

City of Half Moon Bay
Peninsula Resilience Planning
Draft Safety Element Background Report

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INTRODUCTION

This Existing Conditions Background Report discusses the natural and human-caused hazard issues that can affect the City of Half Moon Bay. Each issue identified in this report includes a general overview of each hazard, how/where the hazard affects the city and its residents, information on past hazard events, current programs and regulatory frameworks in place to reduce the impacts associated with these hazards, as well as future conditions (including potential climate change impacts associated with these hazards). The intent of this report is to provide background information that informs how and why the goals, policies, and implementation actions within the updated General Plan Safety Element were developed.

The following are the key issues considered relevant to the City of Half Moon Bay.

[Issue 1 – Emergency Preparedness and Response](#)

[Issue 2 – Geologic Hazards](#)

[Issue 3 – Flooding](#)

[Issue 4 – Sea Level Rise](#)

[Issue 5 – Seismic Hazards](#)

[Issue 6 – Fire Hazards](#)

[Issue 7 – Severe Weather](#)

[Issue 8 – Drought](#)

[Issue 9 – Airport Hazards](#)

[Issue 10 – Extreme Heat](#)

[Issue 11 – Hazardous Materials](#)

[Issue 12 – Human Health Hazards](#)

ISSUE 1: EMERGENCY PREPAREDNESS AND RESPONSE

General Overview

The City of Half Moon Bay (City) employs a multipronged approach for mitigating, responding to, and recovering from emergencies. This section reviews the city’s major evacuation routes, emergency alert systems, and other emergency response programming. State law (Senate Bill 99, or SB 99) requires that the Half Moon Bay Safety Element identify residential areas with only one way in and out, as these may be areas where evacuations are constrained. State law (Assembly Bill 747, or AB 747) also requires that the Safety Element identify potential evacuation routes and their capacity, safety, and viability.

Emergency Alert Systems

SMC Alert/Rave Mobile Safety

SMC Alert is the primary alerting system available to the City of Half Moon Bay. Messages sent vary from agency to agency. SMC Alert can be used to issue flood, fire, severe weather, or tsunami warnings; notify the community about the locations of emergency shelters; provide information about available evacuation routes; and activate special teams within the community such as Community Emergency Response Team (CERT) volunteers. SMC Alert is used in Half Moon Bay for larger regional emergency notifications, while the City uses the Emergency Alert Icon on their City’s webpage, including the Homepage in the News Section, and residents/subscribers can also sign up to receive emergency alerts via E-Notifications from the City. The City also partners with KHMB radio station 100.9 FM and AM 1710 to provide the coastside with up to date information during emergencies. Community members opt in to receiving SMC Alert

messages via email, cell phone, and voice messages to landline phones. Alerts are available in a wide variety of languages, including English and Spanish, which are the primary languages spoken in Half Moon Bay. Individuals can sign up for SMC Alert via the County's website at:

<https://www.smart911.com/smart911/ref/reg.action?pa=smcgov>.

Rave Mobile Safety was adopted by the County in December 2022 as the new alerting platform for SMC Alert.

Wireless Emergency Alerts

Another alert system includes Wireless Emergency Alerts (WEAs) which are short emergency messages from authorized public alerting authorities that can be broadcast from cell towers to any WEA-enabled mobile device in a locally targeted area. Wireless providers primarily use cell broadcast technology for WEA message delivery. WEA is a partnership among FEMA, the Federal Communications Commission and wireless providers to enhance public safety.

Genasys EVAC/Zonehaven

Public safety agencies throughout San Mateo County use the Genasys Protect app (formerly known as Zonehaven) to communicate areas that are being evacuated due to fire or other emergencies. Genasys is not an alert and warning system, but its EVAC evacuation management software provides first responders and public safety workers with tools to navigate the evacuation process, including information about when it is safe to return. Many jurisdictions within San Mateo County host evacuation plans and maps on the Genasys platform.

The Genasys platform divides the community into a number of zones to provide information tailored to impacted areas. Users of the app can choose the zone or zones for which they would like to receive alerts. Half Moon Bay is divided into seven evacuation zones, most of which also include surrounding unincorporated areas.

Major Evacuation Routes

If an evacuation is necessary in Half Moon Bay, it will be conducted by members of the San Mateo County Sheriff's Office, which provides law enforcement services in Half Moon Bay. They will work closely with the Coastside Fire Protection District, the San Mateo County Department of Emergency Management, and emergency responders in neighboring communities to make sure that evacuations are conducted as quickly and safely as possible.

There is currently no standardized countywide evacuation plan, and the City of Half Moon Bay does not have an evacuation plan that is publicly available. The City is participating in the county-wide All-Hazards Evacuation Plan, which will analyze potential evacuation scenarios across San Mateo County, identify potential evacuation routes, and recommend improvements. This work began in 2024, and is expected to finish in 2025. The Safety Element will reference this study to meet the requirements of SB 99 and AB 747. In the interim, SR-1, which runs north to south through Half Moon Bay, and SR-92, which runs east toward San Mateo, could both act as major evacuation routes.

Evacuation Constraints

Under SB 99, jurisdictions are required to identify residential parcels with access to fewer than two evacuation routes and in hazard zones as part of their Safety Element. Occupants and residents of these parcels within the City of Half Moon Bay may be unable to evacuate quickly in the event of an emergency

and are therefore more vulnerable to sudden or fast-spreading emergency conditions, such as flash floods and wildfire.

Past Events

See hazard-specific discussions in the following sections for past hazard events, some of which may have involved evacuations and emergency alerting.

Existing Programs and Regulations

Preparedness and Response Programs

San Mateo County and the City of Half Moon Bay use a variety of programs, plans, and initiatives to manage and guide emergency response. Resources and programs include both City and County-operated and volunteer programs and resources, as well as participation in regional mutual-aid agreements.

County Initiatives

Department of Emergency Management

The San Mateo County DEM, funded in part through a Joint Powers Authority (JPA) governed by the Emergency Services Council, provides essential services that prepares and assists San Mateo County agencies in the event of a disaster or other emergency. DEM coordinates countywide preparedness, response, and protection services and activities for large-scale incidents and disasters. DEM is responsible for alerting and notifying appropriate agencies within the county's 20 cities when disaster strikes, coordinating all responding agencies and ensuring resources are available and mobilized during disasters. DEM is responsible for developing and maintaining plans and procedures for all jurisdictions within San Mateo County. In addition to creating plans, the DEM develops exercises to evaluate operational and response capabilities.

During significant incidents or emergencies, DEM is responsible for activating the County of San Mateo Emergency Operations Center (EOC) to support local jurisdictions as needed. DEM coordinates and contracts to the California Office of Emergency Services (CalOES) and Federal Emergency Management Agency (FEMA) during an emergency for federal and state support.

The City of Half Moon Bay has an Emergency Preparedness Division that works in tandem with San Mateo County Department of Emergency Management, and functions as the overseer of emergency management within the city.

2021 San Mateo County Multijurisdictional Hazard Mitigation Plan

The San Mateo County DEM prepared and adopted the 2021 Multijurisdictional Hazard Mitigation Plan (MJHMP), a large regional and cross-jurisdictional effort to plan for the reduction of risk from natural and human-caused hazards. The MJHMP assesses vulnerabilities to hazards and identifies mitigation strategies and actions that jurisdictions will pursue to reduce the potential of injury, property damage, and community disruption as a possible result of these hazards. The MJHMP addresses both natural and human-caused hazards, including flooding, drought, wildfire, landslides, severe weather, terrorism, cyber threats, pandemic, and the impact of climate change on hazards, as well as other hazards. The MJHMP works with the City's General Plan Safety Element to establish a foundation for increasing the resiliency of the community, and the effectiveness of emergency response for the residents and businesses in the county. While the main body of the MJHMP provides information and strategies that relate to the entire county, the MJHMP also includes separate sections called annexes. Each community and special district

participating in the MJHMP, including the City of Half Moon Bay's, has their own annex, which includes specific information regarding the relevant hazards of concern and mitigation strategies specific to the jurisdiction. The MJHMP and the Half Moon Bay MJHMP Annex are also used as an informative reference when developing policies for the various elements within the City's General Plan, including the Safety, Housing, and Land Use Elements.

San Mateo County Operational Area Emergency Services Council

The San Mateo County Operational Area Emergency Services Council is a JPA composed of all local governments within the geographic area of the county, special districts, unincorporated areas, and participating nongovernmental entities. The Council is responsible for providing coordinated plans for the protection of people and property in the event of an emergency. The Council works in coordination with local government entities to review, approve, and recommend for adoption of emergency and mutual-aid plans and agreements, rules, ordinances, resolutions, and regulations by the Board of Supervisors and other legislative agencies.

Emergency Operations Plan and Center

The County's Emergency Operations Plan (EOP) establishes policies and procedures and assigns responsibilities to ensure the effective management of emergency operations within the county. The County's Office of Emergency Management (OEM) implements the EOP and activates the EOC.

The EOC provides a central location of authority and information and allows for face-to-face coordination among personnel who make emergency decisions. The following functions are performed in the San Mateo County Operational Area EOC:

- Coordinating emergency operations
- Releasing warning information
- Developing emergency policies and procedures
- Collecting and sharing information with county, city/town, special district, state agencies, military, federal agencies, and political representatives
- Maintaining maps, information display boards, and other data pertaining to emergency operations
- Analyzing and evaluating all data pertaining to emergency operations
- Directing and coordinating support of emergency response resources
- Maintaining contact and coordination with Disaster Operations Centers, other local government EOCs, and the Coastal Region.
- Providing emergency information and instructions to the public, making official releases to the news media and the scheduling of press conferences as necessary.

The County's EOP is supplemented by the City of Half Moon Bay EOP, as they work in conjunction with one another depending on the type of emergency. Any emergencies at the city level are addressed by the City through implementation of the Half Moon Bay EOP. Key hazard-specific annexes within the EOP include earthquakes, flooding, wildfires, landslides, severe weather, de-energization, dam failure, tsunami, and public health. In addition, annexes to help address mass care and shelter, EOC activation, and alert and warning are also included in the EOP. Should these emergencies spread beyond the city limits or require greater capabilities than the City can provide, San Mateo County and neighboring jurisdictions would get involved assisting with emergency response and aid.

San Mateo County Emergency Managers Association

The San Mateo County Emergency Managers Association (SMCEMA) is composed of Emergency Managers/Representatives from cities, towns, County departments, special districts, and community organizations within San Mateo County and is intended to support emergency management, training, and exercise planning.

Coastside Fire Protection District

The Coastside Fire Protection District oversees hazardous material safety programs for the City, in coordination with the County.

San Mateo County Sheriff's Office Emergency Services Bureau

The Sheriff's Office Emergency Services Bureau is composed of sworn specialized units and volunteer forces to respond to emergency law enforcement activities, search and rescue missions, evidence searches, and requests for mutual aid. San Mateo County Search and Rescue (SMCSAR) is a professional volunteer force of the San Mateo County Sheriff's Emergency Services Bureau.

Disaster Debris Management Plan

Disasters can produce substantial volumes of debris, creating hazardous conditions that endanger the public and disrupt the essential daily lifestyle and economy of the community. The County of San Mateo Disaster Debris Management Plan (DDMP) provides a comprehensive framework for management of debris following a disaster. It addresses the roles and responsibilities of government organizations as well as private firms and nongovernmental organizations that might have a role in debris operations.¹ The County's Public Works Department serves as the lead department for debris management for unincorporated areas of the county.

The City of Half Moon Bay does not have a publicly available plan for disaster debris removal at this time. The 2023 EOP includes provisions; however, the city does have an active landfill, Ox Mountain Landfill, which can be used as a debris management site. Debris can be sorted at this facility, separating any recyclable material and materials not suited for recycling that are then removed and taken to a landfill.

County of San Mateo Health System

The County of San Mateo Health System operates Emergency Medical Services (EMS), which provides emergency medical resources in response to 911 calls countywide. As of 2019, EMS responded to 90 percent of requests for advanced life support within 6 minutes and 59 seconds in metro and urban areas and 11 minutes and 59 seconds in suburban and rural areas. EMS responded to 90 percent of ambulance transport requests within 12 minutes and 59 seconds in metro and urban areas, and 19 minutes and 59 seconds in suburban and rural areas.

The health emergency preparedness unit (HEP) strengthens the community's ability to respond to all types of public health and medical incidents. The HEP team continually collaborates with community stakeholders and organizations to facilitate response and recovery for public health and medical emergencies.

The San Mateo County Healthcare Coalition (HCC) coordinates strategic planning activities between healthcare facilities of various healthcare delivery sectors, public health agencies, other government entities, and community partners to prepare for, respond to, and recover from emergencies and other incidents that impact public health.

San Mateo County EMS uses ReddiNet as its countywide emergency communications system. ReddiNet allows the County to track hospital status, mass casualty incidents, hospital bed count, and facility assessments and to locate family members through access to the Family Reunification Center.²

Mutual-Aid Agreements

In some cases, local emergency responders may not have the staff, vehicles, equipment, or other resources to fully respond to an emergency in their jurisdiction. In these instances, the local emergency commanders can request assistance from other communities. This external assistance is known as mutual aid. The California Disaster and Civic Defense Master Mutual Aid Agreement, an arrangement between state agencies and local governments, establishes a framework for mutual aid.

Mutual-aid regions are established under the Emergency Services Act. Six mutual-aid regions numbered I-VI have been established within California. The San Mateo County Operational Area is part of the Mutual Aid Region II and the Coastal Administrative Region.

City Plans and Initiatives

Coastside Fire Protection District

The Coastside Fire Protection District provides the fire protection services for the City of Half Moon Bay and the surrounding unincorporated communities of Montara, Moss Beach, Princeton, El Granada, and Miramar. The District's service territory covers 50 square miles and is home to 30,000 residents.

The District operates three fire stations to provide emergency services. One, Fire Station 40, is in downtown Half Moon Bay, which also acts as the headquarter for the District. The other fire stations are in nearby unincorporated communities. There are currently 20 paid staff in the District, along with 12 volunteer firefighters. CAL FIRE provides all operational staff, management, and other personnel to meet the District's needs.

In addition to traditional fire protection service, the District also provides rescue, ambulance (via American Medical Response), lock-out, and other emergency services. The District responds to approximately 2,300 calls for service annually.

San Mateo County Sheriff's Office

As the chief law enforcement officer in San Mateo County, the Sheriff is responsible for planning, organizing, directing, and reviewing the activities and operations of the Sheriff's Office, including adult correctional facilities, rehabilitation, and re-entry services for offenders; public safety and emergency services; forensic laboratory services and specialized programs, such as narcotics, search and rescue, and bomb detection and disposal.

. Since 2011, the City of Half Moon Bay has contracted with the San Mateo County Sheriff to provide law enforcement services in the City. These services include patrolling throughout the City, dispatch response to emergency calls, Investigations, Community policing, Coordinating emergency preparedness efforts, Enforcing traffic laws and managing the Sheriff's Activity League on the Coastside.

The Sherrif runs its Coastside Patrol Bureau law enforcement services from its substation based in the City of Half Moon Bay. The Patrol is staffed with 27 full-time Deputy Sheriffs, four Sergeants, and one Lieutenant which is a level to consistently supply enforcement resources any time of day or night for any emergency.

Coastside Community Emergency Response Team

Coastside CERT is an emergency preparedness volunteer organization focused on creating a ready and resilient community along the San Francisco Bay Area coast from the southern side of the Tom Lantos Tunnel (Devil's Slide) to Tunitas Creek Road. The CERT team is a community-based network of volunteers that assist the City's Emergency Preparedness Division during public safety and health efforts in times of emergency needs and disasters. Each neighborhood within the jurisdiction has trained CERT leaders and members, who have agreed to volunteer their aid during a disaster. These CERT members are contacted during an incident and asked to convene at a designated rally point where they set up a command structure and use equipment to provide support as needed. CERT members are prepared for all forms of disaster, but focus primarily on earthquakes, floods, tsunamis, wildfires, and power outages. They are trained to support communications, gather information, provide basic medical services, and offer general disaster preparedness classes. Training is offered in both English and Spanish.

City of Half Moon Bay Emergency Preparedness Division

The Emergency Preparedness Division works in partnership with the San Mateo County DEM to prepare staff, Coastside agencies, and residents to effectively respond to natural disaster or other emergencies. The Division develops and updates emergency plans, trains staff in emergency operations procedures, and serves as the City's representative on the Coastside Emergency Action Program and the San Mateo County Emergency Managers Association to assist with local and regional emergency preparedness efforts.

City of Half Moon Bay Emergency Operations Plan

The City's Emergency Operations Plan (EOP) provides a guide for managing City services and coordinating response in the event of an emergency. Contents of the EOP include general and specific event checklists, emergency management goals, and directions for activating the City's EOC.

Future Conditions

Climate change is expected to affect the frequency and severity of future natural hazards in Half Moon Bay, necessitating an adapted approach to emergency preparedness and response. The Half Moon Bay vulnerability assessment contains details about how climate change will affect these hazard conditions.

ISSUE 2: GEOLOGIC HAZARDS

General Overview

Situated along the coast located along the bay in between the foothills of the Santa Cruz Mountains and the Pacific Ocean, the only geologic hazards known to affect Half Moon Bay are landslides, soil creep, cliff erosion, land subsidence, expansive soils, and seismically induced subsidence.

Landslide

A landslide is a mass of rock, earth, or debris moving down a slope. They occur when a slope loses its structural integrity and can no longer hold itself together. Landslides can move slowly or very quickly. Mudslides, a type of landslide, are rivers of rock and soil 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.

Slides 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. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by

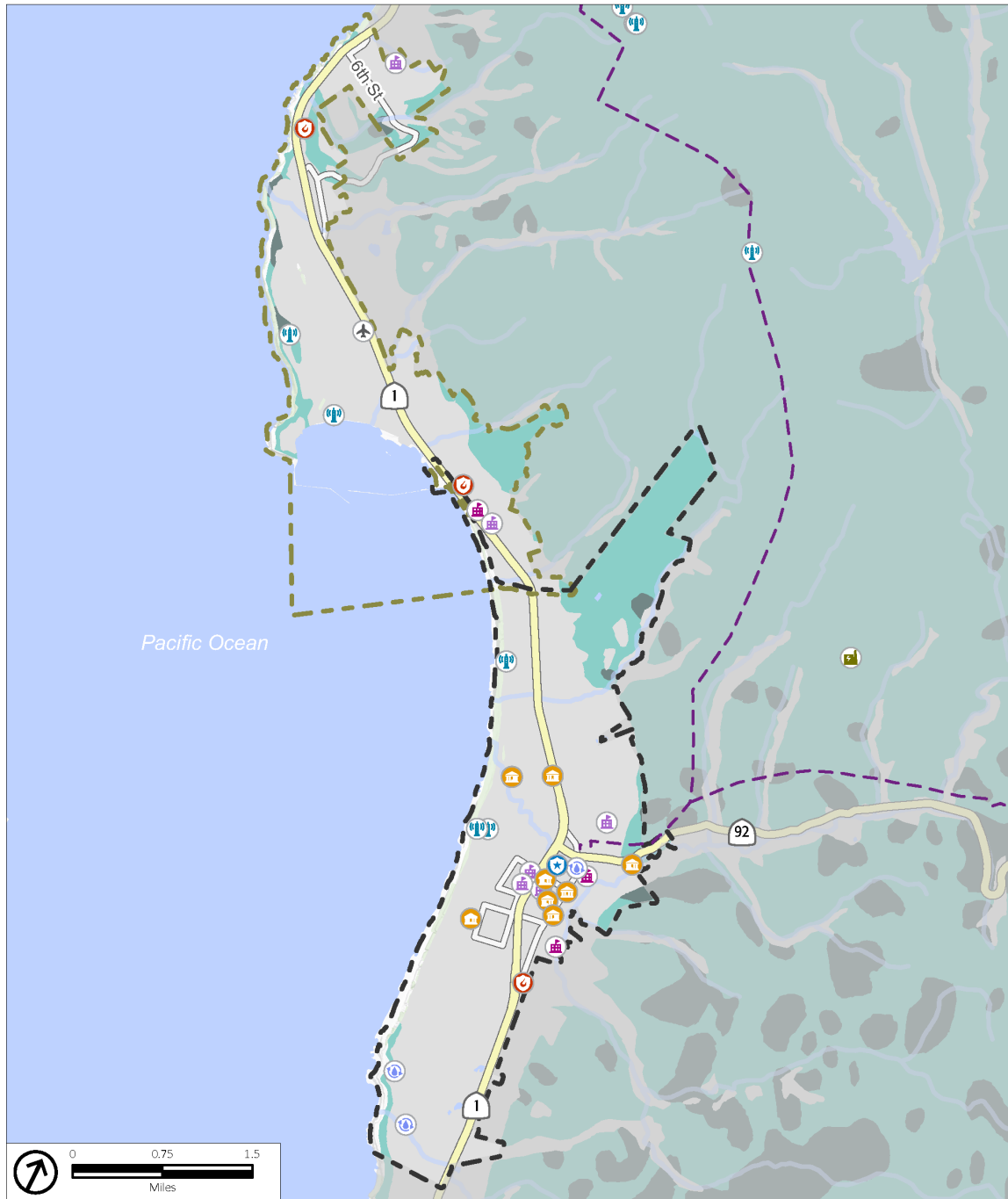
significant precipitation or seismic events. In San Mateo County, landslides typically occur during and after severe storms that saturate steep, slide-prone soils. Most weather-induced landslides in the county occur in the winter after the water table has risen. Landslides that result from earthquakes can occur at any time. The probability of a landslide in the county in any given year is high.

Landslides in hillside terrain can pose a serious hazard to downslope property and structures. They can disrupt roadways and other infrastructure lifelines, destroy private property, and cause flooding, bank erosion, and rapid channel migration. Landslides can travel miles from their source, growing as they descend and pick up debris.

The degree of local landslide hazard depends on 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. Other factors that increase landslide risk include a slope greater than 33 percent, a history of landslide activity in the last 10,000 years, and stream or wave activity, which can cause erosion and undercut a bank and cause the surrounding land to become unstable. Wildfire can also make landscapes more susceptible to landslides, flash floods, and debris flows.

For Half Moon Bay, the area with the highest landslide susceptibility exists in the upland/foothill areas in the northeastern limits of the city, as well as the eastern borders of the city along SR-92 (see Figure 1). There are also areas in southern Half Moon Bay along the coast where susceptibility to landslides exists, especially around the Half Moon Bay Golf Links courses adjacent to the Ritz Carlton.

Figure 1: Landslide and Geologic Hazard Areas



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; USGS

- | | | | |
|-----------------------|-----------------------|--------------------------|---------------------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Landslide Susceptibility |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | |
| Parks and Open Space | Fire Stations | California Power Plants | Most landslides |
| Creeks and Waterways | Government Facilities | Pump Stations | Few landslides |
| | | Communication Facilities | Surficial deposits |
| | | Transmission Lines | |



Soil Creep

Soil creep is the slow downslope movement of soil and weathered bedrock. It is similar to a landslide but occurs on a much longer timescale. The moving layer can range from a few centimeters to several feet in thickness. Rates of movement also vary, ranging from less than a centimeter per year to 10 centimeters or more per week. The rate of soil creep depends on several factors, including slope, slope materials, and climate. The rate of creeping can be increased or decreased by human activities, especially when the load on creeping slopes is increased with buildings or artificial fill. Although it is too slow to be perceptible, the cumulative effects of creep are easily recognized: cracked sidewalks, pavement, and walls; leaning or bent trees and fences; and shifts in the alignment of linear features, such as railroad tracks, streets, and fences. Potential exists throughout the city and isn't confined to any specific area.

Cliff Erosion

Erosion is the geological process in which earthen materials are worn away and transported by natural forces such as wind or water. Erosion generally occurs on steeper slopes; particularly where unnatural slope cuts and grading have occurred. Wave action removes materials from the base of coastal cliffs along the western edge of the city, causing varying degrees of land sliding and cliff erosion. This rate of erosion depends on several factors, including the steepness of coastal slopes, lithology, the degree of consolidation of cliff materials, the response to precipitation, and the incoming intensity and direction of waves. Most of the coastal cliff area of Half Moon Bay is classified by San Mateo County as having moderate stability. The southern area has high stability, and the northern area has low stability characteristics. The most intense wave erosion in a beach environment is directed at headlands, the rocky points that stick out into the sea. The bluffs along Half Moon Bay State Beach are also rapidly eroding in certain areas, and sea level rise is speeding up the process.

Differential Settlement and Subsidence

According to the 1991 General Plan Safety Element, subsidence and differential settlement (the uneven lowering of the ground surface) constitute minor natural hazards in Half Moon Bay. Differential settlement describes a condition in which areas of soil sink or settle at different rates. When buildings or structures straddle lands with differing settlement rates, the portion of the building or structure below the sinking soil can be damaged. Typically, differential settlement occurs slowly so that acute harm to humans is not generally a concern. However, over time, differential settlement can result in substantial damage to buildings and structures.

Peat and other organic soils may pose a subsidence hazard. This soil, generally found in existing or formerly marshy areas, is highly compressible when dry. Upon drainage, the organic material (often partially decomposed plant matter) undergoes oxidation and results in a decrease in soil volume. Organic soils have not been extensively mapped in the city and subsidence from oxidation is likely to affect only a small portion of the city.

Expansive Soils

Expansive soils possess a “shrink-swell” characteristic, which is the expansion and contraction of fine-grained clay sediments from the process of wetting and drying. This will generally occur after heavy rains and/or flooding. Expansive soils contain certain types of clay minerals that expand considerably when wet and shrink when dry.

Past Events

Table 1 lists geologic events that have occurred in Half Moon Bay and the San Mateo County region.

Table 1: Past Landslide Events in Half Moon Bay and San Mateo County

Date	Event Type
December 17, 2005, to January 12, 2006	A series of winter storms caused flooding, landslides, and mudslides in the region. Damage estimates for the San Mateo County region exceeded \$100 million. Three homes were nearly wiped out by mudslides.
Winter 2017	A series of severe winter storms caused flooding and mudslides across San Mateo County.
December 31, 2022	Mudslides caused by flooding closed SR-92 between Lower Lakes and Main Street in Half Moon Bay.
March 2023	SR-84 between Foxhill Road and Portola Road was closed due to landslide triggered by severe weather. The slide resulted in the failure of approximately 250 feet of roadway on March 8, 2023. A temporary one-way traffic control opened on July 27, 2023, with the full reopening of SR-84 tentatively scheduled for December 2023. On March 22, 2023, a landslide on the 600 to 800 blocks of Patrol Road in Woodside impacted approximately 30 homes. Residents were urged to evacuate, and Patrol Road was closed.
September 8, 2023	A landslide shut down eastbound SR-84 west of SR-35. The road was closed for several hours.

Source: San Mateo County, 2021. *2021 Local Hazard Mitigation Plan*.

Existing Programs and Regulations

Half Moon Bay Municipal Code Chapter 12.04.020 and Chapter 14.04.020 of the Building Code provide the necessary regulations for excavation and grading within the city. This chapter of the Municipal Code contains general provisions for excavation and grading, the issuance of permits, requirements for the preparation of soils and engineering geology reports, and regulations for grading activities.

Chapter 18.38, Coastal Resource Conservation Standards, sets the regulations to address erosion and maintain the coastal environments of Half Moon Bay. Chapter 18.40, Local Coastal Program Public Access, helps to mitigate dangers to people and sets the regulations that allow for the maximizing of public access to the coast and recreational opportunities, while exercising sound conservation principles and regulating development.

Future Conditions

The frequency and severity of future geologic hazards in Half Moon Bay is expected to continue.

ISSUE 3: FLOODING

General Overview

Flooding is the rising and overflowing of a body of water onto normally dry land. Flooding can be extremely dangerous, and even six inches of moving water can knock a person over in a strong current. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide,

significantly threatening the health and life of community members and causing substantial damage to structures, landscapes, and utilities. Floodwater can damage buildings and infrastructure, carry off structures or vehicles, and bury property under sediment. Standing water can cause damage to roads, foundations, and electrical circuits, as well as spread vector-borne illnesses. Other problems connected with flooding and stormwater runoff include erosion, degradation of water quality, and losses of environmental resources.

Floods are usually caused by large amounts of stormwater, either from a period of very intense precipitation or a long period of steady precipitation. There are four types of flooding that primarily affect Half Moon Bay:

- Riverine flooding, the most common type of flood event, occurs when a watercourse such as a stream or creek overruns its banks.
- Stormwater flooding, sometimes called “ponding,” occurs when rainfall and runoff accumulates in low-lying areas or areas with insufficient drainage, forming standing water.
- Flash floods are sudden events, typically caused by intense and localized storms. There is often little or no warning of flash floods, making them particularly dangerous.
- Coastal floods occur when the ocean inundates normally dry lands by ocean waters, often a result of storm surges, tsunamis, or extreme high tide events.

Another form of flooding, dam failure, is discussed in greater detail later in this report.

FEMA Regulatory Flood Zones

FEMA creates flood maps as a tool for communities to understand which areas within the community have the highest risk of flooding. FEMA designates these areas as flood zones. FEMA maintains and updates data of these zones through flood maps and risk assessments.

Flood hazard areas, also called floodplains, are the areas that become inundated by a flood. They are usually adjacent to rivers, creeks, lakes, or along the ocean. Floodplains are officially mapped by FEMA, using maps called Digital Flood Insurance Rate Maps (DFIRMs). The two main floodplains of concern are the 100- and 500-year floodplain. The 100-year floodplain is the area that has a 1 percent (1 in 100) chance of being flooded in any given year, also known as a base flood. The 500-year floodplain is the area that has a 0.2 percent chance (1 in 500) of being flooded in any given year.

Watersheds around Half Moon Bay are relatively small and the run to the Pacific Ocean is relatively short. These watersheds are Arroyo Canada Verde, Frenchmans Creek, Pilarcitos Creek, Arroyo Leon Creek, an unnamed creek north of Roosevelt Road crossing Balboa Boulevard, an unnamed creek south of Kehoe Avenue tributary to Pilarcitos Creek, and an unnamed creek at the southern portion of the city extending from north of Fairway Drive. The typical long, slow-rising floods experienced in the Central Valley and along the major rivers of northern California do not occur in Half Moon Bay.

FEMA flood zones are only partially mapped in the City. Flood zones, as shown in Figure 2, are mapped along the beaches, Frenchman’s Creek, portions of Pilarcitos Creek, and Arroyo Leon along the eastern border of the city. However, this is only a partial representation of areas that flood within Half Moon Bay.

Dam Failure

A dam failure is a catastrophic type of structural failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. Dam failures can result from a number of natural causes, such as earthquakes, erosion of the dam face or foundation, a landslide that displaces a large volume of water, rapidly rising flood waters, and structural/design flaws. A dam failure of any size could cause a loss of life, damage to property, and lead to the displacement of people in its pathway. A catastrophic dam failure, depending on the size of the dam and the population downstream, could exceed the response capability of local communities. Damage control and disaster relief support would be required from other local governmental and private organizations and from the state and federal governments.

The California Division of Safety of Dams (DSOD, a division of the Department of Water Resources [DWR]) routinely and periodically inspects the dam for performance and problem identification. If DSOD identifies a problem that could lead to failure potential, the dam owner takes mitigating actions such as reducing the water level to avoid catastrophic loss of water or other actions specified in that dam’s Emergency Action Plan.

The Johnston Dam (owned by Peninsula Open Space Trust) and Pilarcitos Dam (owned by City and County of San Francisco) can affect the city in the event of a dam failure. Figure 3 shows these inundation zones. The area of the city susceptible to inundation is located adjacent to SR-92 along Pilarcitos Creek, portions of Arroyo Leon, and then spreads out along the geographically flatter areas as it travels west to the coast.

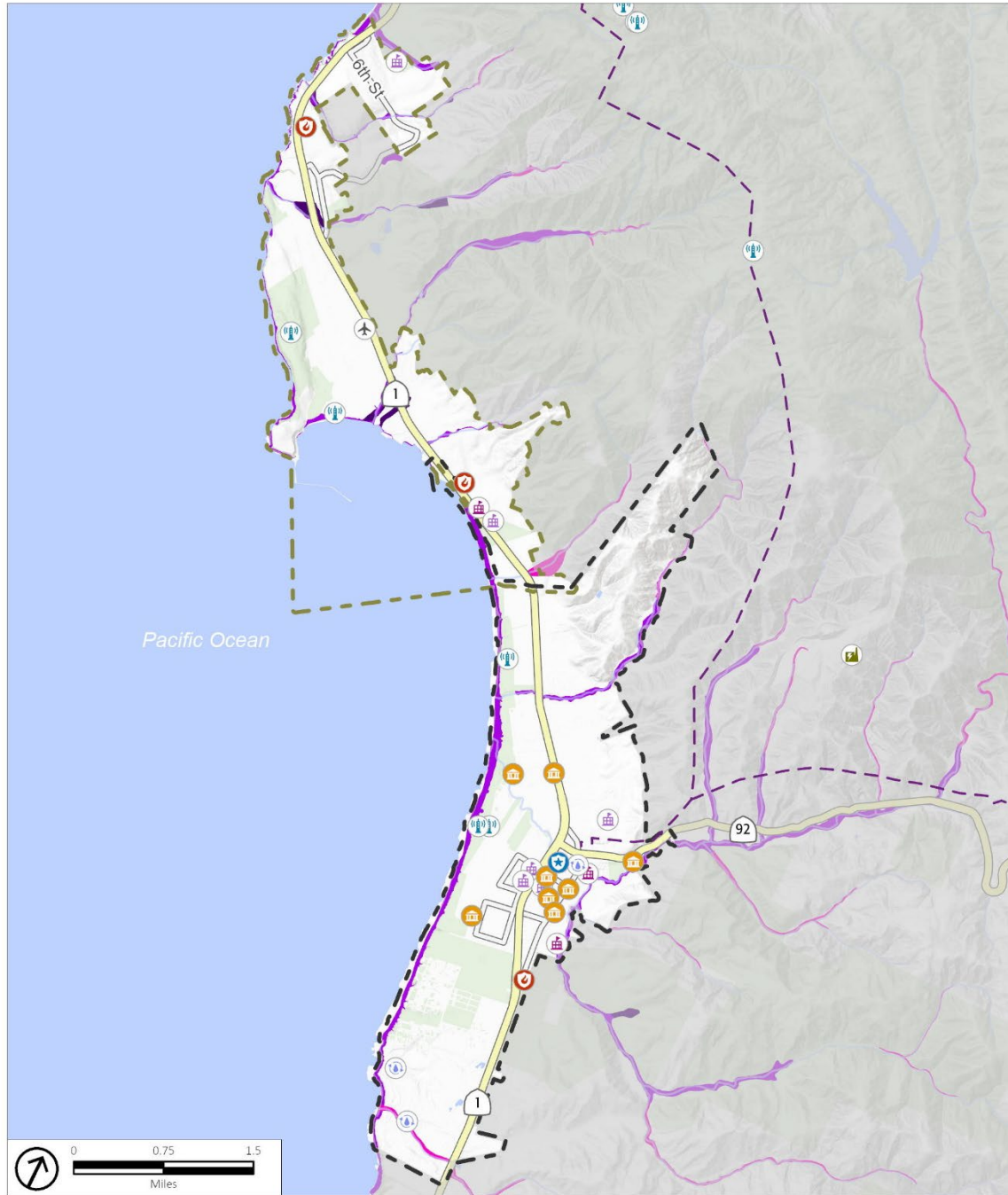
Past Events

Table 2 lists recent San Mateo County and City of Half Moon Bay flood events identified in the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Severe Storms Database (dating back to 1996), as well as previous flood events affecting the county for which federal disaster declarations were issued.

Table 2: History of Recent Flood Events

Date	Event	Locations
December 13, 2021	Flood	Half Moon Bay, Countywide
December 31, 2022	Flood	Half Moon Bay
January 9, 2023	Flood	Half Moon Bay, Countywide
March 15, 2023	Flood	Half Moon Bay, Countywide

Figure 2: Mapped Flood Hazard Zones

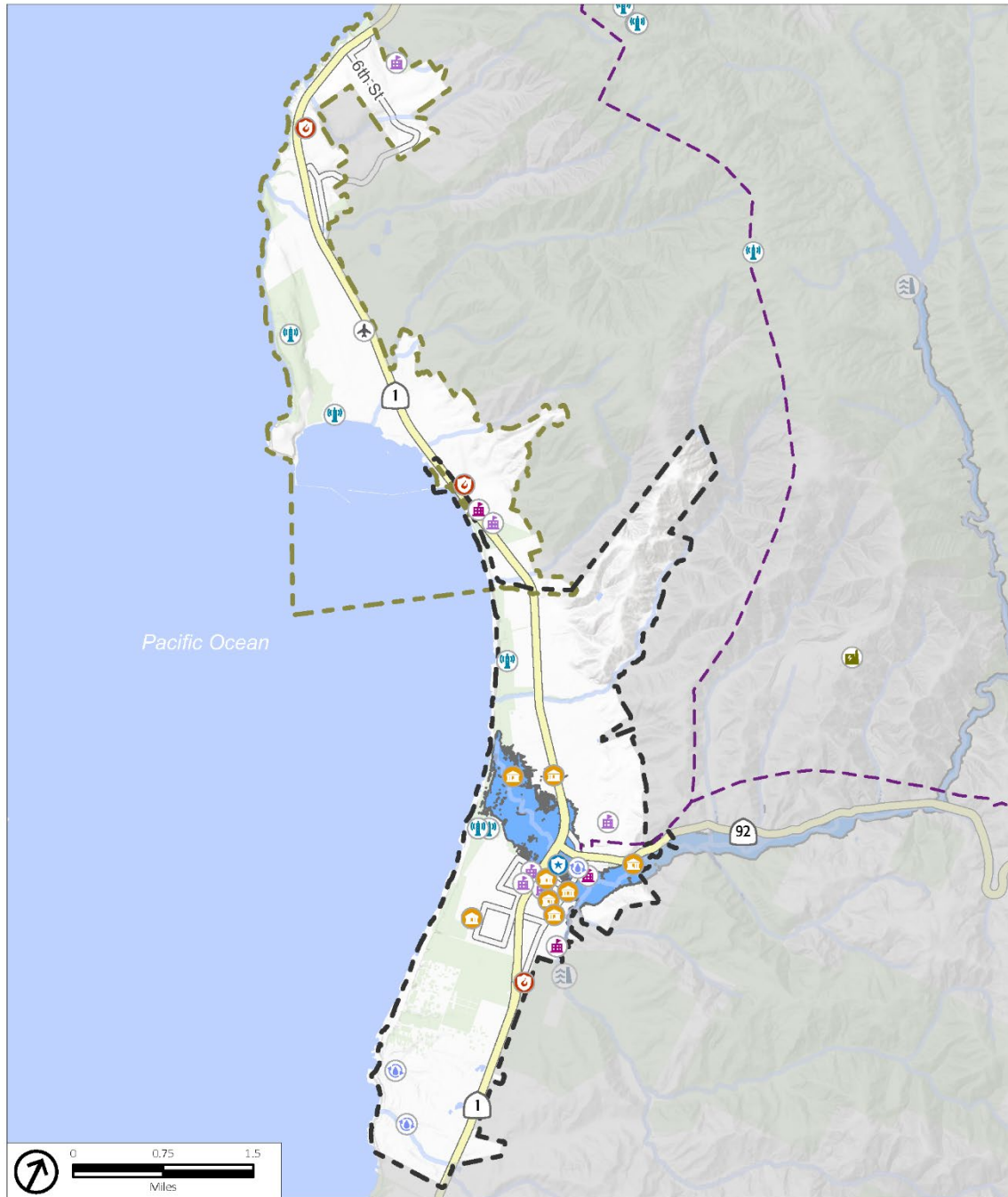


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; FEMA; DWR, 2021

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|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Designated Flood Hazard Zones
100 Year Flood Plain (DWR)
100 Year Flood Zone (FEMA)
500 Year Flood Zone (FEMA) |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | |
| Parks and Open Space | Fire Stations | California Power Plants | |
| Creeks and Waterways | Government Facilities | Pump Stations | |
| | | Communication Facilities | |
| | | Transmission Lines | |



Figure 3: Dam Inundation Areas



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; California Division of Safety of Dams, 2023

- | | | | |
|-----------------------|--------------------------|-------------------------|----------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | State-regulated Dams |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | Dam Inundation Areas |
| Parks and Open Space | Fire Stations | California Power Plants | Pilarcitos |
| Creeks and Waterways | Government Facilities | Pump Stations | Transmission Lines |
| | Communication Facilities | | |



December 13, 2021

An atmospheric river impacted the Bay Area on December 31, 2021, resulting in significant rainfall across the San Francisco Bay Area. During the morning, a surface low developed west of San Francisco and the river stalled over the Bay Area. This resulted in significant rainfall totals for many Bay Area communities. Most notably, downtown San Francisco received 5.46 inches of rain, which is the second-wettest day on record. The Oakland Museum received its wettest day since records began in 1970, with 4.75 inches of rain. Flash flooding prompted the rescue of two people from a vehicle after the flood waters swept it off San Mateo Road and forced a partial closure of SR-92 in Half Moon Bay.

December 31, 2022

A heavy rainstorm hit California, shutting down a section of SR- 92 in Half Moon Bay from Skyline Boulevard to Main Street due to CAL FIRE's San Mateo/Santa Cruz Unit helped evacuate people from flooded homes on Pilarcitos Avenue and Oak Street. No injuries were reported in the evacuations.

January 9, 2023

Weeklong storms in early January 2023 brought massive amounts of water to the Bay Area and San Mateo County. Flooding led to rescues, road closures, and more. Pilarcitos Creek flooded homes and a homeless encampment in the riparian area near Strawflower Village. Residents along Oak Avenue and in the Moonridge Family and Farmworker Housing development had to evacuate their homes due to flooding for up to a week. Many of these evacuees spent a week at local hotels and were able to gather resources from local nonprofits and faith groups. The City of Half Moon Bay opened the Ted Adcock Community Center as a 24/7 "temporary evacuation point" for people to charge devices, access the internet, and grab a small snack.

March 15, 2023

On March 15, 2023, a massive rainstorm with severe winds impacted the area. SR-92 between Skyline Boulevard and Main Street in Half Moon Bay was temporarily closed after a large eucalyptus tree fell across it due to the stormwaters and winds.

Existing Programs and Regulations

Flood Control Agencies and Activities

Agencies responsible for flood control in San Mateo County include the United States Army Corps of Engineers, San Mateo County Flood Control District, San Francisco Public Utilities Commission (SFPUC), Federal Insurance Administration, and DWR. Aside from these federal, state, and regional resources, the City of Half Moon Bay manages and maintains their own system for stormwater management.

Federal Insurance Administration

The U.S Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is administered by FEMA and enables property owners in participating communities to purchase insurance as protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages.

United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) operates projects and programs related to dam safety, levee safety, and emergency operations. Under the authority provided by Section 206 of the 1960 Flood Control Act, the USACE can provide the full range of technical services and planning guidance that is

needed to support effective floodplain management. General technical assistance efforts under this program includes determining site-specific data on obstructions to flood flows, flood formation, and timing; flood depths; floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures.

The USACE Flood Risk Management Program (FRMP) works to focus the policies, programs, and expertise of USACE toward reducing overall flood risk. This includes the appropriate use and resiliency of structures such as levees and floodwalls, as well as promoting alternatives when other approaches, such as land acquisition and flood proofing, to reduce flood risk.

California Department of Water Resources

California Department of Water Resources (DWR) leads activities in California to reduce flood risk, maintain levees, forecast river levels based on weather conditions, promote wise use of floodplains, and provide emergency preparedness and response assistance.

DWR's role in flood preparedness includes working with communities to improve community safety and lower insurance premiums for residents; holding preseason briefings for emergency responders to learn about resources and coordinate with other local agencies to prepare for flood season; conducting meetings with flood emergency response partners and county emergency operation officials throughout the state; providing training in effective flood-fighting methods for mitigating flood; and providing grant funding for flood-management projects, emergency preparedness, and feasibility studies. DWR can help affected communities obtain flood response resources through CalOES and works collaboratively with local, state, and federal agencies to collect and share weather and river runoff data via the California Data Exchange Center. In the event of a major flood, DWR activates its Flood Operations Center to coordinate response between local agencies and provide technical assistance.

San Mateo County Flood Control District (OneShoreline)

The San Mateo County Flood and Sea Level Rise Resiliency District, also known as OneShoreline, is an independent government agency that works across jurisdictional boundaries to secure and leverage public and private resources for the long-term resilience of San Mateo County. OneShoreline plans and implements solutions to the climate change impacts of sea level rise, flooding, and coastal erosion. OneShoreline's major current priorities include working with cities and developers to incorporate consideration for future climate conditions in property and infrastructure planning and advancing new multi-jurisdictional projects. A key component of OneShoreline's work is to partner with municipalities to remove properties from the FEMA-defined floodplain.

Stormwater Infrastructure

The City updated its Storm Drain Master Plan in 2016. This plan guides the City of Half Moon Bay in creating a prioritized Capital Improvement Program to mitigate the impacts of stormwater runoff in the community. It also provides an inventory of the existing storm drain system, as well as an analysis of capacity restrictions within the storm drain networks of Half Moon Bay.

Precipitation that falls within the City of Half Moon Bay generates stormwater runoff. A portion of this runoff is conveyed through the storm drain networks and discharged to the creeks, ditches, or the Pacific Ocean through gravity outfalls. The city's storm drainage system covers about half the community and a portion of the surrounding unincorporated area, while runoff in the remaining area flows overland and

directly discharges to one of several regional creeks (Naples Creek, Frenchmans Creek, and Pilarcitos Creek) or the Pacific Ocean. Regional infrastructure that help provide flood protection to Half Moon Bay include Frenchman’s Creek, Pilarcitos Creek, Arroyo de en Medio, and Arroyo Canada Verde. These drainage facilities include drainage pipes, nodes, channels, and relevant roads, all of which aid in flood protection.

City Plans and Regulations

Chapter 14.34, Flood Damage Prevention, of the Municipal Code, was developed to promote the public’s health, safety, and general welfare, and to minimize public and private losses due to flood conditions. The City has adopted stringent building codes, such as the mandatory adequate anchoring for new construction and substantial improvements, flood resistant building materials, and regulations for proper elevation and floodproofing. This chapter of the Municipal Code also sets the standards for utilities, subdivisions, manufactured homes, recreational vehicles, coastal high hazard areas, and foodways.

California Green Building Code

The City adopted the California Green Building Code in 2022 (Section 14.04.120), which helps to implement green infrastructure (among other things) in new and significantly renovated developments. The code requires stormwater drainage and retention systems during construction to prevent flooding of adjacent properties and prevent pollution from stormwater runoff by retaining soil on-site or by providing filtration to restrict sedimentation from reaching stormwater drainage systems and receiving streams or rivers.

Future Conditions

Climate change is expected to affect the frequency and severity of future flood hazards in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

ISSUE 4: SEA LEVEL RISE

General Overview

Half Moon Bay is already exposed to present-day flooding when large rain events coincide with high tides on the San Francisco Bay. The city becomes more at risk of flooding when considering the effects of rising sea levels. Future flooding and coastal erosion could pose considerable risks to life, safety, critical infrastructure, the city’s natural and recreational assets, and the economy. To address the issue, the County, in partnership with incorporated cities, performed a regional sea level rise vulnerability assessment commonly referred to as the San Mateo County Sea Level Rise Vulnerability Assessment (SMC SLR VA) to evaluate the potential impacts of future flooding and inundation throughout the County. This report discusses sea level rise impacts for three scenarios, discussed below in **Table 3**. The SMC SLR VA revealed:

- The assessed value of parcels in the project area exposed to near-term (present-day) flooding exceeds \$1 billion.
- The assessed value of parcels exposed to erosion and flooding in the long term (50–100 years) totals roughly \$39.1 billion.
- More than 30,000 residential parcels and 3,000 commercial parcels may also be vulnerable in the long term.

- Flooding, erosion, and sea level rise not only directly threaten people and property in the sea level rise hazard areas, but they also affect all communities in the county, even those on high ground. Such indirect effects are present because assets and infrastructure in the sea level rise areas provide critical services and functions to communities outside these areas.

In Half Moon Bay, the SMC SLR VA found that under the mid-level scenario, 76 acres are subject to sea level rise, potentially putting \$25 million of property at risk. Under the high-end scenario, 103 acres are subject to sea level rise in the community, putting \$30 million of property at risk.

Sea Level Rise: Scenarios

The SMC SLR VA used three sea level rise scenarios to evaluate potential impacts to communities (see Table 3). These three scenarios are referenced when discussing potentially affected assets and infrastructure within the community.³ See Figures 4 and 5 for graphic representations of the baseline, mid-level, and high-end flooding scenarios. According to California’s 2024 guidance on sea level rise, communities should plan for as much as approximately 3 feet (36 inches) of sea level rise by 2070, and as much as 6.6 feet (79.2 inches) by 2100.⁴

Table 3: Sea Level Rise Scenarios

Baseline	1% annual chance flood (present-day extreme flood, also known as a 100-year flood)
Mid-Level Scenario	1% annual chance flood + 3.3 feet of sea level rise
High-End Scenario	1% annual chance flood + 6.6 feet of sea level rise

Notes: The SMC SLR VA used sea level rise inundation data from the United States Geological Survey (USGS) and from Point Blue’s *Our Coast, Our Future* tool, which provided the best available data at the time. The best available science on sea level rise projections at the time was the National Research Council’s *Sea Level Rise for the Coasts of California, Oregon, and Washington*. The scenarios were also informed by regional sea level rise guidance documents, such as the California Coastal Commission’s August 2015 *Sea Level Rise Guidance, Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits*. The methodology incorporated strategies from the San Francisco Bay Conservation and Development Commission’s *Adapting to Rising Tides* (ART) project.

All areas along the coastline are vulnerable to the effects of sea level rise. This includes portions of Pilarcitos Creek and Frenchman’s Creek lower watersheds where they connect to the Pacific Ocean.

Sea level rise has secondary effects beyond inundation. As sea levels rise, the dense saltwater moves inland beneath the ground/soil, which forces up the layer of the less dense fresh groundwater that floats above it. In many coastal areas, even a few inches of sea level rise can raise the fresh groundwater table enough to flood basements of homes and buildings, escape through cracks in sewer lines, and damage underground infrastructure hindering its effectiveness. It can also seep into toxic sites (e.g., oil wells, fuel storage tanks) from below, releasing hazardous materials and spreading these pollutants far beyond the limits of the original contamination areas. Low-lying inland areas could flood from below by emergent groundwaters, faster than coastal floodwaters overtop the shoreline. This rising groundwater will create potential exposure pathways that could impact not only the environment, but public health as well. Exposure to new or unearthed pollutants as water rises through the soil, contamination of drinking water sources, contaminants can evaporate rising into the air inside homes, schools, and workplaces, even potentially flooding septic systems and leaching raw sewage into nearby waterways. Rising groundwater can further impact Half Moon Bay by increasing susceptibility to liquefaction during earthquakes. Figures

6 through 9 shows the potential emergency groundwater areas for mid- and high-end sea level rise scenarios in the city.

Past Events

Sea level rise is a dynamic phenomenon that is constantly evolving, the impacts of which are not associated or reported as singular events. This phenomenon is already making its presence felt in Bay Area communities. Over the past century, the water levels in San Francisco Bay have risen by eight inches.⁵

Existing Programs and Regulations

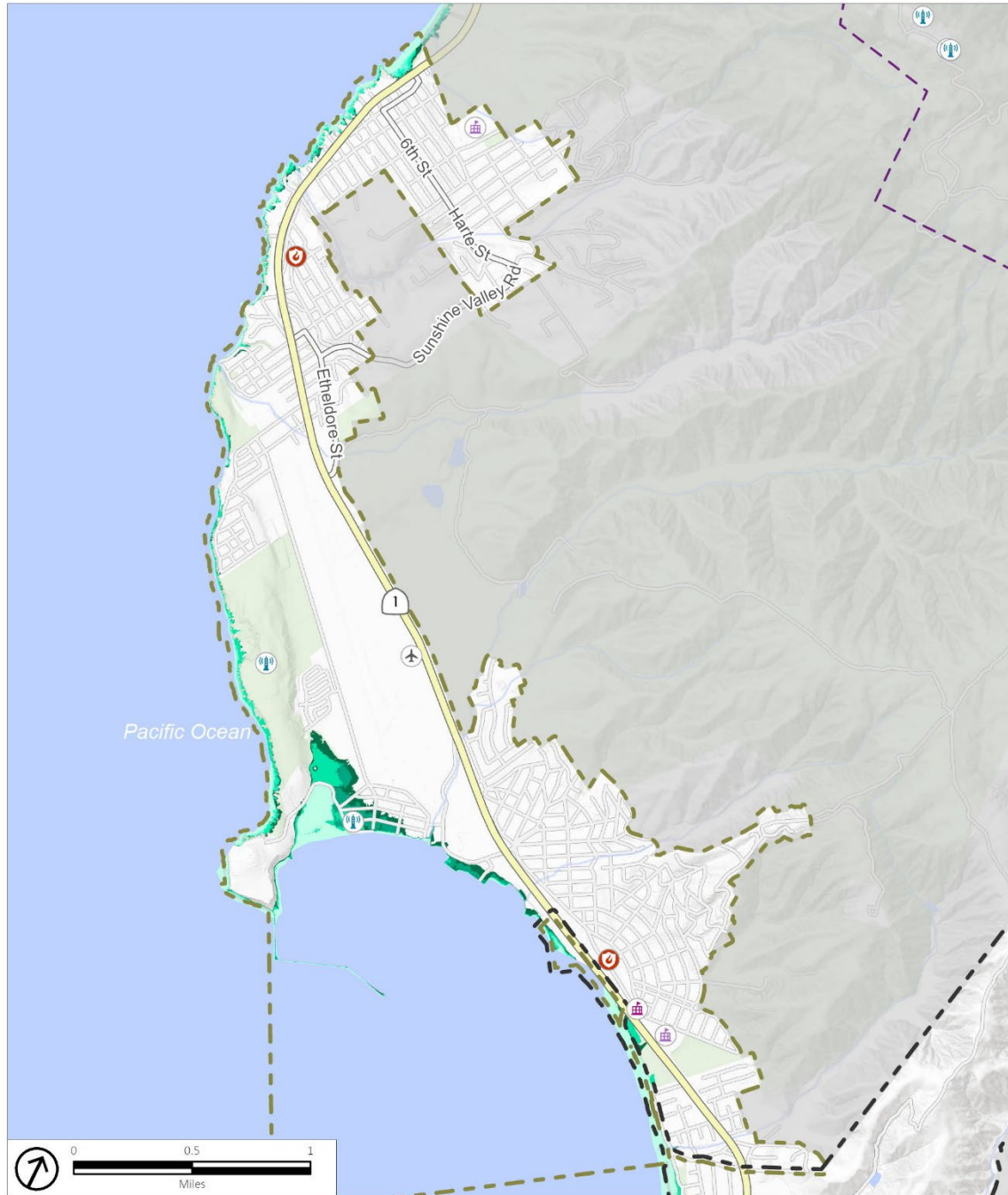
Sea Level Rise Management Agencies and Activities

A number of agencies in San Mateo County and within the greater Bay Area participate in the process of planning for and managing sea level rise, including the Bay Conservation and Development Commission, Adapting to Rising Tides, Sea Change San Mateo County, Bay Adapt, OneShoreline, and the San Mateo County Resource Conservation District. Major reports and initiatives developed by these agencies include the County of San Mateo South Coast Sea Level Rise Vulnerability Assessment & Adaptation Report, County of San Mateo Sea Level Rise Vulnerability Assessment, and the report Sea Level Rise & Overtopping Analysis for San Mateo County's Bayshore.

Future Conditions

Climate change is expected to affect the frequency and severity of future flood hazards in Half Moon Bay. Please review the Plan Half Moon Bay: Sea Level Rise Vulnerability Assessment(April 2016) for details.

Figure 4: Projected Sea Level Rise (North)

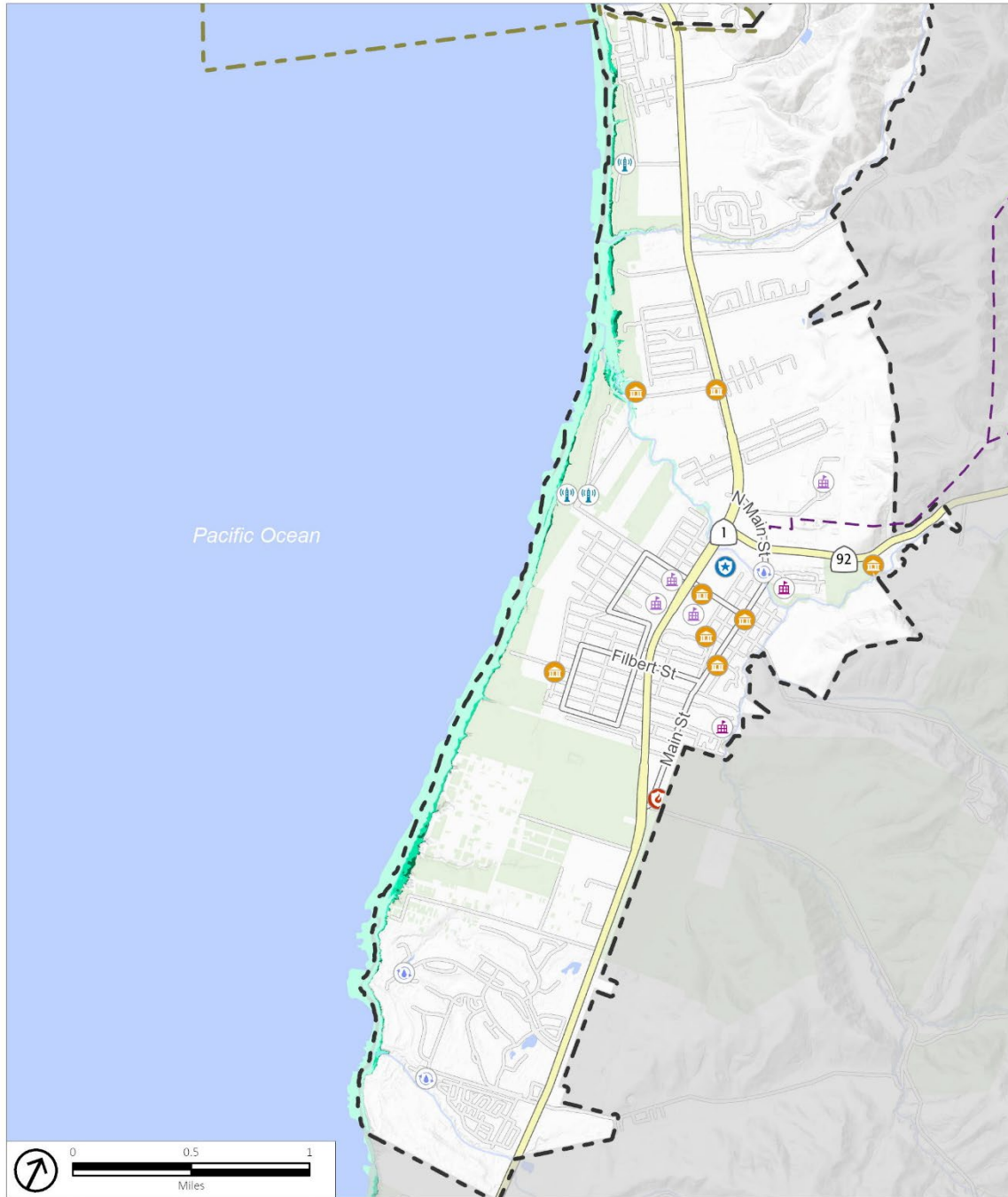


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; USGS CoSMoS

- | | | | |
|-----------------------|---------------|--------------------------|-------------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Sea Level Rise |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | 0.8 ft + 100-year storm |
| Parks and Open Space | | Communication Facilities | 3.3 ft |
| Creeks and Waterways | | Transmission Lines | 3.3 ft + 100-year storm |
| | | | 6.6 ft |
| | | | 6.6 ft + 100-year storm |



Figure 5: Projected Sea Level Rise (South)

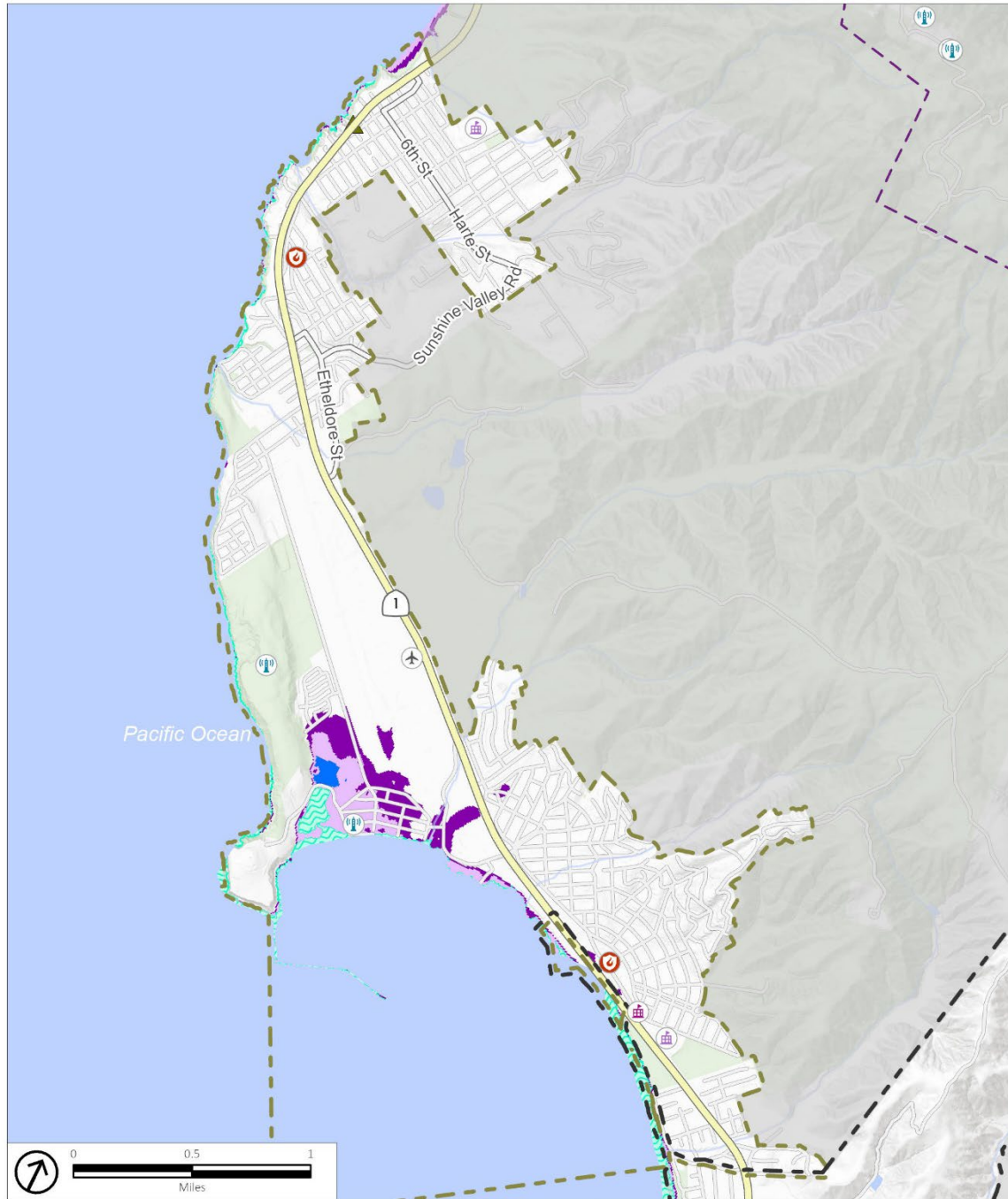


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; USGS CoSMoS

- | | | | |
|-----------------------|-----------------------|--------------------------|---|
| City of Half Moon Bay | Law Enforcement | Public Schools (K-12) | Sea Level Rise
0 ft + 100-year storm
0.8 ft + 100-year storm
3.3 ft
3.3 ft + 100-year storm
6.6 ft
6.6 ft + 100-year storm |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | |
| Parks and Open Space | Government Facilities | Pump Stations | |
| Creeks and Waterways | | Communication Facilities | |
| | | Transmission Lines | |
| | | | |



Figure 6: Groundwater Emergence, Mid-level Sea Level Rise Scenario (North)

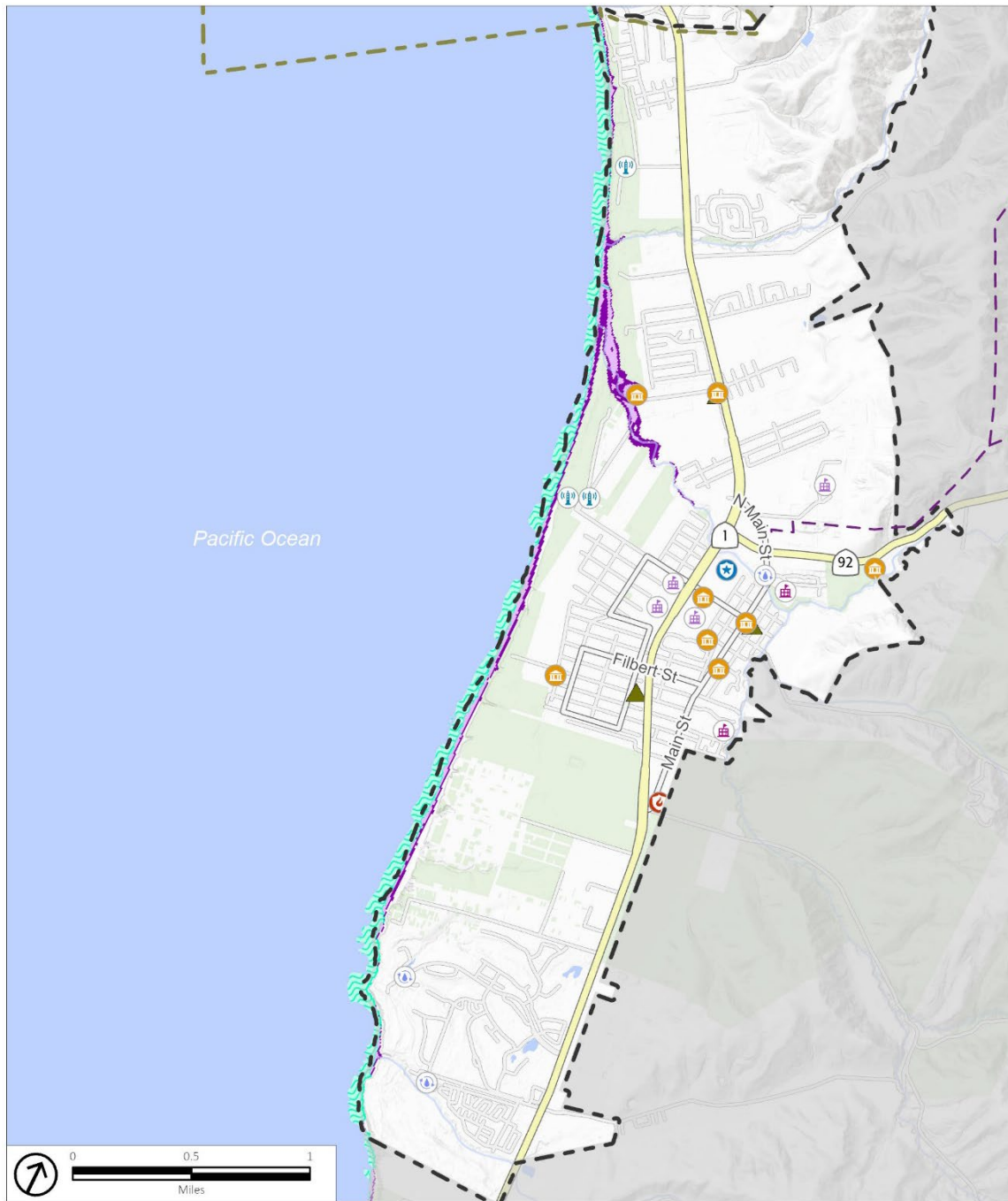


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; California Office of Environmental Health Hazard Assessment, 2021; USGS, 2020

- | | | | |
|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Groundwater Surface Flooding |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | 3.3ft Sea Level Rise |
| Parks and Open Space | Transmission Lines | Communication Facilities | Groundwater depth below surface |
| | Hazardous Waste Sites | 0 - 3.3 feet (Very) | 3.3 - 6.6 feet (Shallow) |



Figure 7: Groundwater Emergence, Mid-level Sea Level Rise Scenario (South)

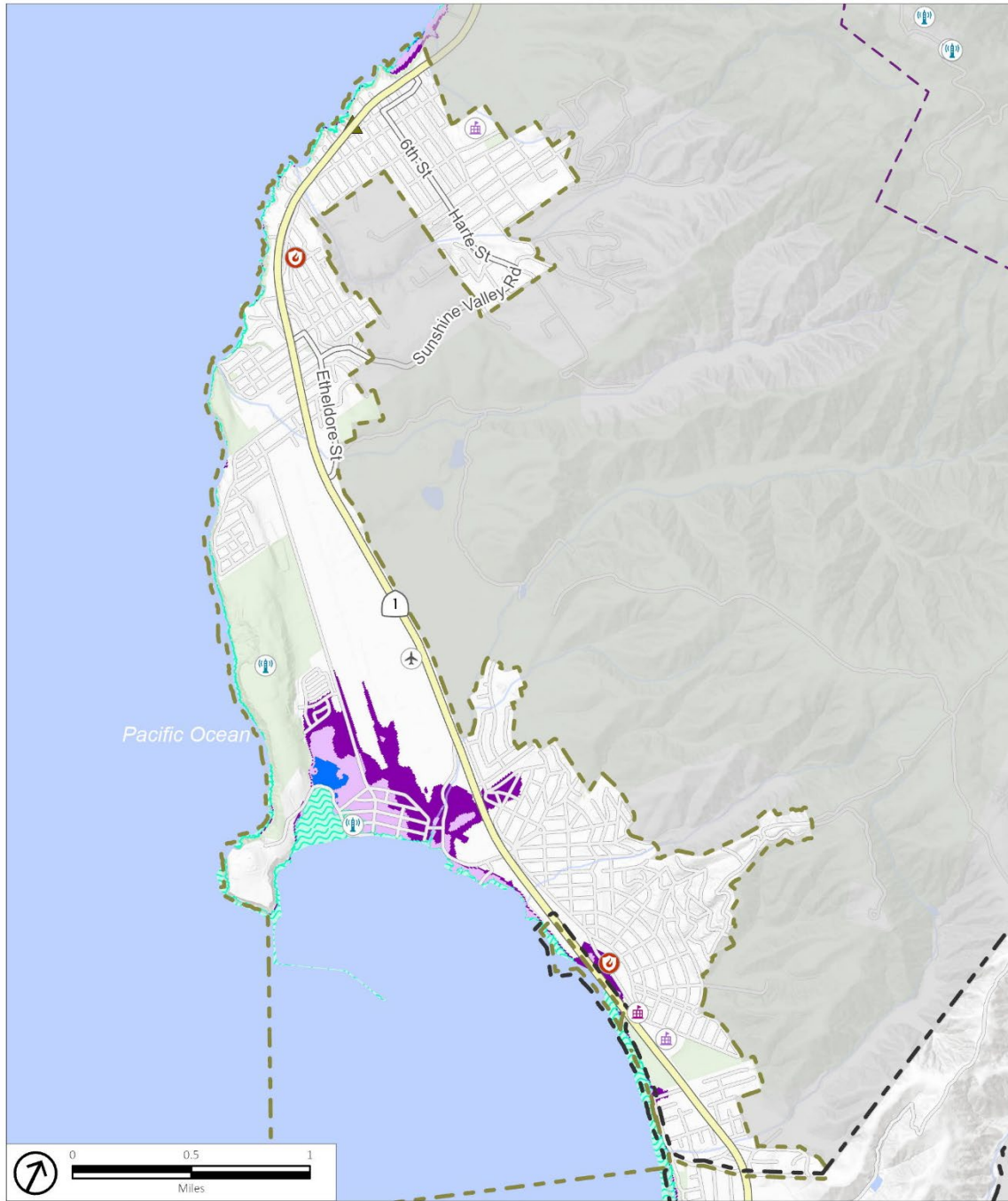


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; California Office of Environmental Health Hazard Assessment, 2021; USGS, 2020

- | | | | |
|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Law Enforcement | Public Schools (K-12) | Groundwater Surface Flooding |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | 3.3ft Sea Level Rise |
| Parks and Open Space | Government Facilities | Pump Stations | Groundwater depth below surface |
| | | Communication Facilities | 0 - 3.3 feet (Very) |
| | | Transmission Lines | 3.3 - 6.6 feet (Shallow) |
| | | Hazardous Waste Sites | |



Figure 8: Groundwater Emergence, High-end Sea Level Rise Scenario (North)

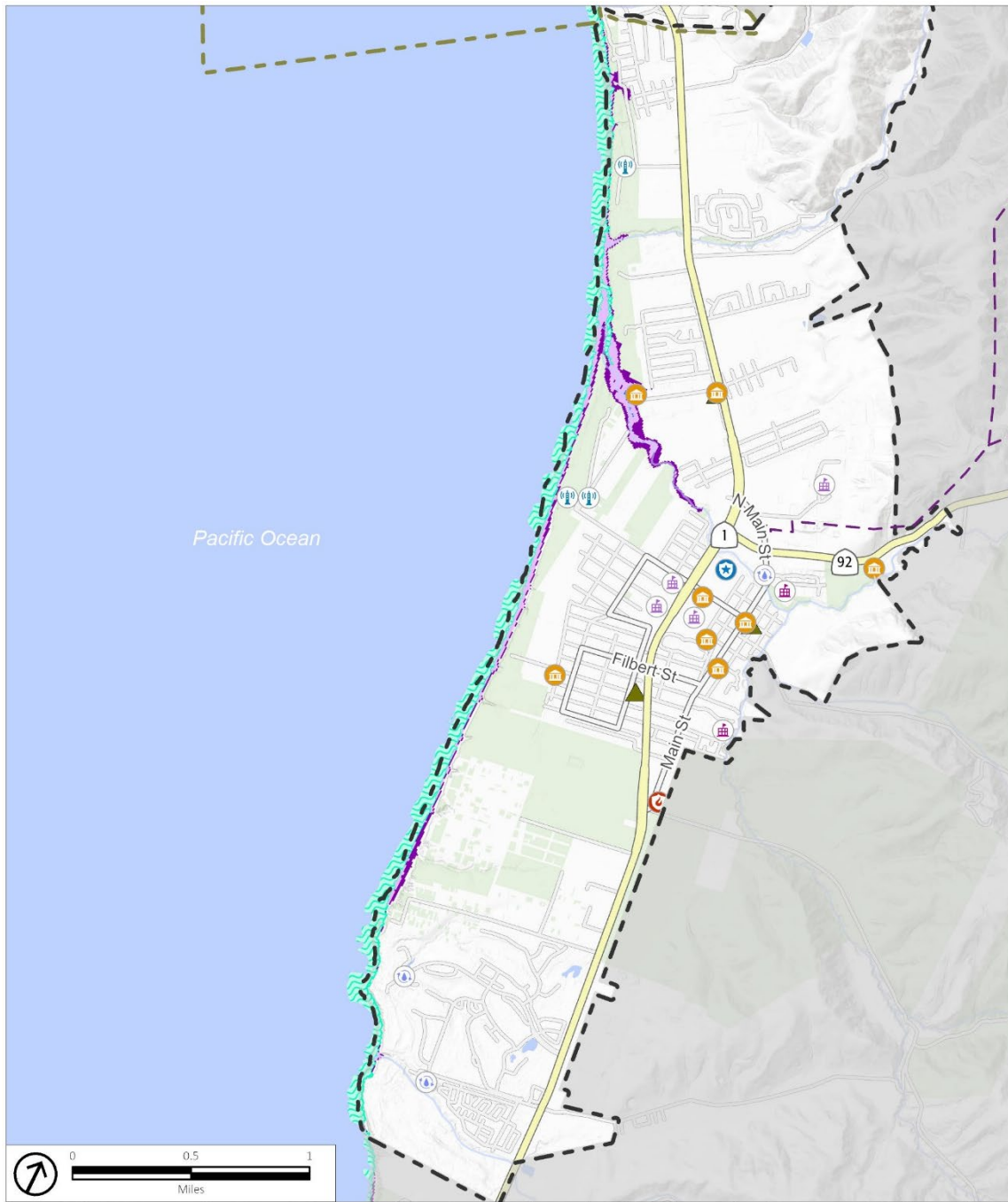


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; California Office of Environmental Health Hazard Assessment, 2021; USGS, 2020

- | | | | |
|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Groundwater Surface Flooding |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | 6.6ft Sea Level Rise |
| Parks and Open Space | Transmission Lines | Communication Facilities | Groundwater depth below surface |
| | Hazardous Waste Sites | | 0 - 3.3 feet (Very) |
| | | | 3.3 - 6.6 feet (Shallow) |



Figure 9: Groundwater Emergence, High-end Sea Level Rise Scenario (North)



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; California Office of Environmental Health Hazard Assessment, 2021; USGS, 2020

- | | | | |
|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Law Enforcement | Public Schools (K-12) | Groundwater Surface Flooding |
| Sphere of Influence | Fire Stations | Private Schools (K-12) | 6.6ft Sea Level Rise |
| Parks and Open Space | Government Facilities | Pump Stations | Groundwater depth below surface |
| | | Communication Facilities | 0 - 3.3 feet (Very) |
| | | Transmission Lines | 3.3 - 6.6 feet (Shallow) |
| | | Hazardous Waste Sites | |



ISSUE 5: SEISMIC HAZARDS

General Overview

An earthquake is the vibration of the earth's surface following a release of energy in its 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 as stress builds up along sections of the crust. When the stress exceeds the strength of the rocks or the friction holding the halves of the fault together, the crust breaks and snaps 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.

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. California is seismically active because of movement of the North American Plate and the Pacific Plate to the west. The major boundary between these plates, the San Andreas Fault, runs through San Mateo County. 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 cause earthquakes.

The sliding movement of the surface of the earth on either side of a fault is called fault rupture. Fault rupture begins below the ground surface at the earthquake hypocenter, typically between 3 and 10 miles below the ground surface in California. If an earthquake is large enough, the fault rupture will travel to the ground surface, potentially destroying structures built across its path.

Faults are more likely to experience earthquakes if they have more rapid rates of movement, have experienced recent earthquakes, 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 displaced layers of rock from the Quaternary period (the last 1,800,000 years).

Earthquake Classification

Earthquakes are typically classified 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 (M_w), the most common scale used today.⁶ This scale is based on the distance a fault moved and the force required to move it. The scale is presented in Table 4.

Table 4: Moment Magnitude Scale

Classification	Magnitude
Great	8 or greater
Major	7.0 to 7.9
Strong	6.0 to 6.9
Moderate	5.0 to 5.9
Light	4.0 to 4.9
Minor	3.0 to 3.9
Micro	Less than 3

Source: San Mateo County. 2021. *2021 Local Hazard Mitigation Plan*.

Intensity

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale as well as the perceived shaking and damage potential for structures are shown in Table 5. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. The intensity of an earthquake varies 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.

Table 5: Mercalli Scale and Peak Ground Acceleration Comparison

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage	
		Resistant Buildings	Vulnerable Buildings
I	Not felt	None	None
II to III	Weak	None	None
IV	Light	None	None
V	Moderate	Very Light	Light
VI	Strong	Light	Moderate
VII	Very Strong	Moderate	Moderate/Heavy
VIII	Severe	Moderate/Heavy	Heavy
IX	Violent	Heavy	Very Heavy
X to XII	Extreme	Very Heavy	Very Heavy

Fault Locations

Half Moon Bay is in a region of high seismicity because of the presence of the San Andreas Fault that bisects the county, the Hayward Fault across the Bay to the east, and the San Gregorio Fault to the west (see Figure 10). The primary seismic hazard for the county and Half Moon Bay is potential ground shaking from these three large faults. Half Moon Bay is especially at high risk, as the community is within 15 miles of both the San Andreas Fault and San Gregorio Fault. The Gregorio Fault is closer to Half Moon Bay, but the larger San Andreas Fault is capable of producing a stronger earthquake. These two faults are two of

the most active faults in the Bay Area. The Hayward Fault is located farther away, but could also lead to a substantial earthquake in Half Moon Bay.

San Andreas Fault

The San Andreas Fault spans the boundary of the Pacific and North American plates, running 810 miles from the Gulf of California through the Mendocino fracture zone off the shore of northern California.

The San Andreas Fault has three segments. The southern segment extends from the Gulf of Mexico to Parkfield, in Monterey County. The central segment extends from Parkfield to Hollister, in San Benito County. The northern segment extends northwest from Hollister, through San Mateo County, including Daly City and San Bruno, to its junction with the Mendocino fracture zone and the Cascadia subduction zone in the Pacific Ocean. The San Andreas Fault has a 21 percent chance of generating a magnitude 6.7 or greater earthquake in the next 30 years.⁷

A rupture along the peninsula would cause extremely violent ground shaking throughout the county. Half Moon Bay is approximately five miles west of this fault.

San Gregorio Fault

The San Gregorio Fault is a northwest-trending right-lateral slip deformation near the western edge of San Mateo County, crossing briefly over uninhabited land in San Mateo County around Pillar Point at Half Moon Bay. The fault runs from southern Monterey Bay through Bolinas Bay, where its north section intersects with the San Andreas Fault offshore north of San Francisco. San Gregorio is the principal active fault west of the San Andreas for the Bay Area region.

The San Gregorio Fault is one of the less studied fault lines, the result of its primary location offshore and its proximity to the better-known San Andreas Fault and Hayward Fault. Its probability of experiencing a magnitude 6.7 or greater earthquake within the next 30 years is 6 percent—significantly less than San Andreas Fault or Hayward Fault.⁸ However, the location of the fault poses a significant threat to San Mateo County, as Half Moon Bay is approximately 0.25 miles east of this fault at its closest point and approximately 2 miles on average.

Hayward Fault

The Hayward Fault is a 45-mile-long fault that parallels the San Andreas Fault in the East Bay. The Hayward Fault extends through some of the Bay Area's most populated areas, including San Jose, Oakland, and Berkeley. The Rodgers Creek Fault in Sonoma County was recently discovered to be linked with the Hayward Fault

The combined Hayward-Rodgers Creek Fault has a 31-percent chance of producing a magnitude 6.7 or greater earthquake in the next 30 years.⁹ An earthquake of this magnitude has regional implications for the entire Bay Area, as the Hayward Fault crosses numerous transportation and resource facilities, such as highways and the Hetch Hetchy Aqueduct. Disruption of the Hetch Hetchy system has the potential to severely impair water service to San Mateo County and the Midcoast. The Hayward Fault is increasingly becoming a hazard priority throughout the Bay Area region because of its increased chance for activity and its intersection with multiple highly populated areas and critical facilities. Additionally, shaking from a major earthquake on the Hayward Fault would likely produce strong to very strong shaking in Half Moon Bay, enough to cause moderate structural damage. Half Moon Bay is approximately 24 miles west of this fault.

Other Faults

Other faults of note in the Bay Area region include, Calaveras, Concord-Green Valley, Serra, and Pilarcitos Faults. Of these, the Pilarcitos Fault is the closest to Half Moon Bay (approximately 4 miles from downtown), although scientists project it has less than a 2 percent chance of producing a major earthquake in the next 30 years. The Serra Fault Zone is approximately 8 miles north of downtown, and does not have projections of future earthquake risks

The Calaveras Fault is 32 miles east of Half Moon Bay and has an estimated 17-percent chance of producing a major earthquake in the next 30 years. The Concord-Green Valley Fault is 38 miles northeast of Half Moon Bay and has an estimated 7-percent chance of producing a major earthquake in the next 30 years both have less than a 10 percent chance of producing a major earthquake in the next 30 years. Scientists project that a major earthquake on the Calaveras Fault could produce slight to moderate structural damage in Half Moon Bay, while such an earthquake on the Concord-Green Valley fault would be felt, but damage in Half Moon Bay would be negligible.

Earthquake-Related Hazards

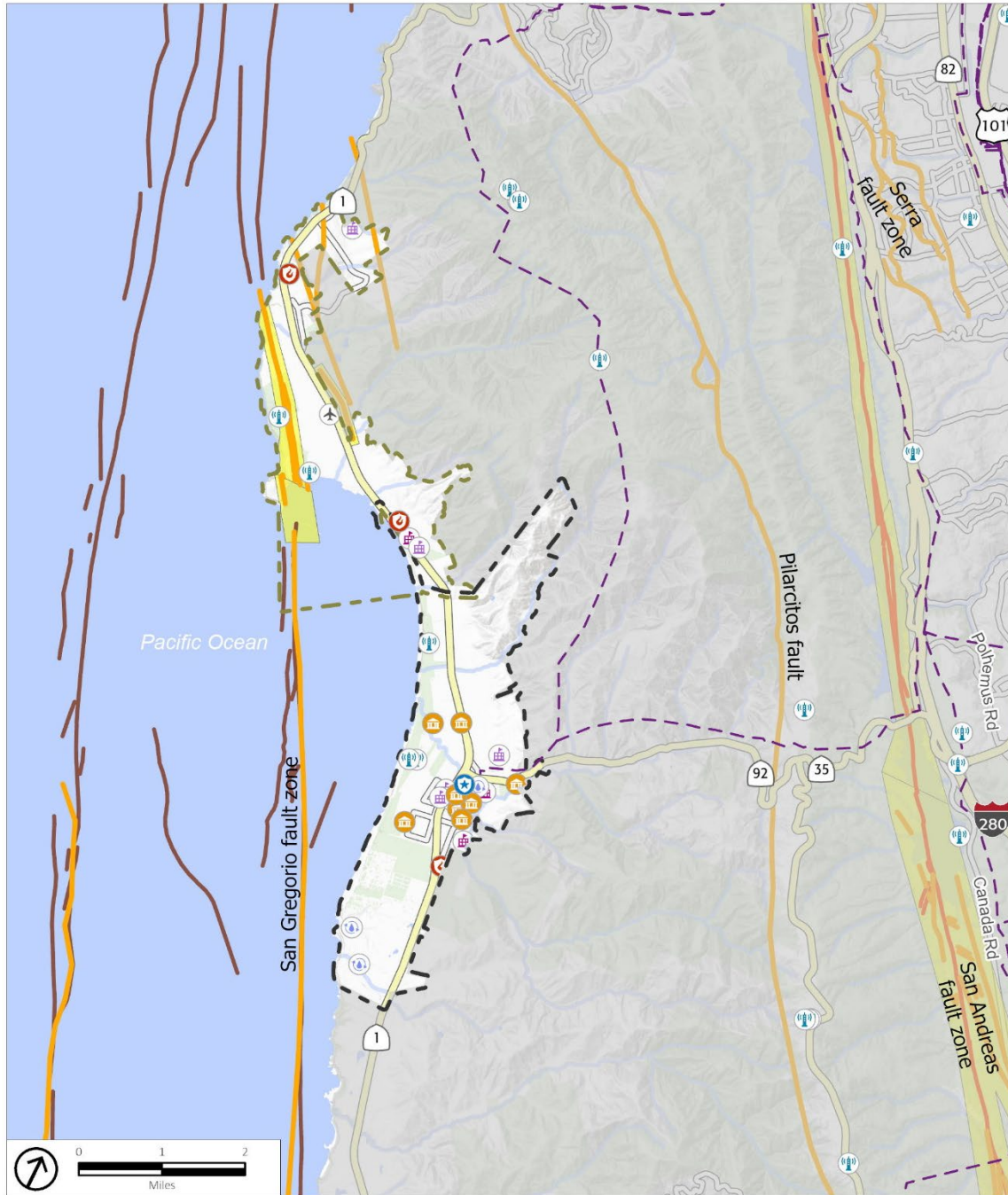
In addition to shaking and surface rupture, this can also include landslides (discussed separately), liquefaction, and tsunamis.

Liquefaction

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 puddinglike liquid. Building and foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

Half Moon Bay's location along California's coastline, the composition of the underlying soils, presence of a shallow groundwater table, and proximity to active faults, makes it particularly susceptible to liquefaction. This susceptibility is moderate throughout the majority of the city, however, increases significantly around Pillar Point Beach, and along the Pilarcitos Creek, Frenchman's Creek, Arroyo Leon Creek, and Canada Verde Creek areas. Figure 8 depicts the Liquefaction Hazard Areas within the city.

Figure 10: Regional Faults and Alquist-Priolo Fault Zones

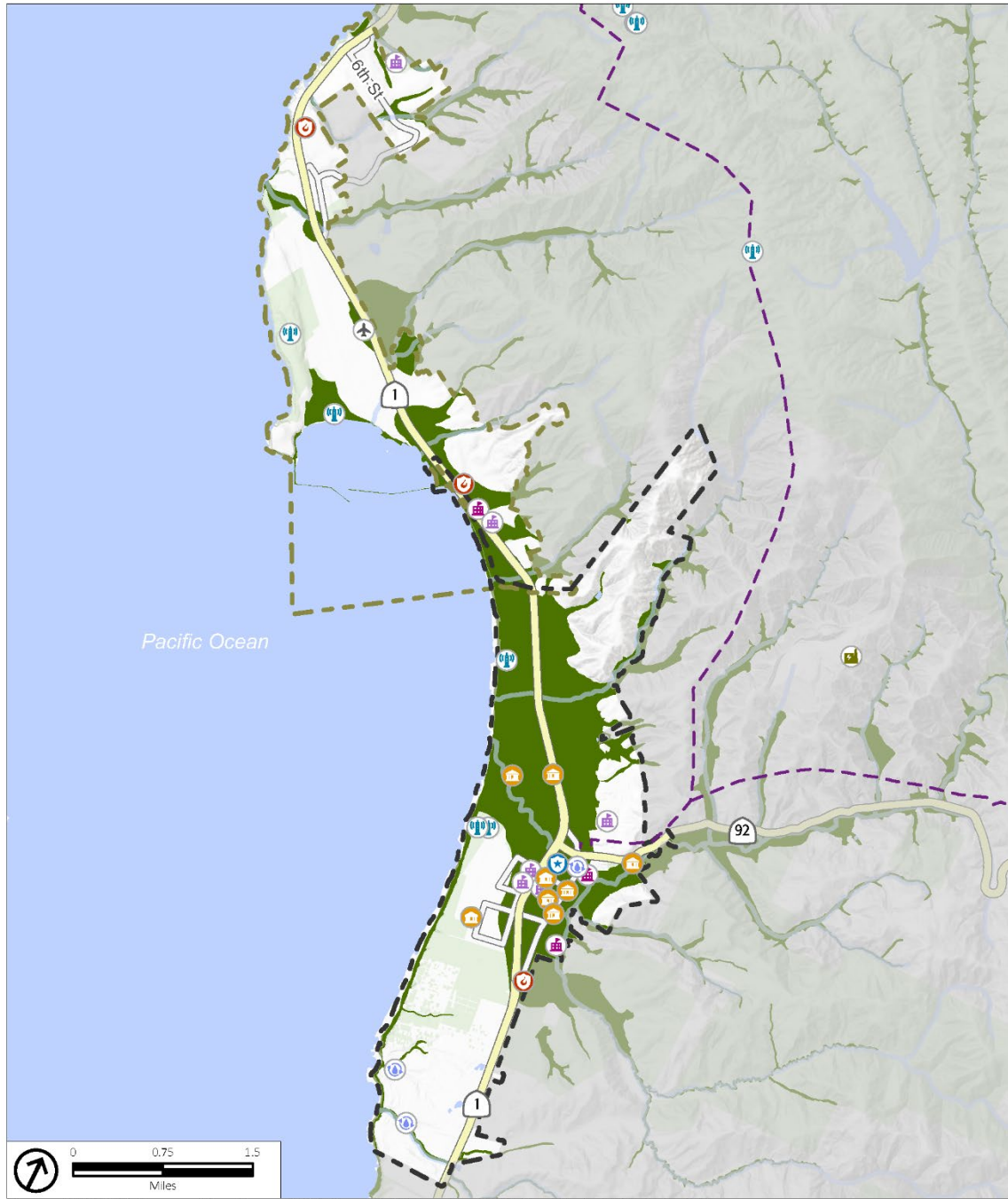


Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; USGS, 2020

- | | | | |
|-----------------------|-----------------------|--------------------------|-----------------------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Surface Faults |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | Historic |
| Parks and Open Space | Fire Stations | Pump Stations | Quaternary |
| Creeks and Waterways | Government Facilities | Communication Facilities | Offshore Faults |
| | | Transmission Lines | Alquist Priolo Fault Zones |
| | | | Alquist Priolo Fault Zones |



Figure 11: Liquefaction Hazard Areas



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; CGS, 2021

- | | | | |
|-----------------------|-----------------------|--------------------------|-------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Liquefaction Zone |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | |
| Parks and Open Space | Fire Stations | California Power Plants | |
| Creeks and Waterways | Government Facilities | Pump Stations | |
| | | Communication Facilities | |
| | | Transmission Lines | |



Tsunami

A tsunami is a series of high-energy waves that radiate outward like pond ripples from an area where a generating event occurs, arriving at shorelines over an extended period. Tsunamis are often referred to as local or distant. The type of tsunami depends on the location of the source of the tsunami and where it may strike land. The source of a local tsunami is close to the coast or shoreline and may arrive in less than one hour. The danger is greatest for local tsunamis because warning time is limited.¹⁰

In the open ocean, a tsunami may be only a few inches or feet high, but it can travel with speeds approaching 600 miles per hour. As a tsunami enters the shoaling waters near a coastline, its speed diminishes, its wavelength decreases, and its height increases greatly. At the shoreline, tsunamis may take the form of a fast-rising tide, a cresting wave, or a bore (a large, turbulent wall-like wave). The first wave is usually followed by several larger and more destructive waves.

At some locations, the advancing turbulent wave front will be the most destructive part of the tsunami wave. In other situations, the greatest damage will be caused by the outflow of water back to the sea between crests, sweeping away items on the surface and undermining roads, buildings, bulkheads, and other structures. This outflow action can carry enormous amounts of highly damaging debris, resulting in further destruction. Ships and boats may be forced against breakwaters, wharves, and other craft, or be washed ashore and left grounded after the withdrawal of the seawater. Tsunamis affecting the Bay Area are most likely to be generated by very distant subduction faults, such as those in Washington and Alaska, but local tsunamis can be generated from strike-slip faults (such as the small one that was triggered by the 1906 earthquake). The 2011 Honshu, Japan, earthquake caused tsunami damage in Santa Cruz, Crescent City, and Berkeley marinas.¹¹ There is a tsunami warning system for the Pacific Ocean, involving 26 countries with numerous seismic stations, water level stations, and information distribution centers. The warning centers issue tsunami watches, warnings, and advisories. A watch is issued when a large earthquake has occurred far away from the region and the threat is still being determined. The warning system is activated when a Pacific basin earthquake of magnitude 6.5 occurs or an earthquake is widely felt along the North American coast.

CalOES has prepared a series of maps showing the potential inundation line for a tsunami runup along the San Francisco Bay shoreline from a number of extreme, yet realistic, tsunami data sources.

Due to the city's location along the coast of the Pacific Ocean, the city is particularly susceptible to tsunami inundation. The entire western border of the city along the coastline could be inundated. The effects would be particularly devastating in the low-lying northern section of the city around Pillar Point Harbor. Inundation mapping prepared by CalOES shows the potential for inundation to reach east of SR-1 and as far south as Kelly Avenue. Waters could travel up Pilarcitos Creek and SR-92, and down the Arroyo Leon watershed. In the southern portions of the city, much of the Half Moon Bay Golf Links course area could be inundated, including the Ritz Carlton Hotel. Figure 9 depicts these Tsunami Hazard Areas in greater detail.

Past Events

Table 6 lists recent earthquakes with a magnitude of 5.0 or greater within 100 miles of San Mateo County. The last significant (greater than magnitude 6.0) seismic event in the San Mateo vicinity was the 7.1 magnitude San Andreas Loma Prieta Earthquake in 1989, which originated 10 miles northeast of Santa Cruz. Other significant local earthquakes include the 1906 earthquake in San Francisco and the 2014 Napa

earthquake. Although the 1906 earthquake is most associated with the City of San Francisco, Half Moon Bay was also greatly affected. In Half Moon Bay the quake’s damage affected businesses and homes on or near Main Street. Buildings such as the general store lost entire walls, other structures simply collapsed into dust and rubble, giant boulders blocked Half-Moon Bay-San Mateo Road (Hwy 92 today) and access to the city. The greatest historical loss was the Vasquez Adobe, dating back to the mid-1800s, which collapsed burying a dozen people alive.

Table 6: Recent Earthquakes Magnitude 5.0 or Larger Within 100-Mile Radius of San Mateo County

Date	Magnitude	Epicenter Location
3/22/1957	5.3	Daly City, CA
3/31/1986	5.70	12 miles east-northeast of Milpitas, CA
10/17/1989	7.1	10 miles northeast of Santa Cruz, CA
9/3/2000	5.17	8 miles northwest of Napa, CA
10/31/2007	5.6	10 miles northeast of San Jose, CA
8/24/2014	6.0	6 miles southwest of Napa, CA

Source: San Mateo County. 2021. *2021 Local Hazard Mitigation Plan*.

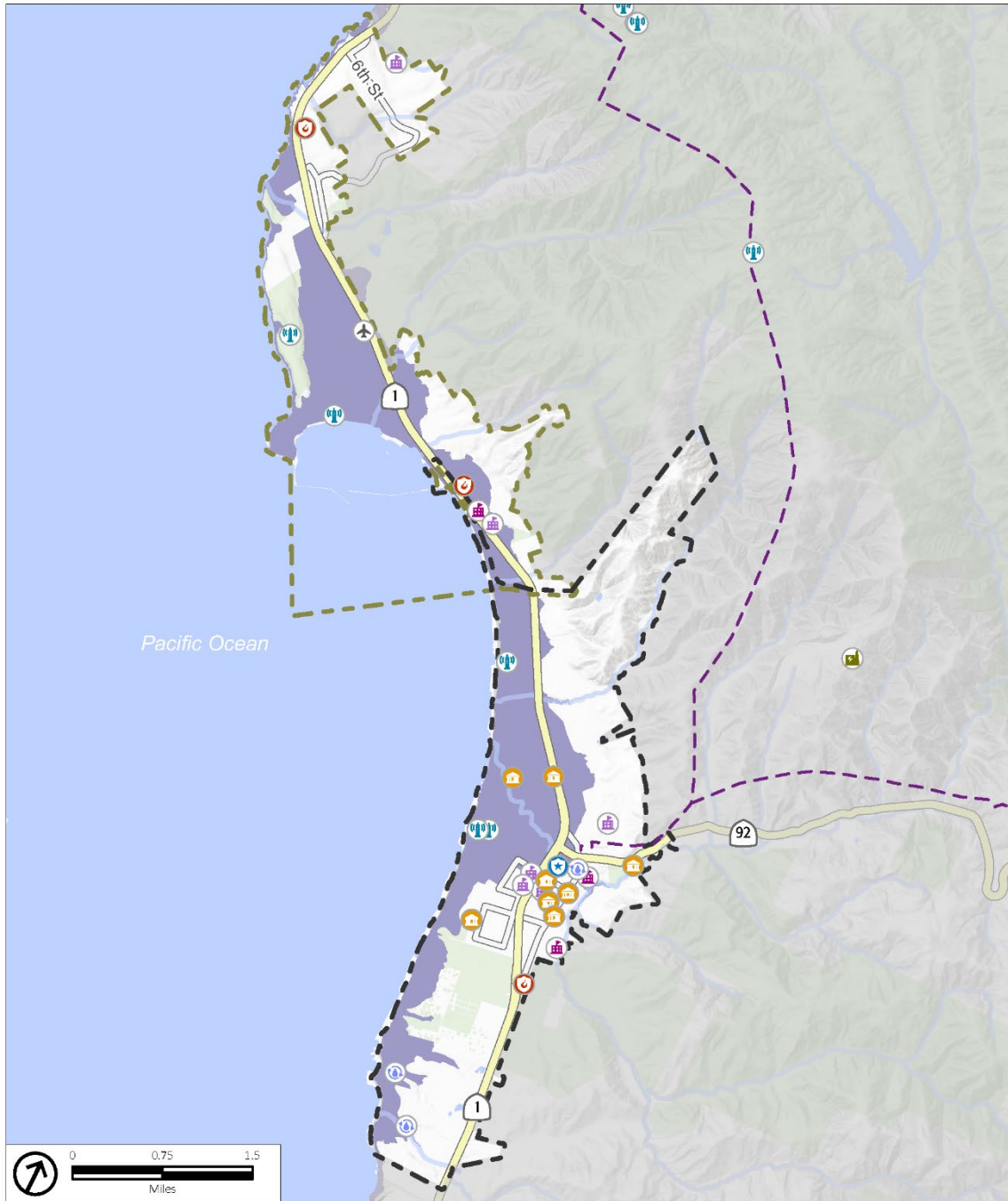
Regulatory Framework

Chapter 14.36 of the Half Moon Bay Municipal Code establishes the Seismic Hazard Identification Program for Unreinforced Masonry Buildings and provides minimum standards for structural seismic resistance. This program is designed to promote public safety by identifying those buildings in Half Moon Bay that exhibit structural deficiencies in their capacities for earthquake resistance, and by determining the severity and extent of those deficiencies in relation to their potential for causing injury or loss of life.

Future Conditions

The frequency and severity of future seismic hazards in Half Moon Bay is expected to continue.

Figure 12: Tsunami Hazard Areas



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; CGS, 2021

- | | | | |
|-----------------------|-----------------------|--------------------------|---------------------|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Tsunami Hazard Zone |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | |
| Parks and Open Space | Fire Stations | California Power Plants | |
| Creeks and Waterways | Government Facilities | Pump Stations | |
| | | Communication Facilities | |
| | | Transmission Lines | |



ISSUE 6: FIRE HAZARDS

General Overview

Fire hazards include both wildfires and urban fires. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Historically, the fire season extended from early summer through late fall of each year during the hotter, dryer months, although it is increasingly a hazard that can occur year-round. Fire conditions arise from a combination of high temperatures, low-moisture content in the air and plant matter, an accumulation of vegetation, and high winds.

Three types of fires are of concern to San Mateo County: (1) wildfires, (2) wildland-urban interface (WUI) fires, and (3) structural fires.

Wildland Fire

A wildland fire is any uncontrolled fire on undeveloped land that requires fire suppression. Wildland fire can occur naturally and are important to many ecosystem processes; however, most are started by people. Wildland fires occur on mountains, hillsides, and grasslands. Fuel, weather, and topography are primary factors that affect how wildland fires spread. The climate of San Mateo County and the surrounding area keeps the grass dry and more readily combustible during fire season.

Wildland-Urban Interface Fires

The WUI is an area where buildings and infrastructure mix with areas of flammable wildland vegetation, allowing wildland fires to easily spread to buildings and structures. Hundreds of homes now border major forests and brush areas in California, exposing an ever-growing number of people living and visiting wildland areas to the threat of wildfire. Human-caused fires are the leading cause of wildland fires.

Fire Hazard Areas

The California Department of Forestry and Fire Protection (CAL FIRE) has identified Moderate, High, and Very High Fire Hazard Severity Zones (FHSZs) in Half Moon Bay. The Very High FHSZs make up most of the land east of SR-1, although the Very High zones do cross into the west side of Half Moon Bay as well. Most of the remaining parts of Half Moon Bay are designated as Moderate or High zones. In total, approximately 47 percent of Half Moon Bay is designated a Very High zone, 26 percent is designated a High zone, and 16 percent is designated a Moderate zone. The remaining 10 percent of the community is not within a mapped FHSZ, but it still faces a risk from wildfires, especially if one were to spread from the areas of elevated hazards. areas All of Half Moon Bay falls under the jurisdiction of the Coastside Fire Protection District. Most of the unincorporated county bordering Half Moon Bay is also a Very High FHSZ. With the exception of the unincorporated areas directly south of the community, these neighboring areas are considered a State Responsibility Areas (SRA), which falls under the jurisdiction of CAL FIRE. Mutual-aid agreements between these fire protection jurisdictions mean that they can call on one another for aid fighting structural fires and large wildland fires should it be required. Figure 13 depicts the FHSZs in and surrounding Half Moon Bay.

Wildfire Protection Responsibility Areas

Hundreds of agencies have fire protection responsibility for wildland and WUI areas in California. Local, state, tribal, and federal organizations have primary legal and financial responsibility for wildfire protection. In many instances, two fire organizations have dual primary responsibility for the same parcel

of land—one for wildfire protection, and the other for structural or improvement fire protection. CAL FIRE designates lands into responsibility areas based on who is financially responsible for fire protection services.

Local Responsibility Areas

Local Responsibility Areas (LRAs) are areas protected by local agencies, including city and county fire departments, local fire protection districts, and CAL FIRE when under contract to local governments. LRAs may include flammable vegetation and WUI areas where the financial and jurisdictional responsibility for improvement and wildfire protection is that of a local government agency. All of Half Moon Bay is an LRA, as are the unincorporated areas in the City's sphere of influence and the unincorporated areas directly south of Half Moon Bay.

State Responsibility Areas

State Responsibility Areas (SRAs) include unincorporated areas and state lands where the state/CAL FIRE has financial responsibility for fire protection. The unincorporated lands east of Half Moon Bay and north of the City's sphere of influence are SRAs. CAL FIRE can also provide fire protection services by contract to cities and counties.

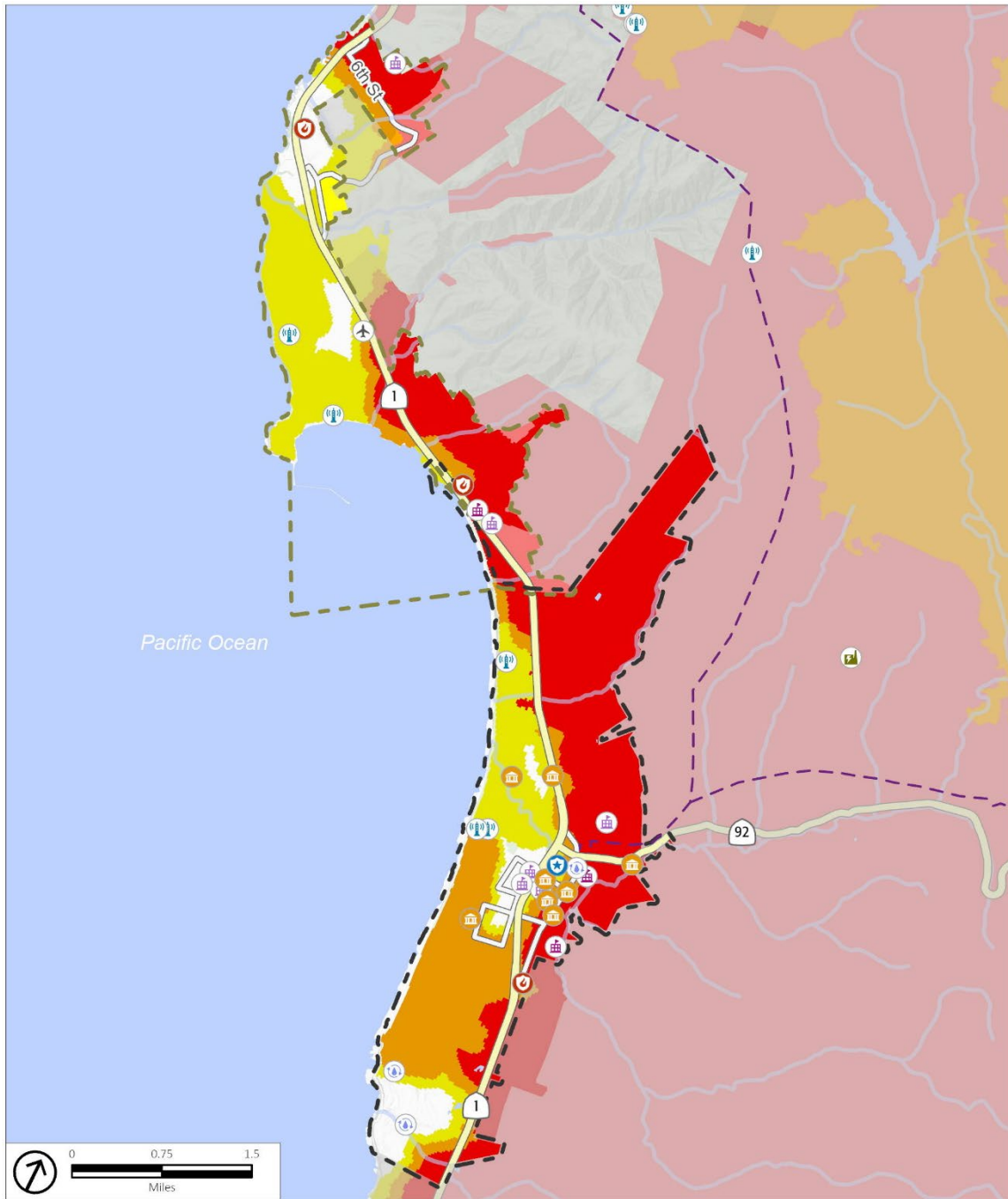
Structural Fires

Structural fires occur in built-up environments, destroying buildings and other human-made structures. These disasters are often due to faulty wiring, mechanical equipment, or combustible construction materials. The absence of fire alarms and sprinkler systems can exacerbate the damage associated with a structural fire. Structural fires are largely from human accidents, although deliberate fires (arson) may be a cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. To minimize fire damage and loss, the local Fire Code, based on the state Fire Code, sets standards for building and construction. They require the provision of adequate water supply for firefighting, fire-retardant construction, and minimum street widths, among other things.

Secondary Hazards

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses due to destruction of businesses and indirect economic losses in reduced tourism. 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 soil and cause landslides and mudslides. Wildfires that burn hot and for long durations can bake soil, thus increasing the imperviousness of the ground. This increases the runoff during storm events and subsequent flooding. Half Moon Bay is also at risk of smoke from wildfires occurring throughout the region. These incidents can increase the potential for poor air quality, affecting residents, workers, and visitors in the city.

Figure 13: Half Moon Bay Fire Hazard Severity Zones



Source: ESRI, 2023; County of San Mateo, 2023; City of Half Moon Bay, 2023; PlaceWorks, 2023; CalFIRE, 2025

- | | | | |
|-----------------------|-----------------------|--------------------------|--|
| City of Half Moon Bay | Airport | Public Schools (K-12) | Fire Hazard Severity Zone
(State Responsibility Area) |
| Sphere of Influence | Law Enforcement | Private Schools (K-12) | |
| Parks and Open Space | Fire Stations | California Power Plants | Very High |
| Creeks and Waterways | Government Facilities | Pump Stations | High |
| | | Communication Facilities | Moderate |
| | | Transmission Lines | Fire Hazard Severity Zone
(Local Responsibility Area) |
| | | | Very High |
| | | | High |
| | | | Moderate |



Past Events

While San Mateo County has a prolific fire history, few of its fires have caused sufficient damage to trigger a state or federal disaster declaration. Notable fires of record are the November 1929 fire near Montara that destroyed 25 homes, a church, and cattle, and the August 2020 CZU Lightning Complex in Santa Cruz and San Mateo Counties, caused by a reported 12,000 lightning strikes.

The CZU Lightning Complex fires burned in San Mateo and Santa Cruz Counties starting on August 16, 2020. This fire destroyed 1,490 structures, damaged 140 others, and caused one injury and one fatality. Fires burned in both Butano and Big Basin Redwoods State Parks, where several historic buildings were destroyed, including the visitor's center at Big Basin. The fire burned a total of 86,509 acres.¹² According to CAL FIRE, the CZU Lightning Complex fire was the 12th-most destructive California wildfire. While no direct impacts to Half Moon Bay occurred during this fire, the County did open a Resource Center at Half Moon Bay High School to aid in the disaster relief effort. Smoke from this massive wildfire did impact many communities throughout the Bay Area, including Half Moon Bay.

Although San Mateo County has not experienced many major wildfire events, nearby Alameda County has demonstrated some worst-case scenario fires that could occur in other Bay Area counties. At the time it occurred, the October 1991 Oakland/Berkeley Hills "Tunnel Fire" was the most damaging fire (now the fifth-most damaging) and the second deadliest (currently the third deadliest) fire in California. This WUI fire resulted in 25 lives lost, including a fire battalion chief and an Oakland police officer, 148 people injured, and 2,900 structures destroyed. The blaze started from a grass fire in the Berkeley Hills and burned 1,600 acres. According to the Insurance Information Institute, the estimated private property loss was \$1.7 billion. While the City of Half Moon Bay experiences mild weather year-round, characterized by cool summers, wet winters, and frequent fog the surrounding topography is similar to the Oakland/Berkeley Hills, and hence needs to plan accordingly for fire.

Regulatory Framework

CAL FIRE Wildfire Mapping

CAL FIRE has modeled and mapped wildfire hazard zones using a computer model that designates moderate, high, or very high FHSZs. FHSZ ratings are derived from a combination of fire frequency (how often an area burns) and expected fire behavior under severe weather conditions. CAL FIRE's model derives fire frequency from 50 years of fire history data. Fire behavior is based on fuel loads (such as the level and type of vegetation), weather conditions (temperature, wind, precipitation, humidity, etc.), slope and elevation, fire ignition patterns, and expected rate of spread. It accounts for flying ember production, which is the principal driver of the wildfire hazard in densely developed areas, as well as the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures.

CAL FIRE periodically reviews and revises the FHSZ boundaries based on updated modeling and scientific information. Individuals should consult the most recent available mapping, available from CAL FIRE's Fire and Resource Assessment Program (FRAP) at <https://frap.fire.ca.gov/>.

County Fire Management and Response

Santa Cruz and San Mateo Counties updated their joint Community Wildfire Protection Plan (CWPP) in 2018. A CWPP is a tool for communities to identify landscape-scale hazards and take strategic action to reduce wildfire risk for healthier ecosystems and more resilient communities. The updated CWPP assesses hazards and priorities within the two counties, identifies at-risk communities, and provides fuel reduction recommendations for high-priority areas. The CWPP can also aid communities to apply for state and federal funding for fire prevention projects and programs.

Wildfire Fuel Management Program

This five-year Wildfire Fuel Management Program is a plan developed by the San Mateo County Parks Department designed to identify and prioritize wildfire fuel reduction projects. The program identifies the projects deemed to have the highest priority to be completed during the selected timeframe. This process involves direct collaboration between department field staff and natural resource management staff to identify the necessity and scope of various projects within park properties and completion of a systematic ranking process of projects to determine which are of the highest priority for the treatment plan timeframe. The plan outlines how the projects will be implemented and then stipulates how these fuel breaks will be maintained in the future. Although no current fuel management activities are proposed in or around Half Moon Bay this program may assist with these activities.

City Fire Management and Response

Fire protection for the city is provided by the Coastside Fire Protection District, which actively works to prevent structural and wildfires through its regulations, education, and training programs. Fire Station 40 is within the downtown area of Half Moon Bay. All stations are staffed with one Fire Captain and two Fire Apparatus Engineers; one of which is a paramedic to provide advance life support service. Shift personnel work a scheduled 3-day/72-hour work week.

Chapter 14.04.110 of the Half Moon Bay Municipal Code establishes the Fire Code for the City, as well as the Bureau of Fire Prevention operated under the supervision of the Chief of the Coastside Fire Protection District, or the Chief's designated assignee. Adherence to these code requirements ensure new development within the city meets the latest fire code requirements, like the proper use of fire-resistant building materials, proper use of clearances around structures to reduce ignitions, and proper site design to accommodate equipment and personnel responding to fire incidents.

Future Conditions

Climate change is expected to affect the frequency and severity of future fire hazards in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

ISSUE 7: SEVERE WEATHER

General Overview

Severe weather is generally any destructive weather event, but usually occurs in San Mateo County as localized storms that bring heavy rain, hail, thunderstorms, and strong winds. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The most common severe weather events that have historically impacted San Mateo County and Half Moon Bay are heavy rains (usually a result of atmospheric rivers), thunderstorms, and windstorms. Utilities may temporarily turn off power to specific areas to reduce the risk of fires caused by electric infrastructure, an

action called a public safety power shutoff (PSPS) event. As there are limited arterial ingress and egress roadways, evacuation during severe weather periods is of concern.

Atmospheric Rivers

Atmospheric rivers are long, narrow regions in the atmosphere that transport water vapor from the tropics. When the atmospheric rivers make landfall, they release this water vapor in the form of precipitation, often causing heavy rains that can lead to flooding and mudslide events. These events can cause significant injuries, disrupt travel, and damage property. However, they also play a critical role in replenishing California's water supply.

Fog

Fog forms when air close to the ground can no longer hold all the moisture it contains, causing the excess moisture to condense as a low cloud. This occurs either when air is cooled to its dew point or the amount of moisture in the air increases. Heavy fog is particularly hazardous because it can restrict surface visibility. Severe fog incidents can close roads, cause vehicle accidents and airport delays, and impair the effectiveness of emergency response. Fog in the Bay Area has different origins depending on the time of year. In the summer, the area is characterized by cool marine air and persistent coastal stratus and fog. According to the San Mateo County Department of Public Works, which oversees the Half Moon Bay Airport, fog affects airport operations approximately 40 percent of the year, which can impact the number of daily flights at this facility.

Thunderstorms

A thunderstorm is a rain event that includes thunder and lightning. According to NOAA's National Severe Storms Laboratory, a thunderstorm is classified as "severe" when it contains hail with a diameter of one inch or greater, wind gusts exceeding 57.5 miles per hour (mph), or tornado. Lightning can cause forest and brush fires and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. "Lightning sieges" are extreme lightning events in which lightning strikes multiple points at once. In August 2020, a lightning siege with a estimated 12,000 lightning strikes caused a set of fires known as the CZU Lightning Complex in San Mateo and Santa Cruz Counties.¹³

Tornadoes

A tornado is a violently rotating column of air extending between a cloud and the surface of the earth, with winds that can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long. Tornadoes can occur throughout the year at any time of day but are most frequent in the spring during the late afternoon. However, tornadoes are rare in San Mateo County as only five have been recorded since 1950.

Windstorms

Windstorms are generally short-term events involving winds or gusts of over 50 to 60 miles per hour (mph) that are strong enough to cause property damage. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles.

Windstorms can cause significant property damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Falling trees and branches can damage buildings, power lines, and other property and infrastructure. During wet winters, saturated soil causes 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. 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.

Secondary Hazards

Major riverine or urban flooding can result from heavy rain. Rain falling on saturated soils on slopes or on areas recently burned by wildfire may lead to landslides. Lightning during thunderstorms presents a risk of starting a wildfire.

Poor air quality is a secondary impact of severe weather. Cold weather may trap air pollutants near the ground surface through an inversion layer.

Electrical Infrastructure

Almost all of the electricity (~97%) for Half Moon Bay is received from Peninsula Clean Energy (PCE), with the remaining coming from Pacific Gas and Electric Company (PG&E). Electrical power transmission lines are owned and operated by PG&E and deliver power throughout the city. These high voltage power transmission lines range from 60kV to 500kV, which then connect to distribution lines that provide power to individual homes and business. Major transmission lines run parallel to San Mateo Road (92) and north through Digges Canyon and Montara Mountain towards Pacifica. Infrastructure in Half Moon Bay has limited redundancy due to the isolated nature of the city, meaning that if a piece of infrastructure fails, there may not be redundant connections and systems in place to support services. Loss of power or communications adversely impacts all community members including local residents, visitors, and workers.

Public Safety Power Shutoff

Electricity utilities throughout California, including PG&E, have begun to occasionally “de-energize,” or turn off the electricity for power lines that run through areas where there is an elevated fire risk. This is intended to reduce the risk of power lines sparking or being damaged and starting a wildfire. A PSPS event may occur at any time of the year, usually during high wind events and dry conditions. PSPS events may be limited to specific communities, or they may affect broad swaths of the state. Given the long, connected nature of power supply systems, a shutoff event targeted to a small at-risk area can affect a larger area outside the risk zone. The duration of a shutoff is related to the severe weather that triggers it. However, a shutoff typically ends within 24 hours after the severe weather has passed.

Past Events

Table 7 lists past severe weather events in San Mateo County as recorded by NOAA since 1950. Several of these events affected Half Moon Bay.

Table 7: Past Severe Weather Events

Date	Type	Description
October 24, 1962	Severe Storms	Federal disaster declaration issued (DR-138)
December 19, 1981 – January 8, 1983	Severe Storms, Flood, Mudslides, High Tide	Federal disaster declaration issued (DR-651)
January 21 – March 30, 1983	Coastal Storms, Floods, Slides, Tornadoes	Federal disaster declaration issued (DR-677)

Date	Type	Description
February 12 – March 10, 1986	Severe Storms, Flooding	Federal disaster declaration issued (DR-758)
December 19, 1990 – January 3, 1991	Severe Freeze	Federal disaster declaration issued (DR-894)
January 3 – February 10, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	Federal disaster declaration issued (DR-1044)
February 13, 1995 – April 19, 1995	Severe Winter Storms, Flooding, Landslides, Mud Flows	Federal disaster declaration issued (DR-1046)
December 28, 1996 – April 1, 1997	Severe Storms, Flooding, Mud, and Landslides	Federal disaster declaration issued (DR-1155)
February 2 – April 30, 1998	Severe Winter Storms and Flooding	Federal disaster declaration issued (DR-1203).
December 17, 2005 – January 3, 2006	Severe Storms, Flooding, Mudslides, and Landslides	Federal disaster declaration issued (DR-1628)
March 29 – April 16, 2006	Severe Storms, Flooding, Landslides, and Mudslides	Federal disaster declaration issued (DR-1646)
March 18, 2011	Tornado	A tornado moved from the waters off the coast of Half Moon Bay to the Francis Beach ranger station. The force of the tornado caused one picnic table to “cartwheel,” according to witnesses. Some damage was sustained, including a downed fence and tree.
December 21 through December 26, 2012	Heavy Rain	A series of storm systems, part of a large Atmospheric River type of pattern, impacted the area during late December 2012. From December 21 through 26, heavy rain, gusty winds, flooding, and mudslides occurred across the Bay Area in these consecutive events. Downed trees, powerlines, and flooded roadways impacted community members.
January 18 – 23, 2017	Severe Winter Storms, Erosion, Flooding, and Mudslides	Federal disaster declaration issued (DR-4305)
February 1 – 23, 2017	Severe Winter Storms, Erosion, Flooding, and Mudslides	Federal disaster declaration issued (DR-4308). The City spent \$411,065.50 in temporary repairs for emergency stabilization of Seymour Ditch.
October 2019	PSPS	Multiple PG&E induced outages due to extreme weather conditions. A community resource center was opened in Half Moon Bay. The Tom Lantos Tunnel closed temporarily. Local businesses took a reported loss of over

Date	Type	Description
		\$1,000,000 during the multiple October 2019 PSPS events.
October 2020	PSPS	Multiple PG&E induced outages due to extreme weather conditions
December 13, 2021	Heavy Rain	An atmospheric river impacted the Bay Area on December 13, resulting in significant rainfall across the San Francisco Bay Area. During the morning, a surface low developed west of San Francisco and the river stalled over the Bay Area. This resulted in significant rainfall totals for many Bay Area communities.

Source: National Center for Environmental Information, 2021.

Regulatory Framework

While the City does not have specific regulations regarding severe weather incidents, several Municipal Code sections contribute to the protection of the community from these types of hazards. The following are key chapters that support City efforts to reduce impacts from these events:

Chapter 12.20.020, Underground Utilities, establishes that unless otherwise specified, all new installations and extensions of public utilities facilities for power, street lighting, and communications purposes shall be installed underground, intended to mitigate the dangers from severe wind and storms.

Chapter 18.37.050, Landscape Design Standards, establishes regulation for the care and maintenance of trees to mitigate potential dangers from severe wind and storms.

Future Conditions

Climate change is expected to affect the frequency and severity of future severe weather in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

ISSUE 8: DROUGHT

General Overview

Drought is a significant decrease in water supply relative to what is needed to meet typical demand, leading to a water shortage for some activity, group, or environmental sector. While drought is a normal occurrence for Mediterranean climates such as that of San Mateo County, long and severe droughts have the potential to impact ecosystems and economic activity across the entire community. Most droughts are defined based on declines in normal precipitation levels, declines in agricultural production, declines in streamflow and groundwater levels, or socioeconomic impacts from water shortages.

The severity of any given drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. While drought does not typically directly result in loss of life or damage to structures, drought can have widespread impacts on the environment and the economy. Potential drought impacts increased costs for water straining household finances and reducing commercial profits, reduced habitat and food supply for plants and animals, and increased risk of wildfire.

Drought response is determined case by case, and response priorities are typically based on imminence of potential water shortages. The U.S. Drought Monitor recognizes a five-point scale for drought events: D0 (abnormally dry), D1 (moderate drought), D2 (severe drought), D3 (extreme drought), and D4 (exceptional drought). During severe drought conditions, water shortages are common and water restrictions may be imposed to meet essential community needs.

Droughts can affect groundwater storage as reserves are drawn down in anticipation of or in response to drought impacts, or as reduced precipitation causes groundwater supplies to be replenished at a slower rate. Drought affects groundwater sources more slowly than it affects surface water supplies, but groundwater supplies generally take longer to recover. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. It can take groundwater supplies years to recover from heightened use during droughts. This reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation. Reduced groundwater levels mean that even less water will enter streams during periods of low precipitation. With expected warmer global temperature trends, droughts are expected to be more severe in coming years. (<https://climateresilience.ca.gov/overview/impacts.html>)

Drought can also increase community susceptibility to wildfire. A prolonged lack of precipitation dries out vegetation and makes plants more vulnerable to pests, both of which can increase susceptibility to wildfires.

Water supplies for the city come from Coastside County Water District (CCWD). The CCWD was formed in 1947 and provides treated water to the City of Half Moon Bay and to the unincorporated communities of Princeton, Miramar, and El Granada. Approximately 75 percent of the CCWD's water supply is purchased from the SFPUC. The CCWD is the only customer of the SFPUC that receives raw (untreated) water. CCWD purchases raw water from two sources owned and operated by the SFPUC: Pilarcitos Reservoir and Upper Crystal Springs Reservoir. The transmission pipelines from each of these sources interconnect in upper Pilarcitos Canyon. The water supplies purchased from SFPUC are treated at the CCWD's Nunes Water Treatment Plant.

The remaining 25 percent of CCWD's water supply is produced locally from wells and surface water. CCWD operates eight groundwater wells in the Denniston Well Field, a majority of which are east of the Half Moon Bay Airport. CCWD's local surface water supplies from Denniston Creek are treated at the Denniston Water Treatment Plant. The Pilarcitos Creek infiltration wells, owned and operated by CCWD, are another source of surface water supplies. The Pilarcitos Creek infiltration wells are in Pilarcitos Creek Canyon between Pilarcitos Reservoir and SR-92 and supplies from the infiltration wells are treated at CCWD's Nunes Water Treatment Plant.

Past Events

San Mateo County has a history of severe droughts, which have affected Half Moon Bay. DWR hydrologic data from the early 1900s shows multi-year droughts from 1912 to 1913, 1918 to 1920, 1922 to 1924, and 1928 to 1934. The 1929 to 1934 drought established the criteria for designing storage capacity and yield for large Northern California reservoirs. The following sections describe the most recent prolonged droughts that have impacted the planning area.

1976 to 1977 Drought

California had a severe drought due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California at that time, with the previous winter recorded as the fourth driest in California's hydrological history at that time. The cumulative impact led to widespread water shortages and severe water conservation measures statewide. Over \$2.6 billion in crop damage was recorded in 31 counties. FEMA declared a drought emergency (Declaration 3023-EM) on January 20, 1977, for 58 California counties.

1987 to 1992 Drought

California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected, the Sierra Nevada range in Northern California and the Central Valley counties were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received. In 1991, the State Water Project sharply decreased deliveries to water suppliers. By February 1991, all 58 counties in California were experiencing drought. Urban areas as well as agricultural areas were impacted.

2007 to 2009 Drought

The state proclaimed a statewide drought emergency on June 4, 2008, after spring 2008 was the driest spring on record. On February 27, 2009, the State proclaimed a state of emergency for the entire state as severe drought continued. State courts imposed what was, at the time, the largest court-ordered water restriction in state history.

2012 to 2017 Drought

This drought set several records for the state. The period from 2012 to 2014 ranked as the driest three consecutive years for statewide precipitation. Calendar year 2014 set new records for statewide average temperatures and for low water allocations from the State Water Project. Calendar year 2013 set minimum annual precipitation records for many communities. Detailed executive orders and regulations addressed water conservation and management. The statewide drought emergency was lifted in April 2017.

2020 to 2023 Drought

The U.S. Department of Agriculture declared a drought disaster that included San Mateo County on April 21, 2020. April 2021 was the third driest April in the past 127 years.¹⁴ Between April and December 2021, San Mateo County was at the D3—Extreme Drought level, putting the county at risk for wildfire on a year-round basis.¹⁵ Excessive rainfall and flooding in late December 2022 and early January 2023 alleviated some of the drought conditions. Governor Newsom officially eased drought restrictions in March 2023. As of October 2023, San Mateo County was not considered to be in a state of drought.

The City's main water wholesaler is SFPUC, so Half Moon Bay's water supply reliability is fundamentally linked with SFPUC's water supply reliability. According to the CCWD Urban Water Management Plan (UWMP), findings show that during single-dry years and multiple consecutive dry years, the City's supplies are not adequate to meet projected demands, starting as early as 2030. This shortfall is primarily due to significant cutbacks in the City's supply from SFPUC, which is significantly reduced in dry years due to the Bay-Delta Plan Amendment. In years with a supply shortfall, the City can implement the CCWD Water Shortage Contingency Plan (WSCP) to reduce demands to the level of available supply.

Statewide water supply conditions, changes in groundwater levels, and actions by other agencies may impact the City's available water supply. Water shortage conditions occur when the available supply of

potable water cannot meet ordinary water demands for human consumption, sanitation, fire protection, and other beneficial uses. In some cases, the City may foresee water shortage, but the water shortage may also be caused by an unforeseen sudden or emergency event.

Regulatory Framework

San Francisco Public Utilities Commission

The SFPUC issued its most recent UWMP in 2021. The UWMP provides an overview of water deliveries and uses, water supply sources, and water conservation programs. It also includes discussions on supply and demand projections over a 25-year planning horizon (from 2020 to 2045), available water supplies to meet existing and future demands under a range of water supply conditions, and water demand management measures, including the WSCP, to reduce long-term water demand. The SFPUC engages in a number of other water conservation activities, including groundwater monitoring and development of water recycling projects, which help support systemwide water conservation.

Coastside County Water District - Water Shortage Contingency Plan (WSCP)

The WSCP serves as a standalone document to be engaged in the case of a water shortage event, such as a drought or supply interruption, and defines specific policies and actions that will be implemented at various shortage level scenarios. This plan ensures the CCWD (and City of Half Moon Bay) have the necessary resources and management responses in place to protect health and human safety, minimize economic disruption, and preserve environmental and community assets during water supply shortages and interruptions. The plan includes a framework to address shortage conditions ranging from 10 to 50+ percent shortage, identifies a suite of demand mitigation measures to implement at each level, and identifies procedures to annually assess whether or not a water shortage is likely to occur in the coming year.

California Statewide Groundwater Elevation Monitoring

Groundwater is a significant portion of the total water supply for the State of California. It is estimated that California's reliance on groundwater will increase during drought periods and with an increase in population. The California Statewide Groundwater Elevation Monitoring (CASGEM) program was created with SB X7-6, as part of the 2009 Comprehensive Water Package. The California legislature created the CASGEM program to collect groundwater elevations, facilitate collaboration, and to report this information to the public. CASGEM is part of the State's plan to sustainably manage groundwater in the State's alluvial groundwater basins and subbasins.

Under CASGEM, CCWD became a monitoring agency in the Half Moon Bay Terrace Basin, along with Montara Water and Sanitary District. The District established a monitoring well in the airport subbasin of the Half Moon Bay Terrace Basin and reports elevations of this well seasonally to the State. In 2011, the CCWD prepared a Groundwater Elevation Monitoring Plan for submittal to DWR for the CASGEM program.

City of Half Moon Bay

Municipal Code

Chapter 13.04, Water Efficient Landscape Ordinance, officially adopts and establishes the California State Model Water Efficient Landscape Ordinance as the guideline within the city. This ordinance will help regulate new construction and landscaping requirements and outlines exemptions. This is to assist in water conservation efforts.

Chapter 13.05, Indoor Water Use Efficiency Regulations, establishes the regulations for indoor plumbing standards and adherence to the California Plumbing Code (2007), it also defines what projects are applicable and which are exempt. This is to assist in water conservation efforts.

Chapter 13.48, Water Well Installation, Conservation and Destruction, outlines where, when, and how a water well can be dug, built, abandoned, converted, or destroyed. This helps to regulate and keep an active inventory of water wells. This is to assist in water conservation efforts.

Chapter 14.38, Growth Management System, establishes the growth management system (GMS), which enables the City of Half Moon Bay to act cautiously in proceeding with residential growth at a time when remaining sewer capacity is becoming exhausted, and the issue of groundwater as a permanent source for domestic water supply is explored. It also describes how available building permits will be issued. Finally, the GMS helps to ensure that residential development remains within the limits established by the Half Moon Bay General Plan, Local Coastal Plan (LCP), and its allocation and phasing policy.

Future Conditions

Climate change is expected to affect the frequency and severity of future drought conditions in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

ISSUE 9: AIRPORT HAZARDS

General Overview

Safety risks associated with airport operations comprise a distinct hazards category. Lands surrounding or near an airport have an increased risk of experiencing accidents involving aircraft.

The Half Moon Bay Airport is 6 miles northwest of the city along the coast, about 20 miles south of San Francisco. It was constructed by the California State Highway Department for the U.S. Army in 1942. The U.S. Army turned the airport over to the Navy following the end of World War II and the County acquired the airport from the Navy in 1947. The airport has served a variety of roles over the years and is currently an important business, transportation, and emergency service asset to the community.

The Half Moon Bay Airport is home to 80 aircraft and a variety of aviation-related businesses.¹⁶ This facility also provides a variety of emergency service and response functions, including Air-Ambulance and Medivac flights, law enforcement and homeland security patrols, Coast Guard sea-rescue operations, and use as a disaster relief staging site for the airlifting of emergency supplies in the event that roads are closed during a disaster or emergency.

According to the *Airport Land Use Compatibility Plan for Half Moon Bay Airport*, approximately 50 percent of the land within the planning area surrounding the airport is designated for agricultural use. The next-largest land use type within the planning area includes a variety of residential uses, followed by open space, commercial, and public uses. See Figure 14 for the Airport Overlay Zones in Half Moon Bay's sphere of influence.

Past Events

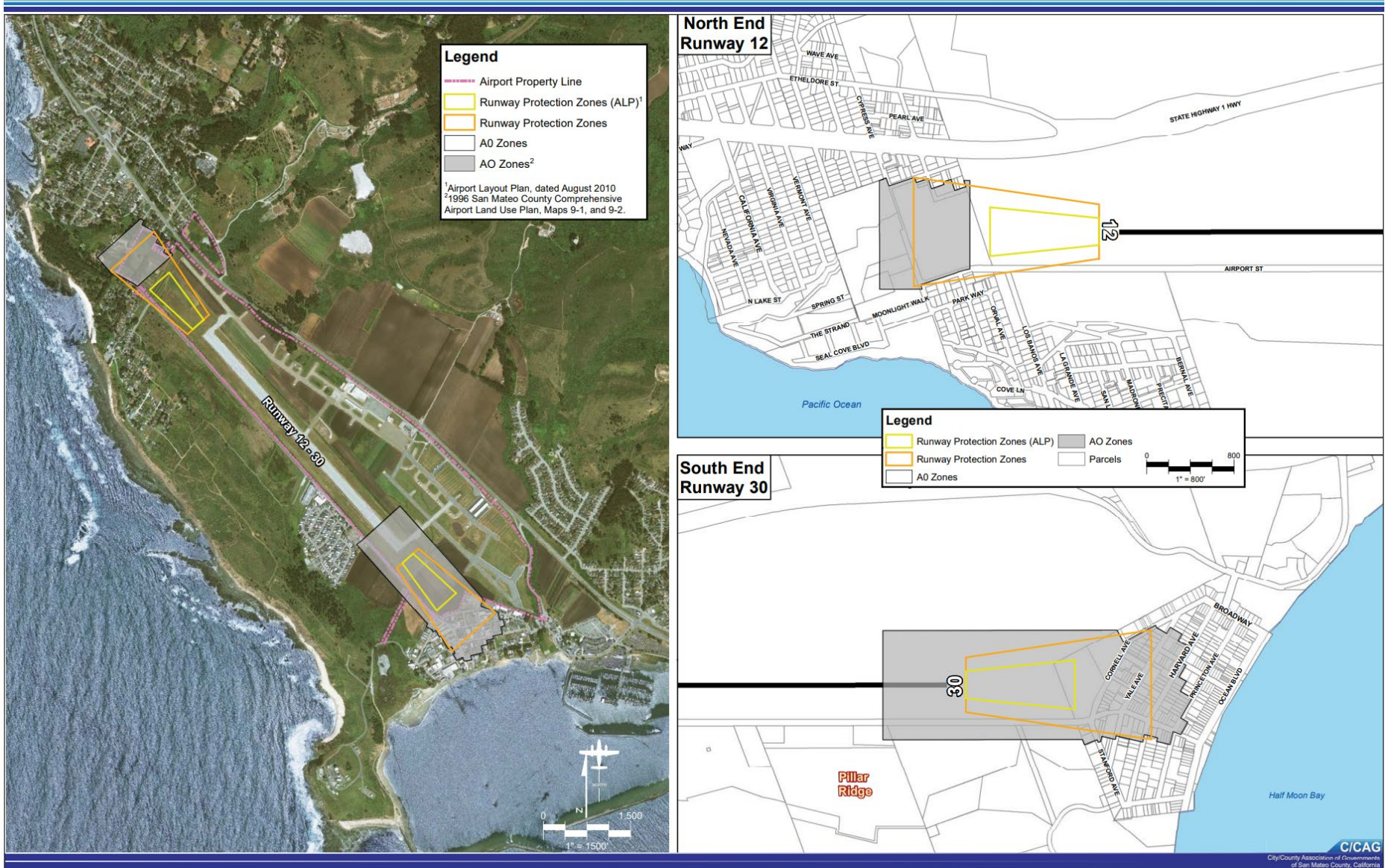
According to the *Airport Land Use Compatibility Plan for Half Moon Bay Airport*, general aviation operations (civilian, noncommercial flights) in 2012 were estimated to be 46,832. Since the preparation of that report, it is estimated that daily operations have increased to nearly 50,000. With an average of 137

aircraft operations¹ per day, the weather on the coast (overcast approximately 40 percent of the year) creates clusters of airport operations resulting in busy days when the weather is clear, and days, or sometimes weeks, of little activity when the weather was overcast.

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¹ Aircraft operations means the airborne movement of aircraft in controlled or noncontrolled airport terminal areas, and counts at en route fixes or other points where counts can be made. There are two types of operations: local and itinerant.

Figure 14: Half Moon Bay Airport Overlay Zones (Exhibit 2E of the ALUCP)



Regulatory Framework

County of San Mateo Airports' Friendly Approach Program

The County of San Mateo Airports' Friendly Approach Program is a noise management outreach plan designed to inform the community about San Carlos and Half Moon Bay airports' operations and how they contribute to thriving bayside and coastal communities. The businesses and users of the county's airports create jobs, transport essential goods and supplies, deliver important emergency services, and bring prosperity to the region. San Carlos Airport and Half Moon Bay Airport are important local assets providing a positive impact on the region, and the airports' staff are also empathetic to community members' concerns.

Federal Aviation Administration

The Federal Aviation Administration (FAA) is the federal agency charged with regulating air commerce and achieving efficient use of navigable airspace. The FAA has established Federal Aviation Regulation Part 77 criteria, which are imaginary surfaces that extend outward from the end of each runway and define the maximum heights of structures within the airport vicinity. Permissible building heights are equal to the difference between the height of the horizontal plane (or imaginary surface of flight pattern) and the ground elevation above mean sea level.

City/County Association of Governments San Mateo County

The City/County Association of Governments (C/CAG) of San Mateo County acts as the Airport Land Use Commission for the County. In this role, C/CAG is the entity that oversees the preparation and implementation of the Airport Land Use Compatibility Plan (ALUCP) for the Environs of Half Moon Bay Airport. This ALUCP is intended to protect and promote the safety and welfare of residents, businesses, and airport users near the airport, while supporting continued airport operation. Key plan purposes are to protect the public from the adverse effects of airport noise, ensure that people and facilities are not concentrated in areas susceptible to aircraft accidents, and ensure that no structures or activities encroach on or adversely affect the use of navigable airspace.

Future Conditions

According to the ALUCP for Half Moon Bay Airport, the annual number of operations at the Half Moon Bay Airport is estimated to increase to nearly 60,000 by 2032.

The frequency and severity of future airport hazards in Half Moon Bay will depend on the scale of future activities. Extreme Heat

General Overview

California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level are called extreme heat days. In Half Moon Bay, extreme heat is a daytime temperature above 80.8 degrees Fahrenheit (°F), and a warm night is nighttime low of above 56°F. An event with five extreme heat days in a row is called a heat wave. Extreme heat affects community members' safety and increases community costs and energy generation as it continues. These events can also exacerbate wildfires and impact water supplies. High demand for power for air conditioning during extreme heat can stress and overwhelm the electrical grid, leading to brownouts or power loss. Extreme heat events may degrade the quality of roadways and railways, resulting in closures and travel delays.

Health impacts are the primary concern with these hazards, though economic and service impacts are also an issue. The Center for Disease Control and Prevention (CDC) recognizes extreme heat as a substantial public health concern. Historically, NOAA data indicates that extreme heat kills about 175 Americans annually, although this number has increased in recent years. From 2004 to 2018, studies by the U.S. Department of Health and Human Services indicate that there is an average of 702 deaths annually that are directly or indirectly linked to extreme heat. According to the California Climate Adaptation Strategy, heat waves have claimed more lives in California than all other declared disaster events combined.

Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat-related illnesses, including heat cramps, heat exhaustion, and (most severely) heat stroke. Areas with lower extreme heat thresholds are not necessarily at lower risk, as persons and community assets used to cooler temperatures may be less prepared for extreme heat events.

Extreme temperatures can harm plants and animals that are not well adapted to these events, including natural ecosystems. Extreme heat can increase the temperature of water in lakes, streams, creeks, and other water bodies, especially during drought conditions when water levels are lower. In some cases, water temperatures may exceed comfortable levels for several plants and animals, causing ecological harm. Outdoor workers in agriculture, construction, and landscaping are also much more exposed to the elements than most people, so they are more susceptible to extreme heat conditions and the potential illnesses associated with extreme temperatures.

Indirectly, extreme heat puts more stress on power lines, causing them to run less efficiently. The heat also causes more demand for electricity (usually to run air conditioning units), and in combination with the stress on the power lines, may lead to brownouts and blackouts.

Secondary Hazards

During heat waves, the air becomes stagnant and traps emitted pollutants, often resulting in increases in surface ozone. Heat waves and drought also dry out vegetation and provide more fuel for wildfires whose smoke is a serious medical hazard.

Past Events

In 2022, a combination of heat advisories and an excessive heat warning was issued for parts of Monterey Bay and its near coastal valleys, the San Francisco Bay Shoreline, and Marin Coastal Mountains from September 4th through 8th, along with a heat advisory for the Central Coast, San Francisco, and coastal North Bay on September 6th. Several daily record high temperature records were shattered, along with a handful of monthly and all-time records. Reports of power outages, heat-related illnesses and deaths were received. Counties opened/operated one or more cooling centers to provide relief from the heat. Half Moon Bay set a daily record high temperature of 81°F, surpassing its previous record temperature of 80°F set in 2004.

Table 8 lists some past extreme heat events in Half Moon Bay and San Mateo County as recorded by NOAA in recent years.

Table 8: Selected Recent Extreme Heat Events

Date	Description
July 22, 2006	High temperatures reached as high as 103°F with low temperatures at night only falling into the lower 70s.

Date	Description
May 17, 2009	High pressure aloft centered over Reno, Nevada along with weak offshore flow at the surface caused temperatures to rise to near 100°F in the inland valleys of north-central California. Temperatures rose into the upper 80s to mid-90s across the peninsula of the San Francisco Bay Area. High temperatures resulted in heat-exhausted individuals, blown electric transformers, and power outages.
September 1, 2017	A strong upper-level ridge brought widespread hot temperatures to the Bay Area. Numerous daily and monthly records were broken as well as a few record max temperatures. Three San Mateo County community members died over the weekend because of the heat.
June 10, 2019	The combination of high pressure and strong offshore flow resulted in an early season heat wave across the Bay Area from June 9th to the 11th. Multiple daily records were broken across the region and multiple power outages were reported due to the heat. The heat wave across the region triggered power outages knocking out service to 57,000 people across nine counties over a two-day period.
August 19, 2020	A prolonged and oppressive heat wave swept the Central Coast and Bay Area for almost a week from August 14th to August 19th with widespread record-breaking temperatures observed across the region. Multiple days of triple-digit temperatures afternoon highs were recorded inland with some coastal locations even reaching the mid-90s.
July 21, 2022	A strong ridge of high pressure developed over the area, allowing temperatures to soar into the 90s to low 100s for all areas, except parts of the immediate coastline. A heat advisory was issued for all but coastal zones from late morning through the evening of June 21st.
September 6, 2022	A strong ridge of high pressure encompassed the Western United States from September 1st through 8th, leading to anomalously hot temperatures along the California coast. A combination of heat advisories and an excessive heat warning was issued for parts of Monterey Bay and its near coastal valleys, the San Francisco Bay Shoreline, and Marin Coastal Mountains from September 4th through 8th, along with a heat advisory for the Central Coast, San Francisco, and coastal North Bay on September 6th. The heat wave shattered several daily record high temperature records, along with a handful of monthly and all-time records. There were also reports of power outages, heat-related illnesses, and deaths due to the high temperatures.

Locally, since 2006, the city has historically experienced an average of 5 extreme heat days per year and 13 warm nights. Within recent years, extreme heat days have been most frequent in August and September.

Regulatory Framework

Chapter 14.04, Building Standards, Section 14.04.120, Green Building Standards Code (official adoption 2022), may help reduce the impacts of high heat by requiring the development of energy-efficient and heat-resilient buildings.

Future Conditions

Climate change is expected to affect the frequency and severity of future extreme heat in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

ISSUE 11: HAZARDOUS MATERIALS

General Overview

Hazardous materials are materials that pose a significant risk to public safety or human or environmental health. These include toxic chemicals, flammable or corrosive materials, petroleum products, and unstable or dangerously reactive materials. They can be released through human error, malfunctioning or broken equipment, or as an indirect consequence of other emergencies. Facilities that hold hazardous materials include hazardous waste storage and treatment facilities, laboratories, hospitals, water and wastewater treatment plants, waste management facilities, fueling stations, and automotive shops. The release of hazardous materials can occur as a result of natural hazard events, such as earthquakes and other geologic hazards, floods, or severe weather. Hazardous materials can also be released accidentally during transportation, as a consequence of vehicle accidents.

A release or spill of hazardous materials could result in fire, explosion, toxic cloud, or direct contamination of water, people, and property. The effects may involve a local site or many square miles. The large-scale release of hazardous materials in combination with events such as flooding or severe weather can spread contaminants across a wide area and amplify the potential long-term impacts on human and ecological health. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual, such as the development of cancer from a carcinogen. Damage to property could range from immediate destruction by explosion to permanent contamination by a persistent hazardous material.

The use of hazardous materials in Half Moon Bay occurs most often in its commercial and industrial areas. Uses that generate hazardous waste can include auto body shops, machine shops, and auto dismantlers. In cooperation with the San Francisco Bay Regional Water Quality Control Board (RWQCB) and the California Department of Toxic Substance Control, the San Mateo County Health Services Agency's Environmental Health Division coordinates investigation and remediation of sites that have been affected by leaking underground storage tanks or hazardous waste.

In addition to the use of hazardous materials at current or former industrial sites, many older buildings may contain lead-based paint or asbestos. Asbestos and lead-based paint can seep into the soil or be released into the air, providing a potential threat to the health of workers, as well as people in the vicinity. Asbestos cleanup is regulated by federal and State laws that include the Clean Air Act and California Occupational Safety and Health Administration (Cal-OSHA). Both the federal OSHA and Cal-OSHA regulate worker exposure during construction activities that affect lead-based paint, including demolition, removal, surface preparation for repainting, renovation, cleanup, and routine maintenance. All sites with existing structures built prior to the 1980s could be at risk for asbestos and lead-based paint contamination, and therefore require individual surveys.

Past Events

Smaller hazardous materials incidents (such as small gasoline or oil spillages) have historically occurred periodically in Half Moon Bay. There have been 147 hazardous materials incidents reported in Half Moon Bay since 2010. Most incidents took place in residences, on roads, at service stations, or in businesses.

Generally, these incidents are confined to a small area, quickly contained, and cleaned up so that these incidents don't pose any sort of long-term threat to the health of community members or to the environment.

Regulatory Framework

In 1993, the Unified Hazardous Waste and Hazardous Materials Management Regulatory Program was established to protect public health and safety, restore and enhance environmental quality, and sustain economic vitality. A Certified Unified Program Agency (CUPA) manages hazardous materials and waste at a local level. The CUPA consolidates, coordinates, and makes consistent the regulatory activities of several hazardous materials and hazardous waste programs, including Hazardous Materials Management, California Accidental Release Prevention, Hazardous Waste Management, Underground Storage Tanks, Aboveground Storage Tanks, and Emergency Response. In 1996, San Mateo County Environmental Health Services was designated by the State Secretary for Environmental Protection as the CUPA for San Mateo County.

A complete list of active and inactive hazardous waste regulated facilities is currently available on the County's Open Data site. This website is maintained by the California Environmental Protection Agency and includes activities related to hazardous materials and waste, state and federal cleanups, impacted ground and surface waters, and toxic materials.

Future Conditions

The frequency and severity of future hazardous materials releases in Half Moon Bay will depend on the scale of future activities. Increases in the frequency and severity of other natural hazards, such as floods or landslides, can affect the frequency and severity of future hazardous materials releases.

ISSUE 12: HUMAN HEALTH HAZARDS

General Overview

Human health hazards are bacteria, viruses, parasites, and other organisms that can cause diseases and illness in people. Some of these diseases may cause only mild inconvenience, but others are potentially life threatening. These diseases can be and often are carried by animals such as mice and rats, ticks, and mosquitos. Warmer temperatures and high levels of precipitation can lead to increased populations of disease-carrying animals, creating a greater risk of disease and increased rates of infection. Diseases regularly spread by animals include West Nile virus, Zika virus, and Lyme disease. Human health hazards and diseases can be local, regional, or even global events. The severity of disease outbreaks varies. Transmission rates depend on local weather and environment, and fatality rates depend on local conditions such as care system quality and capacity, and the general health and immunity of the local population.

Past Events

San Mateo County, like the rest of the United States, was included in the March 2020 FEMA major disaster declaration for the COVID-19 coronavirus pandemic. As of winter 2023, approximately 62 cases of COVID-19 were reported in the county each day and the county has reported a total of 184,001 COVID-19 cases and 912 deaths since monitoring began in January 2020.¹⁷

San Mateo County Health received confirmation on April 1, 2016, from the California Department of Public Health (CDPH) that the first San Mateo County resident has tested positive for Zika virus. The individual was infected with Zika virus while traveling abroad fully recovered. There were 13 cases of Zika reported in the county in 2015 and 2016. No detections of West Nile virus occurred in San Mateo County in 2022. According to testing conducted by the San Mateo County Mosquito and Vector Control District, approximately 3 percent of San Mateo ticks carry the agent for Lyme disease.

San Mateo County also dealt with effects from the 1918 to 1920 flu pandemic. Camp Fremont, a military base in Menlo Park, reported the first death in September 1918. By December of that year, 131 community members had died of the flu.

Existing Programs and Regulations

San Mateo County Health provides health services, including vaccination clinics, disease testing, and emergency response support, to residents of San Mateo County. The San Mateo County Mosquito and Vector Control District is San Mateo County's community-based mosquito control program. This program uses several methods to help control the risk of disease in San Mateo County, including surveillance, prevention, and control of mosquito populations. The Health Alert Center for San Mateo County allows community members to view all alerts and emergencies put out by the County Health Department.

Contact tracing is a public health practice that health departments use to identify and notify people who have been exposed to someone with an infectious disease. Public health departments have used contact tracing for decades to fight the spread of infectious diseases like measles, tuberculosis, syphilis, and HIV.

There is not much warning time for health or pandemic events. The most commonly relied upon warning signal is the appearance of early cases of a disease within a population. The Health Alert Network is the CDC's primary method of sharing cleared information about urgent public health incidents with public information officers; federal, state, territorial, tribal, and local public health practitioners; clinicians; and

public health laboratories. The Health Alert Network collaborates with federal, state, territorial, tribal, and City/County partners to develop protocols and stakeholder relationships to ensure a robust interoperable platform for the rapid distribution of public health information.

Future Conditions

Climate change is expected to affect the frequency and severity of future human health hazards in Half Moon Bay. Please review the Half Moon Bay Vulnerability Assessment Report for details.

CONCLUSION

This background report provides details on the issues that are discussed at a higher level in the City of Half Moon Bay's Safety Element, serving as a foundation for associated goals, policies, and implementation actions. It is a technical appendix to the main Safety Element document. It is not necessary to be familiar with this background report to understand or use the Safety Element, but some readers may find this supplemental information helpful. This background report also contains information that is required by the California Government Code as part of the Safety Element, but which does not need to be included in the main Safety Element document.

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