan.

The Planning Partnership will meet once annually during the 5-year performance period of this Plan. This frequency of meeting will also assist in implementation, as meetings will be coordinated with the strategic planning process. A key agenda item will be to determine which actions are being implemented by members of the Planning Partnership

16.2.3 Ongoing Public Involvement

Local Plan Requirement D1 – 44 CFR Part 201.6(c)(4)(iii)

The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an integral component to the mitigation planning process and will continue to be essential as this plan evolves over time. Public involvement procedures were reviewed as part of the 2026 MJHMP development process. Significant changes or amendments to the plan shall require an opportunity for public comment prior to any adoption procedures by the Planning Partners. Assistant to the City Manager for Rolling Hills Estates also maintains a hazard mitigation planning website that can be used to provide updates and post the most current version of the plan:

https://www.pvpready.gov/resources/hazard-mitigation/

By keeping the plan available on the website with an invitation and instructions on providing feedback, public awareness will be maintained on a continuous basis. Public comment opportunities will be provided during any process to revise or update the plan, prior to jurisdictional approval and/or adoption. Other efforts to involve the public in the maintenance, monitoring, evaluation, and revision process will be made as necessary. These efforts may include the following:

- Posting minutes from Planning Partnership meetings to the hazard mitigation website.
- Utilizing available Planning Partner communication channels to update the public on any maintenance and/or periodic review activities taking place.
- Keeping a current version on the MJHMP at Planning Partner facilities and on the web page.

Additionally, continued public involvement will be accomplished through implementation of mitigation actions.

16.2.4 Monitoring the Plan

Local Plan Requirement D2 – 44 CFR Part 201.6(c)(4)(i)

The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a 5-year-cycle.

Periodic revisions and updates of the Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal and state regulations. Periodic monitoring and evaluation of the plan will also ensure that specific mitigation actions are being reviewed and carried out according to the mitigation action plan. Monitoring refers to tracking the implementation of the plan over time. Evaluating refers to assessing the overall effectiveness of the plan intent and goals.

The Planning Partnership shall meet once annually to monitor and evaluate the progress attained and to revise, where needed, the activities set forth in the plan. The Assistant to the City Manager for Rolling Hills Estates will be responsible for reconvening the Planning Partnership for these reviews. Plan maintenance meeting agenda templates are included in Appendix E.

The annual meetings provide the Planning Partnership with an opportunity to perform the following:

- Review plan goals.
- Document hazard occurrences that occurred during the prior year and their impacts on the Planning Area.
- Document mitigation action implementation or status.
- Evaluate the mitigation actions that have been successful.
- Discuss why mitigation actions were not completed.
- Revise the action plan if new timelines need to be established for projects (e.g., changing a long-term project to a short-term project because of funding availability).
- Consider recommendations for new mitigation projects.
- Review new funding options, including grant opportunities, and determine if contract grant-writing support is needed to pursue the opportunities.
- Document potential losses avoided due to the implementation of specific mitigation measures or other planning programs, if feasible.
- Identify any new or additional vulnerabilities that may be faced by the Planning Partnership and may need to be addressed in a future update of this plan.

- Update the hazard mapping and impact tool to reflect new or revised hazard data.

Any findings or recommendations made during the annual review shall be documented in the form of a memo that can be shared with the governing bodies of the participating jurisdictions and interested stakeholders, including the public, through the website. Further, mitigation action progress can be monitored (i.e., tracked) in an Excel version of the mitigation action plan. The Planning Partnership will also meet following any disaster event warranting a reexamination of the mitigation actions being implemented or proposed for future implementation. This will ensure that the plan is continuously updated to reflect changing conditions and needs within the Palos Verdes Peninsula.

16.2.5 Updating the Plan

Updating

Local Plan Requirement D2 – 44 CFR Part 201.6(c)(4)(i)

The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a 5-year cycle.

The Palos Verdes Peninsula MJHMP will be thoroughly reviewed by the Planning Partnership every 5 years in alignment with federal regulations to ensure its consistency with these requirements. This update is also used to determine whether there have been any significant changes in the Planning Area that may, in turn, necessitate changes in the types of mitigation actions proposed, goals, or priorities. New development in identified hazard areas, an increased exposure to hazards, an increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the plan. The Assistant to the City Manager for Rolling Hills Estates will be responsible for reconvening the Planning Partnership and conducting the 5-year review. In general, the plan update development process begins approximately 2 years prior to plan expiration. First, resources to develop the plan must be obtained, such as obtaining a planning grant. This will be followed by the plan update process, led by the Core Planning Team and Planning Committee. Upon completion of the review and update/amendment process, the Palos Verdes Peninsula MJHMP will be submitted to the State Hazard Mitigation Officer at Cal OES for a compliance review in accordance with 44 CFR 201. The plan will then be reviewed by FEMA Region 9. Once an “approved pending adoption” status has been issued by FEMA Region 9, the Planning Partnership can then review, approve, and adopt the plan. The Planning Partnership review consists of final approval by the respective city councils and district boards during their public meetings.

Disaster Declaration

Following a federal disaster declaration, the Palos Verdes Peninsula MJHMP may be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the Assistant to the City Manager for Rolling Hills Estates to reconvene the Planning Partnership and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

Plan Amendment Process

Unique circumstances, such as availability of critical data or an omission, may necessitate a plan amendment. Upon the initiation of the amendment process, Assistant to the City Manager for Rolling Hills Estates will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected departments, community partners, and customers. Information will also be forwarded to Cal OES and FEMA. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period (unless circumstances necessitate a shorter review). At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the Planning Partnership for final consideration. The Planning Partnership will review the proposed amendment along with the comments received from other parties, and if acceptable, the Planning Partnership will submit a recommendation for the approval and adoption of changes to the plan. In determining whether to recommend approval or denial of a plan amendment request, the following factors may be considered by the Planning Partnership:

- There are major errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan.
- New or previously unknown issues or needs have been identified which are not adequately addressed in the Plan.
- There has been a change in information, data, or assumptions from those on which the Plan is based.

If the Planning Partnership opts to move forward with the amendment, the revised plan must be reviewed and approved by Cal OES and FEMA. The Planning Partners will also need to approve the revised plan. Prior to adoption, Assistant to the City Manager for Rolling Hills Estates shall post the updated plan to the website for public comment. Each participating jurisdiction will review the recommendation from the Planning Partnership (including the factors listed above) and comments received from the public. Following that review, the governing bodies will take one of the following actions:

- Adopt the proposed amendments as presented.
- Adopt the proposed amendments with modifications.
- Refer the amendments request back to the Planning Partnership for further revision.
- Defer the amendment request back to the Planning Partnership for further consideration and/or additional hearings.

APPENDIX A. PUBLIC OUTREACH

APPENDIX B. HAZARD SELECTION

Refer to the table below for a complete comparison of hazards included in the 2023 California State Hazard Mitigation Plan, the prior plans from the Planning Partnership, and this plan update.

Table B. Hazard Comparison—State and Palos Verdes Peninsula

2023 California State Hazard Mitigation Plan	Palos Verdes Estates 2018 Plan, Rancho Palos Verdes & Rolling Hills Estates 2020 Plan, Rolling Hills 2019 Plan	2026 Palos Verdes Peninsula Multi-Jurisdictional Hazard Mitigation Plan	Comment
Air Pollution	Not included	Wildfire	Air pollution from wildfire smoke is a concern for the Planning Area and is discussed in the Wildfire chapter
Civil Disorder	Human-Caused	Human-Caused	Discussed in Other Hazards of Interest
Cyber Threats	Human-Caused	Human-Caused	Discussed in Other Hazards of Interest
Dam Failure	Earth Movement	Not included	The only dam in the Planning Area is decommissioned and no longer in use
Drought	Drought	Drought	This local hazard aligns with the State
Earthquake	Earthquake	Earthquake	This local hazard aligns with the State
Electromagnetic Pulse Attack	Not included	Not included	While risk is low, this hazard is still a possibility and can be addressed in other plan.
Energy Shortage	Not included	Utility-Related	Discussed in Other Hazards of Interest
Epidemic/Pandemic/Vector-Borne Disease	Not included	Not included	Addressed in other plans
Extreme Cold or Freeze	Not included	Not included	Not a concern for the Planning Area
Extreme Heat	Not included	Heat Wave	This local hazard aligns with the State
Geomagnetic Storm	Not included	Not included	While risk is low, this hazard is still a possibility and can be addressed in other plan.
Hazardous Materials Release	Hazardous Materials	Hazardous Materials	Discussed in Other Hazards of Interest

2023 California State Hazard Mitigation Plan	Palos Verdes Estates 2018 Plan, Rancho Palos Verdes & Rolling Hills Estates 2020 Plan, Rolling Hills 2019 Plan	2026 Palos Verdes Peninsula Multi-Jurisdictional Hazard Mitigation Plan	Comment
Invasive and Nuisance Species	Not included	Not included	Addressed in other plans
Landslide, Debris Flow, and other Mass Movements	Landslide	Landslide	The State defines the Portuguese Bend and Abalone Cove landslides as "pre-existing conditions". While the California State HMP and this PVP MJHMP both analyze the landslide hazard, this plan and its data sources acknowledge that land movement is not a pre-existing condition.
Levee Failure	Not included	Not included	No levees in the Planning Area
Natural Gas Pipeline Hazards	Not included	Utility-Related	Discussed in Other Hazards of Interest
Oil Spills	Not included	Not included	Not a concern for the Planning Area
Other Potential Long-Term Electrical Outrages	Not included	Not included	Addressed in other plans
Public Safety Power Shutoff	Utility-Related	Utility-Related	Discussed in Other Hazards of Interest
Radiological Accidents	Not included	Not included	Not a concern for the Planning Area
Riverine, Stream, and Alluvial Flood	Flood	Flood	This local hazard aligns with the State
Sea-Level Rise, Coastal Flooding and Erosion	Sea Level Rise	Flood	Discussed in the Flood chapter
Severe Wind, Weather, and Storms	Not included	Strong Wind	This local hazard aligns with subsections in the SHMP
Snow Avalanche	Not included	Not included	Not a concern for the Planning Area
Subsidence	Not included	Landslide	Discussed in the Landslide chapter
Terrorism	Not included	Human Caused	This local hazard aligns with the State
Transportation accidents Resulting in Explosions or Toxic Releases	Not included	Human Caused	This local hazard aligns with the State
Tree Mortality	Not included	Wildfire	Discussed in the Drought and Wildfire chapters

2023 California State Hazard Mitigation Plan	Palos Verdes Estates 2018 Plan, Rancho Palos Verdes & Rolling Hills Estates 2020 Plan, Rolling Hills 2019 Plan	2026 Palos Verdes Peninsula Multi-Jurisdictional Hazard Mitigation Plan	Comment
Tsunami and Seiche	Not included	Flood	Tsunami discussed in the Flood chapter
Urban Structural Fire	Not included	Not included	Not a concern for the Planning Area
Volcano	Not included	Not included	Not a concern for the Planning Area
Well Stimulation and Hydraulic Fracturing	Not included	Not included	Does not occur in the Planning Area
Wildfire	Wildfire	Wildfire	This local hazard aligns with the State
Not included	Not included	Groundwater Seepage	This is a concern for the Planning Area due to flooding from the aquifer

APPENDIX C. MEETING DOCUMENTATION

APPENDIX D. RISK ASSESSMENT METHODOLOGY

LANDSLIDE ANALYSIS METHODOLOGY

To help understand the potential impact of the landslide hazard, a probabilistic approach was used to quantify potential impacts for a series of landslide scenarios. These impacts were used to calculate a landslide average annualized loss. The scenarios described in this section are generated using a computer model and are not historical events.

This region experiences two types of landslides: (1) deep-seated landslides which occur with little to no warning causing a range of loss depending on the location and magnitude of the event; and (2) slow, constant landslides which has a movement that is tracked several times a year and causes consistent damage across specific parts of the region. These differences required two approaches for the risk assessment. The deep-seated landslide model uses historical events, soil data, and elevation data to determine where a potential landslide may occur; an inventory model to identify the locations, values, and susceptibilities of the buildings and infrastructure; and damage functions which help quantify the loss. The shallow landslide methodology includes the annual loss due to the slow moving landslide and predicts future losses in the current areas of impact.

The following approach was used to assess the deep-seated landslide risk:

1) Identify Scenarios
2) Calculate Losses
3) Calculate Landslide Annual Average Loss

Step 1: Identify Scenarios

To determine which parts of the region are susceptible to landslides, the landslide inventory from CGS data was used. Figure D-1 shows a map of these historical landslide areas. The scenario areas are modeled in and adjacent to these areas as well as in areas with the same environmental conditions (slope and soil type). A map of the slopes is shown on Figure D-2.

The elevation model was then used to determine the slope's direction. Areas with a common direction were grouped together in polygons to identify potential landslide scenarios. 750 of these scenarios were identified using this approach. A map of the slope direction is shown on Figure D-3.

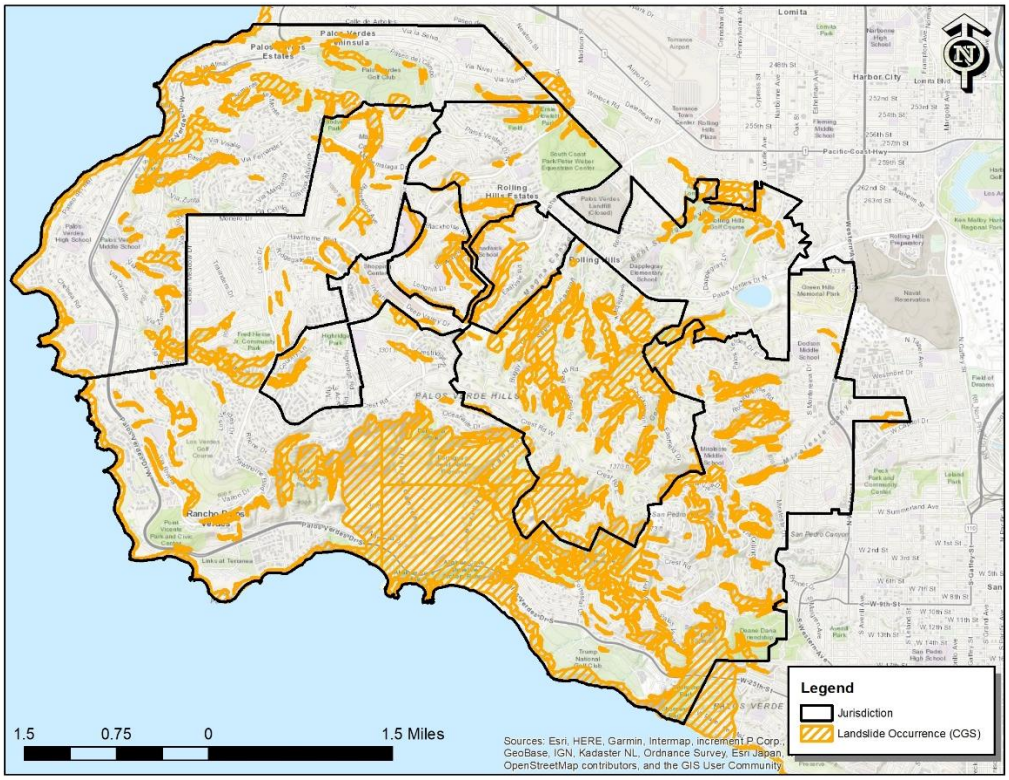


Figure D-1. Historical Landslide Occurrences (CGS, 2022)

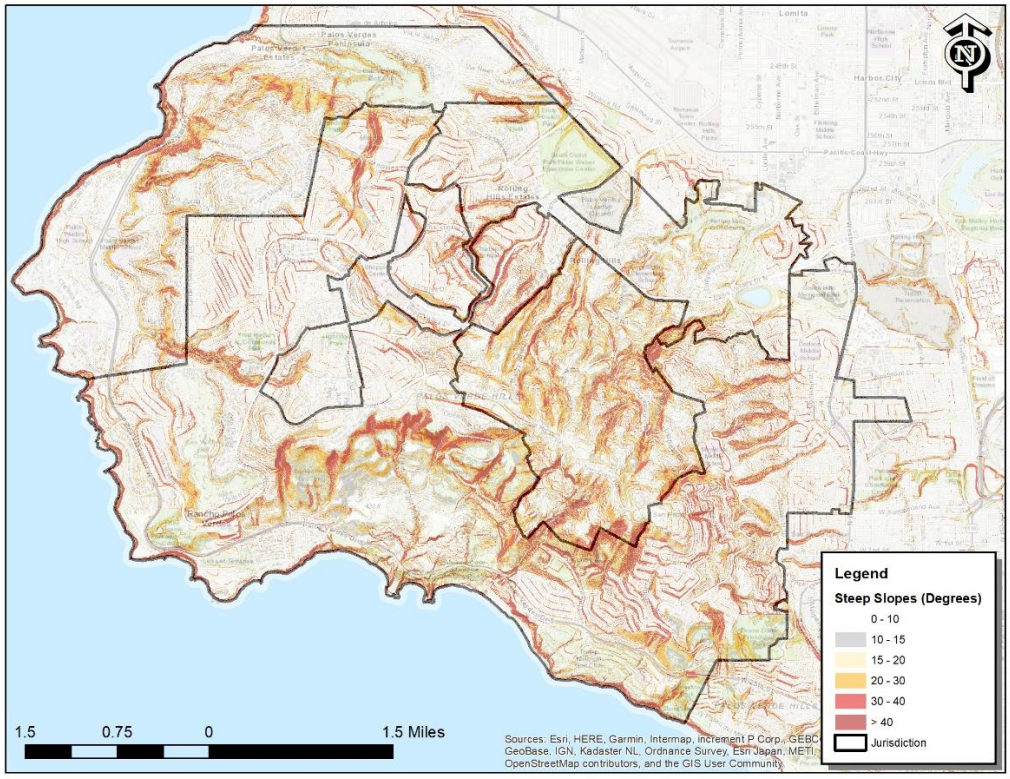


Figure D-2. Steep Slopes

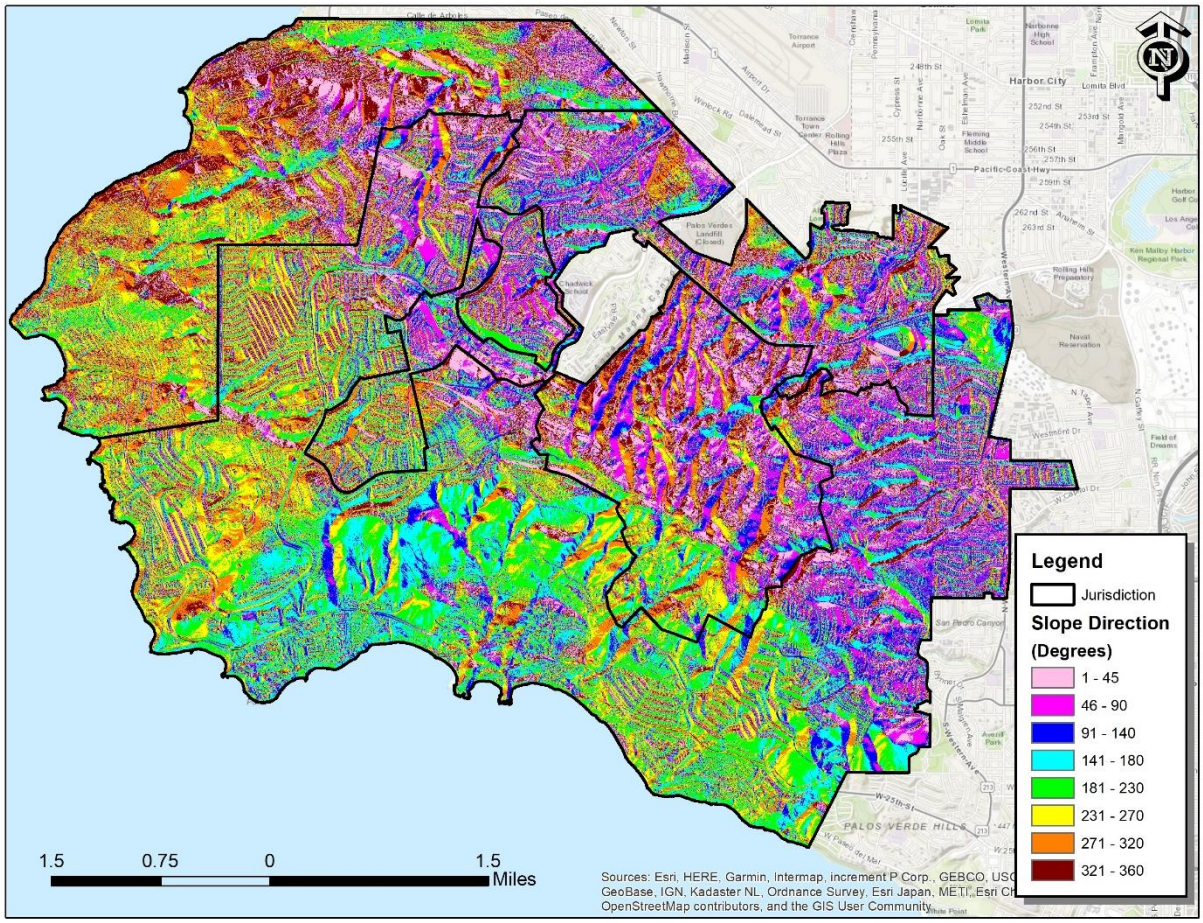


Figure D-3. Slope Direction (Aspect)

Step 2: Calculate Losses

To calculate losses, the building inventory which was developed for the other hazards in this HMP was used. This inventory includes the structure and content values for each structure. To assign damage and loss to these individual structures, a damage function was identified (refer to Figure D-4). This damage function provided minimum and maximum damage curves based on the overall landslide area so for each scenario, a minimum and maximum damage was identified and multiplied by the structure and contents values to get the loss values. The losses were added up for each scenario.

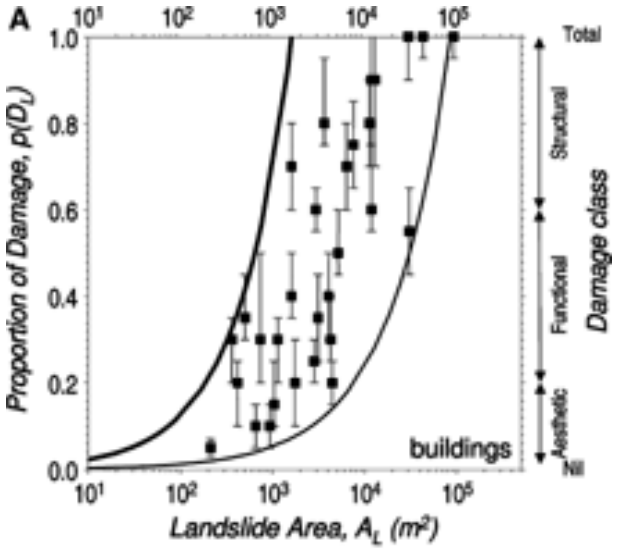


Figure D-4. Landslide Damage Function (CNR–IRPI, 2007)

Step 3: Calculate Landslide Annual Average Loss

Small landslides occur approximately once every 2 to 7 years in the region, while larger occurrences have a 1 to 2 percent chance of occurring every year[1]. The losses for the 750 scenarios were sorted based on magnitude and assigned a probability of the occurrence being exceeded. The values for five specific return periods are plotted on Figure D-6. The deep-seated landslide average annual loss is calculated to have an upper bounds of $77,505 and a lower bounds of $44,282.

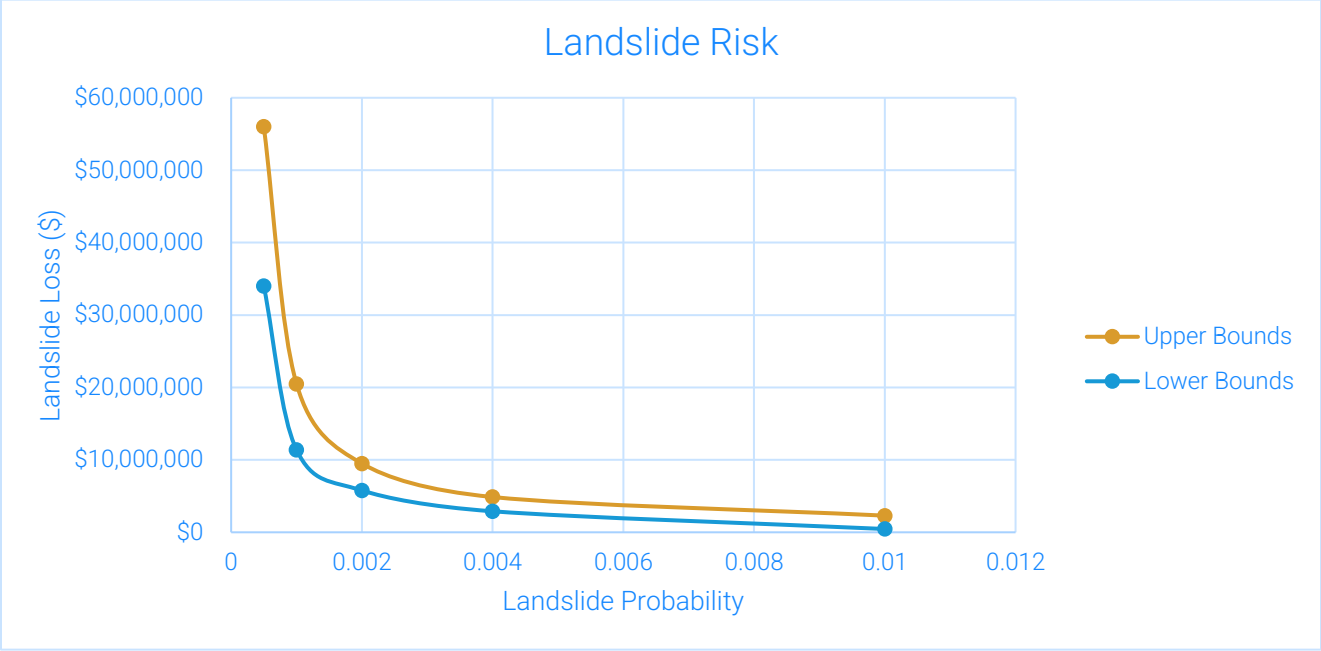


Figure D-6. Landslide Risk

[1] Los Angeles County Hazard Mitigation Plan, 2025.

For the shallow, constant landslides, the damage and loss associated with damage to the utilities, roads[2], buildings, and other infrastructure; and emergency spending primarily on dewatering is more than $10 million per year[3].

[2] Background | Rancho Palos Verdes, CA - Official Website
[3] Rancho Palos Verdes landslide has slowed with below average rainfall, but costs continue to mount | LAist

EQUITY PRIORITY COMMUNITY METHODOLOGY

In accordance with guidance provided by the California Office of Emergency Services (Cal OES) for Local Hazard Mitigation Plans (LHMPs), the Palos Verdes Peninsula Multijurisdictional Hazard Mitigation Plan (MJHMP) includes an assessment of populations that may experience disproportionate impacts during hazard events. Cal OES guidance emphasizes identifying communities that may be disadvantaged in preparing for, responding to, or recovering from disasters. This methodology was developed to align with the requirements outlined in the 2023 California State Hazard Mitigation Plan (SHMP) and Appendix M: Equity Priorities Communities Guidance for LHMPs.

Planning Process and Stakeholder Input

The methodology for identifying Equity Priorities Communities was developed through collaboration with the MJHMP Core Planning Team. Planning partners representing each participating jurisdiction provided local knowledge and guidance in defining vulnerability factors most relevant to the Palos Verdes Peninsula context. This collaborative process ensured that the selected indicators reflect both state guidance and local conditions influencing disaster risk and response capacity.

Rationale for Indicator Selection

Cal OES guidance encourages jurisdictions to use appropriate datasets and analytical approaches to identify populations that may be disproportionately affected by hazards. Commonly used indices, such as the Centers for Disease Control and Prevention's Social Vulnerability Index (SVI), rely heavily on socioeconomic variables including income, poverty, and housing conditions. However, given the overall affluence and relatively high socioeconomic status of Palos Verdes Peninsula communities, and the lack of differentiation in the SVI between property and income wealth that impacts the full understanding of vulnerability, particularly on the Peninsula, use of the SVI alone would not effectively capture locally relevant vulnerability conditions.

To address this limitation, the Core Planning Team identified alternative indicators that better reflect potential disaster-related disadvantage within the Planning Area. The selected indicators focus on demographic and physical access characteristics that influence residents' ability to receive warnings, evacuate safely, and recover following hazard events.

Selected Vulnerability Indicators

Three primary indicators were selected for the Equity Priorities Communities analysis:

1. **Age** – Census populations aged 65 years and older. Older adults may have mobility limitations, increased medical needs, and greater challenges during evacuation and recovery.
2. **Disability Status** – Census populations reporting a disability. Individuals with disabilities may face barriers in evacuation, communication, and access to post-disaster services.
3. **Evacuation Access Constraints** – Residential areas located along road segments with limited ingress and egress options to designated evacuation routes. Limited roadway connectivity may restrict evacuation options during emergencies, increasing exposure to hazard impacts.

These indicators collectively capture social and physical vulnerability factors consistent with CAL OES guidance on identifying communities that may be disproportionately impacted by disasters.

Data Sources

Demographic data for age and disability status were obtained from the U.S. Census Bureau's American Community Survey at the census tract level. Road network and evacuation route data were compiled from jurisdictional GIS datasets and regional transportation databases.

Demographic Vulnerability Analysis

Demographic vulnerability was evaluated using two indicators: population aged 65 years and older and population reporting a disability. These characteristics are recognized in CAL OES guidance as factors that may increase challenges in receiving warnings, evacuating safely, and accessing post-disaster services.

For each census tract, the percentage of residents aged 65 and older and the percentage of residents with disabilities were calculated. Census tracts were ranked separately for each indicator, with higher ranks representing higher concentrations of potentially vulnerable populations. The two ranks were then added together to produce a combined demographic vulnerability score for each census tract. This ranking approach provides a clear and consistent way to compare demographic vulnerability across the Planning Area.

Ranking of Demographic Vulnerability – Age and Disability Status

Census Tract	Total Population	% With Disability	Disability Rank	% of Population Over 65	Age Rank	Total Rank Score
6704.05	2640	17%	17	36%	16	33
6704.06;	1705	12%	15	29%	12	27
6704.17	2780	13%	16	28%	10	26
6705	1511	9%	11	32%	15	26
6707.02	5891	12%	14	28%	11	25
6703.26	3237	8%	8	32%	14	22
6706.04	4953	8%	9	29%	13	22
6703.24	5485	11%	13	26%	7	20
6702.01	3647	8%	10	28%	9	19
6706.03	1856	6%	2	36%	17	19
6704.18	4438	11%	12	22%	4	16
6703.28	4325	7%	5	26%	8	13
6704.16	4098	8%	6	26%	6	12
6707.01	6460	8%	7	24%	5	12
6704.07	5849	7%	4	22%	3	7
6702.02	2559	6%	3	20%	2	5
6704.13	4801	5%	1	19%	1	2

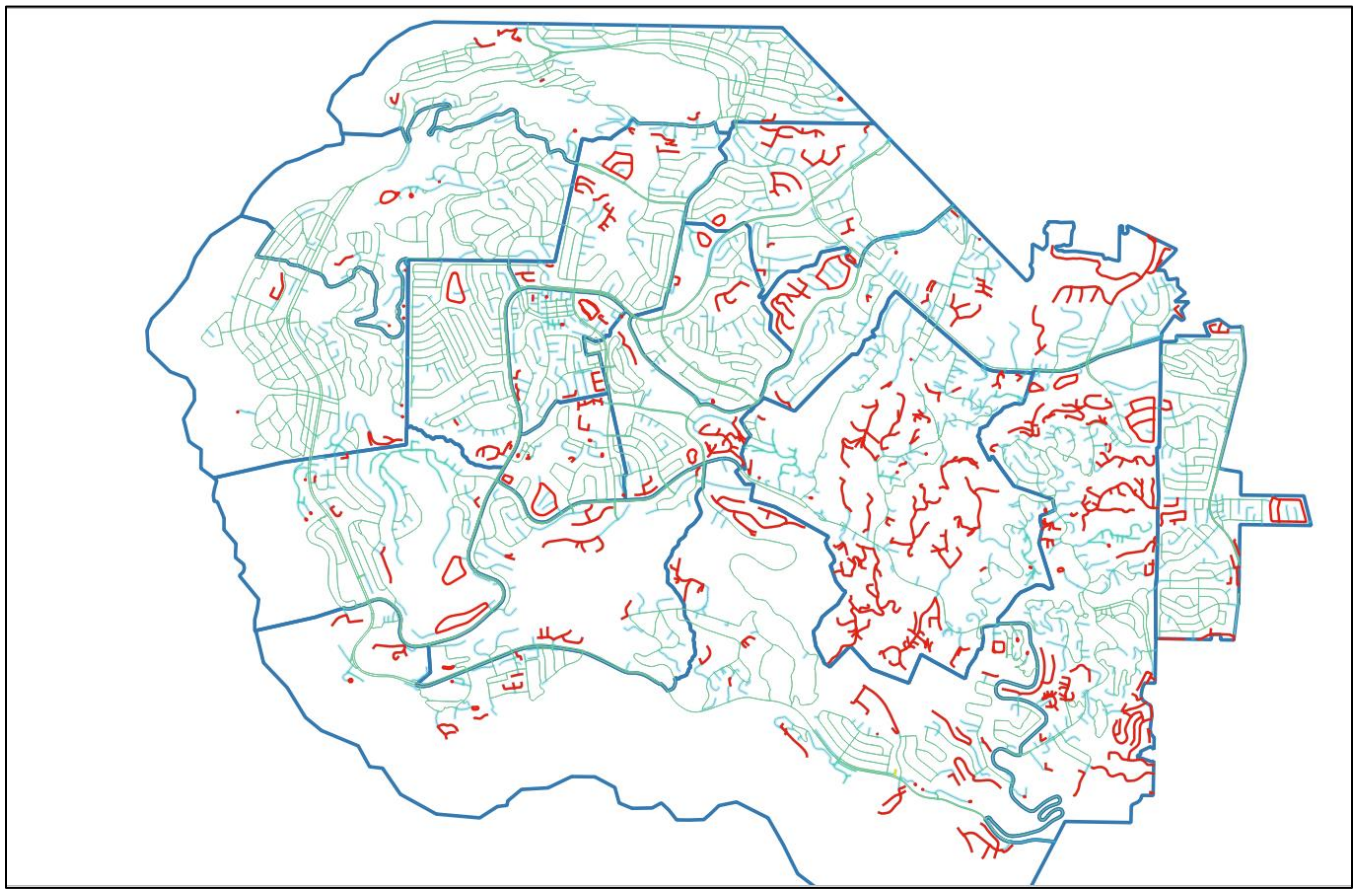
Evacuation Access Vulnerability Analysis

A geospatial analysis was conducted to identify neighborhoods that may have limited evacuation options due to roadway layout and connectivity. On the Palos Verdes Peninsula, steep terrain and a limited number of arterial roads mean that some residential areas have only one practical route to reach major evacuation corridors.

Using geographic information system (GIS) software, the local road network was analyzed to identify groups of residential streets that rely on a small number of exit points to connect to the broader road system. These groups of streets were treated as “network islands,” meaning areas that share internal road connections but have limited external connections to major roads.

Neighborhoods were considered vulnerable if they relied on only one practical route to reach an evacuation corridor or the broader road network. Vulnerable road segments and network islands were mapped, and residential address data were used to estimate the number of homes located along these vulnerable roadways. This number was then compared to the total number of residences in each census tract. Those tracts with a higher portion of single ingress/egress roads, including 6705, 6707.02, 6706.04 and 6702.01 are considered priority areas, as they would be more difficult to evacuate during an emergency.

Map of Palos Verdes Peninsula Vulnerability Analysis



Red represents streets that have **one viable path** leading to an evacuation route. If that path is disrupted, residents would be isolated from major evacuation corridors. Streets that terminate directly onto an evacuation route were **not** classified as vulnerable.

Note that the City of Palos Verdes Estates contains streets with only one viable path leading to an evacuation route. However, these are significantly fewer in number that the other cities. Therefore, the threshold to establish the census tracts most vulnerable to evacuation access did not include tracts in Palos Verdes Estates. This analysis is suitable to establish vulnerability for mitigation planning but should not be used to inform evacuation planning.

Integration of Vulnerability Dimensions

The demographic vulnerability analysis and the evacuation access vulnerability analysis measure two distinct dimensions of disaster disadvantage — social sensitivity and physical access constraints. Because these analyses rely on different units of measurement and represent different aspects of vulnerability, they were not combined into a single composite index.

Instead, both datasets were retained as complementary lenses of vulnerability. In subsequent hazard exposure analyses, hazard footprints were overlaid with the following:

- Census tracts exhibiting elevated demographic vulnerability, and
- Neighborhoods exhibiting evacuation access vulnerability.

This dual-overlay approach allows the plan to identify locations where hazard exposure intersects with one or both forms of vulnerability, supporting targeted mitigation strategies, equitable outreach, and informed prioritization of mitigation investments.

Census Tract	Total Population	Total Rank Score (Disability & 65+)	Evacuation Access Vulnerability
6704.05	2640	33	
6704.06;	1705	27	
6704.17	2780	26	
6705	1511	26	HIGH
6707.02	5891	25	HIGH
6703.26	3237	22	
6706.04	4953	22	HIGH
6703.24	5485	20	
6702.01	3647	19	HIGH

Use of Results

The resulting Equity Priorities Communities map and associated tract rankings are used to inform mitigation strategy development, prioritize outreach and engagement efforts, and guide equitable allocation of mitigation investments. This approach ensures that mitigation actions consider the needs of populations that may face increased barriers in disaster preparedness, response, and recovery.

Consistency with Cal OES Guidance

This two-part vulnerability assessment approach fulfills Cal OES LHMP requirements for identifying Equity Priorities Communities by the following:

- Using locally appropriate indicators and datasets,
- Incorporating stakeholder input in indicator selection,
- Applying transparent and repeatable analytical methods, and
- Demonstrating how identified vulnerable communities inform subsequent hazard and mitigation planning decisions.

APPENDIX E. FEDERAL AND STATE AGENCIES, PROGRAMS, AND REGULATIONS

FEDERAL

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have all necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or other visual alerts. Two technical documents for shelter operators address physical accessibility needs of people with disabilities, as well as medical needs and service animals.

The ADA intersects with disaster preparedness programs in regard to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Civil Rights Act

The Civil Rights Act of 1964 prohibits discrimination based on race, color, religion, sex or nation origin and requires equal access to public places and employment. The Act is relevant to emergency management and hazard mitigation in that it prohibits local governments from favoring the needs of one population group over another. Local government and emergency response must ensure the continued safety and well-being of all residents equally, to the extent possible. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the

chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, and pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. Numerous issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

The CWA is important to hazard mitigation in several ways. There are often permitting requirements for any construction within 200 feet of water of the United States, which may have implications for mitigation projects identified by a local jurisdiction. Additionally, CWA requirements apply to wetlands, which serve important functions related to preserving and protecting the natural and beneficial functions of floodplains and are linked with a community's floodplain management program. Finally, the National Pollutant Discharge Elimination System is part of the CWA and addresses local stormwater management programs. Stormwater management plays a critical role in hazard mitigation by addressing urban drainage or localized flooding issues within jurisdictions.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Community Development Block Grant Disaster Resilience Program

In response to disasters, Congress may appropriate additional funding for the U.S. Department of Housing and Urban Development Community Development Block Grant programs to be distributed as Disaster Recovery grants (CDBG-DR). These grants can be used to rebuild affected areas and provide seed money to start the recovery process. CDBG-DR assistance may fund a broad range of recovery activities, helping communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of FEMA, the Small Business Administration, and the U.S. Army Corps of Engineers. Housing and Urban Development generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. To be eligible for CDBG-DR funds, projects must meet the following criteria:

- Address a disaster-related impact (direct or indirect) in a presidentially declared county for the covered disaster.
- Be a CDBG-eligible activity (according to regulations and waivers).
- Meet a national objective.

Incorporating preparedness and mitigation into these actions is encouraged, as the goal is to rebuild in ways that are safer and stronger. CDBG-DR funding is a potential alternative source of funding for actions identified in this plan.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the special flood hazard area receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5 percent discount if the community is at Class 7 to 9. The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information.
- Mapping and regulations.
- Flood damage reduction.
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Disaster Mitigation Act

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.

Emergency Relief for Federally Owned Roads Program

The U.S. Forest Service's Emergency Relief for Federally Owned Roads Program was established to assist federal agencies with repair or reconstruction of tribal transportation facilities, federal lands transportation facilities, and other federally owned roads that are open to public travel and have suffered serious damage by a natural disaster over a wide area or by a catastrophic failure. The program funds both emergency and permanent repairs. Eligible activities under this program meet some of the goals and objectives for this plan and the program is a possible funding source for actions identified in this plan.

Emergency Watershed Program

The USDA Natural Resources Conservation Service (NRCS) administers the Emergency Watershed Protection (EWP) Program, which responds to emergencies created by natural disasters. Eligibility for

assistance is not dependent on a national emergency declaration. The program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. EWP is an emergency recovery program. Financial and technical assistance are available for the following activities:

- Remove debris from stream channels, road culverts, and bridges.
- Reshape and protect eroded banks.
- Correct damaged drainage facilities.
- Establish cover on critically eroding lands.
- Repair levees and structures.
- Repair conservation practices.

This federal program could be a possible funding source for actions identified in this plan.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- Endangered means that a species of fish, animal or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- Threatened means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- Critical habitat means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- Section 4: Listing of a Species—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or residents may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this

decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.

- Section 7: Consultation—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- Section 9: Prohibition of Take—It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- Section 10: Permitted Take—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- Section 11: Citizen Lawsuits—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every 5 years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Inspection Act in 1972, creation of the National Dam Safety Program in 1996, and reauthorization of the program through the Dam Safety Act in 2006. National Dam Safety Program, administered by FEMA requires a periodic engineering analysis of the majority of dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act
- Dams that the Secretary of the Army determines do not pose any threat to human life or property.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property of the public. The National Dam Safety Program is a partnership among the states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States.

National Environmental Policy Act

The National Environmental Policy Act requires federal agencies to consider the environmental impacts of proposed actions and reasonable alternatives to those actions, alongside technical and economic considerations. The National Environmental Policy Act established the Council on Environmental Quality, whose regulations (40 CFR Parts 1500-1508) set standards for compliance. Consideration and decision-making regarding environmental impacts must be documented in an environmental impact statement or environmental assessment. Environmental impact assessment requires the evaluation of reasonable alternatives to a proposed action, solicitation of input from organizations and individuals that could be affected, and an unbiased presentation of direct, indirect, and cumulative environmental impacts. FEMA hazard mitigation project grant applications require full compliance with applicable federal acts. Any action identified in this plan that falls within the scope of this act will need to meet its requirements.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act.

For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent-annual-chance flood and the 0.2-percent-annual-chance flood. Base flood elevations and the boundaries of the flood hazard areas are shown on Flood Insurance Rate Maps, which are the principle tool for identifying the extent and location of the flood hazard. Flood Insurance Rate Maps are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under the local floodplain management program. In recent years, Flood Insurance Rate Maps have been digitized as Digital Flood Insurance Rate Maps, which are more accessible to residents, local governments and stakeholders.

NFIP participants must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1 percent annual chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

NFIP participation is limited to local governments that possess permit authority and have the ability to adopt and enforce regulations that govern land use. This does not typically apply to special purpose districts. None of the special purpose district planning partners covered by this plan are eligible to participate in the NFIP, so their action plans do not address NFIP participation.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In some cases, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency responder disciplines. These cases necessitate coordination across a spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, technological hazards, and human-caused hazards) regardless of size or complexity.

Although participation is voluntary, federal departments and agencies are required to make adoption of NIMS by local and state jurisdictions a condition to receive federal preparedness grants and awards. The content of this plan is considered to be a viable support tool for any phase of emergency management. The NIMS program is considered as a response function, and information in this hazard mitigation plan can support the implementation and update of all NIMS-compliant plans within the Planning Area.

National Landslide Preparedness Act

The 2021 National Landslide Preparedness Act authorized a national landslide hazards reduction program and a 3D elevation program within the USGS. This broadened the existing Landslide Hazards Program (under the Natural Hazards Mission Area) and the 3D Elevation Program (under the National Geospatial Program). The act required coordination among federal agencies through an Interagency Coordinating Committee on Landslide Hazards representing USGS and other agencies. The act calls for development of a national strategy for landslide loss reduction and a publicly accessible national landslide database of landslide hazard and risk.

Presidential Executive Order 11988, Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values of floodplains. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities.
- Providing federally undertaken, financed, or assisted construction and improvements.
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

Presidential Executive Order 11990, Protection of Wetlands

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The requirements apply to the following activities:

- Acquiring, managing, and disposing of federal lands and facilities
- Providing federally undertaken, financed, or assisted construction and improvements
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing.

All actions identified in this plan will seek full compliance with all applicable presidential executive orders.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The Corps maintains the National Inventory of Dams, which contains information about a dam's location, size, purpose, type, last inspection and regulatory status.

U.S. Army Corps of Engineers Flood Hazard Management

The following U.S. Army Corps of Engineers authorities and programs related to flood hazard management:

- The Floodplain Management Services program offers 100 percent federally funded technical services such as development and interpretation of site-specific data related to the extent, duration and frequency of flooding. Special studies may be conducted to help a community understand and respond to flood risk. These may include flood hazard evaluation, flood warning and preparedness, or flood modeling.
- For more extensive studies, the Corps of Engineers offers a cost-shared program called Planning Assistance to States and Tribes. Studies under this program generally range from $25,000 to $100,000 with the local jurisdiction providing 50 percent of the cost.
- The Corps of Engineers has several cost-shared programs (typically 65 percent federal and 35 percent non-federal) aimed at developing, evaluating and implementing structural and non-structural capital projects to address flood risks at specific locations or within a specific watershed:
    - The Continuing Authorities Program for smaller-scale projects includes Section 205 for Flood Control, with a $7 million federal limit and Section 14 for Emergency Streambank Protection with a $1.5 million federal limit. These can be implemented without specific authorization from Congress.
    - Larger scale studies, referred to as General Investigations, and projects for flood risk management, for ecosystem restoration or to address other water resource issues, can be pursued through a specific authorization from Congress and are cost-shared, typically at 65 percent federal and 35 percent non-federal.
    - Watershed management planning studies can be specifically authorized and are cost-shared at 50 percent federal and 50 percent non-federal.
- The Corps of Engineers provides emergency response assistance during and following natural disasters. Public Law 84-99 enables the Corps to assist state and local authorities in flood fight activities and cost share in the repair of flood protective structures. Assistance is provided in the flowing categories:
    - Preparedness—The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for Corps of Engineers emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
    - Response Activities—Public Law 84-99 allows the Corps of Engineers to supplement state and local entities in flood fighting urban and other non-agricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood fight efforts require a project cooperation agreement signed by the public sponsor and the sponsor must remove all flood fight material after the flood has receded. Public Law 84-99 also authorizes emergency water support and drought assistance in certain situations

and allows for "advance measures" assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.

- Rehabilitation—Under Public Law 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the federal system owner, and at 20 percent cost to the eligible non-federal system owner. All systems considered eligible for Public Law 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the Corps on a regular basis. The Corps has the responsibility to coordinate levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

These authorities and programs are all available to the planning partners to support any related mitigation actions.

U.S. Bureau of Reclamation Safety Evaluation of Existing Dams Program

The U.S. Bureau of Reclamation's Safety Evaluation of Existing Dams Program was officially implemented in 1978 with passage of the Reclamation Safety of Dams Act (Public Law 95-578). This act was amended in 1984 under Public Law 98-404, in 2000 under Public Law 106-377, in 2002 under Public Law 107-117, and in 2004 under Public Law 108-439. Program development and administration of dam safety activities is the responsibility of the Bureau of Reclamation's Dam Safety Office located in Denver, Colorado.

Dams must be operated and maintained in a safe manner, ensured through inspections for safety deficiencies, analyses utilizing current technologies and designs, and corrective actions if needed based on current engineering practices. In addition, future evaluations should include assessments of benefits foregone with the loss of a dam. For example, a failed dam can no longer provide needed fish and wildlife benefits.

The primary emphasis of the Safety Evaluation of Existing Dams program is to perform site evaluations and to identify potential safety deficiencies on Bureau of Reclamation and other Interior Department dams. The basic objective is to quickly identify dams which pose an increased threat to the public, and to quickly complete the related analyses in order to expedite corrective action decisions and safeguard the public and associated resources. The selected course of action relies on assessments of risks and liabilities with environmental and public involvement input to the decision-making process.

U.S. Fire Administration

There are federal agencies that provide technical support to fire agencies/organizations. For example, the U.S. Fire Administration, which is a part of FEMA, provides leadership, advocacy, coordination, and support for fire agencies and organizations.

STATE

AB 32: The California Global Warming Solutions Act

This bill identifies the following potential adverse impacts of global warming:

> "… the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."

AB 32 establishes a state goal of reducing greenhouse gas emissions to 1990 levels by 2020 (a reduction of approximately 25 percent from forecast emission levels), with further reductions to follow. The law requires the state Air Resources Board to do the following:

- Establish a program to track and report greenhouse gas emissions.
- Approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions from sources of greenhouse gas emissions.
- Adopt early reduction measures to begin moving forward.
- Adopt, implement, and enforce regulations—including market mechanisms such as "cap and-trade" programs—to ensure that the required reductions occur.

The Air Resources Board has adopted a statewide greenhouse gas emissions limit and an emissions inventory, along with requirements to measure, track, and report greenhouse gas emissions by the industries it determined to be significant sources of greenhouse gas emissions.

AB 38: Fire Safety: Low-Cost Retrofits: Regional Capacity Review: Wildfire Mitigation

Requires the seller of any real property located in a high or very fire hazard severity zone to provide a disclosure notice, as specified, to the buyer with information relating to fire hardening improvements on the property.

Requires the California Natural Resources Agency, in consultation with the State Fire Marshal and the Forest Management Task Force, to review the regional capacity of each county that contains a very high fire hazard severity zone to improve forest health, fire resilience, and safety.

Requires the California Office of Emergency Services to enter into a joint powers agreement with the Department of Forestry and Fire Protection to administer a comprehensive wildfire mitigation and assistance program to encourage cost-effective structure hardening and facilitate vegetation management, contingent upon appropriation by the Legislature.

AB 70: Flood Liability

This bill provides that a city or county may be required to contribute a fair and reasonable share to compensate for property damage caused by a flood to the extent that it has increased the state's exposure to liability for property damage by unreasonably approving new development in a previously undeveloped area that is protected by a state flood control project, unless the city or county meets specified requirements.

AB 162: Flood Planning

This California State Assembly Bill passed in 2007 requires cities and counties to address flood-related matters in the land use, conservation, and safety and housing elements of their general plans. The land use element must identify and annually review the areas covered by the general plan that are subject to flooding as identified in floodplain mapping by either FEMA or the state Department of Water Resources (DWR). During the next revision of the housing element on or after January 1, 2009, the conservation element of the general plan must identify rivers, creeks, streams, flood corridors, riparian habitat, and land that may accommodate floodwater for the purpose of groundwater recharge and stormwater management. The safety element must identify information regarding flood hazards, including:

- Flood hazard zones.
- Maps published by FEMA, DWR, the U.S. Army Corps of Engineers, the Central Valley Flood Protection Board, and the Governor's Office of Emergency Services (Cal OES).
- Historical data on flooding.
- Existing and planned development in flood hazard zones.

The general plan must establish goals, policies and objectives related to flooding risks, including:

- Avoiding or minimizing the risks of flooding new development.
- Evaluating whether new development should be located in flood hazard zones.
- Identifying construction methods to minimize damage.

AB 162 establishes goals, policies and objectives related to flooding risks. It establishes procedures for the determination of available land suitable for urban development, which may exclude lands where FEMA or DWR has concluded that the flood management infrastructure is not adequate to avoid the risk of flooding.

AB 642: Wildfires

This omnibus fire prevention bill makes changes to support cultural and prescribed fire, including the creation of a Cultural Burning Liaison at the Department of Forestry and Fire Protection, and requires a proposal for creating a prescribed fire training center in California. The Act requires the Director of Forestry and Fire Protection to identify areas in the state as moderate and high fire hazard severity zones and to classify areas into fire hazard severity zones based on additional factors including possible lightning caused ignition. The bill requires a local agency, within 30 days of receiving a transmittal from the director that identifies fire hazard severity zones, to make the information available for public comment.

AB 747: Required Information for General Plan Safety Elements

This bill requires California communities with general plans to address evacuation routes in the safety element of the general plan. Information on the evacuation routes and their capacity, safety and viability under a range of emergency scenarios must be provided. For communities that have not adopted a local hazard mitigation plan, the safety element must be updated with this information by January 1, 2022. For those with a local hazard mitigation plan, the requirement applies upon the next revision of the hazard mitigation plan on or after January 1, 2022. Communities that have adopted a local hazard mitigation plan, emergency operations plan, or other document that fulfills the goals and objectives of this law may

comply with this requirement by summarizing and incorporating by reference the other plan or document in the safety element.

In subsequent revisions to the safety element, communities also will be required to identify new information relating to flood and fire hazards and climate adaptation and resiliency strategies applicable to the city or county that was not available during the previous revision of the safety element. These subsequent updates must occur upon each revision of the general plan housing element or local hazard mitigation plan and not less than once every eight years.

AB 800: Wildfires: Local General Plans: Safety Elements: Fire Hazard Severity Zones

Existing law requires the Director of Forestry and Fire Protection to identify areas of the state as very high fire hazard severity zones, and requires each planning agency to prepare, and the legislative body of each county and city to adopt, a comprehensive, long-term general plan, including a safety element, for the physical development of the county or city. Existing law requires each city or county that contains a very high fire hazard severity zone to submit the draft element of, or draft amendment to the safety element its general plan to the State Board of Forestry and Fire Protection and to every local agency that provides fire protection to territory in the city or county at least 90 days before adoption or amendment.

This requires the director to also identify areas of the state as moderate and high fire hazard severity zones. It requires the draft element of, or draft amendment to, the safety element of a county or city's general plan to be submitted to the state board and to every local agency that provides fire protection to territory in the city or county at least 90 days before the adoption or amendment to the safety element of its general plan for each city or county that contains a moderate or high fire hazard severity zone.

Existing law requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in state responsibility areas and very high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within state responsibility areas and very high fire hazard severity zones.

This bill also requires the state board and authorizes a local agency to review the draft or an existing safety element and recommend changes to the planning agency regarding uses of land and policies in moderate and high fire hazard severity zones and regarding methods and strategies for wildland fire risk reduction and prevention within moderate and high fire hazard severity zones.

The existing Subdivision Map Act vests the authority to regulate and control the design and improvement of subdivisions in the legislative body of a local agency, and sets forth procedures governing the local agency's processing, approval, conditional approval, or disapproval, and filing of tentative, final, and parcel maps, and the modification thereof. The act generally requires a subdivider to file a tentative map or vesting tentative map with the local agency, and requires the local agency to approve, conditionally approve, or disapprove the map within a specified time period. Before approving a tentative map, or a parcel map for which a tentative map was not required, for an area located in a state responsibility area or a very high fire hazard severity zone, existing law requires a legislative body of a county to make specified findings. Existing law requires a legislative body of a county to transmit these findings to the State Board of Forestry and Fire Protection.

This requires a legislative body of a county to make specified findings before approving a tentative map, or a parcel map for which a tentative map was not required, for areas located in moderate and high fire hazard severity zones, and requires these findings to be transmitted to the state board.

By requiring new duties on a county, the bill imposes a state-mandated local program. The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement. This bill provides that, if the Commission on State Mandates determines that the bill contains costs mandated by the state, reimbursement for those costs shall be made pursuant to statutory provisions.

AB 2140: General Plans—Safety Element

This bill provides that the state may allow for more than 75 percent of public assistance funding under the California Disaster Assistance Act only if the local agency is in a jurisdiction that has adopted a local hazard mitigation plan as part of the safety element of its general plan. The local hazard mitigation plan needs to include elements specified in this legislation. In addition, this bill requires Cal OES to give preference for federal mitigation funding to cities and counties that have adopted local hazard mitigation plans. The intent of the bill is to encourage cities and counties to create and adopt hazard mitigation plans.

AB 2800: Climate Change—Infrastructure Planning

This California State Assembly bill passed in 2016 and until July 1, 2020, requires state agencies to take into account the current and future impacts of climate change when planning, designing, building, operating, maintaining, and investing in state infrastructure. The bill, by July 1, 2017, and until July 1, 2020, requires an agency to establish a Climate-Safe Infrastructure Working Group to examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent construction of buildings used for human occupancy on the surface trace of active faults. Before a new project is permitted, cities and counties require a geologic investigation to demonstrate that proposed buildings will not be constructed on active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as liquefaction or seismically induced landslides. The law requires the State of California Geologist to establish regulatory zones around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. All seismic hazard mitigation actions identified in this plan will seek full compliance with the Alquist-Priolo Earthquake Fault Zoning Act.

California Department of Forestry and Fire Protection

CAL FIRE has responsibility for wildfires in areas of the county that are not under the jurisdiction of the Forest Service or a local fire organization, including lands designated as State Responsibility Areas. CAL FIRE also has fire protection responsibilities by contract and mutual aid agreements. For example, CAL FIRE provides year-round fire protection under Amador Plan agreements with certain local government agencies (Public Resources Code §4144). Through these agreements, CAL FIRE provides local structural and wildfire protection or dispatch services to a community and maintains a staffing level that otherwise would be available only during the fire season. The local entity pays the additional cost of the service.

California Department of Parks and Recreation

State Parks manages portions of the California coastline including coastal wetlands, estuaries, beaches, and dune systems. The State Parks Resources Management Division has limited wildfire protection resources available to suppress fires on State Park lands.

California Department of Water Resources

In California, the DWR is the coordinating agency for floodplain management. The DWR works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, participating in statewide flood hazard mitigation planning, and facilitating annual statewide workshops. Compliance is monitored by FEMA regional staff and by the DWR.

California Division of Safety of Dams

California's Division of Safety of Dams (a division of the DWR) monitors the dam safety program at the state level and maintains a working list of dams in the state. When a new dam is proposed, Division engineers and geologists inspect the site and the subsurface. Upon submittal of an application, the Division reviews the plans and specifications prepared by the owner to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for the known geologic conditions. After approval of the application, the Division inspects all aspects of the construction to ensure that the work is done in accordance with the approved plans and specifications. After construction, the Division inspects each dam to ensure that it is performing as intended and is not developing problems. The Division periodically reviews the stability of dams and their major appurtenances in light of improved design approaches and requirements, as well as new findings regarding earthquake hazards and hydrologic estimates in California. Over 1,200 dams are inspected by Division engineers on a yearly schedule to ensure performance and maintenance of dams.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) was passed in 1970, shortly after the federal government enacted the National Environmental Policy Act, to institute a statewide policy of environmental protection. CEQA requires state and local agencies in California to follow a protocol of analysis and public disclosure of the potential environmental impacts of development projects. CEQA makes environmental protection a mandatory part of every California state and local agency's decision-making process.

CEQA establishes a statewide environmental policy and mandates actions all state and local agencies must take to advance the policy. Jurisdictions conduct analysis of the project to determine if there are potentially significant environmental impacts, identify mitigation measures, and possible project alternatives by preparing environmental reports for projects that requires CEQA review. This environmental review is required before an agency takes action on any policy, program, or project. Any project action identified in this plan will seek full CEQA compliance upon implementation.

California Fire Safe Council

In 1993, the statewide Fire Safe Council, consisting of private and public membership, was formed to educate and encourage Californians to plan and prepare for wildfires by reducing the risk of fire to property, communities, and natural/structural resources. In 2002, this group created a nonprofit organization and board of directors, called the California Fire Safe Council. The Council works with the California Fire Alliance to facilitate the distribution of National Fire Plan grants for wildfire risk reduction and education (www.grants.firesafecouncil.org). The Council also provides assistance to local Fire Safe Councils through its website (www.firesafecouncil.org), the distribution of educational materials, and technical assistance, primarily through regional representatives. More than 130 local Fire Safe Councils have formed in California to plan, coordinate, and implement fire prevention activities.

California Fire Service and Rescue Emergency Mutual Aid Plan

The Governor's Office of Emergency Services Fire and Rescue Branch administers the California Fire Service and Rescue Emergency Mutual Aid Plan. The agency provides guidance and procedures for agencies developing emergency operations plans, as well as training and technical support, primarily to overall emergency service organizations and urban search and rescue teams.

California General Planning Law

California state law requires that every county and city prepare and adopt a comprehensive long-range plan to serve as a guide for community development. The general plan expresses the community's goals, visions, and policies relative to future land uses, both public and private. The general plan is mandated and prescribed by state law (Cal. Gov. Code §65300 et seq.), and forms the basis for most local government land use decision-making.

The plan must consist of an integrated, internally consistent set of goals, policies, and implementation measures. In addition, the plan must focus on issues of the greatest concern to the community and be written in a clear and concise manner. City and county actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan.

California Hazard Mitigation Plan

Under the DMA, California must adopt a federally approved state multi-hazard mitigation plan to be eligible for certain disaster assistance and mitigation funding. The intent of the State of California Multi-Hazard Mitigation Plan is to reduce or prevent injury and damage from hazards in the state through the following:

- Documenting statewide hazard mitigation planning in California
- Describing strategies and priorities for future mitigation activities

- Facilitating the integration of local and tribal hazard mitigation planning activities into statewide efforts
- Meeting state and federal statutory and regulatory requirements.

The plan is an annex to the State Emergency Plan, and it identifies past and present mitigation activities, current policies and programs, and mitigation strategies for the future. It also establishes hazard mitigation goals and objectives. The plan will be reviewed and updated annually to reflect changing conditions and new information, especially information on local planning activities.

Under 44 CFR Section 201.6, local hazard mitigation plans must be consistent with their state's hazard mitigation plan. In updating this plan, the Planning Committee reviewed the California State Hazard Mitigation Plan to identify key relevant state plan elements (refer to Section 3.7).

California Residential Mitigation Program

The California Residential Mitigation Program was established in 2011 to help Californians strengthen their homes against damage from earthquakes. The program is a joint powers authority created by Cal OES and the California Earthquake Authority, which is a not-for-profit, publicly managed, privately funded provider of home earthquake insurance to California homeowners and renters.

Earthquake Brace + Bolt was developed to help homeowners lessen the potential for damage to their houses during an earthquake. A residential seismic retrofit strengthens an existing older house, making it more resistant to earthquake activity such as ground shaking and soil failure. The seismic retrofitting involves bolting the house to its foundation and adding bracing around the perimeter of the crawl space. Most homeowners hire a contractor to do the retrofit work, and owners of houses in ZIP Codes with house characteristics suitable for this type of retrofit are eligible for up to $3,000 toward the cost. A typical retrofit by a contractor may cost between $3,000 and $7,000, depending on the location and size of the house, contractor fees, and the amount of materials and work involved. If the homeowner is an experienced do-it-yourselfer, a retrofit can cost less than $3,000.

California State Building Code

California Code of Regulations Title 24 (CCR Title 24), also known as the California Building Standards Code, is a compilation of building standards from three sources:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes adopted to address particular California concerns.

The state Building Standards Commission is authorized by California Building Standards Law (Health and Safety Code Sections 18901 through 18949.6) to administer the processes related to the adoption, approval, publication, and implementation of California's building codes. These building codes serve as the basis for the design and construction of buildings in California. The national model code standards adopted into Title 24 apply to all occupancies in California, except for modifications adopted by state

agencies and local governing bodies. Since 1989, the Building Standards Commission has published new editions of Title 24 every three years.

On January 1, 2014, California Building Code Accessibility Standards found in Chapter 11B incorporated the 2010 Americans with Disabilities Act (ADA) Standards as the model accessibility code for California. The purpose was to ensure consistency with federal guidelines. As a result of this incorporation, the California standards will fully implement and include 2010 ADA Standards within the California Building Code while maintaining enhanced levels of accessibility already provided by existing California accessibility regulations.

Disadvantaged and Low-income Communities Investments

Senate Bill (SB) 535 directs state and local agencies to make investments that benefit California's disadvantaged communities. It also directs the California Environmental Protection Agency to identify disadvantaged communities for the purposes of these investments based on geographic, socio-economic, public health, and environmental hazard criteria. Assembly Bill (AB) 1550 increased the percent of funds for projects located in disadvantaged communities from 10 to 25 percent and added a focus on investments in low-income communities and households. This program is a potential alternative source of funding for actions identified in this plan.

Division of the State Architect's AB 300 List of Seismically At-Risk Schools

In 2002, California's Division of the State Architect completed an inventory of public school buildings built before 1978 that identifies buildings with characteristics that might make them unsafe in future earthquakes. This inventory provides a list of potentially at-risk schools known as the AB 300 list (the inventory was authorized by Assembly Bill 300 in 1999). Using available information on school buildings' dates of construction, seismic retrofits, and structural systems (wood frame, concrete shear wall, or steel moment frame, etc.), the inventory categorized California public school buildings into one of two categories: those expected to perform well in future earthquakes; and those that are not expected to perform well and require more detailed seismic evaluation.

The Division of the State Architect recommends that public schools on this list undergo detailed seismic evaluations to determine if they pose life safety risks, but the state has neither required nor funded school districts to do this.

Governor's Executive Order S-13-08

Governor's Executive Order S-13-08 enhances the state's management of climate impacts from sea-level rise, increased temperatures, shifting precipitation and extreme weather events. There are four key actions in the executive order:

- Initiate California's first statewide climate change adaptation strategy to assess expected climate change impacts, identify where California is most vulnerable, and recommend adaptation policies. This effort will improve coordination within state government so that better planning can more effectively address climate impacts on human health, the environment, the state's water supply and the economy.
- Request that the National Academy of Science establish an expert panel to report on sea-level rise impacts in California, to inform state planning and development efforts.

- Issue interim guidance to state agencies for how to plan for sea-level rise in designated coastal and floodplain areas for new projects.
- Initiate a report on critical infrastructure projects vulnerable to sea-level rise.

Office of the State Fire Marshal

The Office of the State Fire Marshal is a division of CAL FIRE that has a wide variety of fire safety and training responsibilities and provides technical support to fire agencies/organizations.

Senate Bill 12: Local Government: Planning and Zoning: Wildfires

This bill imposes new planning requirements on local governments, as follows:

- Defines "very high fire risk areas" to be the VHFHSZ in both the SRA and the Local Responsibility Area.
- Requires each city or county, upon the next revision of the housing element or local hazard mitigation plan on or after July 1, 2024, whichever occurs first, to review and update its safety element to include a comprehensive retrofit strategy that includes specified contents.
- Requires a city or county with VHFHSZ within its jurisdiction to amend the land use element of its general plan upon the next revision of the housing element on or after July 1, 2024. This amendment of the land use element must include the locations of all VHFHSZ within the city or county, the data and analysis described in the Office of Planning and Research's publication *Fire Hazard Planning–General Plan Technical Advice Series*, and other specified goals, objectives, and implementation measures.
- Requires, after the initial amendment to the land use element, that a city or county review upon each revision of the housing element the implementation of the wildfire risk reduction standards within the jurisdiction and the designation of VHFHSZ.
- Provides for review and comment on draft findings by the Board and local fire agencies on whether the city or county has implemented the standards or made adequate progress, as defined.
- Requires, on or before January 1, 2023, to develop and post on its web site a clearinghouse of local ordinances, policies, and best practices relating to land use planning in VHFHSZ, wildfire risk reduction, and wildfire preparedness. The Office of Planning and Research must also regularly update the clearinghouse.

Senate Bill 79: Housing Development: Transit-Oriented Development

Senate Bill 79, enacted in October 2025, establishes a statewide framework that significantly increases allowable residential density near major transit stops and corridors. Beginning July 1, 2026, Senate Bill 79 requires cities within designated urban transit counties to allow qualifying transit-oriented housing projects "as an allowed use" on land zoned for residential, mixed-use, or commercial development within one-quarter to one-half mile of major transit stations.

Senate Bill 99: Evacuation Route Planning

Senate Bill 99, enacted in 2019, requires that cities' and counties' general plans address evacuation routes from any hazard area identified in the safety element. Under this law, the safety element must include information to identify residential developments in hazard areas that do not have at least two

emergency evacuation routes. Each city or county must update its safety element with the new information upon the next revision of its housing element on or after January 1, 2020.

Senate Bill 182 Local Government: Planning and Zoning: Wildfires

California Senate Bill 182 made a number of changes to state law regarding planning for and permitting development in areas designated as very high fire risk areas. The bill requires a local jurisdiction to do the following:

- Include a comprehensive retrofit strategy in its safety element to reduce the risk of property loss and damage during wildfires.
- Amend its land use element to identify all very high fire risk areas and to establish measures to protect lives and property from unreasonable risk of wildfire.
- Adopt a very high fire risk overlay zone for its zoning ordinance.
- Allocate a lower portion of projected future housing to very high fire hazard severity zones

This bill prohibits local governments from entering into a development agreement for property in a very high fire risk area, approving a permit for a project in a very high fire risk area, or approving a tentative map for a subdivision in a very high fire risk area, unless the jurisdiction makes specified findings based on substantial evidence.

Senate Bill 379: General Plans: Safety Element—Climate Adaptation

Senate Bill 379 builds upon the flood planning inclusions into the safety and housing elements and the hazard mitigation planning safety element inclusions in general plans outlined in AB 162 and AB 2140, respectively. SB 379 focuses on a new requirement that cities and counties include climate adaptation and resiliency strategies in the safety element of their general plans beginning January 1, 2017. In addition, this bill requires general plans to include a set of goals, policies and objectives, and specified implementation measures based on the conclusions drawn from climate adaptation research and recommendations.

Senate Bill 1000: General Plan Amendments—Safety and Environmental Justice Elements

In 2016, Senate Bill 1000 amended California's Planning and Zoning Law in two ways:

- The original law established requirements for initial revisions of general plan safety elements to address flooding, fire, and climate adaptation and resilience. It also required subsequent review and revision as necessary based on new information. Senate Bill 1000 specifies that the subsequent reviews and revision based on new information are required to address only flooding and fires (not climate adaptation and resilience).
- Senate Bill 1000 adds a requirement that, upon adoption or revision of any two other general plan elements on or after January 1, 2018, an environmental justice element be adopted for the general plan or environmental justice goals, policies and objectives be incorporated into other elements of the plan.

Senate Bill 1035: Fire, Flood, and Adaptation Safety Element Updates

Senate Bill 1035 clarifies that revisions to a community's General Plan Safety Element—to address fire hazards, flood hazards, and climate adaptation and resilience strategies—must occur upon each revision to a Housing Element or Local Hazard Mitigation Program.

Senate Bill 1241: General Plans: Safety Element—Fire Hazard Impacts

In 2012, Senate Bill 1241 passed requiring that the safety elements of all future general plans address fire risk in state responsibility areas and very high fire hazard severity zones. The bill requires cities and counties to make findings regarding available fire protection and suppression services before approving a tentative map or parcel map.

Standardized Emergency Management System

CCR Title 19 establishes the Standardized Emergency Management System (SEMS) to standardize the response to emergencies involving multiple jurisdictions. SEMS is intended to be flexible and adaptable to the needs of all emergency responders in California. It requires emergency response agencies to use basic principles and components of emergency management. Local governments must use SEMS by December 1, 1996, to be eligible for state funding of response-related personnel costs under CCR Title 19 (Sections 2920, 2925 and 2930). The roles and responsibilities of Individual agencies contained in existing laws or the state emergency plan are not superseded by these regulations. This hazard mitigation plan is considered to be a support document for all phases of emergency management, including those associated with SEMS.

APPENDIX F. PLAN MAINTENANCE AGENDAS

APPENDIX G. FEMA APPROVAL AND PLANNING PARTNER ADOPTION