

ALAMEDA

Climate Adaptation and Hazard Mitigation Plan

June 2022

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- Members of the Mitigation Planning Team
 - Danielle Mieler, Sustainability and Resilience Manager
 - Gerry Beaudin, Assistant City Manager
 - Amy Wooldridge, Parks and Recreation Director
 - Andrew Thomas, Planning, Building and Transportation Director
 - Greg McFann, Building Official
 - Gail Payne, Planning, Building and Transportation
 - Erin Smith, Public Works Director
 - Andrew Nowacki, Public Works
 - Robert Vance, Public Works
 - Nicolas Procos, Alameda Municipal Power General Manager
 - Lisa Maxwell, Community and Economic Development
 - Rick Zombeck, Fire Chief
 - Sharon Oliver, Fire Department
 - Jane Chisaki, Library Director
 - Carolyn Hogg, Information Technology Director
 - Ryan Derespini, Police
 - Stephani Shipe, Alameda Housing Authority
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 - Professor Gregory Deierlein
 - Dr. Adam Zsarnoczay
 - Tamika Bassman
 - Jaewon Saw
 - Sijin Wang

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Executive Summary

April 2022

The City of Alameda is a low-lying island community in the San Francisco Bay that is highly vulnerable to climate hazards from rising seas and earthquakes as a result of its older building stock and proximity to two major faults, as well as other hazards. That sea level rise or a natural disaster will impact Alameda in its future is a certainty, what is not certain is the extent to which the hazards will damage buildings and infrastructure and disrupt life for Alameda's residents and businesses. By understanding our risks and taking proactive action now, Alameda can be prepared for future disasters and reduce their impact.

The purpose of the Climate Adaptation and Hazard Mitigation Plan (Plan) is to help Alameda adapt to climate change, reduce the impact of future disasters and help us recover more quickly when disasters do occur.

The City of Alameda Climate Adaptation and Hazard Mitigation Plan:

- Meets the requirements established by the Federal Disaster Mitigation Act of 2000 (DMA 2000) and maintains eligibility for Federal Emergency Management Agency (FEMA) assistance grant programs, including:
 - Hazard Mitigation Grant Program (HMGP)
 - Building Resilient Infrastructure and Communities (BRIC)
 - Flood Mitigation Assistance (FMA)
- Aligns with other plans, including the CARP, General Plan and the City's Emergency Management Plan;
- Increases education and awareness of natural and climate-induced hazards and community vulnerabilities;
- Establishes a basis for coordination and collaboration among community entities such as private and public agencies, key stakeholders, and residents; and,
- Identifies and prioritizes future mitigation and adaptation projects.

The Plan addresses natural and climate induced hazards that impact the City of Alameda and lays out Alameda's strategy for mitigating natural hazards and adapting to a changing climate. A hazard is an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss. Hazard mitigation and climate adaptation refers to the actions taken to reduce or eliminate risk to human life and property from natural and climate change-induced hazards.

The success of this plan rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City's Climate Action and Resiliency Plan (CARP). The goal of CARP is to reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030 and become carbon neutral soon as possible. In 2019, the City of Alameda declared a climate emergency and called for an urgent and just citywide climate mobilization effort to reverse global warming and adapt as rapidly as possible to the growing global and local effects of climate change. In 2021, the sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) observed that human-induced climate change is already causing more extreme weather patterns and that global surface temperature will continue to increase until at least the mid-century and global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO₂ and other greenhouse gas emissions occur in the

coming decades.¹ By taking strong actions to reduce our GHG emissions, Alameda will do our part to achieve a climate safe path and avoid some of the most extreme climate effects we could face. The City of Alameda cannot avert global warming on its own. It will take an immediate and concerted effort on the part of community members, businesses, other cities and counties, the state, federal government and the world to come together and reduce our global emissions. Here in Alameda, we will do our part to reduce our emissions and prepare for the impacts that we will face. This Plan is our roadmap for adapting to the impacts of climate change we anticipate today and for mitigating other hazards we face such as tsunamis and earthquakes.

The CARP identifies 12 priority flooding locations where assets or areas are exposed to flooding risk soonest and with greatest consequence. Locations with significant flooding at a total water level of 24 or 36 inches (above today's high tide) were identified as at risk of sea level rise flooding "soon." Since the CARP adoption in 2019, Alameda has developed a deeper understanding of the implications of sea level rise for our island community, global greenhouse gas emissions have continued to increase at alarming rates, and the federal government has not provided the financial and technical support that we need to meet our greenhouse gas reduction and adaptation goals. Furthermore, the city conducted a study in 2020 on emergent groundwater issues that showed sea level rise as elevating the water table, which is expected to cause more flooding, liquefaction and soil contamination issues in every neighborhood in Alameda. With six to seven feet of sea level rise expected in 80 years, 25 miles of shoreline to improve at a cost of \$10 to \$20 million per mile, and needed conveyance and storm drain pump station upgrades, the City must immediately focus on short term strategies to delay the most severe impacts of sea level rise and buy time to improve our community's understanding and capabilities to implement local and regional long term solutions for the next generation of Alamedans.

Climate and Natural Hazard Risks in Alameda

Due to Alameda's proximity to major earthquake faults, our geography as a low-lying island community with older building stock, Alameda faces risks from a number of climate and natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property.

Earthquakes, floods and sea level rise pose the greatest risk to people and property in Alameda. Over 23 miles of shoreline surround both the main island of Alameda and Bay Farm Island. Today, much of this shoreline is vulnerable to flooding from both coastal storms where water enters the land along the lower elevations of the shoreline and overland from rainfall within the City during and after storm events. In the near term, both are likely to be temporary in nature, limited by high tide cycles and intensity of events, with flooding likely shallow - on the order of 2 feet or less in depth. However, as climate change increases the intensity of storm events, sea levels, and groundwater levels, the depth and extent of flooding is expected to increase and may become more frequent or permanent. Today's 100-year floodplain is approximately equivalent to 3 feet of sea level rise. This inundation zone includes land valued at over \$1.738 Billion and \$1.423 Billion in building value with land uses ranging from business, mixed-use, and residential to wildlife habitat and open space. Alameda's utilities and transportation network will all be

¹ IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

impacted, especially the storm drain system which will be forced to manage increasing demands over time. Groundwater inundation in many of the island's interior low spots will increase these risks.

Combining all likely scenarios on nearby faults, Alameda has a 10 percent chance of experiencing “Very Strong” to “Violent” (MMI 8 to MMI 9) shaking in the next 50 years. This probability can also be expressed as a 0.2 percent chance per year, or a 500-year event, which could happen any time. A major earthquake would cause significant damage to Alameda's older buildings and infrastructure, significant and prolonged disruption to the economy, and would harm and displace residents. Particularly vulnerable buildings in Alameda include unbraced single-family homes with a crawl space, above ground basement or living spaces over a garage as well as multi-family apartment buildings with open spaces on the ground floor or parking or retail, also known as ‘soft-story’ buildings. Liquefaction resulting from an earthquake will damage buried infrastructure and roads across much of the island and lead to prolonged utility outages.

Other hazards also may have significant impacts but are less likely to occur, or the consequences may be more limited in duration or impact. These hazards include tsunamis, heat, drought, wildfire related hazards of smoky air and power outages, and dam breach inundation. Each of these hazards and the risks they pose to Alameda is evaluated in the plan.

Focus on Equity

Alameda recognizes that some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to lack of stable housing, financial resources, and by zoning laws that have historically disproportionately placed people of color into areas of the city more vulnerable to natural hazards. Natural disasters disproportionately impact low-income residents, people of color, the young, the old and the disabled.

Social equity is critical to promoting healthy, resilient communities. Equity is the idea that one's race, ethnicity, gender, age, disability, sexual orientation should not determine their outcomes and should not have an effect on the distribution resources, including housing, access to jobs and education, food, and environmental exposure.

By explicitly addressing the needs of most impacted populations, the City seeks to undo historic and structural racism and contribute to building a healthy and diverse community, where everyone truly belongs. Given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively to address equity not only for Alamedans but also for priority equity communities in adjacent jurisdictions such as Oakland and San Leandro. Working collaboratively with key stakeholders will help ensure more uniform protections exist for all, especially for under resourced communities, and will help establish a unified voice to expedite hazard mitigation and climate adaptation.

Climate Adaptation and Hazard Mitigation Strategy

Vision

The Plan's vision is that the City of Alameda will be better prepared for future hazards and climate impacts by reducing the impact of climate change and disasters on our community and by ensuring equitable recovery from disasters when they do occur.

Hazard Mitigation and Adaptation Goals

In addition to the vision statement, nine mitigation and adaptation goals were identified. These mitigation goals were developed in the 2016 Local Hazard Mitigation Plan (LHMP) and remain unchanged. The mitigation goals are broad statements that are achieved through implementation of the more specific mitigation actions. The mitigation goals are as follows:

- Reduce exposure to hazards where possible.
- Protect the health, safety and welfare of City of Alameda residents, workers and visitors.
- Minimize damage of public and private property.
- Minimize damage of the natural environment.
- Minimize disruption of essential services, facilities, and infrastructure.
- Timely and complete recovery.
- Increase understanding and awareness of hazards and hazard mitigation by City employees and the public.
- Participate in mitigation and resiliency by all stakeholders, as appropriate.
- Protect the City's character.

Hazard Specific Goals

The Climate Action and Resiliency Plan (CARP) identified hazard specific goals, which have been updated and adopted for this Plan. The hazard specific goals are as follows:

- **Sea level rise and storm surges:** Protect assets from sea level rise and storm surges, including community vitality and recreational opportunities, plan future land use to avoid impacts, and enhance natural shoreline habitat to mitigate impacts.
- **Inland flooding:** Increase the resiliency and capacity of the stormwater system to prevent flooding of assets during extreme precipitation events.
- **Drought:** Reduce water consumption and increase drought-resistant landscaping.
- **Extreme heat:** Reduce the heat island effect and protect vulnerable populations from heat impacts during heat waves.

- **Wildfires:** Protect public health from smoke impacts during wildfire events, especially among vulnerable populations.
- **Earthquakes:** Reduce property damage and loss of life in an earthquake, especially for areas at risk of liquefaction, and increase the ability for a timely restoration of service.
- **Tsunamis:** Reduce property damage and loss of life in a tsunami and prepare for the safe evacuation of people from the tsunami zone.
- **Effective implementation and capacity building:** Develop financial and human resources and increase transparency, community engagement, social resilience, and support for effective implementation of climate adaptation and hazard mitigation strategies.

Completed Strategies

Alameda has accomplished much towards increasing our community's disaster resilience since the development of the 2016 Plan, including:

- Constructed a new Emergency Operations Center and Fire Station #3 (Strategy I.A in 2016 Plan)
- Integrated Local Hazard Mitigation and other planning efforts and adopted CARP strategies into Local Hazard Mitigation Plan (Strategy III.C in 2016 Plan)
- Updated Health and Safety Element of the General Plan, including key features of the Local Hazard Mitigation Plan (Strategy III.F in 2016 Plan)
- Conducted study of sea level rise impacts on water table in Alameda and potential contaminant mobilization (CARP strategy)
- Adopted and implemented new air quality / smoke response protocols for City staff and employees (CARP strategy)
- Raised stormwater fees to implement Storm Drain Master Plan (CARP Strategy)
- Upgraded air filtration system and installed A/C at the West End library to serve as a Cooling and Clean Air Center (strategy not previously identified)
- Developed draft Environmental Emergency Annex to the Emergency Operations Plan (strategy not previously identified)
- Purchased two water tenders are capable of drafting (pulling) water from the bay or other static water source to fill the tank or as a constant supply to fight fires (strategy not previously identified)
- Conducted awareness campaign on tsunamis, including Tsunami Preparedness week in March and to targeted groups such as the boating community and vulnerable community members (strategy not previously identified)
- Implemented additional drought mitigation measures to reduce municipal water consumption, including Increasing composting, reducing irrigation of decorative lawns (resulting in 3.6% reduction), turned off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converting to decorative lawns at city facilities and some parks to

drought tolerant landscape, prioritizing fixing pipe leaks, converting irrigation clocks to rain sensitive clocks (resulting in 15% reduction).

- Convened the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. Sub groups are focusing on adaptation of Doolittle Drive and Northern Shoreline near Posey/Webster Tubes (CARP strategies).

Priority Climate Adaptation and Hazard Mitigation Strategies

The priority climate adaptation and hazard mitigation strategies include those from the 2016 LHMP that were selected for continuation, adaptation strategies from the Climate Action and Resiliency Plan, and new strategies identified by staff and community members. The strategies in this plan align with General Plan policies.

Buildings

- **B1. Solar Panels.** Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill.
- **B2. Water Efficiency and Conservation.** Minimize water use in new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.
- **B3. Rising Groundwater.** Prepare for the impacts of rising groundwater levels on private and public property.
- **B4. Seismic Retrofit for Private Buildings.** Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled.
- **B5. Flood Insurance.** Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community.
- **B6. Floodproofing for Existing Buildings.** Implement programs to encourage flood-proofing retrofits to existing buildings and redevelopment in flood-prone areas.
- **B7. New Development.** Require all new development to design for sea level and associated groundwater rise based on the most current regional projections.
- **B8. Building Codes for New Development.** Require new development to comply with the City's current Electrification, Fire, Seismic, and Sprinkler Codes.
- **B9. Fire Prevention in Existing Properties.** Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.
- **B10. Building and Infrastructure Standards.** Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure.

- **B11. Cool/Green Buildings.** Encourage or require the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods. These methods mitigate heat impacts and reduce runoff (green roofs) for new development and substantial redevelopment that involve roof repair/replacement. Consider prioritizing and incentivizing cool/green roofs in heat island areas.
- **B12. Sea Level Rise Protection.** Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise.

Infrastructure

- **I1. Critical Public Assets.** Continue to strengthen and rehabilitate city buildings and infrastructure, including but not limited to, city buildings, wastewater systems and pump stations, stormwater systems and pump stations, and electric systems and facilities, and the transportation system to ensure their resilience and long-term functionality.
- **I2. Water Retention.** Develop and maintain large and small areas to retain water within the city that may serve as areas of “retreat” during large storm events.
- **I3. Urban Forest.** Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects.
- **I4. Lagoons.** Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City’s green infrastructure network and flood control system.
- **I5. On-Island Generation.** Support development of on-island solar power generation and on-island wind power with appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment.
- **I6. Public Infrastructure Priorities.** Identify public transportation, open space, streets, electric systems and facilities, and stormwater and wastewater facilities, open space, shoreline assets, city owned buildings and other public assets vulnerable to sea level and groundwater rise and flooding hazards, and prioritize projects for adaptation funding.
- **I7. Green Infrastructure.** Require the use of “green infrastructure”, landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events.
- **I8. Underground Utilities.** Require new development to underground utilities to minimize disruption by fire or other natural disasters.
- **I9. Lifeline Standard Estuary Crossing.** Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event.
- **I10. Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.

Land Use

- **L1. Groundwater Rise.** Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable.
- **L2. Land Development.** Require that new development reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise.
- **L3. Resilient Rights-of-Way and Open Spaces.** Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding.
- **L4. Easements.** Require the creation and maintenance of easements along drainage ways necessary for adequate drainage of normal or increased surface runoff due to storms.

Emergency Response

- **E1. Heat and Wildfire Smoke Emergencies.** Create a network of clean air and cooling emergency shelters throughout Alameda.
- **E2. Emergency Preparedness.** Maintain emergency management and disaster preparedness as a top City priority.
- **E3. Tsunami Preparedness.** Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations.
- **E4. Emergency Coordination.** Coordinate local emergency preparedness efforts with the Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies.
- **E5. Wildfire Smoke.** Prepare for future wildfire smoke events.
- **E6. Emergency Response and Disaster Preparedness.** Preserve access for emergency response vehicles to people and property and for evacuation.

Communication, Community and Coordination

- **C1. Public Communication.** Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.
- **C2. Air Quality Alerts.** Continue to partner with BAAQMD to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents.
- **C3. Regional Partnerships.** Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies.

- **C4. Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.
- **C5. Neighborhood Resilience Coordination.** Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use.
- **C6. Social Vulnerability.** Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change.

Studies and Plans

- **S1. Adaptation Pathway Master Plan.** Develop an adaptation pathway master plan. The plan will include additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels.
- **S2. Rising Groundwater.** Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
- **S3. Flood Hazard Maps.** Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources.

Implementation and Updates

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time.

The City Manager's Office will be charged with maintaining, evaluating and updating this Plan on an annual basis within the 5-year cycle. Progress on Plan implementation will be reported to City Council at a public meeting annually, coincident with the annual report of the Climate Action and Resiliency Plan.

Per federal regulations, this plan must be updated every five years. The City Manager's Office will ensure that a complete review and update of the Plan, including the hazard analysis and mitigation strategy, is completed before the expiration of the current Plan. The plan update process will follow much the same process as followed in the 2021 update.



Chapter 1

Introduction

June 2022

Background

The City of Alameda is a low-lying island community of approximately 80,000 people in the San Francisco Bay that is highly vulnerable to inundation from rising seas and rising groundwater. Alameda is also highly vulnerable to earthquakes as a result of its older building stock and proximity to two major faults, as well as other hazards. That a disaster will strike Alameda in its future is a certainty; what is not certain is the extent to which the hazards will damage buildings and infrastructure and disrupt life for Alameda's residents and businesses. Climate change has ensured that our future will be riskier than our past. By understanding our risks and taking proactive action now to mitigate risks and reduce our greenhouse gas emissions, Alameda can be prepared for future disasters and reduce their impact.

The Alameda Climate Adaptation and Hazard Mitigation Plan (Plan) serves as an update to the 2016 Local Hazard Mitigation Plan. It aligns with and builds on adaptation chapter of the Climate Action and Resilience Plan (CARP). Some of the information contained in CARP is directly translated into this Plan, and some of it is updated and adapted for this Plan. The Plan is also aligned with the General Plan Safety Element.

The CARP identifies 12 priority flooding locations where assets or areas are exposed to flooding risk soonest and with greatest consequence. Locations with significant flooding at a total water level of 24 or 36 inches (above today's high tide) were identified as at risk of sea level rise flooding "soon." Since the CARP adoption in 2019, Alameda has developed a deeper understanding of the implications of sea level rise for our island community, global greenhouse gas emissions have continued to increase at alarming rates, and the federal government has not provided the financial and technical support that we need to meet our greenhouse gas reduction and adaptation goals. Furthermore, the city conducted a study in 2020 on emergent groundwater issues that showed sea level rise as elevating the water table, which is expected to cause more flooding, liquefaction and soil contamination issues in every neighborhood in Alameda. With six to seven feet of sea level rise expected in 80 years, 25 miles of shoreline to improve at a cost of \$10 to \$20 million per mile, and needed conveyance and storm drain pump station upgrades, the City must immediately focus on short term strategies to delay the most severe impacts of sea level rise and buy time to improve our community's understanding and capabilities to implement local and regional long term solutions for the next generation of Alamedans.

Purpose

The purpose of the Plan is to help Alameda adapt to climate change, reduce the impact of future disasters and help us recover more quickly when disasters do occur. The Plan:

- Meets the requirements established by the Federal Disaster Mitigation Act of 2000 (DMA 2000) and maintains eligibility for Federal Emergency Management Agency (FEMA) assistance grant programs, including:
 - Hazard Mitigation Grant Program (HMGP)
 - Building Resilient Infrastructure and Communities (BRIC)
 - Flood Mitigation Assistance (FMA)
- Aligns with other plans, including the CARP, General Plan and the City's Emergency Management Plan;

- Increases education and awareness of natural and climate-induced hazards and community vulnerabilities;
- Establishes a basis for coordination and collaboration among community entities such as private and public agencies, key stakeholders, and residents; and,
- Identifies and prioritizes future mitigation and adaptation projects.

Key Terms

The Plan addresses the risk the City of Alameda faces from natural and climate induced hazards and describes mitigation and adaptation actions that can be taken to reduce the risk we face and enhance the community's resilience to hazards.

Risk is the consequence of the interaction between a hazard and the characteristics that make people, and places vulnerable and exposed (UNDRR Terminology, 2017).

A **hazard** is an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss.

Exposure refers to the people, infrastructure, housing, and other assets located in hazard prone-areas.

Vulnerability is the physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

Hazard mitigation and **climate adaptation** refers to the actions taken to reduce or eliminate risk to human life and property from natural and climate change-induced hazards.

Resilience refers to the ability of a city's systems, businesses, institutions, communities, and individuals to survive, adapt, and grow no matter what kinds of acute shocks and chronic stresses they experience.

Relationship to Other Plans

The Plan is different from the Emergency Response Plan which prepares the City to respond when a disaster occurs, and may include such actions as providing emergency response, equipment, food, shelter, and medicine. However, climate adaptation and hazard mitigation planning support emergency response planning by minimizing the community disruption, loss of life, and property damage resulting from disasters.

The General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. The 2040 General Plan provides a long-term strategy for how Alameda will address climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation. As this plan must be updated every five years, it provides the near-term actions Alameda will take to achieve our long-term goals and is adopted as an appendix to the General Plan Safety Element.

The Plan lays out Alameda’s strategy for mitigating natural hazards and adapting to a changing climate. The success of this plan rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City’s Climate Action and Resiliency Plan (CARP). The goal of CARP is to reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030 and become carbon neutral soon as possible. In 2019, the City of Alameda declared a climate emergency and called for an urgent and just citywide climate mobilization effort to reverse global warming and adapt as rapidly as possible to the growing global and local effects of climate change. By taking strong actions to reduce our GHG emissions, Alameda will do our part to achieve a climate safe path and avoid some of the extreme climate effects we face. Of course, this City of Alameda cannot avert global warming on its own. It will take an immediate and concerted effort on the part of community members, businesses, other cities and counties, the state, federal government and the world to come together and reduce our global emissions. Here in Alameda, we will do our part to reduce our emissions and prepare for the impacts that we will face.

Focus on Equity

Alameda recognizes that some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to lack of stable housing, financial resources, and by zoning laws that have disproportionately places people of color and community members with the fewest resources into areas of the city that are more vulnerable to natural hazards. Natural disasters disproportionately impact low-income residents, people of color, the young, the old, and the disabled. The goal of this plan is to identify and mitigate those needs to reduce the impact of future disasters on all Alameda residents and speed recovery when disasters do occur.

Social equity is critical to promoting healthy, resilient communities. Equity is the idea that one’s race, ethnicity, gender, age, disability, sexual orientation should not determine their outcomes and should not have an effect on the distribution resources, including housing, access to jobs and education, food, and environmental exposure.

By explicitly addressing the needs of most impacted populations, the City seeks to undo historic and structural racism and contribute to building a healthy and diverse community, where everyone truly belongs.

Given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively to address equity not only for Alamedans but also for priority equity communities in adjacent jurisdictions such as Oakland and San Leandro. Working collaboratively with key stakeholders will help ensure more uniform protections exist for all, especially for under resourced communities, and will help establish a unified voice to expedite hazard mitigation and climate adaptation.

The Plan’s equity goal aligns with the Alameda 2040 General Plan equity goal to:

“...promote equity, environmental justice, and a high quality of life for everyone irrespective of income, race, gender, sexual orientation, cultural background or ability by recognizing and changing local policies, programs, ordinances, and practices that serve to perpetuate injustices suffered by under-served and underrepresented populations and proactively engaging these populations in all City decision making.”

The General Plan includes several policies designed specifically to “prioritize the needs of the most vulnerable communities when prioritizing public investments and improvements to address climate change” (General Plan, CC-2).

- **Equity.** Ensure opportunities for leadership and actions to involve and benefit Alameda’s low-income individuals, seniors, youth, people of color, unhoused, individuals with disabilities, and socio-economically disadvantaged communities from environmental and climate change impacts.
- **Environmental Justice.** Ensure the equitable treatment and full involvement of all people when considering actions to reduce the adverse impacts of climate change on residents regardless of age, culture, ethnicity, gender, race, socioeconomic status, or geographic location. Prioritize actions that will reverse historic policies of racial discrimination and exclusion.
- **Assessments.** Utilize Alameda’s Social Vulnerability Assessment in the Climate Action and Resiliency Plan or similar tool to identify neighborhoods and specific groups with high levels of social vulnerability in order to prioritize locations for action and improvements.

The CARP included a social vulnerability assessment that informed the consequences and strategies in this plan. Each strategy also includes an equity consideration to help guide equitable implementation of the strategy.

Vision Statement and Hazard Mitigation and Adaptation Goals

According to Alameda’s 2040 General Plan Safety Element to which is Plan is aligned,

“Alameda aspires to be a resilient city that is able to adapt to a changing climate and reduce the loss of life, property damage, and environmental degradation from disasters while accelerating economic recovery from those disasters. Alameda enhances community resilience by improving the buildings and infrastructure we all rely on, responding to disasters quickly and effectively, helping owners rebuild damaged buildings quickly, protecting tenants, and keeping businesses open during recovery.”

Vision

The Plan’s vision is that the City of Alameda will be better prepared for future hazards and climate impacts by reducing the impact of climate change and disasters on our community and by ensuring equitable recovery from disasters when they do occur.

Hazard Mitigation and Adaptation Goals

In addition to the vision statement, nine mitigation and adaptation goals were identified. These mitigation goals were developed in the 2016 Local Hazard Mitigation Plan (LHMP) and remain unchanged. The mitigation goals are broad statements that are achieved through implementation of the more specific mitigation actions. The mitigation goals are as follows:

- Reduce exposure to hazards, where possible.

- Protect the health, safety, and welfare of City of Alameda residents, workers, and visitors.
- Minimize damage of public and private property.
- Minimize damage of the natural environment.
- Minimize disruption of essential services, facilities, and infrastructure.
- Ensure timely and complete recovery.
- Increase understanding and awareness of hazards and hazard mitigation by City employees and the public.
- Participate in mitigation and resiliency by all stakeholders, as appropriate.
- Protect the City's physical and social character and diversity.

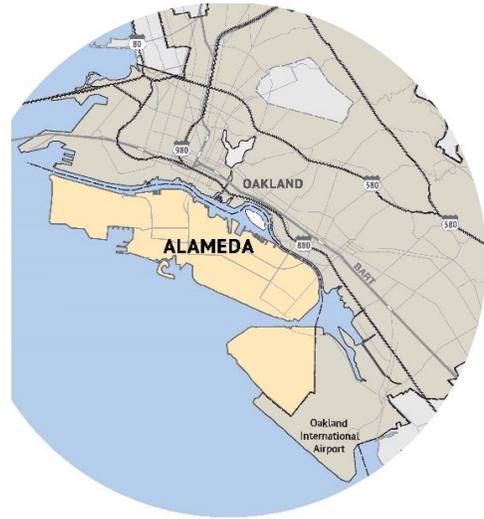
Hazard Specific Goals

The Climate Action and Resiliency Plan (CARP) identified hazard specific goals, which have also been updated and adopted for this Plan. The hazard specific goals are as follows:

- **Sea level rise and storm surges:** Protect assets from sea level rise and storm surges, including community vitality and recreational opportunities, plan future land use to avoid impacts, and enhance natural shoreline habitat to mitigate impacts.
- **Inland flooding:** Increase the resilience and capacity of the stormwater system to prevent flooding of assets during extreme precipitation events.
- **Drought:** Reduce water consumption and increase drought-resistant landscaping.
- **Extreme heat:** Reduce the heat island effect and protect vulnerable populations from heat impacts during heat waves.
- **Wildfires:** Protect public health from smoke impacts during wildfire events, especially among vulnerable populations.
- **Earthquakes:** Minimize loss of life, community disruption, and property damage in an earthquake, especially for areas at risk of liquefaction, and prepare for a timely and equitable restoration of community functionality.
- **Tsunamis:** Reduce property damage and loss of life in a tsunami and prepare for the safe evacuation of people from the tsunami zone.
- **Effective implementation and capacity building:** Develop financial and human resources and increase transparency, community engagement, social resilience, and support for effective implementation of climate adaptation and hazard mitigation strategies.

The History of Alameda

The City of Alameda, located seven miles east of San Francisco and just west of Oakland, is made up of Alameda Island and Bay Farm Island. The City includes 10.61 square miles of land. Alameda is a charter city founded in 1854 and incorporated in 1872. The City of Alameda provides a full range of municipal services, including public safety, public works, community development, and community services. The City also provides electric utility services through Alameda Municipal Power.



At the time of the arrival of the Spanish, Alameda was a peninsula of land covered by a dense forest of coastal live oak and inhabited by the Confederated Villages of Lisjan, an Ohlone people who spoke Chochoeny and sustained themselves through hunting, fishing and gathering. Settlement of Alameda by Europeans and other non-natives began in 1820, when Luis Peralta divided Rancho San Antonio among his four sons. Alameda derived its original name, “the Encinal,” from the large stands of native oaks (“encino” means “oak” in Spanish) on the Main Island. The name “Alameda,” meaning “grove of poplar trees,” was given to the City as a poetic gesture upon popular vote in 1853.

In 1849, the California Gold Rush brought Americans and Northern Europeans to the San Francisco Bay. Many made their fortunes in supplying goods and services to the region’s burgeoning population. Among these were two young entrepreneurs, William Worthington Chipman and Gideon Aughinbaugh, who purchased the Encinal from Antonio Maria Peralta for \$14,000 in 1851, the year after California became a state. They subdivided the land and sold tracts for residences and orchards. By 1872, three separate settlements, the Town of Alameda, Encinal, and Woodstock, were established in the east, central and western sections of the peninsula. The Town of Alameda was granted a charter by the State Legislature in 1854; incorporation of all peninsula settlements under one local government occurred in 1872.

Early growth of residential, commercial and industrial areas depended upon water and rail transportation and an excellent climate. The City’s industrial waterfront and small commercial districts (“the stations”) were developed in conjunction with rail improvements, while neighborhoods of Victorian homes and beach resorts were built attracting tens of thousands of weekend visitors. Major shipyards and Neptune Beach (the “Coney Island of the West”) were established along the northern and southern shores to take advantage of the island’s coastal assets. In 1902, the Tidal Canal was completed and Alameda became an island.

In the decades between 1920 and 1970 the City witnessed cycles of boom and bust. Following an enlightened era of civic building during the 1920s, Alameda endured difficult years of political scandal and corruption through the 1930s. The entry of the United States into World War II focused the City’s attention on the war effort. During World War II, shifts ran around the clock at the Alameda Naval Air Station (commissioned in 1940) and in the City’s shipyards. The City’s population reached an all-time high of 89,000

By 1973 concern about replacement of Victorian homes by boxy apartment buildings and the prospect of all-apartment development on Bay Farm Island led to passage of initiative Measure A, which prohibits residential structures having more than two units. Despite this restriction, an average of 300 homes per

year were built between 1970 and 1990, mainly on Bay Farm Island. Bay Area growth pressure has facilitated redevelopment of unused shipyards on the Northern Waterfront as business park, homes, and marinas. The City is currently redeveloping the former Alameda Naval Air Station into mixed use residential, commercial, and industrial use called Alameda Point. Master planning and environmental documents that were developed in 2014 envision a cumulative build out by 2035 of 1,425 housing units and 5.5 million square feet of office, retail and manufacturing, with a significant portion of the buildout during the first 10 years (by 2025).¹

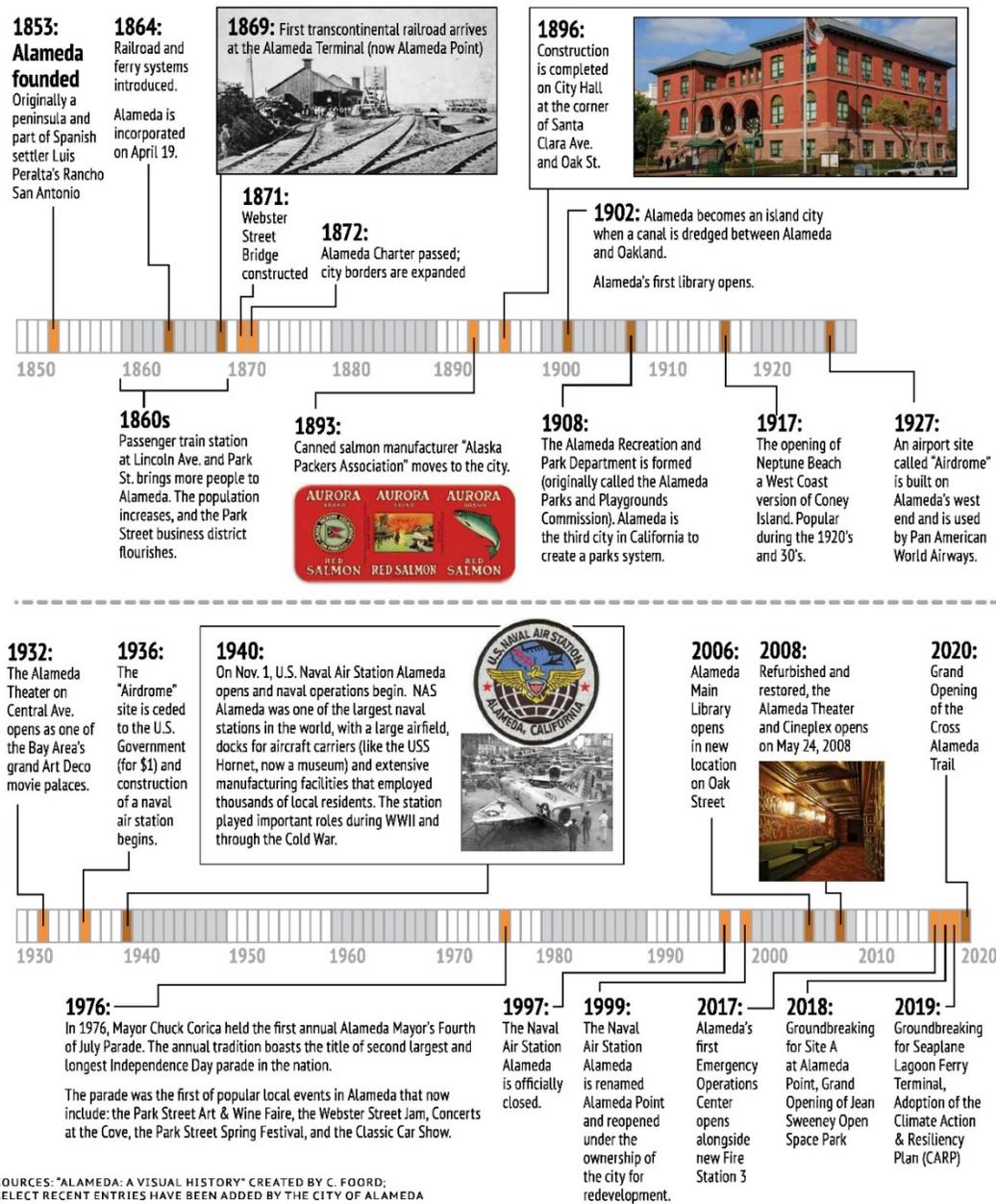


Figure 1-1 Timeline of Alameda History

¹ Alameda Point Transportation Demand Management Plan, 2014

What Has Changed Since the Last Plan

Since the 2016 Local Hazard Mitigation Plan was adopted, several significant things have occurred. Alameda has updated its General Plan, which includes a Safety Element and new Conservation and Climate Change Element. Alameda also adopted a Climate Action and Resiliency Plan (CARP) in 2019, which laid out the first comprehensive strategy for the city to adapt to the effects of climate change. In 2020, [The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise in Alameda](#) report was published which provided additional information about the issue of rising groundwater and soil contamination associated with sea level rise.

In light of these developments, the Plan was significantly revised and reorganized to better meet the needs of Alameda today and to align with the updated General Plan and CARP. The Plan more fully considers climate change impacts and serves as an update to the adaptation chapter in CARP.

The Plan considers two new hazards:

- Wildfire-related hazards we now regularly face of smoky air and power shut-offs
- Dam failure hazard resulting from the very unlikely failure of Chabot and New Upper San Leandro Dams.

In light of recent hazard events and climatic changes, significant updates were also made regarding the hazards of drought, heat, and the future flooding assessment, which were incorporated from CARP. The flooding section also includes more detailed information about the hazard of groundwater rise, as well as associated strategies to address the issue.

Detailed risk assessments were developed for the two most significant hazards facing Alameda: flooding and earthquakes. These risk assessments can be found in **Appendix E and F**.

The plan also has a focus on equity as a priority and includes equity considerations for the mitigation and adaptation strategies.

Scope and Content

The Climate Adaptation and Hazard Mitigation Plan presents recommendations and strategies for implementing climate change adaptation and mitigation actions in Alameda. **Chapter 2** describes the process used to update the plan. **Chapter 3** describes the assets within Alameda, including the people, economy, buildings, and infrastructure at risk in natural disasters. **Chapter 4** describes the hazards we face and consequences of those hazards for Alameda. **Chapter 5** describes the actions the City will take to reduce our risk from natural and climate-related hazards. Finally, **Chapter 6** describes how the City will implement and maintain the Plan over time. Appendices provide additional detail and supporting information for the Plan's chapters.



CHAPTER 2

How We Developed the Plan

June 2022

Plan Development Process

Key steps in the Plan development process included the following steps:

- Step 1: Review previous plan and new information.
- Step 2: Scope and organize the Planning Team.
- Step 3: Identify assets and assess hazards.
- Step 4: Conduct risk assessment and analysis.
- Step 5: Develop and prioritize hazard mitigation and adaptation strategies.
- Step 6: Conduct stakeholder engagement and community outreach.
- Step 7: Draft and finalize the plan. The City developed a draft Plan, which was revised to incorporate community input during the review process in Step 6, and then produced a final Plan.

Incorporation of Existing Plans, Studies, Reports, and Technical Information

The plan update included the review and incorporation of existing plans, studies, reports, and technical information to inform the hazard and risk assessment and development of strategies.

- **City of Alameda 2040 General Plan (2021).** The General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. California State law requires that every city adopt and maintain an up to date, internally consistent general plan. The City's current General Plan has not been comprehensively updated since 1990, and many new and important challenges are facing the Alameda community. The draft General Plan addresses climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation.
- **Plan Bay Area 2050 (2021).** Plan Bay Area 2050 focuses on four key issues: the economy, the environment, housing and transportation. This new regional plan outlines strategies for growth and investment through the year 2050, while simultaneously striving to meet and exceed federal and state requirements. The plan will identify a path to make the Bay Area more equitable for all residents and more resilient in the face of unexpected challenges. The Metropolitan Transportation Commission and the Association of Bay Area Governments are expected to adopt Plan Bay Area 2050 in fall 2021.
- **The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise (2020).** The study developed an estimate of the existing groundwater surface and analyzed the response of the shallow groundwater table to a suite of sea level rise scenarios. Areas with emergent groundwater flooding and existing contaminant concentrations above human health benchmarks were identified as potential areas of concern.
- **Climate Action and Resiliency Plan (2019):** The Climate Action and Resiliency Plan is a long-term plan to reduce Alameda's Greenhouse Gas emissions that cause climate change

through equitable improvements to transportation, buildings, energy use, and waste management and adapt to the impacts of climate change, such as rising seas and increasing extreme heat and smoke days.

- **USGS HayWired Scenario (2018).** The HayWired project models the impacts on housing, infrastructure, the economy and community in the San Francisco Bay area from a magnitude 7 earthquake and associated aftershocks on the Hayward Fault.
- **BCDC Adaptation to Rising Tides, Oakland-Alameda Resilience Study (2016).** The Oakland-Alameda Resilience Study assessed resilience of the Oakland International Airport, the Oakland Coliseum, the East Oakland neighborhoods around the Coliseum and Bay Farm Island. The project included an assessment of vulnerabilities, risks and mitigation opportunities for multiple hazards – earthquakes, sea level rise, and flooding – that threaten the people, facilities, infrastructure, and community services. The study was led by the Adapting to Rising Tides (ART) Program and conducted in partnership with the Association of Bay Area Governments Resilience Program
- **ABAG Stronger Housing Safer Communities (2015).** The project was designed to better understand the challenges Bay Area housing and communities face from earthquakes. The project engaged local stakeholders and topical experts to identify the housing and communities that are particularly vulnerable, and to develop locally relevant strategies to address the specific vulnerabilities and consequences identified. The project was led by the ART Program and the Association of Bay Area Governments (ABAG) Resilience Program
- **BCDC Adapting to Rising Tides, Alameda County Vulnerability and Risk Report (2012).** The project assessed the vulnerability and risk to the Alameda County shoreline and community resources from sea level rise and storm events. The project led to strategies to help communicate and resolve these complex issues, as well as processes to integrate adaptation into local and regional planning and decision-making. The project was led by the ART Program.

Stakeholder Engagement and Community Outreach

An open public involvement process is essential to the development of an effective plan. As demonstrated below, community members were provided multiple opportunities for public comment on the plan during the drafting stage and prior to plan approval. In addition, the City also engaged neighboring communities and jurisdictions on the plan development. Comments received during the public engagement phase were incorporated into the final plan.

Green Team

The City's Green Team meets monthly and is comprised of department heads and oversees implementation of the Climate Action and Resiliency Plan (CARP) and ensures that key milestones are met. The Green Team served as the Executive Review Team for this effort to ensure the effort was aligned with CARP implementation priorities.

Planning Team

The City convened an interdepartmental planning team to guide development of the Plan and met between May and October 2021. The planning team met monthly throughout the plan development process to oversee and guide the Plan update process. The planning team was specifically responsible for:

- Developing and participating in community and key partner engagement strategy
- Providing updates to plan sections as needed
- Reviewing and providing input on draft plan
- Identifying new mitigation strategies (goals, actions, prioritization of actions, implementation plan)
- Ensuring integration with other citywide plans (two-way exchange)

Agendas for the planning team meetings and a list of participants are included in **Appendix A**.

Community Engagement

Website

The planning team established a dedicated webpage for the plan update on the City website. The site can be found at: <https://www.alamedaca.gov/hazardmitigationplan>.

Social Media

The community survey, virtual open houses and draft plan were promoted on the city's Facebook account on July 22 and September 9 and reshared on several other community Facebook accounts. The City's Facebook account has over 12,000 followers. The community survey was also promoted on the Recreation and Parks Department Facebook page on July 21. The page has over 3,000 followers.

Community Survey

In July 2021, a community survey was shared to provide the opportunity for community members to identify their natural hazards of concern and actions that they have taken to prepare for natural hazards. A link to the survey was included on the city's website and was shared via the city's social media account and the Parks Department's social media. An invitation to complete the survey was also included in a Parks Department newsletter in July. The Alameda Real Estate Association included a link to the survey in its August newsletter. Postcards with a link to the survey and information about the virtual open houses were also printed and distributed to each of the branch libraries and in city hall (finance office, passport office and permit desk) to make them available to members of the public. CASA members placed flyers on doorsteps on residents in the neighborhood around Woodstock Park the weekend of September 11-12, 2021, a neighborhood that contains socially vulnerable populations and is exposed to a number of hazards.

657 responses were received to the community survey between July 9, 2021 and October 12, 2021. The survey responses were reviewed and analyzed for incorporation into the draft plan. A copy of the survey questions is included in **Appendix B**. Of all the listed hazards, survey respondents were most concerned with earthquakes, sea level rise and impacts from wildfires with 66% of respondents concerned about one of these hazards. Respondents who selected "Other" were concerned about evacuation off the island in

the event of disaster, water supply, transportation infrastructure damage impacting disaster relief response post disaster, and concerns about hazardous waste and toxins underground. A summary of hazard responses is shown in **Figure 2-1**.

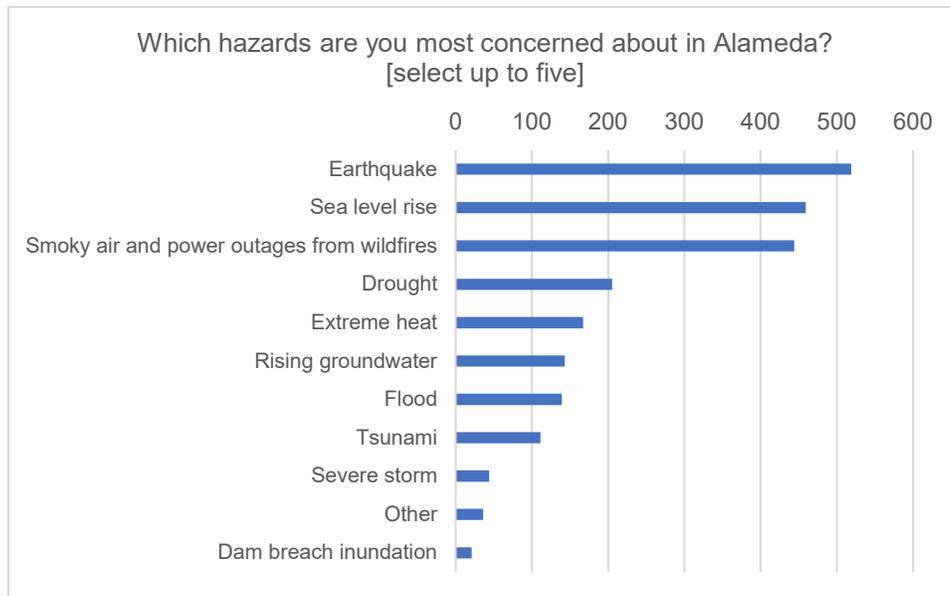


Figure 2-1 Hazards of Greatest Concern to Survey Respondents

As shown in **Figure 2-2**, more than 50% of the survey respondents feel that they and their households are “somewhat prepared” for disasters. About 10% of survey respondents feel “very prepared” or “extremely prepared” for disasters while over 30% of survey respondents do not feel at all prepared for disasters.

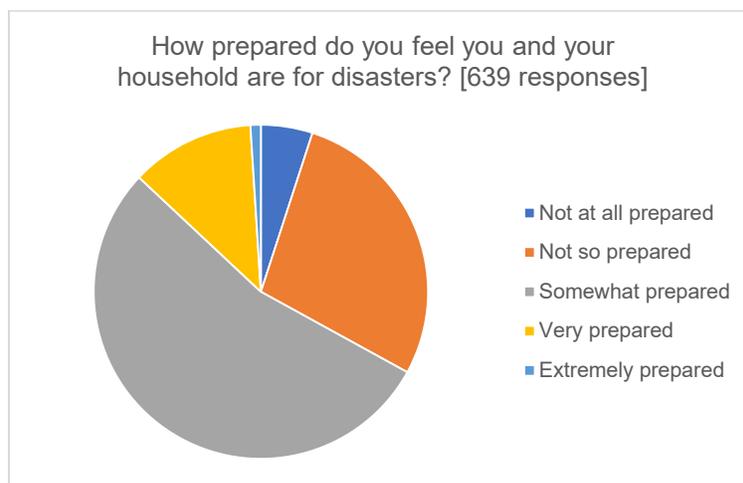


Figure 2-2 How Prepared Are Survey Respondents for Disasters in Alameda

As shown in **Figure 2-3**, of the listed actions that survey respondents can take to prepare for disasters, more than 68% of respondents have stored three days of emergency food and water and more than 60% have braced their water heater. A majority of respondents have installed gas shut-off valves on their home, secured heavy furniture to the wall or purchased earthquake insurance. A few respondents have

moved brick chimneys or taken flood proofing measures for their home. Twenty-five respondents have taken none of the listed actions.

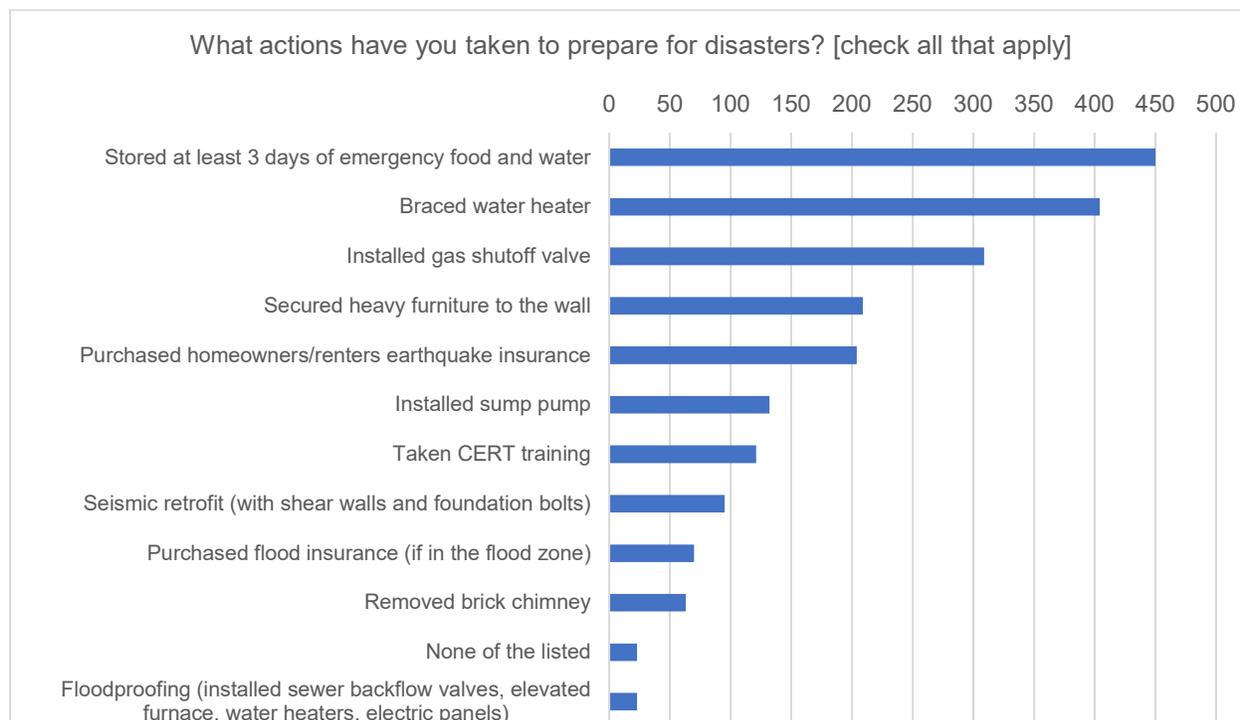


Figure 2-3 Actions Respondents Have Taken to Prepare for Disasters

As shown in **Figure 2-4**, while a large majority of the respondents were Alameda residents, a few respondents don't live but work or shop and dine in Alameda. Of those that live in Alameda, about 20% each live in Bay Farm, West End, Central, and East End. About 10% live in Southshore and 1% live in Alameda Point.

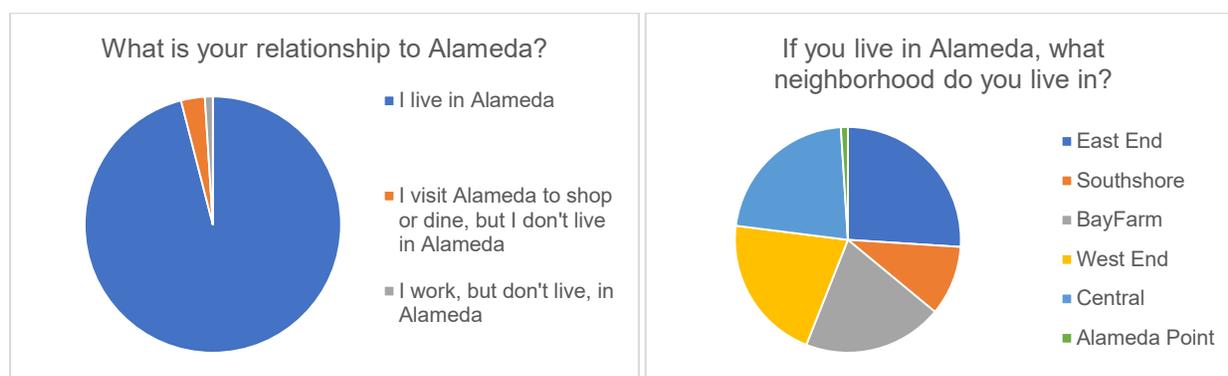


Figure 2-4 Respondents' Relationship to Alameda

As shown in **Figure 2-5**, 22% of survey respondents rent their homes and 78% own their homes, compared to the City as a whole which is about 52% renters and 48% homeowners.¹

¹ [Quick Facts Alameda city, California](#), U.S. Census Bureau

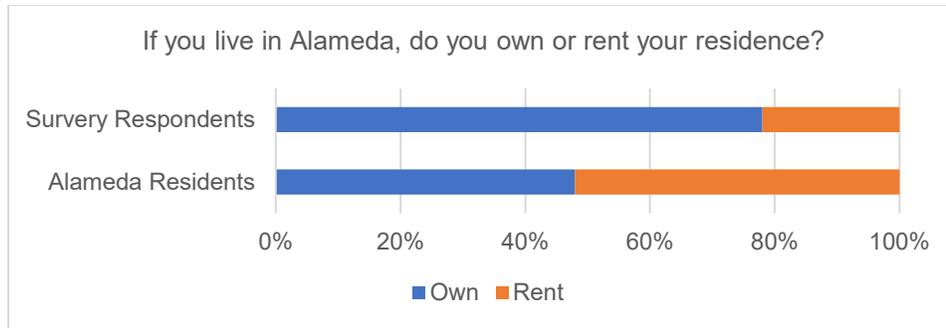


Figure 2-5 Respondents Who Own or Rent Their Homes Compared to Residents Citywide

The survey respondents are over-represented by individuals that identify as White or Mixed compared to Alameda residents over all. Alternatively, there is under representation from Asians, Hispanics or Latinos, Black or African American, American Indian or Alaskan Native and Native Hawaiian or other Pacific Islander as compared to Alameda residents overall.²

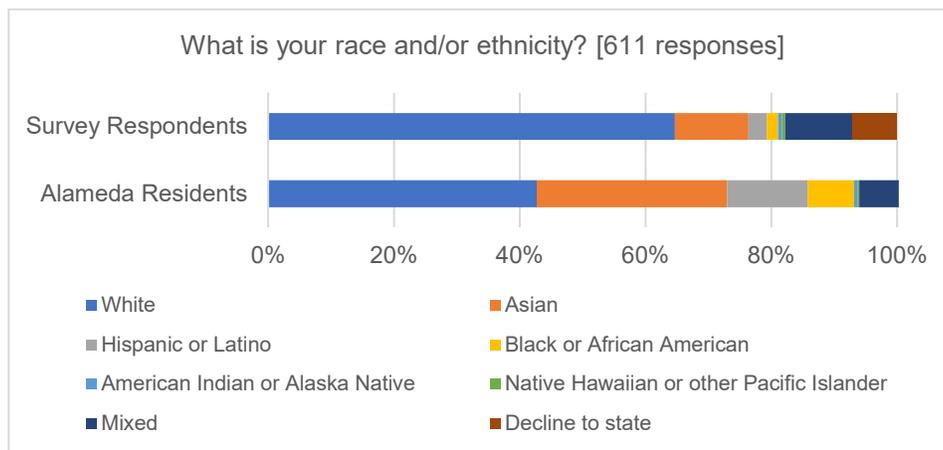


Figure 2-6 Race and/or Ethnicity of Survey Respondents Compared to Residents Citywide

Emails

Survey respondents were asked to provide their email address to receive updates on the Plan and an email list sign up was also created on the Plan website. The email list was used to advertise the community survey, dates for the virtual open houses, board and commission meetings, and to share a link to the draft plan for public comment.

Emails were sent on September 9, 16, 27 and October 28, 2021 to survey respondents and newsletter registrants notifying them that the draft plan was posted and dates of virtual open houses and board and commission meetings. The Recreation and Parks Department also sent an email to their listserv on July 21, 2021. Copies of the emails are included in **Appendix B**.

² [Quick Facts Alameda city, California](#), U.S. Census Bureau

Virtual Open Houses

Virtual open houses for the community we conducted to provide input on the draft plan on the following dates:

- Thursday, September 16, 2021, 6-7 pm
- Wednesday, September 22, 2021, 12-1 pm
- Tuesday, September 28, 2021, 7-8 pm

A copy of the presentation used for these community meetings is provided in **Appendix B**.

Farmers' Market

City staff tabled at the farmers' market on October 19, 2021 from 8:30-12:30pm. Staff displayed posters showing the earthquake and sea level rise risk to Alameda and provided handouts in English, Chinese and Spanish describing how residents could prepare their homes and families for natural disasters. One staff member present was fluent in Mandarin and Cantonese. During the event, staff had conversations with 33 individuals and a group of 45 school children. Copies of the flyers provided at the farmers' market are provided in **Appendix B**.

Newspaper Articles

Staff published a newspaper article in the Alameda Journal providing an overview of the draft plan in Alameda's local newspaper on November 19, 2021. A copy of the article is included in **Appendix B**.

Incorporation of Public Comment

Responses from the community survey were considered in the development of the draft plan and helped inform the prioritization of hazards in the plan. Comments on the draft plan were received by email or verbally during public comments at board and commission meetings and from virtual open houses and were documented and incorporated into the final plan. For example, as a result of comments received, staff provided additional definitions in the Key Terms section, enhanced the discussion of how persons with disabilities will be impacted by hazards, additional language was added to the Introduction framing the plan relative to the climate challenges we face and what it will take for us to tackle it, and strategies were added and/or enhanced.

Key Partner and Neighboring Jurisdiction Outreach

Key partners and neighboring jurisdictions were invited to comment on the draft plan during the public review period by emails to staff and through announcements at San Leandro/Oakland-Alameda Estuary Adaptation Working Group meetings, as well as through emails to the membership of that group. Specific agencies with mitigation strategies in the plan were also contacted by email during the drafting of the plan to provide input to the plan. In addition, the Alameda Housing Authority and Alameda Unified School District were invited to participate in the planning process. Agencies that were contacted during the development of the Plan include:

- Alameda County
- Alameda Housing Authority
- Alameda Unified School District

- Association of Bay Area Governments (ABAG)
- BART
- Bay Conservation Development Commission (BCDC)
- Caltrans
- East Bay Regional Parks District
- EBMUD
- City of Oakland
- City of San Leandro
- City of San Francisco
- Metropolitan Transportation Commission (MTC)
- PG&E
- Port of Oakland

Boards and Commissions

The draft plan was presented at publicly noticed meetings of the following boards and commissions:

- Planning Board, September 27, 2021
- Commission on Persons with Disabilities, October 13, 2021
- Public Utility Board, October 25, 2021
- Transportation Commission, October 27, 2021
- Social Service and Human Relations Board, October 28, 2021
- Alameda Collaborative for Children, Youth and their Families, October 28, 2021
- Historical Advisory Board, November 4, 2021

An example staff report and presentation used for board and commission meetings can be found in **Appendix B**.

Plan Approval and Adoption Process

Staff will follow the following process for approval and adoption of the Climate Adaptation and Hazard Mitigation Plan:

- The final draft Plan incorporating public comments will be submitted to CalOES for initial review.
- Following CalOES determination that the planning requirements have been met and the Plan is ready to be approved, the Plan was forwarded to FEMA for review and approval.

- Staff reviewed and updated the General Plan Safety Element and Climate Conservation Element as necessary for consistency with the Climate Adaptation and Hazard Mitigation Plan.
- Following FEMA's determination that the Plan is "Approvable, Pending Adoption", staff will present the final Plan to City Council for adoption by resolution. The resolution will also incorporate the plan into the General Plan Safety Element for compliance with AB 2140. Council will also adopt the associated amendments to the General Plan.



CHAPTER 3

Asset Inventory

June 2022

This chapter describes the assets within Alameda, including the people, economy, buildings, and infrastructure at risk in natural disasters. A detailed asset inventory is provided **Appendix D**.

The People of Alameda

In 2020, Alameda’s population was approximately 79,000 with a diverse array of businesses employing an estimated 25,000 people. Alameda’s population at 89,000 with the commissioning of the Alameda Naval Air Station (NAS) in 1940 declined rapidly following its closure in 1997; however, the City has seen slight growth (2.1 percent) since 2000. This is partly due to residential growth in the former military installations, as well as in the formerly industrial Northern Waterfront; this growth is expected to continue in the coming decade.

The Association of Bay Area Governments projects that the San Francisco Bay Area will add 2.1 million new residents by 2040.¹ Alameda’s population is projected to reach 92,000 by 2040. To meet that demand, the City of Alameda will add 10,000 to 12,000 new housing units over the next 20 years.² Alameda’s projected population increase will result largely from residential development in industrial areas and former military installations, which are susceptible to liquefaction and coastal flooding. New housing development is planned at Alameda Point and Alameda Landing, and along the Northern Waterfront with mitigations planned to account for coastal hazards. These areas are designated as priority development areas in the regional plan, Plan Bay Area. Both areas are also subject to sea level rise, liquefaction in earthquakes and tsunamis. Additional housing opportunities exist for accessory units and additional units on existing residential properties, and along the Park Street and Webster Street commercial corridors and the community’s several shopping center sites. All new infrastructure in these areas are built to modern day standards. A Master Infrastructure Plan was completed for Alameda Point in December 2014 that addresses flood protection and site grading with extensive consideration given to projected sea level rise.

Age Characteristics

Alameda’s population is becoming older over time – see Table 3-1. As with many communities in the county and across the nation, there has been an increase in the percentage of community members over the age of 55, while the percentage of children is declining and especially with the pandemic. This shift toward an older population is important in planning for future disasters, as seniors may have more difficulty preparing for disasters and may need additional assistance when a disaster occurs.

Table 3-1 Population Age Distribution, 2000–2019

Age Group	Alameda Population		
	2000	2010	2019
Under 15	18.0%	17.1%	17.4%
15 – 19	5.5%	5.7%	4.9%
20 – 34	20.4%	18.3%	20.3%
35 – 54	34.0%	31.7%	27.9%

¹ <http://projections.planbayarea.org/>

² Alameda 2040 General Plan

55 – 64	8.8%	13.8%	12.7%
65 +	13.3%	13.5%	16.9%
Total	100.0%	100.0%	100.0%

Sources: 2000 and 2010 Census, 2019 American Community Survey

Race and Ethnicity

Alameda has a diverse population and has become more diverse over the last two decades. The non-Hispanic white population declined 9 percent from 2000 to 2019. At the same time, the Asian population grew 4 percent since 2000. American Indian and Pacific Islanders decreased and the Hispanic population (of every race) grew by 2 percent.

Table 3-2 Race and Ethnicity Distribution, 2000–2019

Race and Ethnicity	Alameda Population		
	2000	2010	2019
White alone	56.9%	50.8%	48.2%
Black or African American alone	6.2%	6.4%	7.4%
American Indian or Alaska Native alone	0.7%	0.6%	0.5%
Asian alone	26.1%	31.2%	30.3%
Native Hawaiian or other Pacific Islander alone	0.6%	0.5%	0.3%
Some other race alone	3.3%	3.3%	5.1%
Two or more races	6.1%	7.1%	8.2%
<i>Total</i>	<i>100.0%</i>	<i>100.0%</i>	<i>100.0%</i>
Hispanic (of any race)	9.3%	11.0%	11.5%

Sources: 2000 and 2010 Census, 2019 American Community Survey

Household Composition

The City of Alameda had 30,418 total households.³ 9,401 households have children under 18 in the home and 8,734 households have members over 65. Alameda has an average 2.54 people per household. 34.9% of residents over 5 years old speak a language other than English at home. 5.9% of Alameda residents under 65 are living with a disability. These residents may have additional challenges responding to a disaster.

Income and Employment

Alameda's per capita income is \$52,448 and 66.9% of residents over 16 years old are in the labor force.⁴ According to the ACS, the median household income in 2019 was \$109,545, which is significantly higher

³ U.S. Census Bureau, American Community Survey, 2015-2019

⁴ U.S. Census Bureau, American Community Survey, 2015-2019

than both the county (\$99,406). As shown in **Table 3-3**, more than one-third of the households in Alameda are categorized as lower income.

Table 3-3 Households by Income Level, 2017

Income Level	Renter Occupied		Owner Occupied		Total	
	No.	%	No.	%	No.	%
Extremely Low Income ≤30% of AMI	3,440	11.2%	985	3.2%	4,425	14.5%
Very Low Income >30 to ≤50% of AMI	1,540	5.0%	820	2.7%	2,360	7.7%
Low Income >50 to ≤80% of AMI	2,170	7.1%	1,305	4.3%	3,475	11.4%
Moderate >80 to ≤100% of AMI	1,960	6.4%	1,055	3.4%	3,015	9.9%
Above Moderate >100%+ of AMI	7,085	23.2%	10,225	33.4%	17,310	56.6%
Total	16,195	53.0%	14,390	47.0%	30,585	100.00%

Source: [CHAS 2013–2017 ACS](#)

The US Department of Housing and Urban Development’s (HUD) 2017 Comprehensive Housing Affordability Strategy (CHAS) data set provides information on households by income group for the City of Alameda. According to the CHAS data, in 2017, approximately 4,425 households (14.5 percent of total households) in the City of Alameda were extremely low income. Of those households, 3.2% percent were owner-occupied and 11.2 percent were renter-occupied households (see **Table 3-3** above).

Forty four percent of all renters and 28 percent of all homeowners in Alameda are housing burdened, meaning they spend more than 30 percent of their income on housing costs.⁵ 20% of renters and 10% of homeowners spend more than 50 percent of their income on housing costs. Low-income, Black and Latinx, Native American and female renters are more likely to be rent burdened. Black and Latinx homeowners are also more likely to be rent burdened.

⁵ Bay Area Equity Atlas, <https://bayareaequityatlas.org/>

Social Vulnerability Assessment

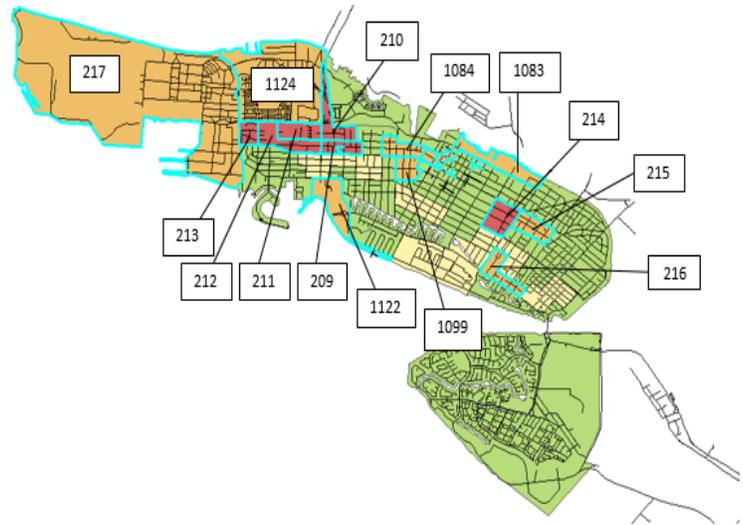
As Alameda prioritizes and implements adaptation actions, the City must continue to consider how vulnerable populations may be disproportionately impacted and ensure that residents with the fewest resources to protect themselves are given the support they need.

To guide strategy development, Alameda’s Climate Action and Resiliency Plan examined social factors affecting Alamedans’ ability to respond to climate threats like extreme heat and wildfire smoke. The results are documented in a SVA included in its entirety in **Appendix G** of the CARP. Building on previous work by the ART Program and ABAG, the SVA used 10 indicators of social vulnerability based on census household data:

- Transit-dependent (no personal vehicle);
- Renters;
- Severe housing cost burden;
- Residents under 5;
- Residents over 65 living alone;
- Disabled;
- Single-parent households;
- No high school degree;
- Very low-income;
- Communities of color;
- Limited English proficiency; and
- Not U.S. citizens.

Figure 3-1 presents the number of social vulnerability indicators that are within the 70th or 90th percentile when compared against the rest of the Bay Area for each of the 57 census block groups in Alameda (with high and highest vulnerability block groups outlined in blue and labeled by block group number). See **Table G-3** in **Appendix G** of CARP for a description of each individual block group and its bordering streets. Key takeaways from the SVA include the following:

- Households with multiple indicators face unique challenges and exacerbated vulnerabilities. For example, an individual who is low-income and a renter may have fewer options to invest in flood-proofing their home and may struggle to replace possessions damaged in a flood. Considering the causes and effects of compounded vulnerability is crucial for developing effective resilience strategies.
- Most of the neighborhoods prone to flooding in the near term are among the 14 most socially vulnerable block groups identified.



Social Vulnerability Level		Number of Indicators
Highest		8 or more in the 70 th percentile 6 or more in the 90 th percentile
High		6-7 in the 70 th percentile 4-5 in the 90 th percentile
Moderate		4-5 in the 70 th percentile 3 in the 90 th percentile
Low		Does not meet any of the above criteria

Figure 3-1. Social vulnerability index for City of Alameda.

- All 14 of the most vulnerable block groups have a high rate of transit dependence, and 12 of those 14 have a large proportion of low-income households. Building resilience can result in increased tax burden, which could be particularly harmful for low-income residents.
- A significant population of households speak English “less than very well”; almost half of these households primarily speak Chinese.
- It is important to not only create programs and services for climate resilience, but also to ensure that residents know about them, trust them, and know how to use them. For example, for a wildfire smoke communications service to be effective, it must be available in multiple languages, provided through a variety of relevant media, and delivered in a user-friendly format.
- The SVA informed both the vulnerability assessment and the recommended strategies to address those vulnerabilities.

Alameda Economy

Employment

Just as with population growth, employment history has been turbulent in Alameda over the past decades. Jobs decreased in the 1990s as the result of the NAS and FISC closures and declined again between 2000 and 2010 as result of the nationwide economic recession. Job growth is expected to rise in the decades ahead in Alameda with the redevelopment of the former NAS and the Northern Waterfront. Currently, the largest private employers in Alameda include Penumbra Inc., Abbott Diabetes Care, Exelixis Inc., Alameda Hospital, Bay Ship and Yacht, and Safeway Stores. The largest employment industries are restaurants and drinking establishments; media, computer technology & professional services; maritime industries; and life sciences & alternative energy. **Table 3-4** shows current and projected jobs for Alameda and Alameda County; however, these projections do not consider experienced and expected economic shifts as a result of the coronavirus pandemic.

Table 3-4 Historic and Projected Employment, 2010–2040

Year	Alameda		Alameda County	
	Total Employment	% Change	Total Employment	% Change
2010	29,265	--	705,540	--
2020	38,905	32.9%	858,685	21.7%
2030	41,730	7.3%	901,080	4.9%
2040	42,420	1.7%	952,940	5.8%

Source: ABAG Projections 2018

The City continues to grow, as industrial and former military lands are turned into residential housing, and as densities increase in already built out area. Rents and housing prices continue to rise as tech workers from Silicon Valley, San Francisco, and the San Mateo Peninsula are priced out of the housing markets there. The short-term effect is the decreased resiliency of residents who must spend more of their disposable income on housing, and less on disaster preparation and recovery. The likely long-term

effects will be a shift to a more affluent population, and the loss of retirees, people with disabilities, families with young children, and more diverse populations.

With the coronavirus pandemic, Alameda's economy, along with the entire world, has changed significantly. Many businesses were forced to close or change drastically to respond to public health restrictions. Many workers were laid off, but some sectors of the economy continued to do very well, especially in the highly skilled knowledge sectors. Deep inequities in the economy were exposed during the pandemic, as those without access to internet or unable work from home experienced significantly more economic hardship than those who were more easily able to work remotely. At the time of this writing, it is still too early to tell what exactly the economy of the future will look like, however Alameda seeks to strengthen and diversify our business community and economy, encouraging a broad range of businesses to provide for the needs of Alamedans on the island, promoting and enhancing our two main commercial streets, and increasing on-island employment opportunities (General Plan Land Use Element *draft*, 2021). Alameda seeks to actively break down barriers to full and meaningful employment for historically marginalized populations, such as youth, senior, people with disabilities, formerly incarcerated residents and those with limited English proficiency. Making the economy work for everyone will create a more resilient community that is better able to respond to disruptions such as natural disasters and enhance quality of life for all members of the community.

Buildings

Alameda's building stock contains a wide range of building types, ages and uses that house and serve the residents and businesses of Alameda. According to Assessor's Parcel Data (date), the City of Alameda contains 18,868 buildings, ranging in age from the mid 1800's to present. The majority of Alameda's buildings are privately owned, but the city and other public agencies own and maintain many buildings critical to the functioning of the community. Many of Alameda's buildings are vulnerable to flooding from sea level rise, storm surge, and major rainfall events, primarily due to access issues created by flood events and the resulting inability to provide services. Alameda's mild climate combined with its older building stock means that many buildings are not properly weatherized and can be uncomfortable in very cold or hot days and older buildings are also not designed to protect occupants from the effects of poor air quality. Many of Alameda's older buildings are also vulnerable to damage in earthquakes, particularly buildings with cripple walls, soft-stories, unreinforced masonry buildings, nonductile concrete buildings, and tilt ups. Even most newly constructed buildings built to code are designed to protect the safety of the occupants inside, but not necessarily to be reused following a major earthquake. These building types and their vulnerability to earthquakes is described in more detail in **Appendix E**.

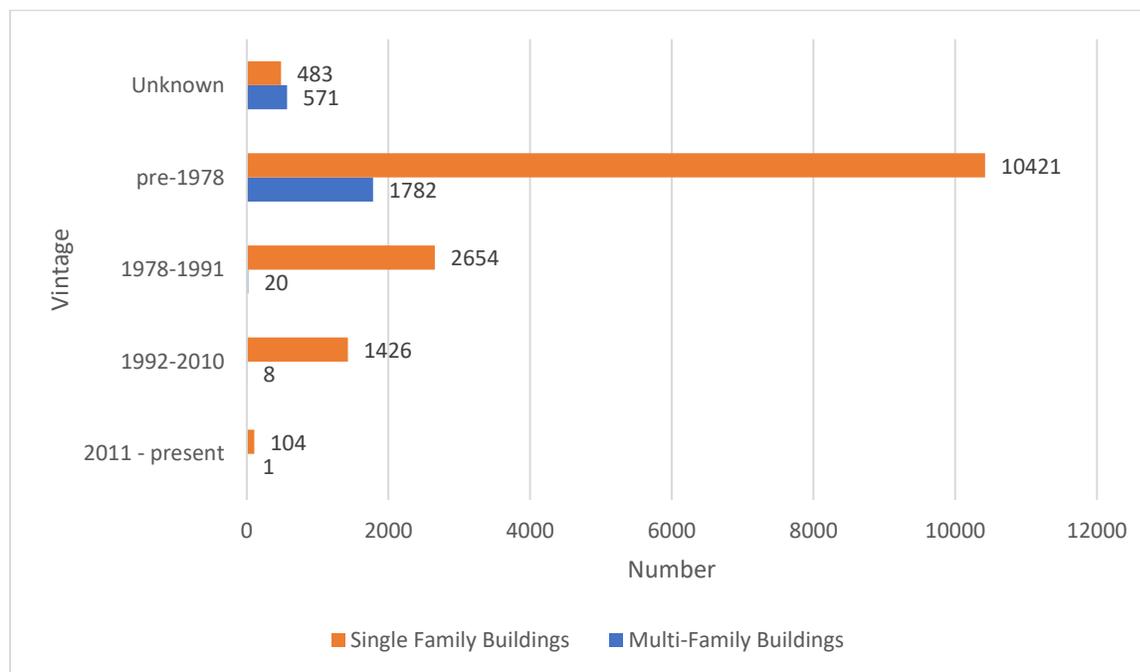
This section describes the general building stock of Alameda. A more detailed inventory of City owned buildings is provided in **Appendix D**.

Residential Buildings

The vast majority (92.5%) of Alameda's building stock is residential.⁶ Alameda's residential building stock includes 15,088 single family residential buildings and 2,382 multi-family buildings, containing 14,679 units, meaning about half of Alameda's residential units are multi-family and half are single family, including townhomes and duplexes. About half of Alameda's residents are renters and half own their homes. Seventy percent of Alameda's residential buildings were built before 1978 when most modern

⁶ Electrifying Alameda's Existing Residential Buildings, 2021

building and energy codes took effect, and very few were built in the last decade, however current ongoing development projects will provide more newer homes in the coming years than Alameda saw over the previous decade. These pre-1978 homes and apartments are in the greatest need of upgrades and retrofits for weatherization, energy efficiency, and seismic and flood. They are also more likely to have issues with lead, asbestos and mold that can impact the health and safety of residents.



Source: [Electrifying Existing Residential Buildings in Alameda, 2021](#)

Figure 3-2 Breakdown of residential buildings by year-built

City Owned Buildings

The City of Alameda’s building portfolio consists of 47 structures, totaling approximately 575,000 square feet of property. The properties vary greatly, both by age and design. By way of comparison the City’s oldest building, City Hall, was constructed in 1895, and it’s most recent, Krusi Park Recreational Center, was built in 2021. Alameda’s critical facilities are equipped with backup generators. Other City buildings are being equipped with technology to enhance the standard HVAC filtration, enabling fresh filtered air beyond the HVAC unit’s standard specifications. Buildings without central air handling are furnished with mobile filtration units. In an effort to provide fresh air and cooling respite during periods of heat and/or poor air quality from wildfire smoke, renovations are nearly complete at the Mastick Senior Center and West End Library to designate them as Fresh Air and Cooling Centers. The West End Library is also replacing its natural gas furnace and water heater with electric ones in an effort to reduce the building’s carbon emissions, in line with the City’s Climate Action and Resiliency Plan. The new Krusi Park Recreation Center was built all-electric as well.

Buildings Owned by Other Agencies

The City houses a number of facilities belonging to other governmental agencies and school districts. These include buildings of the Alameda Housing Authority, Alameda Unified School District, Peralta Community College District, Alameda County, East Bay Regional Park District, the State of California,

and the U.S. Government. Many of these buildings serve vulnerable populations including children and people with low incomes.

Care Facilities

The City is home to a number of facilities that serve and/or house vulnerable populations, such as day cares, elder cares, medical offices and clinics, a hospital, private schools, and others. These facilities range from private homes to larger facilities and range in age and construction type as well. The City maintains a listing of current locations as this is critical information for effective disaster response that includes:

- Health Care
 - Alameda Hospital
 - Medical offices, clinics, urgent care centers, pharmacies, and laboratories
 - Six skilled nursing and rehabilitation facilities
- Child care
 - 68 child care and family day care centers
- Adult care and housing
 - Six assisted living facilities
 - Three adult day care facilities
 - 11 elder care residential facilities
 - One housing facility for people with disabilities
- Schools
 - College of Alameda
 - Public K-12 schools
 - Private K-12 schools

Land Use

The goal of Alameda’s 2040 General Plan Land Use Element is to “maintain and enhance safe, healthy, sustainable, complete and connected neighborhoods, districts, and waterfronts that support a high quality of life and fair and equitable access to affordable housing, employment, education, recreation, transportation, services, and participation in public decision making.” Alameda contains a variety of land use classifications that describe the existing and intended location, distribution, intensity and physical character and form of development and land use across the city, as shown in **Figure 3-3**. Since 2016, most new development in Alameda has occurred in designated mixed-use areas along the Northern Shoreline and Alameda Point. Development in these areas must be designed to accommodate at least two feet of sea level rise with adaptive measures to accommodate future sea level rise, including preserving inland land and right of way along the perimeter of the site such that existing shorelines and floodwalls could be elevated to manage sea level rise. While more development has occurred in areas vulnerable to natural hazards in recent years, the mitigation actions described here are working to minimize that vulnerability.



Source: Alameda 2040 General Plan

Figure 3-3 Land Use Designations

Given Alameda’s exposure to a wide range of climate hazards, most notably sea level rise and storm surge flooding, existing and future land use planning needs to incorporate adaptation strategies to keep residents and businesses out of harm’s way. This involves important decisions about how to modify existing land use, where development opportunities still exist, and how to design new development and redevelopment that can adapt to future climate conditions—particularly flood and liquefaction risk. Land use policies are an important avenue to creating a resilient Alameda.

Utilities

The broad types of utilities in the City are overhead (power, telecom), underground-dry (power, telecom, gas), underground-wet (water, sanitary sewer, storm drain), and utility buildings (substations, telecom switching, pump stations). In addition, there is solid waste handling (trash pickup and landfills), and there are abandoned fuel pipelines on Alameda Point. The City owns and maintains the sanitary sewer collection system (excluding the interceptor pipes that convey flow to the regional treatment plant), storm and electrical infrastructure. The City also is responsible for the Doolittle Landfill. Potable water and natural gas are provided by the East Bay Municipal Utility District (EBMUD) and Pacific Gas and Electric (PG&E), respectively. The following entities manage and maintain utility systems in Alameda:

- Stormwater system = City of Alameda;
- Wastewater system = EBMUD (treatment and transmission) and City of Alameda (sewer collection system within city limits);
- Drinking water system = EBMUD and City of Alameda (Alameda Point water system);
- Electric System = AMP;
- Natural Gas System = PG&E; and
- Communications = varied (private).

These agencies have completed assessments on some utility sectors in Alameda, including the PG&E vulnerability assessment, City of Alameda storm drain modeling, and EBMUD water supply assessments. Plans are in place for specific utility sectors, including the City of Alameda Storm Drain Master Plan, City of Alameda Sewer Master Plan, EBMUD 2015 Urban Water Management Plan, and EBMUD Sewer System Management Plan. Collectively, these plans address key vulnerabilities to the city's utility systems to ensure climate change impacts are integrated into short- and long-term planning.

City-owned water, sewer, storm, and electrical utilities are summarized in **Table 3-5**.

Table 3-5. City-Owned Sewer, Storm and Electrical Utilities

Utility	Amount
Sewer Mains	142 miles
Sewer Manholes	3,122 each
Sewer Pump Stations	42 each
Storm Pipes and Cross Culverts	90 miles
Storm Manholes	2,058 each
Storm Pump Stations	11 each
Other Storm Structures (ex. Catchbasins, outlets)	401 each
Storm Outfalls	227 each
Alameda Point Water System	35.8 miles
Alameda Municipal Power Distribution Overhead	86 pole miles
Alameda Municipal Distribution Underground	181 circuit miles
Alameda Municipal Transmission Overhead	6.8 pole miles
Alameda Municipal Transmission Underground	1.9 circuit miles

The sewer, storm and electrical systems are vulnerable to a variety of hazards. In storm events downed trees can damage overhead lines and flooding can impact pump station function. In earthquakes electrical substation and pump station components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. Underground pipes can shear, crack or reverse grade. Alameda Municipal Power recognizes that large earthquakes may damage key facilities and that electric power might be lost for limited periods of time. The potential for a loss of power means that emergency and critical uses should have dedicated emergency power sources.

Stormwater and Sewer Systems

Stormwater

Drainage generated within Alameda's main island and Bay Farm Island watersheds can come from a variety of sources such as storm events, residential sump pump groundwater discharges, vehicle washing, hydrants/firefighting, pressure washing of sidewalks, and illegal mopwater discharges from restaurants directly into the gutter. On the main island, Central Avenue is the "spine," or high point that runs east/west through Alameda, and drainage generated from these sources flows either north or south from Central Avenue along street gutters, crossing intersections along the way via channels cut under the sidewalks. A closed-system network located in the lower elevations of the island composed of catch basins, manholes, and pipes receives this drainage when it has increased in volume and discharges it either to the estuary to the north, and to the south either to the Alameda West Lagoon system or directly to the Bay (depending on the outfall location). Pump stations located around the main island lift stormwater up that has drained to low points around the island and discharge it directly to the Bay.

There are 5 lagoons interconnected by bridges and cross-culverts that make up the lagoon system. This salt-water fed system plays an important role in Alameda's stormwater treatment, because it receives runoff containing oils, greases, and trash that has accumulated on pavement and properties throughout the watershed and can trap them within the lagoons rather than discharging them directly to the Bay. The lagoon system also receives runoff from approximately half of the South Shore Center property. Due to the two-mile length of the lagoon system, it has stilling qualities for pollutants and sediments and ultimately discharges out of a concrete weir and outfall channel that crosses under Bayview Avenue to the Elsie Romer Bird Sanctuary.

In recent years full trash capture (FTC) devices have been installed in many catch basins to trap items greater than 5mm in size and preventing them from flowing downstream. The City has an ongoing maintenance program that cleans out the FTC devices on a periodic basis.

Sewer

The City of Alameda owns and maintains the sanitary sewer system that includes 142 miles of sewer mains and 43 pump stations. When the network reaches a low point, sewer pump stations lift wastewater and help it further along to its ultimate destination.

Collected wastewater is conveyed to East Bay Municipal Utility District's (EBMUD) regional. EBMUD treats wastewater for seven communities in its wastewater service area, including Alameda. It owns and operates an award-winning wastewater treatment plant near the Bay Bridge that serves 650,000 customers in the San Francisco Bay, including Alameda residents.

The City's Sewer Master Plan includes a hydraulic capacity assessment and recommendations for upgrades and replacements. As the state and others release new guidance, the City of Alameda can determine the best way to incorporate climate change in sewer system modeling and planning. Potential impacts from climate change include infrastructure damage associated with flooding (e.g., to sewer pumps), rising groundwater levels (e.g., to pipes and other subsurface assets), and low flow during periods of drought and increased water conservation efforts.

Drinking Water System

EBMUD provides high-quality drinking water for 1.3 million customers in Alameda and Contra Costa counties. EBMUD owns and maintains all water lines within Alameda. Water service to the City of Alameda is provided by four underwater pipeline crossings at three separate locations between the City of Oakland, Alameda Island, and North Bay Farm Island. The two locations that serve Alameda's main island are under Oakland inner Harbor, and run between Marina Village Parkway and Oakland's Embarcadero, and between Broadway and Oakland's Derby Avenue. The pipeline serving Bay Farm Island runs under the Tidal Canal from the end of Veterans Court to Towata Park on the main island. Failure of one of three existing crossing locations could lead to a reduction in the level of service for existing customers and potentially reduce the available water supply to Alameda Island and North Bay Farm Island. Three new pipeline crossings are proposed to replace the existing pipeline crossings to ensure long-term reliability of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

In the future, EBMUD plans to extend its recycled water service to the City of Alameda, including Alameda Point. EBMUD's source of recycled water for Alameda Point is generated at their Main Wastewater Treatment Plant (MWWTP) located at the eastern landing of the Bay Bridge. The recycled water facilities at the MWWTP utilize microfiltration and extra disinfection to produce recycled water that meets or exceeds the California Department of Health standards for unrestricted use.

EBMUD is internationally recognized for its proactive seismic improvements of facilities in its service area, as well as strengthening vulnerable portions of aqueducts, dams and Sierra reservoirs. The District also works closely with other agencies on emergency responses planning and hazard mitigation.

Many residences in Alameda have private wells on their property that are primarily used for irrigation. These however in an emergency these wells could potentially be used for drinking water if the EBMUD system is down. These wells are generally deep and not impacted by surface contaminants or saltwater intrusion from rising sea levels. It is currently unknown how many of these wells currently exist and are in operation.

Alameda Point Water System

The Alameda Point water system is a community water system serving the area formerly known as the Alameda Naval Air Station. The water system is located within the street network east of Main St. The City of Alameda has caretaker responsibilities for the water system pursuant to a Cooperative Agreement between the City and United States Department of the Navy. As part of the planned development at Alameda Point, the water system will be upgraded in accordance with the Alameda Point Master Infrastructure Plan and will be owned and operated by EBMUD.

The Alameda Point water system is a water distribution system but it does not include water treatment plants. The City of Alameda contracts with EBMUD to operate and maintain the water system. Water distributed by the Alameda Point water system was purchased from EBMUD and treated in EBMUD's Orinda or Upper San Leandro Water Treatment Plants.

Electric System

AMP serves all of Alameda and has approximately 86 pole miles of overhead distribution lines, 181 circuit miles of underground distribution lines, 6.8 pole miles of overhead transmission lines, and 1.9 circuit miles of underground transmission lines. It serves approximately 34,809 customers, comprised of

approximately 30,650 residential customers and 3,779 commercial customers, and 370 other users, and had a peak demand of approximately 61.5 megawatts.

AMP sources its 100% clean power from a variety of geothermal, wind, landfill gas, and hydropower generation resources across northern California. Power is delivered to Alameda through PG&E's transmission system. AMP's transmission lines cross beneath the estuary to Oakland in two locations - one to the north and one south. These lines provide redundant service to Alameda and if one line goes out, the other can supply all of Alameda's power demand. In the unlikely event that enough transmission lines serving the greater Bay Area are taken offline by PG&E, it is possible curtailment affecting Alameda could occur.

Rolling blackouts can occur when the California electric grid becomes overtaxed. This occurred recently in August 2020 during a heat event when projected power demand exceeded capacity. There is an elevated risk of additional CAISO supply shortages over the coming summers due to the drought (drought impacts the availability of hydropower) and continued extreme heat events. AMP has procured sufficient resources to meet AMP's loads, however, during rolling outages all utilities must participate in load shedding. If a rolling blackout is called for, AMP will typically have one of 10 circuits (2,000 –4,000 customers each) on outage for 30-60 minutes before rotating to the next circuit in the list. A circuit will not repeat until all other circuits have experienced an outage.

If there is limited power available in the grid, AMP will coordinate with the Northern California Power Agency (NCPA) to support Alameda's system. Two Combustion Turbines (CTs) NCPA are located in Alameda, each with a capacity of approximately 25 megawatts. Along with two other CTs owned by NCPA, these facilities provide peak load and reserve capacity for NCPA member communities and districts. Central Dispatch Center in Roseville can remotely start or stop each turbine, and bring these units fully online within ten minutes. These facilities possess dual fuel capability, with natural gas as the primary fuel and diesel fuel being available in the event of a natural gas curtailment. The CTs cannot independently provide power to Alameda however; they provide additional resources to the grid and can help relieve pressure on the local area's transmission lines.

AMP is planning to install a 2.0-megawatt photovoltaic solar facility at Doolittle Landfill (Mt. Trashmore) at the intersection of Doolittle Drive and Harbor Bay Parkway. The electricity will be fed directly into the electric grid from an interconnection point adjacent to the site. Transformers and switchgear will potentially be located at the bottom of the property. The landfill is being monitored by City of Alameda while decomposition occurs beneath the landfill cap. An open space park is planned at the former landfill in 25 years when the site is anticipated to be safe for public use. Increasingly residents also have rooftop solar with battery storage on their homes and businesses. This technology is becoming more widespread and affordable and provides a resilient local supply of clean energy with added resiliency during grid outages.

As part of modernization of its system, AMP is in the process of undergrounding its electrical system. About half of Alameda's power system has already been undergrounded since the inception of the program in 1984. The undergrounding projects typically convert overhead wires to underground, install pad-mounted equipment, install updated streetlighting poles, and install a joint trench with other utilities, including City use.

City-owned electrical assets are summarized in **Table 3-5** and examined in detail in **Appendix D**.

Natural Gas System

PG&E provides natural gas to Alameda residents. PG&E has a staff of 20,000 prepared to respond to restore service after disasters and storms. They also have a well-established priority system for restoring power to emergency services before other community needs.

Natural gas infrastructure is subject to damage and disruption in areas with soil failure, for example landslide and liquefaction. Natural gas lines can also rupture in earthquakes when buildings are damaged or when natural gas appliances topple. Broken lines can create fires if ignited until the fuel supply is exhausted. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake, it took about 30 days to repair damaged lines in the San Francisco Marina.

The large-scale natural gas transmission lines that service the cities along the East Bay shoreline of Alameda County are primarily located near the bay shore. The transmission line does not run through the City of Alameda but instead runs along a single corridor through Albany, Berkeley, Emeryville before splitting into two parallel lines in Oakland that run through Oakland, San Leandro and Hayward. Across the entirety of the natural gas line between Albany and Hayward the natural gas transmission line(s) pass through medium-level susceptibility zones with some lines passing through very high liquefaction susceptibility zones in East Oakland and San Leandro.

Communications and Technology Systems

The City owns a variety of communications and technology infrastructure.

Webster Street Smart Corridor

In 2016, City and Alameda County Transportation Commission (Alameda CTC) completed a Smart Corridor on Webster Street and Constitution Way, two of Alameda's most travelled corridors and island ingress/egress routes. The corridor includes CCTV cameras, video detection systems, dynamic message signs, microwave detection, and emergency vehicle and transit priority equipment on existing traffic signal infrastructure on Webster Street between the exit of the Webster Street Tube and Central Avenue and surrounding areas. Wireless communications were also installed via the unlicensed 5GHz wireless band to facilitate the management of the corridor infrastructure; however, the City does not currently engage the Smart Corridor infrastructure for traffic management, which could be a later project phase.

Citywide 5G Deployment

As the climate for wireless service changes, many large service providers are actively pursuing opportunities for 5G installations via collocation on public equipment or on public property. In light of that, Public Works staff proactively developed a City ordinance, permitting, procedure, and design guidelines to support the deployment of 5G equipment in Alameda. Public Works now has an approved master license agreement with Verizon, which would allow Verizon to deploy small wireless facilities on City street light poles to enhance 5G coverage. This is currently limited to commercial use by Verizon subscribers/customers.

Development-Built Infrastructure

The City requires developers to install empty conduit to serve future City communications needs in the vicinities of new development projects. Empty conduit has been deployed in this manner under several development projects in the last several years, including, but not limited to:

- Alameda Point – Two 2-inch conduits roughly bounding the project along Tower Avenue, Pan Am Way, Midway Avenue, and Saratoga Street.
- Webster-Posey Tube Interconnection (Caltrans) – One 4-inch conduit along Mitchell Avenue between Mariner Square Loop and Mariner Square Drive east of the tunnel portal buildings as AMP conduit.
- 2100 Clement – Two to three-inch conduit was installed on the project frontage and nearby cross street which is located at Clement Avenue and Willow Street as AMP conduit.
- Alameda Landing – One to two-inch conduit was installed for traffic signal interconnect in the general project vicinity, which is generally bounded by Fifth Street, Mitchell Avenue, Mariner Square Loop, and Willie Stargell Avenue as AMP conduit.
- Del Monte – Two to four-inch conduit for traffic signal communications is planned in the general project vicinity which is bounded by Entrance Street, Clement Avenue, Buena Vista Avenue, and Sherman Street.

Public Works-Built Infrastructure

In 2021, Public Works completed an installation of wireless radios along Webster Street, Park Street, and Constitution Avenue. The deployment placed 18 wireless radios along the corridor for wireless communication to support signal timing coordination along these key corridors.

Municipal Area Network

When founded originally, Alameda Municipal Power (AMP) was also intended to be a telecommunications provider and began development of a citywide fiber network. Financial constraints caused AMP to ultimately sell that portion of their business to Comcast. Despite the sale, AMP maintains a private fiber optic network that it uses to manage its own systems and also leases some of the infrastructure to the City for administrative use. The administrative network in use by the City is referred to as the Municipal Area Network (MAN). As part of this agreement, AMP provides the technical support and management of the MAN.

Currently, the MAN utilizes AMP fiber infrastructure to interconnect the City's various facilities, which are spread around the City. City buildings are interconnected via four core sites where key network infrastructure is housed. AMP has deployed layer 3 switches at all four core sites and each City facility. The four core sites are located at the City Hall Building 2, AMP's Service Center facility, the Corica Park Golf Course, and City Hall. The network topology is set up as a redundant ring for the core sites and hub and spoke topology for the edge sites. Each of these cores is interconnected with each other via AMP fiber to form a ring and the remaining facilities are interconnected in a spoke configuration via AMP fiber from one of the cores.

Planned Projects

In recent year when AMP has undergrounded electrical wires, the City has installed conduit for other City use as part of the joint trench and plans to do so on future undergrounding efforts. This effort includes the installation of conduits for communications interconnect of traffic signals. There is one upcoming undergrounding project on Otis Drive between Broadway and High Street, and on Broadway between Encinal Avenue and La Jolla Drive.

Private Communications Service Providers

Communications systems, including cellular networks (for mobile data and voice), fixed landlines and broadband internet systems are owned by a wide range of private operators. These networks also rely on private third-party operated fiber networks and data centers. Broadband internet connection is provided by cable, DSL, and increasingly, fiber networks. The largest internet providers in Alameda are Xfinity/Comcast and AT&T. The primary cellular operators are AT&T, Verizon, Sprint and T-Mobile.

Cellular networks are organized around cell sites, which transmit data from the user and the cell site via radio waves.⁷ Macro cell sites are typically located on buildings and cell towers, while small cell sites used to add capacity to the network or typically located on utility poles. Macro cell sites typically have battery backup for 4 to 12 hours, while small cell sites typically have no backup power. Small cell sites route data to hubs where it is aggregated and sent to switching centers via the fiber network. No hubs or switching centers are located in Alameda.

Alameda Community Radio 96.1 KACR-LP is a low power FM station that broadcasts from a rooftop on Park St. The frequency is shared with 96.1 KJTZ Encinal Radio, a Low-Power FM radio station operating at Encinal High School, and KEXU-LP broadcasting from Jack London Square in Oakland.

The communications system is critical to emergency services, and protections to ensure uninterrupted connectivity are very important. However, the varied ownership and oversight of the telecommunications system makes it difficult to implement adaptations because the City of Alameda does not directly control assets. In the event of an emergency where cell sites are damaged or there is no power, communications providers will deploy temporary generators or cell towers to augment and restore the network. Fuel is critical to the continued operation of the communications network when the power is out.

Transportation

The transportation sector contains a network of assets that are critical to social, economic, and physical well-being, as well as emergency response. These transportation assets connect Alameda to other services in neighboring Oakland and beyond, and they support vehicular movement (roads, bridges, tubes), public transit (buses and ferries), bicycle/pedestrian paths and water access (marinas, docks and waterways with private boats). Connections to adjacent communities are uniquely limited and therefore particularly sensitive and prone to congestion. Alameda has three ferry terminals operated by the Water Emergency Transportation Authority (WETA), five ways on/off the main island via bridges/tubes and three roadways in/out of Bay Farm Island. Access to BART stations in Oakland are relatively close but require using the already congested crossings. WETA also has their Central Bay Operations and Maintenance Facility located in Alameda Point. The facility, which opened in 2018, provides a base to maintain its fleet, includes an Operations Control Center for service dispatch and an Emergency Operations Center, which would serve as a primary location for WETA to coordinate the provision of emergency transportation services in the event of a regional disaster or transportation disruption.

The transportation sector's vulnerability to sea level rise and flooding from intensifying storm events not only puts these assets at risk, but also impacts other sectors, amplifying socioeconomic and public health risks. Some of the transportation system's vulnerability stems from its lack of redundancy. With limited connections on and off the island of Alameda, the community will strongly feel any disruptions to tubes,

⁷ [Lifelines Restoration Performance Project](#), City and County of San Francisco, 2020.

bridges, or ferry service. Some isolated areas, like Ballena Island, rely on single methods of access and are at elevated risk if inundation undermines or blocks transportation assets.

During and right after a disaster, transportation facilities serve vital functions of providing access for emergency vehicles, Public Works and utility repair teams, evacuation, distribution of food and supplies, and movement to shelters. For long term recovery, transportation corridors are needed to facilitate removal of debris, delivery of repair materials, and restoration of normal commuting and daily activities. Fuel is a vital part of the transportation system. Power and telecom are needed for full restoration of traffic signal, SMART technology functions as well as electric vehicles, which are estimated to total at least 1,500 in Alameda. **Table 3-6** summarizes street ownership/responsibility within City limits. The City of Alameda is also responsible for 89 signalized intersections.

Table 3-6. Street Inventory

Street Owned By	Mileage
City - Local Classification	113.2
City - Arterial Classification	33.5
Caltrans	4.9
Private & Federal	39.4
<i>Total:</i>	<i>191.0</i>
Bikeways	51.2

In addition to the City and State maintained streets, the following transportation structures are located within the City of Alameda and owned by the agencies listed:

- High Street bridge (Alameda County)
- Park Street bridge (Alameda County)
- Miller-Sweeney bridge at Fruitvale Avenue (Alameda County)
- Fruitvale rail bridge - abandoned (U.S. Army Corps of Engineers)
- Bay Farm Island vehicular and bike/pedestrian bridges (Caltrans)
- Webster and Posey Tubes (Caltrans)
- Constitution Way Overcrossing (Caltrans)
- Grand St bridge (City of Alameda)
- Ballena bridge (City of Alameda)

Shoreline, Natural, and Recreation Areas

Alameda is unique in that it is an island community with dense, urban development. It has approximately 23 miles of combined perimeter shoreline, between the main island and Bay Farm Island. Shoreline consists of a mixture of both engineered shorelines (primarily seawalls or levees and associated riprap and other armoring) and a variety of natural shoreline habitats. Alameda’s main island is composed mostly of riprap shoreline, and to a lesser extent bulkheads, natural shoreline, and beach. Bay Farm

Island's shoreline is almost exclusively riprap of large diameter, due to the wave action that can be seen coming from the west. Susceptibility of shoreline to wave action has played a large role in determining the shoreline protection level required.

In many areas, including the full perimeter of Bay Farm Island, shorelines provide a protective distance between the Bay waters and residential homes, buildings, properties, utilities, and other infrastructure. Shorelines also provide a public access area for the public to enjoy the waterfront and many parts of it are designated as the San Francisco Bay Trail.

The engineered structures and natural shorelines that surround Alameda are not FEMA-accredited, and it is unknown how they will behave in the event of a large-scale coastal flooding or earthquake event - given development of Alameda in many places (particularly Bay Farm Island) mainly consisted of placing a few feet of sandy fill over the existing young bay mud. Several shoreline protection projects currently underway have the goal of becoming FEMA accredited.

Like engineered shorelines, natural shorelines can attenuate waves and mitigate the impacts of sea level rise and storms. They also provide ecosystem benefits, including open space, water quality, air quality, carbon sequestration, and species habitats. Shoreline areas include wetlands, tidal flats, and marshes. Both engineered and natural shorelines provide recreational benefits, as the San Francisco Bay Trail and other public shoreline access points run along them. Both engineered and natural shorelines face risks of overtopping, erosion, and potential failure as San Francisco Bay water levels rise, and they will need to be adapted over time. Deferred maintenance of some flood protection structures makes them more vulnerable.

The City of Alameda also maintains 24 parks and a total of 492 acres of parkland as shown in **Source:** Alameda 2040 draft General Plan

Figure 3-4. Alameda parks include a variety of sports facilities, playgrounds, open space, pools, recreations centers and a golf complex. 94% of Alamedans use the parks at least once annually and the golf complex receives over 25,000 visitors a year.



Source: Alameda 2040 draft General Plan

Figure 3-4 Existing and Planned Parks and Open Space in Alameda

While open spaces may not be required during or immediately after a disaster, quick recovery of these facilities is necessary for the full recovery of the City. Restoration of open spaces is also needed for the recovery of the wild animals and plants that call Alameda home. Some recreation facilities, including the O’Club and Alameda Point Gym are designated staging and pickup sites for the school district in the event of an emergency. City owned park and open space facilities are examined in **Appendix D**.

Contaminated Lands and Waste

Properties with land use histories that include heavy industrial and manufacturing operations could potentially have contaminants in their soil and groundwater. Contaminants at these properties are addressed through remedial action plans that are implemented under the oversight of the California Environmental Protection Agency (CalEPA) or, in the case of federal properties and Superfund properties, the U.S. EPA. These types of properties can be vulnerable to sea level rise impacts such as flooding and rising groundwater if those changes result in a release of hazardous substances. CalEnviroScreen (June 2018) identifies several contaminated and cleanup sites within Alameda. Additional information regarding contaminated sites within Alameda can be found at the CalEPA Department of Toxic Substances Control (DTSC) [EnviroStor website](#) and the CalEPA [RWQCB GeoTracker website](#).

Case Study: Alameda Point

Alameda Point can be used as a case study for how contaminated sites can be managed to account for the effects of sea level rise. Alameda Point is the former naval air station previously located on the western portion of Alameda. The naval base operated from 1940 until it was officially closed in 1997. During its operation, a number of industrial activities across the base resulted in residual contamination in soil and groundwater that continue to be addressed today. Contaminants in soil and groundwater include petroleum hydrocarbons, metals, chlorinated solvents, semi-volatile organic compounds, and radiological isotopes. The U.S. Navy is required to complete remedial activities under the oversight of the U.S. EPA as well as the DTSC and the RWQCB. Remedial technologies implemented at Alameda Point generally include the following:

- **Excavation and removal:** Soil contamination is excavated from the property and disposed of at a facility outside of Alameda. Under this scenario, it is not expected that sea level rise will adversely affect the site because the source material has been removed.
- **In situ groundwater treatment:** These technologies typically use substrates that can be injected into the groundwater to degrade the specific contaminant. They are generally used for sites that have chlorinated solvents or petroleum hydrocarbons in groundwater. The Alameda Point remedial plan requires extensive monitoring during remediation and post-remediation to verify that the remedial action can achieve its goals. The monitoring programs can assess what a change in condition (e.g., rising groundwater levels) has on the contaminant in question. These remedial activities typically degrade the contaminant to concentrations that are protective of human health and the environment; therefore, it is not expected that sea level rise will adversely affect the site.
- **Capping and institutional/engineering controls:** In some instances, soil contamination or contamination within subsurface utilities is addressed through capping or institutional controls. Typically, a cap will require the installation of a layer of soil that eliminates direct contact with the contaminated soil and can prevent surface water from infiltrating into the contaminated soil and into the groundwater. Institutional controls are measures recorded in a property deed that restrict how a property is used and/or what activities are permissible. A remedy that includes these types of measures requires long-term monitoring to verify that the remedy remains protective of human health and the environment. Inspections are typically required annually, and the remedy must be evaluated in detail at five-year intervals. The additional monitoring will identify if changing conditions resulting from sea level rise are adversely affecting the environmental conditions at the site.



This former naval base is being remediated and provides opportunity to expand the existing wetlands. Photo credit: Richard Bangert.

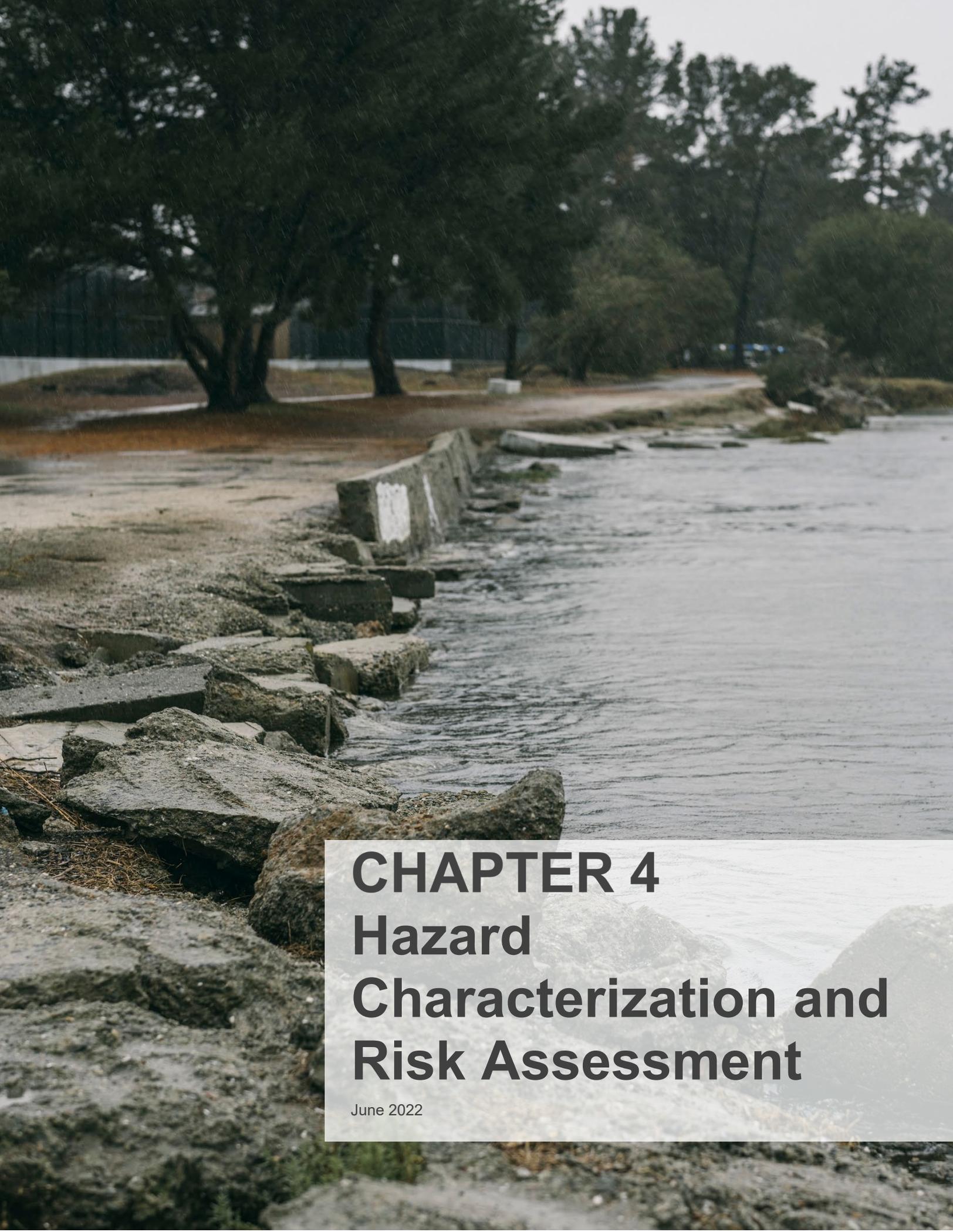
Public Health and Welfare

Natural disasters can have major and insidious impacts on public health, the extent of which varies depending on geography, the number and severity of impacts affecting a particular population, socioeconomic status, and other factors. Socially vulnerable populations are particularly at risk. Climate hazard-related public health impacts affecting Alameda consist primarily of higher temperatures, increased air pollution from wildfires, increased flooding from sea level rise and rainstorm events, and severe drought.

Flooding can cause multiple public health impacts, such as mobilizing contaminants in soil (from hazardous waste sites), preventing access to safety, or preventing access to health care facilities due to flooded roads or public transit routes. More extreme heat events represent another major public health risk, as vulnerable populations (elderly, infants, those with existing health conditions, those living and working in areas without adequate shade, and those with limited access to air conditioning) can suffer heat exhaustion, stroke, difficulty breathing, and even death. When heat is combined with air pollution impacts, such as elevated ozone levels and wildfire smoke, the impacts are exacerbated. In addition, Alamedans are inexperienced in dealing with extreme heat and wildfires and therefore lack adequate preparation. Others lack resources to purchase air conditioning. More energy use for air conditioning results in increased costs, further affecting those with limited resources. It also increases GHG emissions, which further affects climate change and its associated impacts.

California's Fourth Climate Change Assessment highlights the indirect effects of climate change in the Bay Area, such as the combined impacts of increased allergens, air pollution, harmful algal blooms, heat, and disease vectors (e.g., insect and rodent populations). While each of these stressors can seem minor in isolation, their combined effects represent significant public health impacts to socially vulnerable populations who lack the financial capacity to respond.

Earthquakes and tsunamis would also have widespread significant public health impacts and are the two hazards likely to cause significant fatalities in Alameda. Both hazards will also damage a significant number of residences and buildings and result in widespread displacement. Disruptions to schools, housing and basic services will stress vulnerable populations especially and the very long recovery and rebuilding period following a major event will disrupt everyone's daily lives for many years.

A photograph of a rocky shoreline. In the foreground, there are large, dark, jagged rocks. A concrete barrier, made of several rectangular blocks, runs along the water's edge. The water is calm and greyish. In the background, there are several large, dark trees and a sandy area. The sky is overcast.

CHAPTER 4

Hazard Characterization and Risk Assessment

June 2022

Review of Hazards

Alameda is impacted by a number of natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property. This chapter provides an overview of the hazards that impact Alameda and assesses the risks they pose to Alameda’s people, economy, buildings, and infrastructure.

Hazards impacting Alameda that were considered in the plan were reviewed and assessed based on their likelihood of future occurrence and their consequences to Alameda’s people and assets if the hazard were to occur. **Table 4-1** provides a summary of the hazards considered and their relative likelihood and consequence. Based on this analysis, it was determined that earthquakes, floods and sea level rise pose the greatest risk to people and property in Alameda. Other hazards may also have significant impacts but are less likely to occur, or the consequences may be more limited in duration or impact. These hazards are still considered and addressed in the context of this plan, but the primary focus of the plan is on the three hazards of greatest concern.

Table 4-1 Summary of Hazard Analysis

Hazard	Likelihood	Consequence	Hazards of Concern
Earthquakes	Likely	Catastrophic	Hazards of Greatest Concern
Flooding from storms	Likely	Moderate to Catastrophic	
Sea level rise	Likely	Catastrophic	
Tsunamis	Possible	Moderate to Catastrophic	Hazards of Concern
Heat	Likely	Moderate	
Drought	Likely	Moderate	
Wildfire-related hazards (smoky air, PSPS)	Likely	Moderate	
Dam breach inundation	Unlikely	Moderate	

This risk posed by natural hazards can be defined as the consequence of the interaction between a hazard and the characteristics that make people, and places vulnerable and exposed (UNDRR Terminology, 2017).

This chapter provides a brief description of the risk posed by each hazard. For hazards of greatest concern, the following appendices provide additional details on the analysis, including exposure of assets to hazards:

- Appendix E: Detailed Earthquake Risk Assessment
- Appendix F: Detailed Flooding and Sea Level Rise Risk Assessment
- Appendix G: Priority Coastal Inundation Locations
- Appendix H: Additional Maps
- Appendix I: Tsunami Table

Earthquakes

An earthquake is the hazard most likely to cause rapid, extensive damage in Alameda. This damage will primarily result from violent shaking and ground disturbances. Other hazards association with earthquakes such as fault rupture and landslides are not possible for Alameda. The perceived intensity of an earthquake is related to the energy released by the earthquake (its magnitude), how close it is, and the underlying soil conditions. Bay Farm Island and Alameda Island consist of central cores of higher ground that are relatively stable, and surrounding areas of man-made fill or “made-ground” that can amplify shaking and liquefy in earthquakes.

In addition to the damage to Alameda itself, the city depends upon its mainland connections for transportation, utilities, commerce, and services. Major damage to Oakland, San Leandro, and adjacent cities would have an indirect impact on Alameda in both the short term and long-term recovery of the City. After an earthquake, Alameda may experience isolation and disruption until bridges and utility crossings are restored.

Hazard Description

The total amount of energy released in an earthquake is described by the earthquake magnitude. The moment magnitude scale (abbreviated as M) is logarithmic; the energy released by an earthquake increases logarithmically with each step of magnitude. For example, the 1906 San Andreas earthquake, M7.8, released 500 times more energy than the 2014 South Napa Quake, M6.0. But fortunately, the frequency of large earthquakes is much less than that of smaller earthquakes. “Strong” earthquakes, M6.0-6.9, occur about 120 times per year somewhere in the world, “major” earthquakes, M7.0-7.9 occur about 18 times per year, and a “great” quake of M8.0 or more is likely to occur only once in the world per year. Fortunately, the types of faults in the Bay Area (strike/slip) are unlikely to produce quakes larger than M8.0. Farther up the coast in Oregon, Washington and Alaska, with subduction faults, M9.0 quakes are possible. When subduction zone earthquakes occur offshore, they may also produce tsunamis, which can impact Alameda.

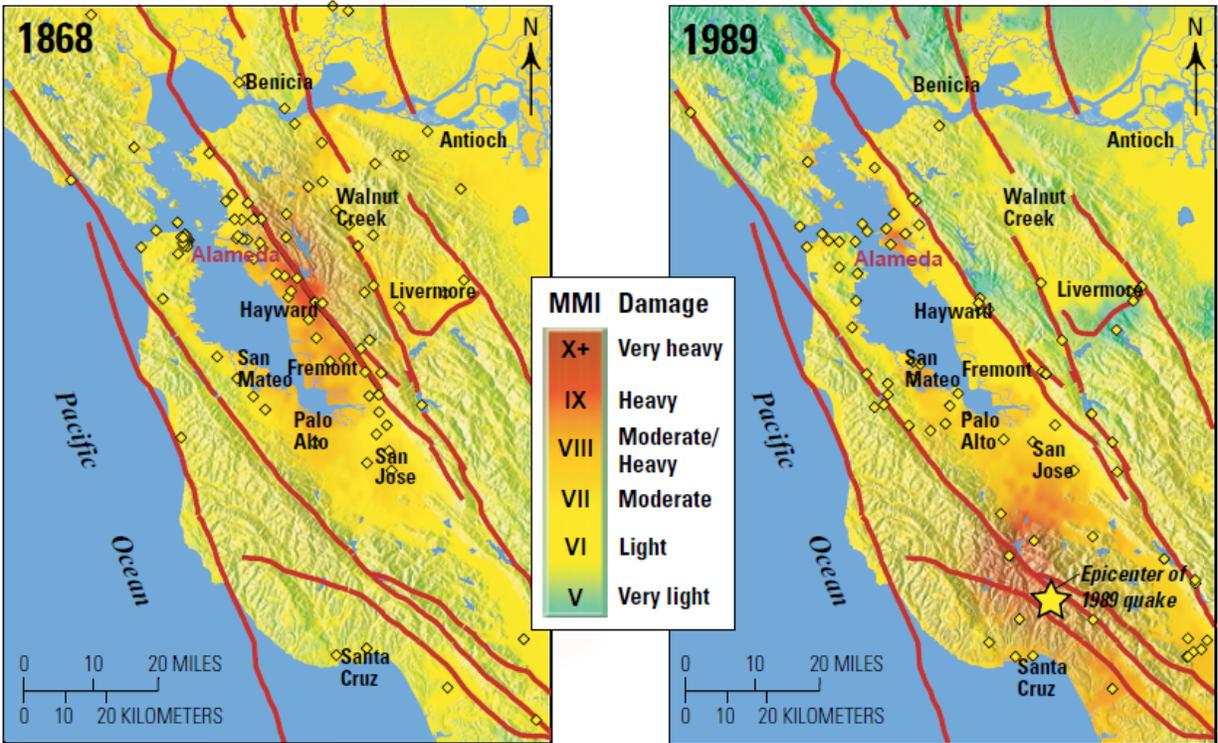
Earthquakes with the same magnitude of energy released can have different effects on nearby facilities, depending upon how close the rupture is, direction of the rupture, and the type of soil at the site. The Modified Mercalli Intensity (MMI) scale illustrates the intensity of shaking experienced at a particular location by considering the effects on people, objects, and buildings. The MMI scale describes shaking intensity on a scale of 1-12. MMI values less than 5 don't typically cause significant damage; MMI values greater than 10 have never been recorded. The USGS makes shake maps that show the MMI in areas surrounding the epicenter of an actual or scenario earthquake. **Table 4-2** below shows the expected damage caused by various MMIs.

The worst-case scenario for Alameda is a major earthquake along the southern portion of the Hayward Fault, because that is the closest fault to Alameda, only four miles away. A major earthquake on any one of the faults in the Bay Area is predicted to cause at least some ground disturbance on the made-ground portions of Alameda. Made-ground is much more sensitive to shaking and ground disturbance. Shaking is likely to be felt all over Alameda, but more violently on made-ground. **Figure 4-1** shows shake maps showing the MMI of ground shaking for the historic magnitude M 6.9 quakes in 1868 on the Hayward Fault and the 1989 Loma Prieta earthquake on the San Andreas fault. In places, Alameda experienced MMI 8 (very strong) to 9 (violent) intensity shaking during these two quakes.

Table 4-2. MMI Intensity Table

Intensity	Building Contents	Masonry Buildings	Multi-Family Wood-Frame Buildings	1&2 Story Wood-Frame Buildings
MMI 6	Some things thrown from shelves, pictures shifted, water thrown from pools	Some walls and parapets of poorly constructed buildings crack.	Some drywall cracks.	Some chimneys are damaged, some drywall cracks. Some slab foundations, patios, and garage floors slightly crack.
MMI 7	Many things thrown from walls and shelves. Furniture is shifted.	Poorly constructed buildings are damaged and some well-constructed buildings crack. Cornices and unbraced parapets fall.	Plaster cracks, particularly at inside corners of buildings. Some soft-story buildings strain at the first-floor level. Some partitions deform.	Many chimneys are broken and some collapse, damaging roofs, interiors, and porches. Weak foundations can be damaged.
MMI 8	Nearly everything thrown down from shelves, cabinets, and walls. Furniture overturned.	Poorly constructed buildings suffer partial or full collapse. Some well-constructed buildings are damaged. Unreinforced walls fall.	Soft-story buildings are displaced out of plumb and partially collapse. Loose partition walls are damaged and may fail. Some pipes break.	Houses shift if they are not bolted to the foundation, or are displaced and partially collapse if cripple walls are not braced. Structural elements such as beams, joists, and foundations are damaged. Some pipes break.
MMI 9	Only very well anchored contents remain in place.	Poorly constructed buildings collapse. Well-constructed buildings are heavily damaged. Retrofitted buildings damaged.	Soft-story buildings partially or completely collapse. Some well-constructed buildings are damaged.	Poorly constructed buildings are heavily damaged, some partially collapse. Some well-constructed buildings are damaged.
MMI 10	Only very well anchored contents remain in place.	Retrofitted buildings are heavily damaged, and some partially collapse.	Many well-constructed buildings are damaged.	Well-constructed buildings are damaged.

Source: ABAG, 2013, Modified Mercalli Intensity Scale



A ShakeMap showing the inferred intensity of ground shaking in the 1868 earthquake (measured as MMI, or Modified Mercalli Intensity), compared to a ShakeMap for the 1989 magnitude 6.9 Loma Prieta earthquake. Red lines are major earthquake faults; black line shows the portion of the Hayward Fault that ruptured in 1868; diamonds show locations of damage reports (1868) and seismic recordings (1989).

Figure 4-1 Shake Maps Comparing Damage from the 1868 Hayward Earthquake (approx. M6.9) to the 1989 Loma Prieta Earthquake (M6.9)

Earthquake Liquefaction

Earthquakes can cause ground disturbances, including liquefaction and subsidence. Liquefaction occurs when the underlying saturated sands and muds lose strength and liquefy during shaking and may even come to the surface as mud boils. Subsidence happens when small pockets or whole neighborhoods sink down permanently because of the loss of strength during liquefaction. During the Loma Prieta Earthquake for example, Franciscan Way, which was built on 40-year-old made-ground, sank slightly due to liquefaction. This caused difficulties with the sanitary sewer system and necessitated the construction of a sanitary sewer pump station to boost flows from the neighborhood to the main line. The storm drain lines, while still functional, were also impaired. Several residential streets needed emergency repair due to differential settlement. Ground improvement techniques to mitigate liquefaction and subsidence, include replacement of the liquefiable soils, compaction by various techniques, grouting, deep pile mixing, gravel piles and lowering the groundwater table, all of the techniques are challenging in an already built environment. **Figure 4-2** shows areas that are highly susceptible to liquefaction throughout the city. **Appendix H** shows maps of city sewer and storm drain facilities in relation the liquefaction susceptibility. In a Hayward Fault earthquake, the areas of the city with very high liquefaction potential have an

approximately 50 percent chance of liquefying, while the medium liquefaction potential areas have less than a 5 percent likelihood of liquefying.¹

As groundwater rises with rising sea level, more areas of Alameda may become susceptible to liquefaction. For more information on rising groundwater, see the Flooding section. Because Alameda's groundwater table is already relatively high, the impact of a rising groundwater table is anticipated to be relatively minor, especially over shorter time horizons.²



Figure 4-2 Liquefaction Susceptibility Map

Earthquake Caused Fires

After direct losses caused by violent shaking, liquefaction and subsidence, the largest secondary effect to consider during and after an earthquake is fire. The Great Earthquake of 1906 was also known as the Great Fire of 1906, because much of the damage to San Francisco was caused by fires started by the earthquake. Post-earthquake fires can be caused by damage to natural gas lines, electrical lines, toppled water heaters, and appliances. After an earthquake, fire-fighting efforts may be hampered by the number of simultaneous fire ignitions across the city, streets blocked by rubble or trees, lack of water pressure, lack of mutual aid if Oakland and San Leandro are equally hard-hit, and loss of access across bridges. Firefighting personnel would have to be split between fighting fires and performing paramedic services.

¹ Jones, J.L., Knudsen, K.L., Wein, A.M., 2017, HayWired scenario mainshock—Liquefaction probability mapping, chap. E of Detweiler, S.T., and Wein, A.M., eds., The HayWired earthquake scenario—Earthquake hazards: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, 126 p., <https://doi.org/10.3133/sir20175013v1>.

² Grant, A.R., at al. (Draft) Changes in Liquefaction Severity in the San Francisco Bay Area with Sea-Level Rise

In Alameda, fires following earthquakes could be very damaging due to firefighting resources being stretched thin and the dense urban environment with older wood structures likely to be damaged and the ability of fires to rapidly spread between structures. Areas that experience liquefaction are also more vulnerable to post-earthquake fires because of the greater potential for underground natural gas lines to rupture and start fires and because water lines in these areas may also be damaged by liquefaction, preventing firefighting with regular resources. Areas with hazardous materials may have the potential for explosion, fires, or toxic smoke. Laboratories are significant concern for hazardous material fires.

Other Earthquake Related Losses

In addition to the direct losses caused by earthquakes and earthquake-started fires, there are other secondary effects to consider during and after an earthquake, especially if the surrounding cities are impacted. This includes loss of circulation for emergency vehicles, evacuation, damage to buildings, lack of access to hospitals, lack of access for mutual aid outside of the City, loss of utilities such as power, water, telecom, and natural gas, generation of large quantities of debris, release of hazardous materials, and loss of population displaced by damaged housing, industry and commerce.

Since Alameda is relatively flat, it is not exposed to the earthquake hazards of seismically triggered landslides. There are no known faults running through Alameda and no history or geological evidence of fault rupture in Alameda. There is a hypothetical chance of minor sloughing along the shoreline perimeter, since much of the perimeter is built on mudflats, subject to liquefaction.

Historic Earthquakes

The Bay Area has experienced about 20 strong earthquakes and one major earthquake in the past 165 years, including the 1868 Hayward Fault quake (~M6.9) and 1906 San Andreas quake (M7.8). Those two earthquakes occurred before the infilling of made-ground in Alameda, and when the majority of buildings in Alameda were relatively flexible wood construction. The most notable damage was to the brick tower at Alameda City Hall, built in 1895 and damaged by the San Francisco earthquake in 1906. The damage was extensive enough to warrant removal of the tower in 1937.

Table 4-3 and **Table 4-4** show the historic recorded earthquakes along the Hayward and San Andreas Faults, respectively.

Table 4-3. Recorded or Deduced Strong (M6.0+) Earthquakes along the Hayward Fault

Date	Magnitude	Notes
1315	Over M6.3	Based on geologic data
1470	Over M6.3	Based on geologic data
1630	Over M6.3	Based on geologic data
1725	Over M6.3	Based on geologic data, predates California missions
1868	M6.8 to M7	Based on geologic data, predates California missions
1984	M6.2	Morgan Hill (on nearby Calaveras Fault)

Table 4-4. Recorded Strong (M6.0+) and Major (M7.0+) Earthquakes along the San Andreas Fault

Date	Magnitude	Notes
1812	M7+	Southern California
1838	M7	Santa Cruz Mountains
1857	M7.9	Fort Tejon
1890	M6.3	Corralitos
1906	M7.8	San Andreas (San Francisco Quake)
1940	M7.1	Imperial Valley
1983	M6.5	Coalinga
1989	M6.9	Scotts Valley (Loma Prieta Quake)
1991	M6.3	Fortuna
1992	M7.2	Fortuna
2019	M6.4, M7.1	Ridgecrest sequence

The 1989 Loma Prieta earthquake, M6.9, occurred after the infilling of Alameda along South Shore, Bay Farm Island, and Alameda Point. This quake caused \$2.1M damage to properties owned by the City of Alameda, including buildings, fuel tanks, broken water mains, broken sewer lines, street buckling, and bulkhead damage. The dollar amount of private properties is not included here.

The earthquake was strong enough to cause the collapse of the nearby Cypress Structure in Oakland. There were documented liquefaction (mud boils) in the made ground at Alameda Point and Harbor Bay Business Park on Bay Farm Island. Several neighborhoods including South Shore experienced buckled streets and sidewalks, and subsidence that made the sanitary sewer pipes no longer flow downhill, requiring the City to build a new sanitary sewer pump station. **Figure 4-3** shows a map of the settlement damage to streets from the Loma Prieta Earthquake. All were in areas of made ground, outside of the original shoreline. The Loma Prieta earthquake also caused damage to the Miller Sweeney Bridge at Fruitvale Avenue causing it to be shut to all vessel traffic until repaired.

The only strong quake to occur in the Bay Area since the 1989 Loma Prieta Earthquake is the 2014 South Napa Earthquake, M6.0, which caused extensive building and underground utility damage in Napa, along the rupture of the West Napa Fault. The damage was highly concentrated in the Napa area and no damage was reported in Alameda.

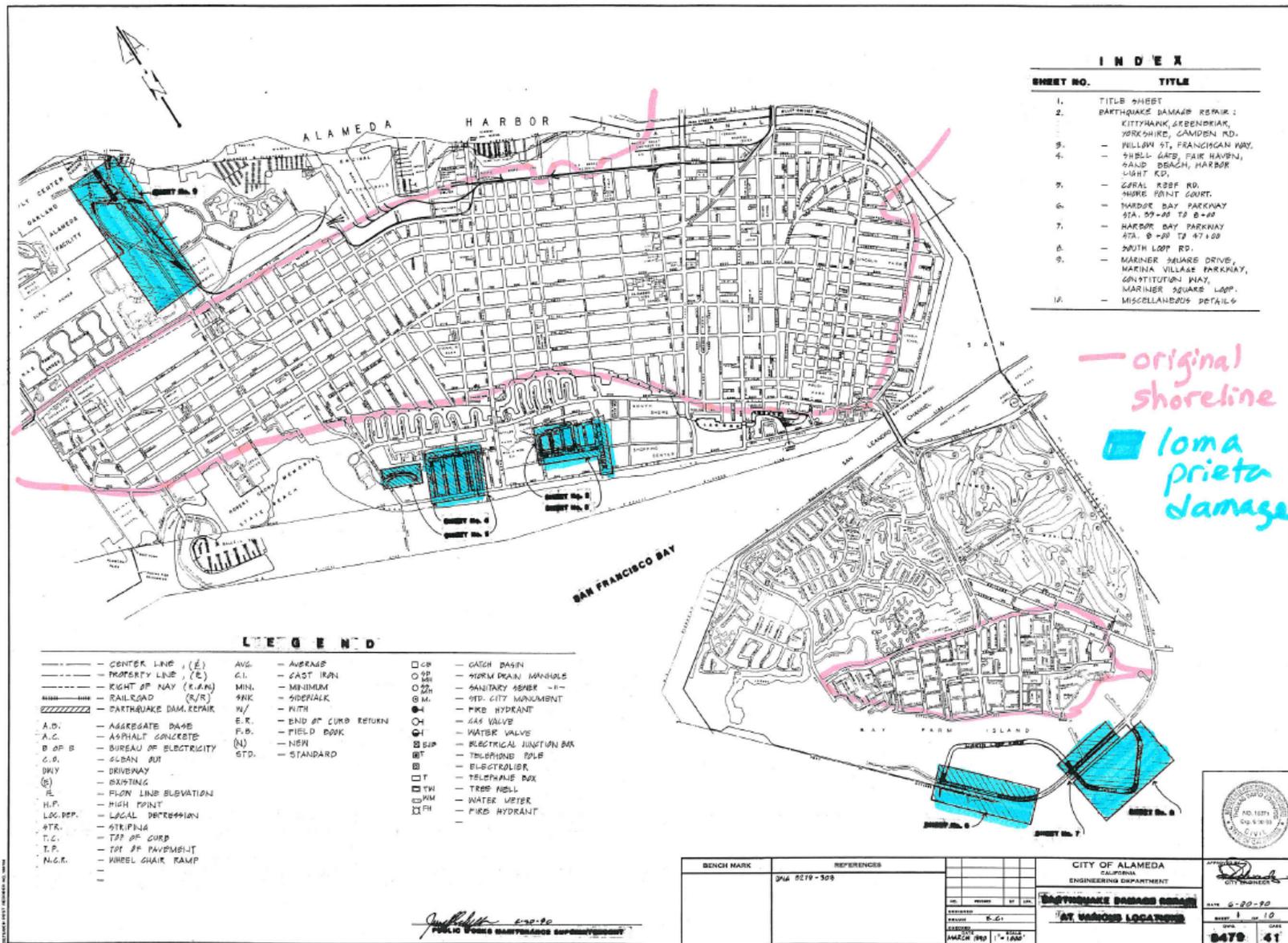


Figure 4-3 Areas of Loma Prieta Earthquake Damage and Original Shoreline of Alameda

Future Earthquakes

According to the USGS, the chance of an earthquake of M6.7 or greater somewhere in the Bay before 2043 is 72 percent.³ As shown on **Figure 4-4**, the chance of a M6.7 or greater earthquake on our closest fault, the Hayward-Rodgers Creek Fault, before 2043 is 33 percent. The likelihood of an earthquake on the next closest fault, the San Andreas, is 22 percent.

The California Integrated Seismic Network has developed scenario earthquakes and has shown what areas will be affected by each earthquake. A M6.8 quake on the Hayward fault or a M7.2 quake on the San Andreas fault is likely to cause at least a “strong” or MMI 7 shaking in Alameda. Combining all likely scenarios on nearby faults, Alameda has a 10 percent chance of experiencing “Very Strong” to “Violent” (MMI 8 to MMI 9) shaking in the next 50 years. This probability can also be expressed as a 0.2 percent chance per year, or a 500-year event, which could happen any time. **Figure 4-5** portrays this probabilistic seismic hazard.

Strong earthquakes strike the Hayward Fault at approximately 140-year intervals, with the last major one in 1868, so we may be due for another strong quake in the relative short term. USGS developed the HayWired earthquake scenario to depict a scientifically realistic depiction of a moment magnitude (Mw) 7.0 earthquake on the Hayward Fault with an epicenter in Oakland. In the scenario the Hayward Fault ruptures for 52 miles along its length. Such an earthquake would result in strong shaking that will trigger surface fault rupture, liquefaction, landslides, fires, and severe impacts throughout the entire Bay Area. **Appendix E** describes these impacts in greater detail. The HayWired scenario represents an earthquake with approximately a 150-year return period; one that has about a 20 percent chance of occurring in the next 30 years. While the impacts of this scenario are severe, it does not represent the worst-case earthquake by any means. By comparison, most newer buildings today are designed to protect the safety of occupants in earthquake shaking with approximately a 975-year return period, or a 2 percent chance of occurring in any 50-year period.

³ Earthquake Outlook for the San Francisco Bay Region 2014–2043, USGS Fact Sheet 2016-3026. Available at <https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf>.



Figure 4-4 Probability that a magnitude 6.7 or greater earthquake will occur on the Bay Area fault system before 2043



Figure 4-5 Probabilistic Earthquake Shaking Hazard Map

Climate Adaptation and Earthquakes

Climate change is expected to have a role in earthquake hazards. Rising sea levels correspondingly cause rising groundwater levels. Soils that are more saturated with groundwater are more likely to liquefy and subside. Rising groundwater is explored in further detail in the Future Flooding section.

Earthquake Risk Assessment

The vulnerability of Alameda assets to earthquake hazards is examined in detail in **Appendix E** and summarized below.

Certain types of buildings are more susceptible to the shaking and ground disturbances of earthquakes. Older buildings constructed before modern building codes are generally not designed to withstand earthquake shaking. Single family cripple wall, multi-family soft-story, unreinforced masonry, nonductile concrete, and tilt-up buildings are building types that are particularly vulnerable to damage in earthquakes. Alameda has an unreinforced masonry program that has resulted in the seismic retrofit of all unreinforced masonry buildings with 5+ units. Alameda also has a soft-story evaluation program that has resulted in the voluntary seismic retrofit of 159 buildings with five or more housing units; however, sixty-three buildings containing over 900 housing units remain unretrofitted.

Newer buildings constructed to current California building codes are designed protect occupant safety but do not ensure that a building will be usable after an earthquake. In a region experiencing a housing shortage, designing newer buildings to a higher standard would a faster recovery of these critical

buildings and the recovery of the community as whole. An additional 1 percent in construction cost to build new buildings to a “functional recovery standard” could increase the availability of homes and businesses by 75 to 95 percent following a major earthquake.⁴

Buildings subject to violent shaking can also dislodge asbestos or encapsulated (abated) asbestos, lead paint, and other hazardous materials. Broken plumbing can discharge sewage. Broken gas lines and damaged electrical wiring can spark fires and present health and safety hazards. Other hazards from shaking buildings include falling piping, shelving, and goods.

Some of the City’s most important buildings are vulnerable to earthquake shaking because they were constructed with the building standards that pre-dated current knowledge about earthquake dynamics. The City Hall, for example, completed in 1896, lost its central bell tower during the 1906 San Francisco Earthquake. The tower was never re-built. Since then, most of the City buildings have been seismically retrofit, or have been constructed to more modern standards. Of particular concern are the 1940s era residences and hangers on Alameda Point, the former Alameda Naval Air Station, that would be subject to earthquake shaking, liquefaction, ground settlement, and flooding. The Alameda Point Master Infrastructure Plan addresses areas of redevelopment, where buildings will be constructed to modern day seismic standards and reuse areas where retrofit work may be needed.

Alameda’s five estuary crossings have all be retrofitted to a “no collapse” standard, which means that while the bridge will survive without loss of life, significant repairs or replacement may be necessary. The Fruitvale railroad bridge is a collapse hazard that poses a hazard for the adjacent Miller-Sweeney bridge. Alameda is advocating for this bridge to be removed and replaced with a pedestrian/bike bridge. The City of Alameda has requested that Miller-Sweeney bridge and Bay Farm Island bridges be upgraded to a “lifeline” standard, which would allow them to be nearly immediately usable following an earthquake.

The hundreds of miles of natural gas, water, sewer, and stormwater distribution and collection lines are all at risk to damage from liquefaction. **Appendix H** shows maps of city sewer and storm drain facilities in relation the liquefaction susceptibility and shaking hazard. Neighborhoods that experience significant liquefaction may not have service restored for weeks or months. An average East Bay customer would lose water for an estimated six weeks and some will lose service for as long as six months. Water supply outages will impede fighting post-earthquake fires. Full restoration of the natural gas system can take up to six months because of the time it will take to integrity test the lines prior to repressurizing and number of qualified personnel required to relight pilot lights.⁵

Flooding

Over 23 miles of shoreline surround both the main island of Alameda and Bay Farm Island. As such, the City of Alameda is vulnerable to flooding from both coastal storms where water enters the land along the lower elevations of the shoreline and overland from rainfall within the City during and after storm events. In the near term, both are likely to be temporary in nature, limited by high tide cycles and intensity of events, with flooding likely shallow - on the order of 2 feet or less in depth. However, as climate change increases the intensity of storm events, sea levels, and groundwater levels, the depth and extent of flooding is expected to increase and may become more frequent or permanent. Today’s 100-year floodplain is approximately equivalent to 3 feet of sea level rise. Coastal storm and overland flooding are not mutually exclusive. During high tides many of the city’s outfalls are already under water and the pipes

⁴ [Haywired Earthquake Scenario](#), U.S. Geological Survey, 2018.

⁵ [Lifelines Restoration Performance Project](#), City and County of San Francisco, 2020.

upstream are partially full as a result. Additionally, some outfalls have chronic issues with mud deposition and their inherent capacity is already reduced. When a coastal storm event occurs, temporarily higher sea levels back up already submerged pipes even more, and as rainfall enters the pipes from upstream this capacity is diminished further. An example of recurrent flooding in the city due to the combination of rainfall and a submerged outfall is on Main Street, next to the old entrance gate for the former Naval Air Station. This location can be seen with several inches of water in the street during certain combinations of tides and storm events.

Note: In 2013 the City's storm drain outfalls were assessed visually for capacity, condition, and operation and maintenance prioritization. An updated comprehensive cleaning and condition assessment for the entire stormwater system is planned for fiscal year 2021-23.

Although there are not a significant number of recurrent flooding locations within the city, the combined factors described above may cause additional flooding issues if the storm drain system becomes overtaxed due to rising sea levels.

In some areas of the city, storm drainage is collected through pipes and flows down to a pump station. Alameda has 11 stormwater pump stations in total. In the case of pump stations, stormwater is pumped out to the Bay under pressure through a discharge line, not a gravity outfall pipe. Therefore, if the discharge line outfall is below high tide, it can still effectively pump. This is why rising sea levels will tend to have less of an effect on some portions of the city where pump stations exist, in lieu of gravity outfalls which can back up readily.

Alameda is very flat, especially in areas of made-ground, with many streets originally constructed at minimum longitudinal grade. Over time the significant number of trees along City streets has led to an abundance of heaves caused by tree roots along street gutterlines. As a result, ponding of stormwater in front of homes is frequent and recurrent, and keeping catch basin grates and culvert inlets free of clogs caused by leaves is an issue the maintenance department stays busy with during the wet season. Many homes have sump pumps below them that discharge to the gutter as well, to minimize structural damage due to the high-water table found in various parts of the city. For this reason, ponding can occur within the gutterline during the dry season.

Hazard Description

Tides

Because the Island of Alameda and Bay Farm Island have such extensive shorelines, an understanding of tidal influence is important for existing and future flood hazard characterization. The City of Alameda normally experiences tides that range from (-) 0.2 ft Mean Lower Low Water (MLLW) to 6.4 ft Mean Higher High Water (MHHW), based on the NAVD88 datum (the NAVD88 datum, or zero elevation, is approximately the same as the elevations used in local tide tables, and is the datum used in the Flood Insurance Rate Maps described below). The highest tides of the year, or "king tides", normally occur during the winter months of November thru February, and are usually about 7.4 ft NAVD88. The ten highest king tides recorded by NOAA in Alameda for the last 80 years measured 8.6 ft to 9.5 ft NAVD88 in elevation.

Coastal Flooding

In 2018 the Federal Emergency Management Agency (FEMA) published new Flood Insurance Rate Maps (FIRMs) that show approximately 2,000 Alameda properties mapped within the 100-yr flood zone, and at

least 1,100 buildings (significantly more than in the previously published 2009 FIRMs). Areas within the 100-yr flood zone have a statistical 1 percent chance per year of flooding if an extreme storm event happens during an extreme high tide, though the event could feasibly happen in any year (or even multiple times within one year).

With the 2018 update, FEMA modeling shows Both AE Zones (high risk flood zone, with wave heights less than 3 ft) and VE Zones (high risk zone, with wave heights greater than 3 ft) surrounding Alameda's shorelines with varying associated Base Flood Elevations, or BFEs (the computed elevation to which the flood is anticipated to rise). Some BFEs are as high in elevation as 14 ft NAVD88. Thankfully, all of the low points in the city's shoreline that serve as entry points for coastal flooding occur in AE Zones where the BFE is limited to 10 ft NAVD88, and therefore floodwaters would extend onto city land until they meet land at that same elevation. Nearly the entire city's land-based flood zone has a BFE = 10 ft NAVD88. For context, the BFE of 10 ft NAVD88 is 2.6 ft above the yearly typical king tide described previously and could theoretically be achieved by a combination of a king tide plus a weather-related temporarily higher sea level. The updated flood mapping for Alameda is shown below and available at msc.fema.gov.

According to the FIRMs, the main island of Alameda has its most extensive coastal flood entry locations in three main areas where the City shoreline is lower in elevation than the 100-year BFE; these occur along the northern, eastern, and Alameda Point shorelines (see **Figure 4-6**). Along the northern shoreline, this entry point is approximately 1,100 ft long and located behind (north of) the Webster and Posey Tube portals. Alameda Point is the largest portion of the main island affected by the 100-yr coastal storm event (portions shown on **Figure 4-6**); to the north, floodwaters would enter along a 1.5 mile stretch along Main Street and extend toward the northwest tip of the former Naval Air Station airfield. They would also enter from the south along a 1.6 mile stretch that includes the former seaplane lagoon and federal property. Along the eastern shoreline, the entry location is approximately 350 ft long and includes the end of the Liberty Avenue right-of-way (see **Figure 4-7**).

Bay Farm Island is especially vulnerable to coastal flooding, as the lowest property elevations within the city are found here and are included within the flood zone. The issue of most importance is that flood waters can enter from multiple locations and combine into one interconnected flood zone. These entry points within city limits include the end of Veterans Court, the low point at the Lagoon System 1 North Outfall on the northern shoreline, and approximately 1,900 ft of Doolittle Drive. Additionally, flood waters originating within the City of Oakland along the 2 miles of shoreline along Doolittle Drive/SR 61 would also affect Bay Farm Island: they would flow across the airport and enter into Alameda over a stretch of 1.2 miles of Harbor Bay Parkway (the city line), inundating city properties.

While the Chuck Corica Golf Course is shown as part of the flood zone in **Figure 4-8**, it is worth noting that extensive site grading has taken place over the last few years, and now mounds are in place along its eastern perimeter and throughout its interior. The exact effect that this regrading may have on Bay Farm Island flooding scenarios is unknown (the regrading was not done for flood protection purposes or using FEMA-accreditation methodology and therefore is not reflected on the FIRMs). Regardless, floodwaters entering Bay Farm Island at the 100-yr event could potentially block Island Drive, Doolittle Drive, Harbor Bay Parkway, Ron Cowan Parkway, and the approach to the Bay Farm Island Bridge, compromising Bay Farm Island egress from both Oakland and the main island for emergency and recovery purposes.

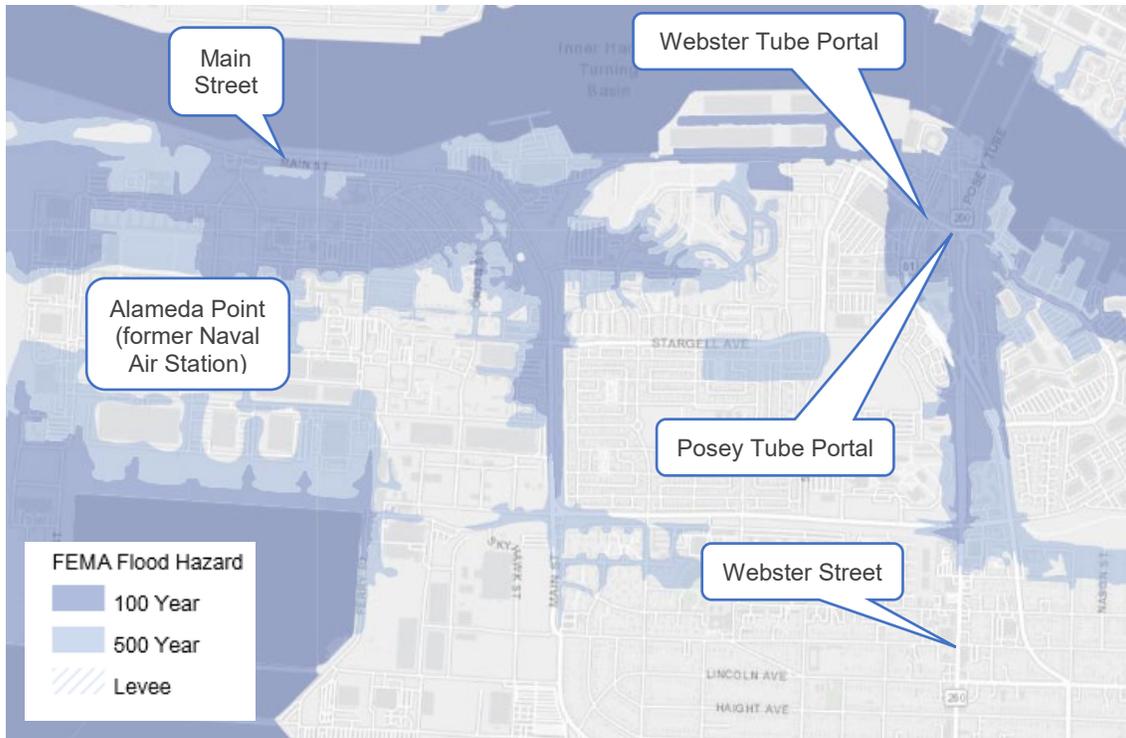


Figure 4-6 Main Island: Current (2018) FEMA Flood Mapping Along Portion of Northern and Western Shorelines. Areas affected include Webster St and Tube Portals.

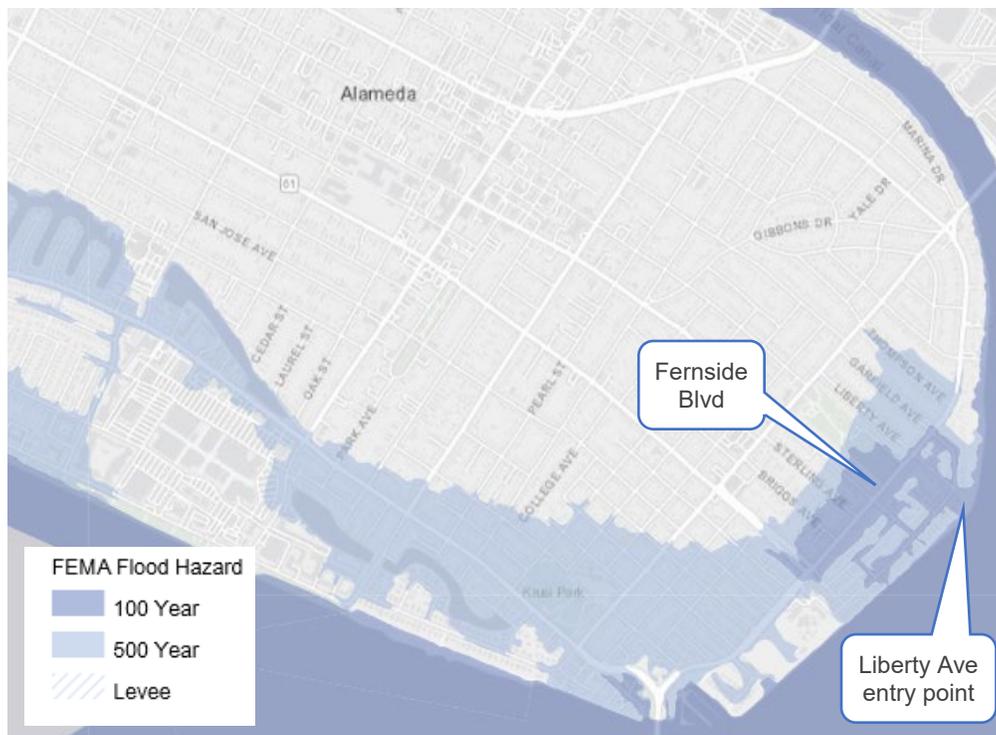


Figure 4-7 Main Island: Current (2018) FEMA Flood Mapping of Eastern Shoreline. Areas affected are Liberty Avenue and Fernside Boulevard neighborhoods.



Figure 4-8 Bay Farm Island: Current (2018) FEMA Flood Mapping. Areas affected are homes along Lagoon System 1 North, Island Drive, Maitland Drive and Mecartney Road

In the above discussion, potential flooding is considered temporary – induced by storm events that have a beginning and end, and the FEMA flood maps reflect these temporary conditions. However, in the subsequent discussion on sea level rise the key difference will be that flooding conditions are considered permanent even though they may impact the same geographical area as a temporary storm today would. As such, a higher baseline sea level in the future could be considered the new “normal.”

Overland Flooding

Figure 4-9 and Figure 4-10 depict modeled surface flooding in Alameda based on a historic 25-year rainstorm event. The model shows where water may overwhelm the stormwater system in a theoretical storm (these are not actual flooding locations). Red nodes indicate locations where surface flooding is expected to be greater than 1 ft in depth. Open circle nodes indicate locations expected to be 0.5 ft to 1 ft deep. Locations with less than 0.5 ft of flooding are not shown. These modeled flood nodes were used during the vulnerability assessment to specifically consider the risk of overland flooding separately from flooding due to sea level rise and storm surge.

As the figures illustrate, flooding over 1 ft deep on the main island is concentrated on the western side, along Singleton Avenue and the Webster Street corridor (and a few locations a block east or west of it). On Bay Farm Island there is only one location, at the northern end of Lagoon System 1 North. Otherwise flooding is limited to less than 1 ft at the theoretical event.

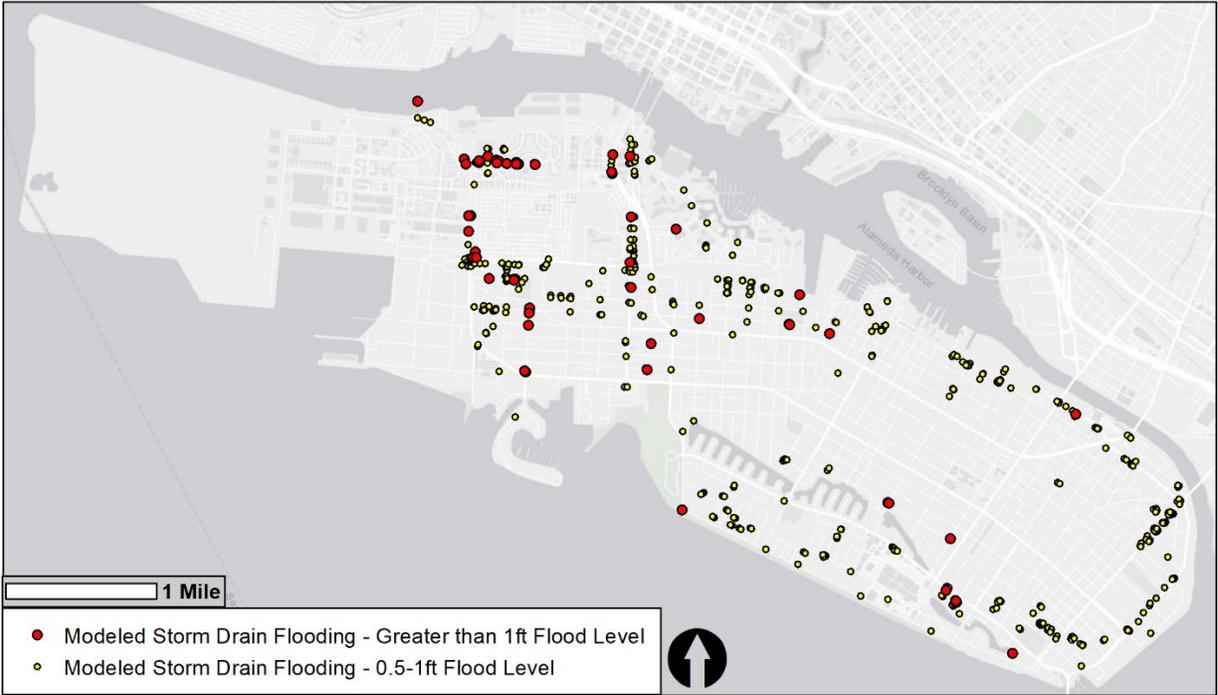


Figure 4-9 Modeled surface flooding on the main island for a 25-year storm event. Results were filtered to show only locations with modeled flood depths of greater than 0.5 ft above street level. The points shown on this map reflect model node locations

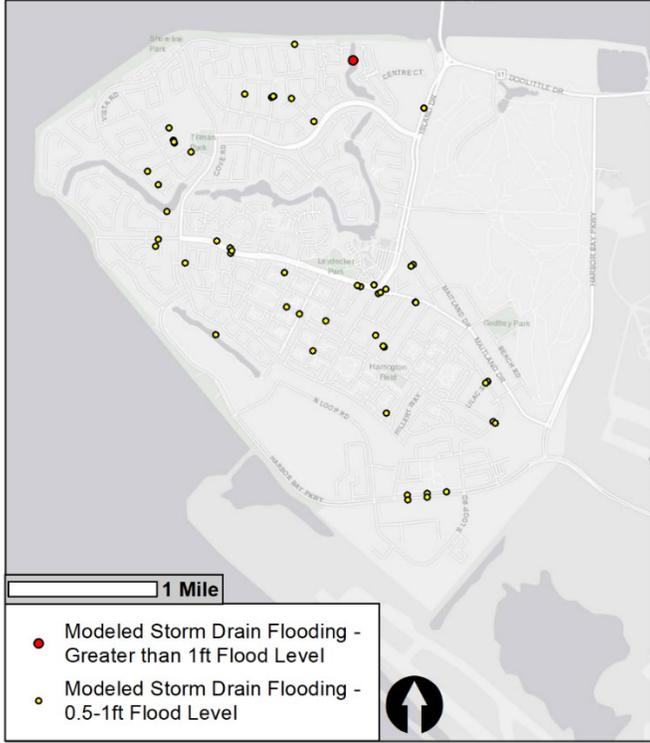


Figure 4-10 Modeled surface flooding on Bay Farm Island for a 25-year storm event. Results were filtered to show only locations with modeled flood depths of greater than 0.5 ft above street level. The points shown on this map reflect model node locations

The City has also modeled the existing stormwater collection system and determined what intersections are at risk of flooding during a 10-year storm or 25-year storm due to undersized pipes, undersized pump stations, or the inability to drain during high tides. Maps showing collection system-related flooding potential are shown in **Appendix H**. The City's storm drain modeling looked at 10 and 25-year storms, which is the normal return period used for storm drain construction.

Historic Flooding

Winter months are when the City is most likely to experience storm events. During an extreme storm event, the level of the sea can temporarily rise several feet above the level predicted by tide tables. This is caused by "wind set-up," which is the tendency for water levels to increase at the downwind shore and to decrease at the upwind shore if the storm pushes and piles up water along the coast. Temporary sea level rise can also be caused by wind-caused waves, and by the seawater increasing in volume as its temperature rises (as happens during an El Niño year) among other factors.

California experiences a megaflood, or outburst flood, event every 100 to 200 years. During the megaflood of 1861-62 that destroyed a quarter of California's economy, 28 in of rainfall fell on San Francisco in 1 month, and a record 7.76 in fell in one 24-hour period. Other areas on the West Coast experienced similarly intensity and volume. Since then, there have been less extreme flood-inducing storms every two to three years striking some part of California.

These storms are not necessarily related to El Niño or La Niña years. During normal conditions in the Pacific Ocean, trade winds blow west along the equator, taking warm water from South America towards Asia. To replace that warm water, cold water rises from the depths — a process called upwelling. El Nino and La Nina are two opposing climate patterns that break these normal conditions. During El Nino, trade winds weaken. Warm water is pushed back east, toward the west coast of the Americas. La Nina has the opposite effect of El Nino. During La Nina events, trade winds are even stronger than usual, pushing more warm water toward Asia. Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface.

Of the ten costliest California storm seasons between 1949 and 1997, four (1979-80, 1985-86, 1992-93, and 1996-97, in 1998 dollars) were neither El Niño nor La Niña types. The most expensive storm (1994-95) was a weak El Niño with 100-year to 1,000-year events. (J. Null, "El Niño and La Niña ... Their Relationship to California Flood Damage", http://ggweather.com/enso/calif_flood.htm). Therefore, in any given year, El Niño or not, there could potentially be a severe storm. With the increased understanding and tracking of atmospheric rivers, these events will become easier to predict and prepare for.

In 1981, storms eroded Crown Beach up to the edge of Shoreline Drive. During the El Niño event of 1997-98, there was up to 2 feet of standing water on Main Street due to higher sea levels (king tide plus weather-related temporary sea level rise) and heavy rainwater runoff. And in 2006, storm waves damaged the Harbor Bay Ferry Terminal and washed away portions of the adjoining Coastal Trail. These events were relatively minor in terms of damage, and none involved structures. However, there is the potential for more extensive flooding and erosion.

The most problematic recurring flooding location in the city was alleviated in 2021, which involved construction of two relief manholes in the Crown Beach sand dune. The manholes were constructed inline with two culvert outfalls from Shoreline Drive and have their grates at a lower elevation than the catch basin grates feeding the outfalls within Shoreline Drive. This thereby prevents Shoreline Drive and Kitty

Hawk Road from flooding during a combination of large rain events and clogged outfall pipes, which maintenance crews had historically struggled with every wet season.

As of May 2021, FEMA's National Flood Insurance Program (NFIP) Claims Dashboard shows that FEMA has handled 10 flood loss claims for the City of Alameda since 1970 - a time span of 51 years. These claims have resulted in a net total payment of \$30,865. There are currently no open claims, and FEMA Region IX personnel informed the City that as of May 2021 there are no Repetitive Loss (RL) or Severe Repetitive Loss (SRL) structures in the City of Alameda (Community ID# 060002) and therefore none in the identified flood hazard areas.

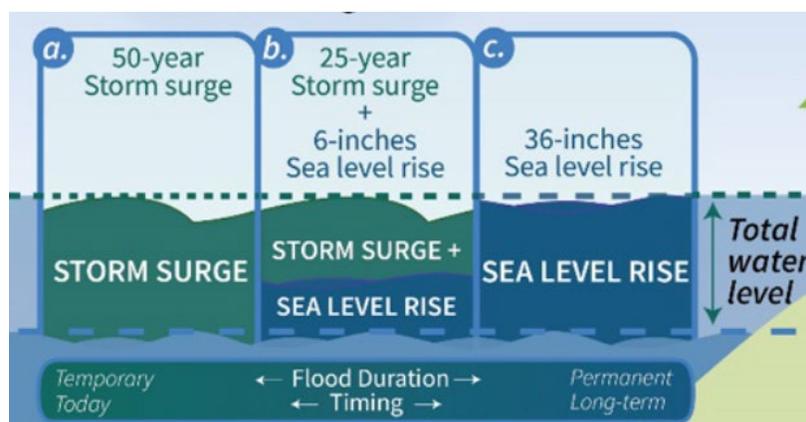
Future Flooding

Earlier, it was discussed that today's coastal flood scenario can be viewed as a potential and temporary condition, induced by a storm event that has a beginning and an end. When discussing future flooding scenarios, sea level rise may be a key difference - making flooding conditions permanent due to a higher baseline sea level. It is anticipated that future storm surge, higher sea level, and elevated groundwater levels will have a compound effect on increasing flooding scenarios within the city.

Total Water Level vs. Sea Level Rise

When discussing sea level rise, the CARP and this document evaluate tidal flooding due to storm surge and sea level rise in terms of total water level (TWL) above today's MHHW level. Using TWL recognizes the contribution of both sea level rise and storm surge to flooding and reflects a range of scenarios. For example, a total water level of 36 inches above today's high tide can result from any of the following (as shown in **Figure 4-11**):

- 50-year storm event today;
- 6 inches of sea level rise plus a 25-year storm event in the short term (6 inches sea level rise likely by 2030); and
- 36 inches of sea level rise (around 2060–2070).



(Credit: ART, San Francisco BCDC).

Figure 4-11 Image depicting total water level as a combination of sea level rise and storm surge

Applying a TWL approach enables us to plan actions that address temporary impacts of today's winter storms while simultaneously planning to address more permanent inundation from sea level rise.

Flooding Scenarios and their Timing

Table 4-5 is taken from the CARP and presents the main TWL projections shown on **Figures 4-12 and 4-13** (and referenced in the CARP) as well as additional projections, their respective elevations in NAVD88, the various flood scenarios represented by these TWLs, and the anticipated timing for these projections.

Table 4-5 Total Water Levels, Flooding Scenarios, and Timing for Sea Level Rise Projections

TWL	Elevation (NAVD88)	Flooding Scenarios: SLR + Storm Surge	Timing for SLR Projections
MHHW + 36"	~9.5 feet	50-year storm 6" SLR + 25-year storm 12" SLR + 5-year storm 18" SLR + 2-year storm 24" SLR + king tide 36" SLR	Immediate (storm risk) Before 2030 2030–2040 2040–2050 2050 2060–2070
MHHW + 42"	~10 feet (base flood elevation)	100-year storm 42" SLR	Immediate (storm risk) 2070
MHHW + 66"	~12 feet	24" SLR + 100-year storm 30" SLR + 50-year storm 36" SLR + 25-year storm 42" SLR + 5-year storm 48" SLR + 2-year storm 52" SLR + king tide 66" SLR	2050 2060 2060–2070 2070 2070+ 2070+ 2070+
MHHW + 108"	~15.5 feet	66" SLR + 100-year storm 84" SLR + 5-year storm 108" SLR	2070+ 2070+ 2070+
MHHW + 124"	~16.75 feet	84" SLR + 100-year storm	2100

Note: Sea level rise (SLR) projections correspond to medium-high risk aversion decision, high emissions scenarios from *Rising Seas in California: An Update on Sea-Level Rise Science* (Griggs et al., 2017).

California's Ocean Protection Council, in its March 2018 Sea-Level Rise Guidance, recommends California communities plan for at least 50 years of sea-level rise at the Council's Medium-High Risk Aversion, high emissions scenario and prepare for 100-year events at that level, such as inundation from a 100-year storm surge. For the City of Alameda, this means preparing for:

- MHHW + approximately 3.5 feet of sea level rise by 2070 plus the potential for a 3.5-foot coastal storm surge; and,
- MHHW + 5.9 to 6.9 feet of sea level rise by 2100, plus the potential for a 3.5-foot coastal storm surge.

Alameda must also consider the increased risks that 3.5 feet of sea-level and groundwater rise, as well as changing weather patterns, would bring for tsunamis, liquefaction and rainfall events.

Total Water Level Mapping

Figure 4-12 and Figure 4-13 show maps depicting inundation for four TWL scenarios: today's MHHW plus 24 in, 36 in, 77 in, and 108 in. Additionally, as described in the discussion below, while the current FIRMs show us temporary 100-yr flood conditions as of today, they also show us a TWL scenario of today's MHHW plus 42 in. Refer to **Appendix H**.

The maps show us that at a TWL of 24 in above today's MHHW, the main island can expect flooding to impact Main Street and Alameda Point, particularly the Barbers Point Road residential area to the north and the wetland/tarmac area along the southern shore. For Bay Farm Island, mainly the coastline north of Doolittle Drive is affected.

At a TWL scenario of 36 in flooding is far more extensive, and affects slightly less area than what was described previously for flood zone impacts shown on the current FIRMs (refer to Coastal Flooding section). This is because a TWL of 36 in is just a few tenths of a foot lower than the BFE shown on the FIRMs. Note: while the FIRMs represent temporary 100-yr flood conditions as of today, they also show us what the permanent flooding extent is for a TWL scenario of 42 in: MHHW + 42 in sea level rise = TWL of 10 ft NAVD88, aka area covered by the blue shown on the FIRMs.

At a TWL scenario of 77 in, the main island sees approximately three-quarters of Alameda Point flooded while northern shoreline flooding reaches as far as the Buena Vista Avenue neighborhood. The South Shore area and Crown beach is heavily inundated, and South Shore flooding connects to an also heavily inundated eastern end of the island. Bay Farm Island experiences flooding of properties along the remainder of the lagoon system as well as inundation extending southerly of Mecartney Road to a greater extent than shown on the FIRMs.

Finally, at the 108 in TWL scenario the western half of the main island is flooded as well as the entire South Shore area, East End, and northern end of the island. The central portion of the island above Elevation 15.4 ft NAVD88 remains unflooded. Bay Farm Island is approximately 80 percent flooded at this scenario, since only a select few upland areas exist above Elevation 15.7 ft NAVD88.

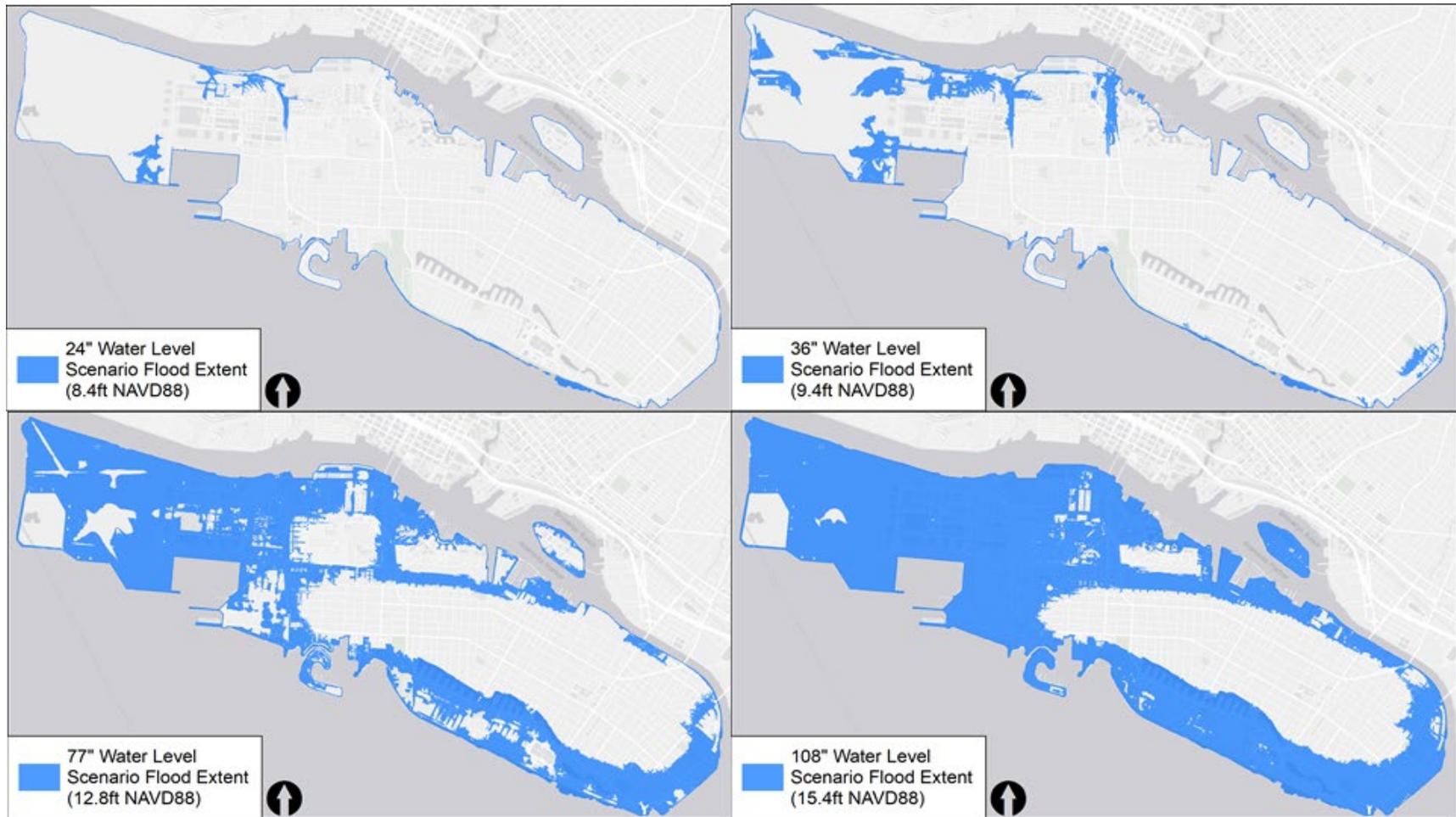


Figure 4-12 Maps depicting inundation for MHHW (6.4ft NAVD88) plus 24 in, 36 in, 77 in, and 108 in total water level scenarios for the main island.

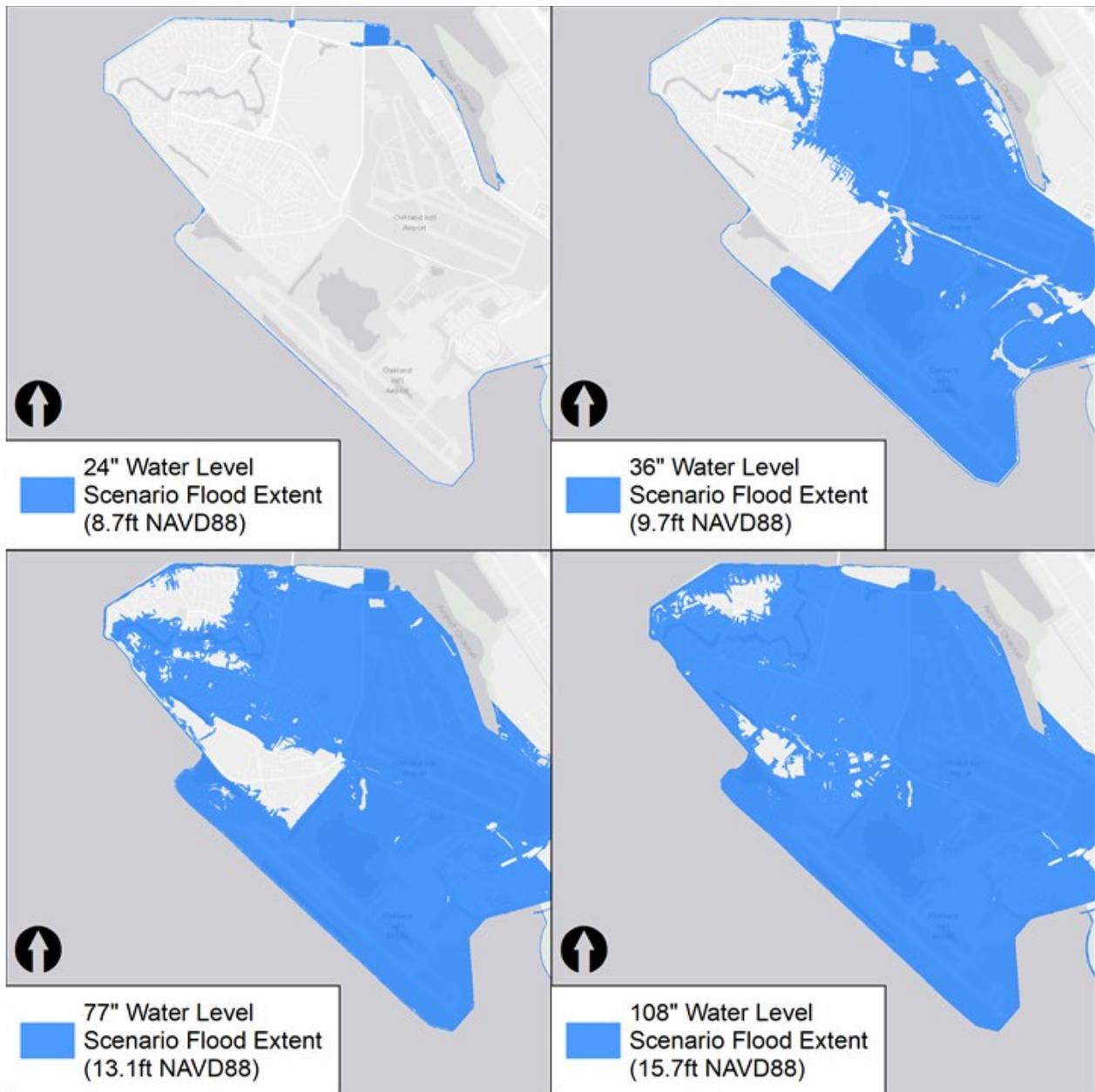


Figure 4-13 Maps depicting inundation for MHHW (6.7ft NAVD88) plus 24 in, 36 in, 77 in, and 108 in total water level scenarios for Bay Farm Island.

Impacts of Sea Level Rise on Groundwater Levels

Sea level rise can have a major impact on local and regional groundwater levels. **Figure 4-14** shows the relationship between sea level rise and groundwater in areas such as Alameda with shallow coastal aquifers. As sea level rises the freshwater lens rises as well – even in areas that are not hydrologically connected to the ocean. The magnitude of groundwater rise due to sea level rise varies based on local geology and hydrology.

Rising groundwater can damage underground assets like cables and pipes and increase the basement flooding that many Alamedans already experience (see **Figure 4-15**). Depending on the thickness of the freshwater lens and the rate of groundwater level rise, saltwater intrusion can corrode some metallic-based infrastructure materials. High groundwater levels can also reduce the efficacy and capacity of the stormwater system, potentially resulting in surface flooding.

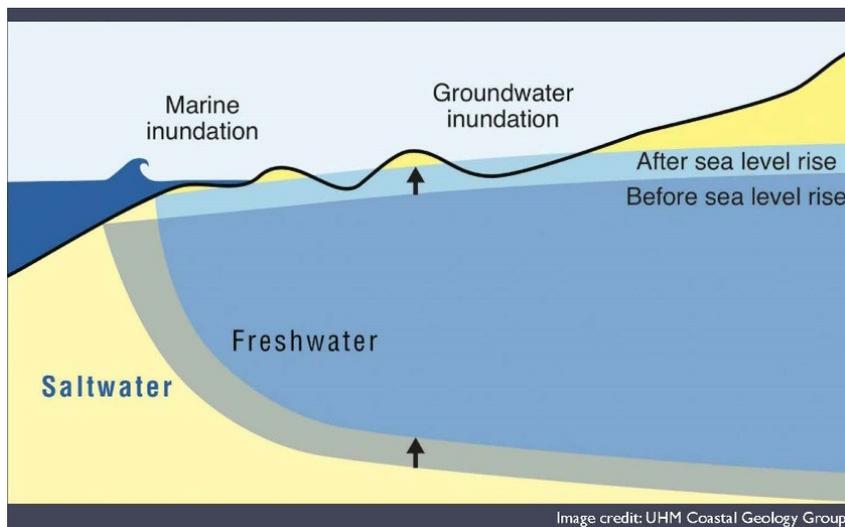


Figure 4-14 Conceptual diagram of the relationship between sea level rise and groundwater, highlighting the potential for flooding and inundation to occur in shallow areas that are not hydrologically connected to the ocean (Habel et al., 2017).

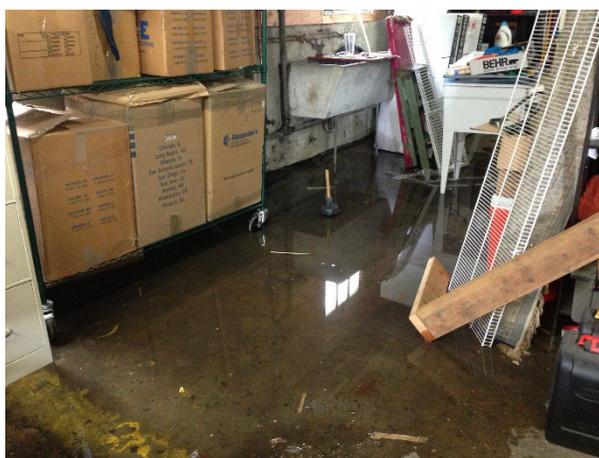


Figure 4-15 Example of basement flooding, similar to what can be found in Alameda basements. Photo Credit: Arthaey Angosii

Researchers at Silvestrum Climate Associates and the University of California, Berkeley collaborated on the development of a high level, regional shallow groundwater layer in the San Francisco Bay Area using groundwater monitoring well data. The results of the analysis, released in 2020, revealed widespread shallow groundwater conditions along most of the shore of San Francisco Bay. As sea levels rise, the groundwater surface will also rise, and these areas are at highest risk of experiencing impacts to buried infrastructure, soil behavior, human health, and nearshore ecosystems. These areas are also at risk for

flooding due to emergent groundwater. The findings of this high-level assessment highlighted the need to understand the full range of sea level rise impacts for prioritizing adaptation investments, and selecting appropriate strategies in coastal communities. The CARP recognized that many homes in Alameda are already affected by groundwater and given the findings in the newly published research, recommended further characterizing rising groundwater as a potential future hazard in Alameda's climate change vulnerability assessment.

The 2018 research revealed the City of Alameda is at-risk for rising groundwater in the face of climate change. However, due to sparse well data within city limits, and a strong tidal and precipitation influence within the Alameda soils, enhancements to the regional mapping were needed to characterize the shallow groundwater layer in Alameda. Staff engaged Silvestrum Climate Associates to develop a more refined model using geotechnical soil boring data collected throughout the City and the Oakland International Airport. This local groundwater model was then used to assess the groundwater surface response to various sea level rise scenarios. As the groundwater table rises, contaminants with the shallow groundwater will rise closer to the ground. The potential for contaminants to become emergent was also looked at.

The groundwater report finds that the areas at risk of future flooding increase by up to 25 percent when considering emergent groundwater, and in certain areas this flooding occurs well before coastal floodwaters overtop the shoreline. Rising groundwater, even before it is emergent, will affect below grade infrastructure such as building foundations, basements and utilities. **Figure 4-16** illustrates emergent groundwater under 24, 36, 66, and 108-inch sea level rise scenarios.

The groundwater report recommends adaptation solutions to include in the next update to the CARP, such as amendments to local building codes to address floodproofing and guidance for homeowners regarding sump pumps. Other follow-ups to the groundwater report include, among other items, integrating the study's results into relevant chapters of the General Plan, further analyzing potential landfill risks, and updating the digital elevation model used in the groundwater mapping given recent changes in grade at the Corica Golf Course and other areas of recent land development.



Source: *The Response of The Shallow Groundwater Layer and Contaminants to Sea Level Rise, 2020.*

Figure 4-16 Map depicting emergent groundwater for 24, 36, 66 and 108 inches of sea level rise

Flood Risk Assessment

If 100-year floodwaters as modeled on the FEMA FIRMs were to enter along the northern shoreline's 1,100ft long span of entry behind the Webster and Posey Tube portals, they would extend southerly down Webster Street to the intersection of Atlantic Avenue by the College of Alameda, flooding the tubes as well as affecting commercial businesses, and to a lesser extent residential buildings. While land elevation ranges between 5 ft and 10 ft NAVD88 within this flood zone area, elevations of developed properties are generally between 7 ft to 10 ft NAVD88, meaning that depth of flooding would be limited to 3 ft or less for these properties (depending on the location) at the 100-yr flood event. The tubes however would be more severely affected, as they descend to a depth such that the top of the tubes is at least 40 ft beneath the northern shoreline ground surface. In a coastal flood event waters would enter the tubes via the Webster and Posey portals and the extent/level of flooding within the tubes themselves would likely depend on the elevation of floodwaters during the event and the amount of time the tubes were exposed to it.

Along the eastern shoreline, the 350 ft long entry span for the 100-year flood places roughly 250 residential homes in the Fernside Boulevard / Liberty Avenue neighborhoods within the flood zone. Ground elevation ranges between 8 ft and 10ft NAVD88 in this area, meaning flooding at this event would be limited to a depth of 2 ft or less for these residential properties.

On Alameda Point, 100-year floodwaters entering along the 1.5 mile stretch of Main Street to the north and 1.6 mile stretch to the south would affect commercial businesses, industrial, residential, and City-owned properties, and federal lands such as the Least Tern nesting habitat on the former airfield tarmac. While elevations can be found as low as 5 ft NAVD88 on undeveloped properties within the Alameda Point flood zone, elevations of developed properties are generally between 8 ft to 10 ft NAVD88, meaning that depth of flooding would be limited to 2 ft or less at this event for developed properties with structures.

On Bay Farm Island, the interconnected 100-year flood zone spans a large enough area to include over 600 homes within it. Properties on Island Drive and Maitland Drive (south of the Chuck Corica Golf Course) are at the lowest ground elevations, as low as 2 ft NAVD88. This means the event on Bay Farm Island could result in a depth of flooding as great as 8 ft in these locations. However, several hundred of the homes included in the flood zone are along Lagoon System 1 North and are generally between 8 ft and 10 ft NAVD88 in elevation, meaning they would be subjected to a flood depth of 2 ft or less.

As described earlier, the current 100-yr flood event reaches the same elevation as a future TWL scenario of 42 in would, and therefore similar flood depths/impacts would be expected for both scenarios.

Note that roadways serving the areas described above would also be flooded to various depths depending on the road elevations. Roadways in the northern shoreline, eastern shoreline, and Alameda Point areas will all experience flooding to a different degree. Similarly, the three major roadways that provide egress from Bay Farm Island to the main island (and Oakland via Doolittle Drive) will experience flooding to various degrees. This is explained in further detail in the detailed flood and sea level rise risk assessment **Appendix F** and summarized below. Priority Coastal Inundation Locations are summarized in CARP and reproduced in **Appendix G**.

When floodwaters do occur, they result in the flooding of buildings, yards, and streets and can cause loss of use and damage of contents of residences, commercial establishments, schools, and other buildings. Floodwaters can damage underground utility boxes, prevent emergency circulation if streets are blocked,

and release of hazardous material leachates. Recovery efforts may include removal of water, mud and debris; removal of moldy building material; repair of salt water damage to electrical and telecom facilities; and replacement of goods and furniture stored in low-lying areas.

Flooding affects natural shorelines as well. When erosive issues are at play from floodwaters, the underlying berm fill material that the shoreline is composed of is eaten away and the integrity of the shoreline is compromised. The effects are less pronounced with hardened shorelines such as riprap or seawalls. With natural shoreline areas like the northern shoreline of Bay Farm Island, the erosion becomes pronounced over time because there are not large boulders present to buffer the wave energy. In turn, the protective distance between homes and the waterfront is lessened and the potential for coastal flooding moving inland increased.

Increased flooding from sea level rise and rising groundwater levels can, depending on site-specific conditions, mobilize and release some of the contaminants in the ground, potentially creating exposure pathways, or increasing risk of exposure. Contaminated lands within Alameda are the result of previous land uses, such as manufacturing, that involved the use, storage, or disposal of hazardous wastes. Sites were identified, and the responsible entities are in the process of assessing or cleaning them up to meet current environmental and public health standards. A two-pronged strategy is needed to increase Alameda's resilience to contaminated lands: 1) all citizens and businesses should properly dispose of waste products to prevent future contamination, and 2) the City should assess timelines for cleaning up existing contaminated lands with regard to the potential for releases from increased flooding due to rising sea and groundwater levels.

High winds associated with storms can damage or knock down trees onto streets, power lines or buildings. Storms combined with high tides can cause coastal erosion, beach loss, habitat loss, shoreline street damage, shoreline trail damage, and marina damage.

Tsunamis

Hazard Description

Tsunami waves are triggered by ground displacements from large underwater earthquakes or landslides.⁶ Tsunami waves do not "break" when they reach the shore like normal waves, instead they rush ashore like a fast-rising tide with powerful currents that extends much farther inland than normal tides. Even small tsunamis are associated with extremely strong currents capable of knocking someone off their feet.

Tsunamis impacting Alameda can result from offshore earthquakes within the Bay Area, or from distant offshore subduction faults such as those in the Pacific Northwest, Alaska, Japan and South America. Alameda will have several hours warning time for tsunamis generated in distant locations. Local tsunamis can also be generated from offshore strike-slip faults within the Bay Area and would provide little warning time. However, these faults are not likely to produce significant tsunamis because they move side to side, rather than up and down, which is the displacement needed to create significant tsunamis. They may have slight vertical displacements, or could cause small underwater landslides, but overall there is a minimal risk of any significant tsunami occurring in the Bay Area from a local fault. The greatest risk to Alameda is from events in the Cascadia subduction zone and the Aleutian Islands. These events could

⁶ See: USGS, [What are tsunamis?](#)

generate significant tsunami waves that would reach Alameda within a few hours, providing short time for evacuation.

Historic Tsunamis

Over 70 tsunamis have been observed or recorded within the San Francisco Bay in the past 200 years, but none have caused significant damage in Alameda. Only two were recorded in the vicinity of Alameda before 1946. One of questionable record was in 1868 with a latitude and longitude in the Bay near Oakland Airport, listed as 4.5 feet, plus a sighting of unknown height at Government (Coast Guard) Island. Another was recorded in 1898 in Oakland at 0.31 feet.

Since 1946, when record keeping increased, there have been 30 tsunamis within the San Francisco Bay, and of those, about half have been recorded in Alameda. Recorded heights in Alameda have ranged from 0.02 feet to 0.51 feet. Most records are under 3 inches. There are no reported inundation run-ups within the Bay.

There have been two tsunamis in this time period that have caused damage within the San Francisco Bay, including the 1964 Alaskan event (M9.1) which caused widespread damage to the West Coast, including \$2.2M in recorded damage and water heights up to 1.52 feet in the San Francisco Bay Area and Half Moon Bay and one death in Bolinas. The other major earthquake was the 2011 Tohoku (Japan) event (M8.9) which caused \$125,000 damage at the Berkeley Marina and had water heights up to 1.50 feet. This tsunami caused at least \$48M statewide, but resulted in only a non-destructive 6-inch wave along the shoreline of Alameda. **Figure 4-6** contains a detailed list of all tsunamis that have been measured in Alameda or Oakland, along with measurements taken elsewhere in the Bay Area.

Table 4-6 Tsunamis in the San Francisco Bay with Measurements Recorded in Alameda

Year	Location Name	Latitude	Longitude	Distance From Source (km)	Travel Hours	Maximum Water Height (m)
1946	ALAMEDA, CA	37.79	-122.27	3545	5:54	0.2
1952	ALAMEDA, CA	37.79	-122.27	7601		0.02
1952	ALAMEDA, CA	37.79	-122.27	6003	8:57	0.4
1957	ALAMEDA, CA	37.79	-122.27	4388	6:10	0.18
1960	ALAMEDA, CA	37.79	-122.27	9787	15:39	0.31
1964	ALAMEDA - NAVAL AIR STATION, CA	37.79	-122.27	3130	5:30	0.8
1968	ALAMEDA, CA	37.79	-122.27	7727		0.1
1992	ALAMEDA, CA	37.79	-122.27	337		0.04
1994	ALAMEDA, CA	37.79	-122.27	7265		0.04
2006	ALAMEDA, CA	37.79	-122.27	8402		0.04
2010	ALAMEDA, CA	37.79	-122.27	9635	15:10	0.12
2011	ALAMEDA, CA	37.79	-122.27	7939	10:49	0.51
2012	ALAMEDA, CA	37.79	-122.27	1833	4:08	0.11
2015	ALAMEDA, CA	37.79	-122.27	9304	14:49	0.06
2021	ALAMEDA, CA	37.79	-122.27	3295		0.06

Source: National Geophysical Data Center / World Data Service (NGDC/WDS): Global Historical Tsunami Database. National Geophysical Data Center, NOAA. <http://dx.doi.org/10.7289/V5PN93H7>, accessed 1/21/22

Recent studies of Tsunami conducted by the United States Geologic Survey (USGS) Science Applications for Risk Reduction (SAFRR) tsunami scenario also examine paleo tsunami.⁷ This study looks back in geological time by using core sampling and other means to identify tsunami events before record keeping. Although there has not been an impact or any major devastation from tsunami in more than 100 years, geologic study suggest that significant tsunamis have impacted the San Francisco Bay Area in the past and are likely to happen again.

Future Tsunamis

Although tsunamis are rare events that have not historically caused significant damage for Alameda, future events could have significant consequences, including the complete inundation of Bay Farm Island and significant inundation of the Main Island. Damage to marinas, ships and piers, low-lying homes, and other facilities within the tsunami inundation zone would be catastrophic.

Because the largest potential tsunamis have likely not yet occurred in Alameda County, the state tsunami program developed a suite of maximum credible tsunami scenarios as part of their tsunami inundation mapping project for local evacuation planning. This information is displayed below in **Figure 4-17**, which is also taken from the City of Alameda Tsunami Evacuation Playbook (No. 2017-Alam-05) developed by the National Tsunami Hazard Mitigation Center. Tsunami heights range from 3-4 feet above mean sea level for a local tsunami source to a maximum of 16 feet for a magnitude 9.2 Central Aleutian (Alaska) earthquake. The inundation from these events is dependent in part by the geography of the shoreline and whether the tsunami wave arrival coincides with high or low tide. For reference, the 100-year flood discussed in the previous section is mapped at about 7 feet above Mean Sea Level.

These are important scenarios for emergency managers to prepare for as there could only be tens of minutes to evacuate or just a few hours to conduct response or evacuation activities before a tsunami arrives.

⁷ USGS, [The SAFRR \(Science Application for Risk Reduction\) Tsunami Scenario](#)

Modeled Tsunami Scenarios: Because very large tsunamis are infrequent and the likelihood that the largest potential tsunamis have not yet occurred in Alameda County, the state tsunami program developed a suite of maximum credible tsunami scenarios as part of their tsunami inundation mapping project for local evacuation planning. The general tsunami wave height for key locations from these scenarios are provided below. As identified in the historical tsunami table, the largest tsunamis could occur from large earthquakes in the Alaska-Aleutian Islands region, or from a local fault or landslide offshore.

Tsunami Source Scenario Model Results for the San Francisco Bay Area

Near shore tsunami heights (flow depths) for both local and distant source scenarios, in FEET above Mean Sea Level. NOTE: The projections do not include any adjustments for ambient conditions, such as storm surge and tidal fluctuations, and model error (it is very important to note this difference, as those numbers can increase the projected water height during an event).

	TSUNAMI SOURCES	Approximate Travel Time	Pacifica	Ocean Beach	Black Point Aquatic Park	Candlestick Park	Alcatraz Island	Treasure Island	Yerba Buena Island	Redwood City	Alameda	Richmond	Mare Island	Sausalito	Bollinas
Local Sources	M7.3 Point Reyes Thrust Fault	10-15min	7	6	4	3	4	3	3	4	4	4	3	6	8
	M6.6 Rodgers Creek-Hayward Fault	10-15min	2	2	2	2	2	2	2		3	3	3	3	
	M7.1 San Gregorio Fault	10-15min	4	4	3	3	3	3	3		4	3	3	3	
Distant Sources	M9 Cascadia-full rupture	1hr	4	5	3	3	3	4	3		4	3	3	4	4
	M9.2 Alaska 1964 EQ	5hr	13	12	7	4	6	5	6		9	7	3	8	10
	M8.9 Central Aleutians I	5hr	9	11	6	4	6	5	4	4	9	7	3	7	7
	M8.9 Central Aleutians II	5hr	5	6	5	3	5	4	4		5	4	3	5	7
	M9.2 Central Aleutians III	5hr	18	22	11	6	10	8	7	5	16	10	4	10	19
	M8.8 Kuril Islands II	9hr	3	3	3	3	3	3	2		5	3	3	4	3
	M8.8 Kuril Islands III	9hr	4	4	3	3	3	3	3		4	3	3	4	5
	M8.8 Kuril Islands IV	9hr	5	5	3	3	3	3	3		4	3	3	4	5
	M8.8 Japan II	10hr	5	5	4	3	3	3	3		6	3	3	3	4
	M8.6 Marianas Trench	11hr	3	3	3	3	3	3	3	4	3	3	3	6	3
	M9.5 Chile 1960 EQ	13hr	5	6	3	3	3	3	3		5	4	3	5	5
M9.4 Chile North	13hr	4	5	4	3	4	4	4		6	3	3	4	5	
Maximum Runup - Local Source			8	6	3	3	4	4	4	4	5	4	3	7	9
Maximum Runup - Distant Source			20	24	12	6	12	10	9	6	18	10	4	11	22

Figure 4-17 Inundation Depths in Feet based on Tsunami Scenarios from Local and Distant Sources

Tsunami Risk Assessment

A significant tsunami event would inundate large portions of Alameda main island and, in the worst-case scenario, would completely inundate Bay Farm Island. Inundation at this level would destroy homes, businesses, and city infrastructure, causing billions of dollars in damage and possible loss of life and loss of population due to displacement brought on by the damaging event.

Even where flooding and inundation are not a significant tsunami hazard for a particular event, the strong and erratic currents induced by the Tsunami can still lead to substantial damage. Areas that are particularly exposed to Tsunami current hazards are ports, harbors, and marinas. The 2011 Japan tsunami caused widespread damage to harbors along the California coastline and within the San Francisco Bay; these effects were almost exclusively due to strong currents. A Tsunami entering the San Francisco Bay accelerates as the wave is forced into the narrow estuary channel between Alameda and Oakland, causing damaging currents to accelerate and intensify. Piers and boats may be ripped from their moorings, causing damage in the millions of dollars in loss, as was the case with the Berkeley Marina and Santa Cruz Harbor during the 2011 Tsunami event. Although Tsunami events that may impact Alameda are rare, any tsunamis that enters the Bay pose a risk to marinas, beaches, and low-lying areas that regularly flood.

Evacuation Planning

If a tsunami is expected, the City would issue tsunami warnings to alert the public of areas that would need to be evacuated based on the Tsunami Playbook. Notifications would come from AC Alert, NextDoor, Facebook, broadcast TV, radio, wireless emergency alerts and reverse 911 calls, as well as directly from the U.S. Tsunami Warning System (<https://tsunami.gov>).

Central Avenue is the highest point in Alameda, and community members are encouraged to walk or bicycle to the center part of the main island or drive/bike beyond I-880. Community members west of Grand Street will exit through the tubes, and east of Grand Street will exit over Park Street, Miller-Sweeney, and the High Street Bridge. Bay Farm Island will exit via Doolittle or Ron Cowan Parkway by car or bus. Community members on Bay Farm Island can also bicycle or walk to the main island. Vertical evacuation to multi-story stable structures is an option if it is not safe to evacuate. Contraflow travel lanes will be used to expedite evacuations. Community members can also support traffic flow off the island by minimizing the number of cars used to evacuate. Evacuation from Alameda into Oakland will be coordinated between the Alameda Police and Oakland Police to route traffic out of Alameda and through Oakland towards safety and out of identified danger zones. For boaters, it is not recommended to evacuate in a boat offshore. Instead, it is safer to keep the boat docked, since a boat would be difficult to navigate and would need to stay offshore in water of at least 180 feet in depth for over 24 hours. Detailed information about evacuation routes and their capacity and viability can be found in the Tsunami Emergency Annex of the City's Emergency Operations Plan.

Due to the extreme risk tsunamis present for Alameda, the National Tsunami Hazard Mitigation Program has supported the development of tsunami response “playbooks” to areas with the highest risk of tsunami impacts. One such playbook was developed for the City of Alameda (California Tsunami Evacuation Playbook No. 2015-Alam-05), which provides tsunami-specific maps, guidance about in-harbor hazards, and plans to help emergency management officials respond to tsunamis of different sizes and distances from the California coast. The map depicted in **Figure 4-19**, taken from the City of Alameda Tsunami Playbook, identifies the Maximum Phase Tsunami Evacuation Zone for Alameda. In 2013, there were an estimated 39,515 Alameda residents in the maximum tsunami hazard zone, the highest residential

exposure for one city to tsunami hazards in California.⁹ This number has certainly increased with the population growth of the city since 2013 and the ongoing development at Alameda Point.

A response “Playbook” has been developed to assist the City of Alameda emergency management staff in making critical decisions about evacuation notification. Evacuation areas are based on expected run up, plus a margin of error, for a Tsunami generated from local or distant earthquake events.

There are four phases of evacuation scenarios in the “Playbook”, with Phase One being evacuation of the shoreline and harbors up to the Maximum Evacuation Phase, which effects large areas of the City.

Figure 4-19 shows a map of the four phases and they are described below.

- Phase 1 evacuates beaches, harbor docks/piers and boats. Strong currents and potential scour are expected in harbors. Mitigation actions include encouraging the maritime community to improve the harbors to mitigate the risk of damage due to the threat of Tsunami and make use of the Maritime Response Playbook Guidance documents.
- Phase 2 evacuates areas outlined in red on the map. The zones of inundation shown are similar to that of flooding caused by storms plus king tides and therefore mitigation actions to decrease flooding damage will also address tsunami inundation.
- Phase 3 evacuates areas outlined in red on the map. Mitigation actions include public education, utilizing the mass notification system and working closely with the media to alert the public. Inundation of this magnitude is generally precipitated by an earth quake occurring in the Alaskan-Aleutian subduction zone.
- Maximum Phase evacuates areas are outlined in red on the map. Mitigation actions include public education, utilizing the mass notification system and working closely with the media to alert the public. Inundation of this magnitude is generally precipitated by an earth quake occurring in the Alaskan-Aleutian subduction zone.

⁹ Wood N, Ratliff J, Peters J, Shoaf K (2013b) Population vulnerability and evacuation challenges in California for the SAFRR tsunami scenario, chap. I. In: Ross SL, Jones LM (eds) The SAFRR (Science Application for Risk Reduction) tsunami scenario, U.S. Geological Survey Open-File Report 2013-1170

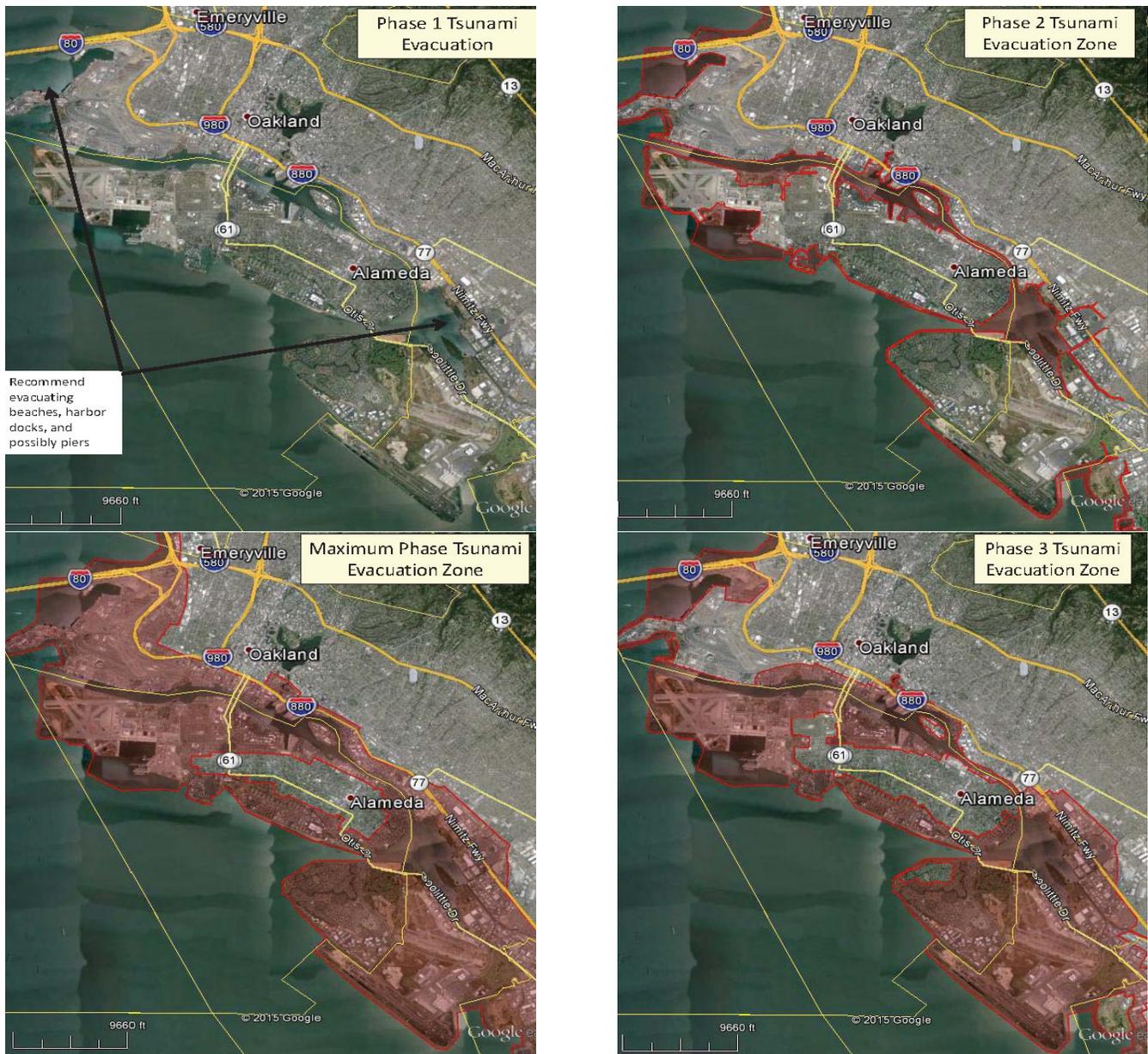


Figure 4-19 Tsunami Evacuation Phases

Heat

Extreme heat events are expected to increase in frequency, severity and duration in Alameda due to climate change with an increased number of extreme heat days and nights, increased temperatures over extreme days and greater duration of extreme heat events. Extreme heat events impact all of Alameda and can be exacerbated by Alameda’s relatively high average maximum relative humidity (California Energy Commission, 2018).

The heat index shown in **Figure 4-20** is an accurate measure of how hot it really feels when the effects of humidity are added to high temperature.



National Weather Service Heat Index Chart



Temperature (°F)

	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure and/or Strenuous Activity

■ Caution
 ■ Extreme Caution
 ■ Danger
 ■ Extreme Danger

Figure 4-20 National Weather Service Heat Index Chart According to Cal-Adapt¹⁰, an Extreme Heat day is defined as a day in April through October when the Maximum Temperature exceeds the location's Extreme Heat Threshold, which is calculated as the 98th percentile of historical maximum temperatures between April 1 and October 31 based on observed daily temperature data from 1961–1990. For Alameda, the Extreme Heat Threshold is 89° F. As shown in **Table 4-7**, between 1961 and 1990, Alameda averaged three Extreme Heat Days per year when daily maximum temperature was above 89° F. According to the National Weather Service, daily maximum temperature exceeded 89° F 142 times between 1970 and 2021 at the Oakland Museum weather station. Under a medium emissions scenario, Alameda is projected to experience an average of six Extreme Heat Days per year by mid-century and eight by end of century.

Cal-Adapt defines a Warm Night as a night during which the minimum temperature does not fall below the 98th percentile of historical overnight minimum temperatures for a place, computed using data from April through October for 1961 to 1990. For Alameda, the Warm Night Threshold is 61.5° F. As shown in **Table 4-7**, between 1961 and 1990, Alameda averaged five Warm Nights per year when daily minimum temperature was above 61.5° F. Under a medium emissions scenario, Alameda is projected to experience an average of 25 Warm Nights per year by mid-century and 46 of end of century. Warm nights are concerning because buildings do not naturally cool down when overnight temperatures are warm, thereby potentially increasing overnight energy consumption for cooling and producing public health impacts such as heat stress and even excess mortality. Warm nights can also negatively impact ecosystems and water supplies, particularly snowpack.

¹⁰ <https://cal-adapt.org/tools/extreme-heat/>

Table 4-7 Number of Extreme Heat Days and Warm Nights per Year in Alameda

Timeframe	Number of Extreme Heat Days per Year when daily maximum temperature is above 89° F	Number of Warm Nights per Year when daily minimum temperature is above 61.5° F
Modeled Historical (1961-1990)	3	5
Mid-Century Projection (2035-2064)*	6	25
End-Century Projection (2070-2099)*	8	46

*Projections assume a medium emissions scenario (RCP 4.5 from the Fifth Intergovernmental Panel on Climate Change (IPCC) Assessment Report on Climate Change): a scenario where GHG emissions peak by 2040 and then decline. In California, annual average temperatures under this scenario are projected to increase 2°C - 4°C by the end of this century, depending on the location.

The National Weather Service has created the HeatRisk forecast which provides a quick view of heat risk potential over the upcoming seven days.¹¹ The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. During heat or extreme heat events, local National Weather Service offices may issue heat-related messages as conditions warrant. Such messages include:

- **Excessive Heat Outlook:** Issued when the potential exists for an excessive heat event in the next three to seven days. An outlook carries a minimum 30 percent confidence level that the event will occur.
- **Excessive Heat Watch:** Issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A watch is given when the level of confidence that the event will occur reaches 50 percent or greater.
- **Excessive Heat Advisory:** Issued when an excessive heat event is expected in the next 36 hours. An advisory is used for a less severe event that is not assumed to be life-threatening, when caution is advised to mitigate the event's impact.
- **Excessive Heat Warning:** The most serious alert, issued when an excessive heat event is expected in the next 36 hours, or such an event is occurring, is imminent, or has a very high probability of occurring. A warning assumes the potential for health consequences due to extreme heat.

More extreme heat events represent a major public health risk that can cause heat exhaustion, stroke, difficulty breathing, and even death. These negative impacts are particularly acute for the economically disadvantaged, the transit-dependent, the very young, the elderly, those in poor health, the homeless, and those who work or spend significant time outdoors. The impacts of extreme heat events will be most severely felt for residents with pre-existing health issues, that have limited access to cooling, and/or those who live in highly developed areas of Alameda that are mostly paved and surrounded by buildings constructed of dark (heat absorbing) materials without the cooling benefits of tree shade. This creates what is known as the heat island effect, which can increase the temperature locally during extreme heat events. Extreme heat may also cause pavement heave and damage to transportation infrastructure and functioning (Caltrans, 2018). Increasing extreme heat events also increase the risk of drought and wildfire, and increased use of air conditioning during heat waves will increase energy use and GHG

¹¹ National Weather Service Experimental HeatRisk: Identifying Potential Heat Risks in the Seven Day Forecast. Retrieved from: <https://www.wrh.noaa.gov/wrh/heatrisk/?wfo=hnx>

emissions associated with energy use. While extreme heat events are less dramatic than other hazard events, they are potentially deadlier. A California Energy Commission study indicates that over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined.

When heat is combined with air pollution impacts, such as elevated ozone levels and wildfire smoke, the impacts are exacerbated. In addition, Alamedans are inexperienced in dealing with extreme heat and wildfires and therefore lack adequate preparation. Others lack resources to purchase air conditioning. More energy use for air conditioning results in increased costs, further affecting those with limited resources. It also increases GHG emissions, which further affects climate change and its associated impacts.

Drought

Increasing average daily temperatures, decreasing snowpack, and “boom or bust” precipitation patterns are increasing California’s risk of more frequent and severe droughts. Drought impacts all of Alameda and statewide droughts have been declared in 1976-1977, 1987-1992, 2008, 2013-2016, and 2020-2021. The 2013–2016 drought resulted in the most severe moisture deficit in 1,200 years. The time series shown in **Figure 4-21** shows the percentage of land area in Alameda County within each drought category over time.

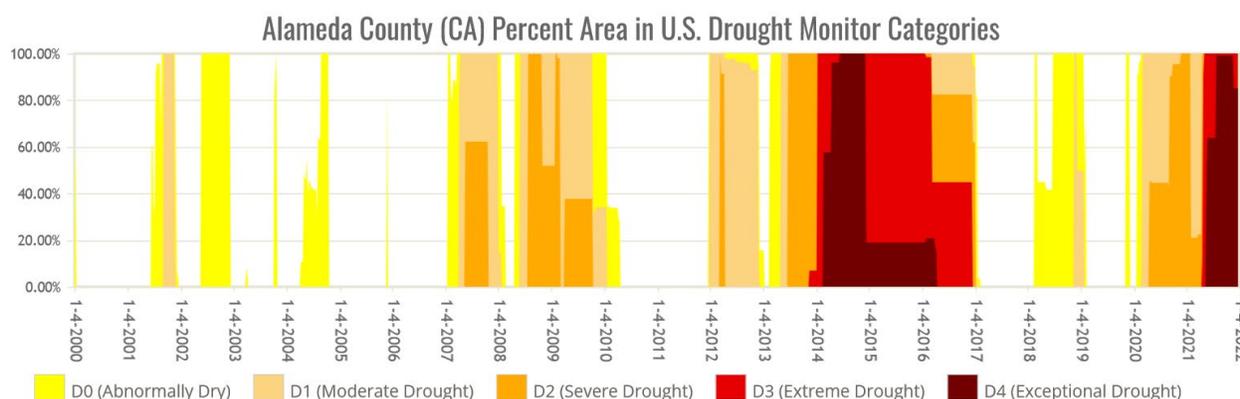


Figure 4-21 Alameda County Percent Area in U.S. Drought Monitor Categories

It can be difficult to predict the exact probability of a future drought due to their nature, but California is currently experiencing a drought in 2022. NOAA’s spring outlook, predicts prolonged, persistent drought in the West where below-average precipitation and above-average temperatures is most likely.¹² Although droughts are a natural part of our climate cycle in California and the primary driver for the occurrence of droughts in the state, studies have shown that warmer temperatures and lower precipitation associated with climate change increases the overall likelihood of extreme droughts in California.¹³ Studies have also shown that precipitation deficits in California were more than twice as likely to yield drought years if

¹² NOAA. Spring Outlook: Drought to expand amid warmer conditions. March 17, 2022. Retrieved from <https://www.noaa.gov/news/spring-outlook-drought-to-expand-amid-warmer-conditions>

¹³ Williams AP, Seager R, Abatzoglou JT, Vook BI, Smerdon JE, Cook ER. (2015). Contribution of Anthropogenic Warming to California Drought During 2012-2014. Retrieved from: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015GL064924>

they occurred when conditions were warm and that such confluences have increased in recent decades.¹⁴

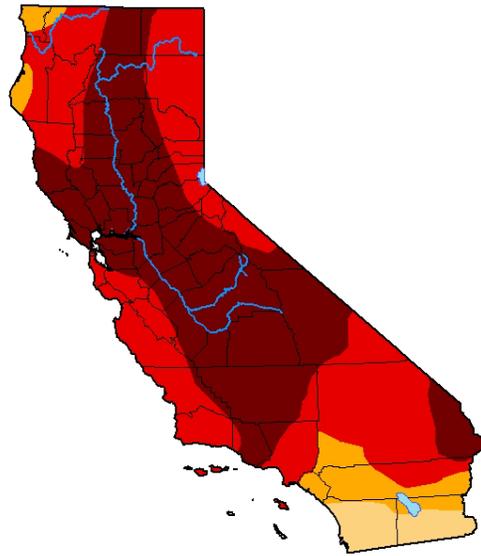
Most rain and snow fall in California from November through April. This precipitation fills our reservoirs and aquifers that we use to supply homes, businesses and farms with water. It is also a vital resource for fish and wildlife that rely on our rivers and wetlands. The primary impact of recent droughts on the City of Alameda has been loss of, or decreased health of, landscaping material and trees in the City's parks and street rights-of-way. This may contribute to more downed trees during future storms. Long term concerns are a lack of adequate water for drinking and irrigation.

Alameda – along with all of California and the western United States – is currently entering into extreme drought conditions after the second year in a row of below average precipitation. **Figure 4-22** shows the California Drought Monitor for August 2021, 2015 and 2009. In August 2021, Alameda and most of the Bay Area were classified as “Exceptional Drought” conditions.

¹⁴ Diffenbaugh NS, Swain DL, and Touma D. (2015) Anthropogenic warming has increased drought risk in California. Retrieved from: <https://www.pnas.org/content/112/13/3931>

**U.S. Drought Monitor
California**

August 24, 2021
(Released Thursday, Aug. 26, 2021)
Valid 8 a.m. EDT



August 4, 2015

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Curtis Riganti
National Drought Mitigation Center



droughtmonitor.unl.edu

August 4, 2009

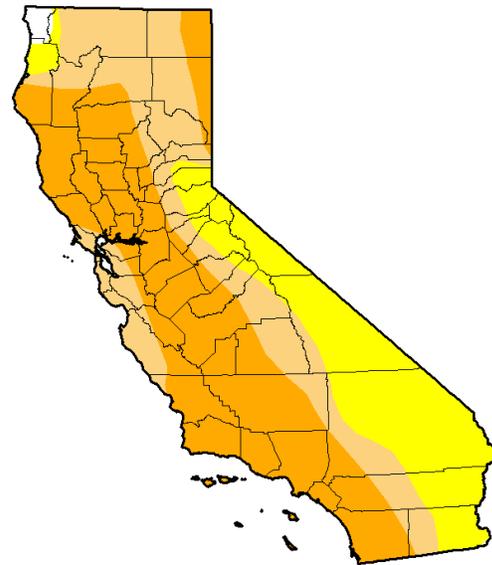
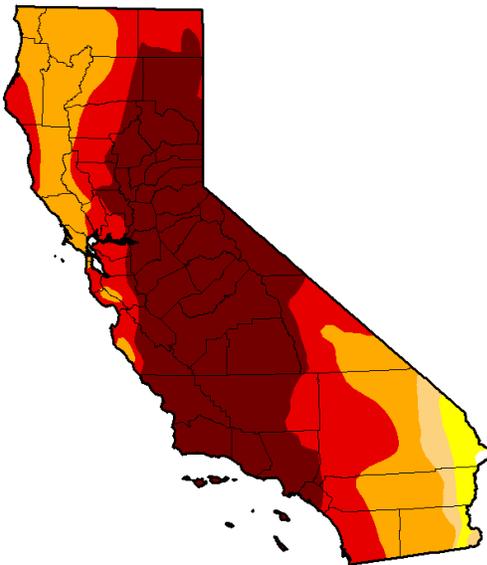


Figure 4-22 California Drought Monitor for August 2021, 2015, 2009

In response to worsening drought conditions, EBMUD called for voluntary 10 percent reduction in water use. In July 2021, Governor Newsom also called for 15 percent voluntary reduction by urban water users statewide. As this drought progresses, more significant water reduction measures may become necessary. Scientists believe we are in the beginning stages of a historical drought. All of California has been in drought conditions since late April 2021, and 88 percent of the state has been experiencing extreme drought or exceptional drought since late July 2021. Record-low water levels at the state's

reservoirs have forced curtailment of hydro power production from hydroelectric dams, an important source of power for Alameda Municipal Power.

Ninety percent of Alameda's water supply—provided by EBMUD—comes from the Mokelumne River watershed in the Sierra Nevada; the remaining 10 percent is runoff from watershed lands in the East Bay. Thus, Alameda's drought vulnerability is tied to the vulnerability of EBMUD's water supply system. Rising temperatures that reduce snowpack also pose a major risk to EBMUD's water supply. Additionally, EBMUD relies on over 15 miles of aqueducts and pipes that transport water across the Sacramento-San Joaquin River Delta ecosystem, which has become increasingly vulnerable to flooding, landslides, and earthquakes. Both the quality and quantity of potable water can be impacted when the water supply distribution system is compromised. For example, in September 2017, an unprotected cross connection from an irrigation line impacted the quality of water supplied to hundreds of Alameda homes and businesses.

According to EBMUD's (2014) Climate Change Monitoring and Response Plan, potential risks to water supply include:

- Increased demands for outdoor water use;
- Increased drought frequency, intensity, and duration;
- Decreased snowpack; and
- Changes in the timing of the Mokelumne River spring runoff.

Alameda can reduce its per capita water use to increase resiliency to drought by limited showers to 5 minutes, turning off the faucet when brushing teeth, only washing full loads of laundry, and planting drought resistant plants. Outdoor landscaping is one of the most significant uses of water and the place where residents and businesses can have the most impact in conserving water. EBMUD's (2015) Urban Water Management Plan calls for a combination of rationing, conservation, and use of recycled water to satisfy demand through 2040. The City of Alameda has taken a number of measures to further reduce water usage, including, increasing composting, reducing irrigation of decorative lawns (resulting in 3.6 percent reduction), turning off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converting decorative lawns at city facilities and some parks to drought tolerant landscape, prioritizing fixing pipe leaks, converting irrigation clocks to rain sensitive clocks (resulting in 15 percent reduction).

Wildfire-Related Hazards

Drought conditions helped fuel another destructive wildfire season in California in 2021, burning more than 2.5 million acres, which is more than double the number of acres that burned on average in the previous five years to date.¹⁵ The Dixie Fire in northeastern California 963,309 acres before being 100% contained on October 25, 2021 and became the second largest wildfire in California's history behind last year's 1.03-million-acre August Complex as the largest fire in state history. While wildfires do not directly impact the City of Alameda, the impacts of smoky air from wildfires across the state have been regularly experienced in Alameda and public safety power shutoffs (PSPS) designed to prevent wildfire ignitions from power lines have the potential to cause power shut offs in Alameda, though none have been

¹⁵ California Department of Forestry and Fire Protection

experienced to date and Alameda has redundant power feeds helping decrease the likelihood of shut-offs impacting Alameda.

Smoky Air

Breathing smoky air can have serious consequences for human health. Exposure to smoke is known to impact lung health and has been associated with respiratory infections and increased risk of death. Those who are especially vulnerable existing cardiovascular and respiratory ailments such as asthma, diabetes, pregnancy, young children, older adults, and those who work outdoors. Individuals with COVID-19, or recovering from COVID-19, are also at greater risk from smoke. The high unpredictability of wildfires and their impact on downwind areas heightens the vulnerability of Alamedans to wildfire risk. Furthermore, because wildfires spread so quickly and wind direction may suddenly change, there is little lead time to warn and prepare residents for wildfire smoke impacts. It is also difficult to predict the severity of wildfire smoke impacts or how long they are likely to last. Community members are generally taken by surprise and don't realize how hazardous air quality may be to their health.

Over the last decade wildfires have become increasingly frequent and intense and have impacted all of Alameda and the state. While wildfires do not occur within the City of Alameda, wildfires occurring outside the region can impact public health in Alameda. Winds can carry smoke from active wildfires into the region and wildfire smoke can reach hazardous levels in Alameda as measured by the U.S. Environmental Protection Agency's (EPA's) Air Quality Index (AQI). Air quality impacts from wildfires recently raised public awareness and concern beginning during the Camp Fire that occurred in fall 2018. During that event, air quality, measured by PM_{2.5} (particulate matter with a diameter of 2.5 micrometers or less), was rated "hazardous for all groups" for 12 consecutive days, with the peak occurring on November 16, 2018, when "very unhealthy" levels were recorded at a monitoring station near Alameda (Bay Area Air Quality Monitoring District).

Table 4-8 below lists the number of Spare the Air Days that were called by the Bay Area Air Quality Management District because particulate matter (PM) was forecast to exceed national standards, as well as the number of days on which PM concentrations officially exceeded the state and federal health-based air quality standards. PM exceedance typically occurs because of winter time wood burning, but since 2020 has more commonly occurred in the summer as a result of wildfires. The Spare the Air Days shown in **Table 4-8** were called for the entire 9-county Bay Area, including the City of Alameda.

Table 4-8 Number of Spare the Air Days Issued for Excess PM Levels

Year	Spare the Air Alerts	National 24 Hour PM 10 Excess Days	CA 24 Hour PM Excess Days	National 24 Hour PM 2.5 Excess Days
2022	0	0	0	0
2021	5	0	0	2
2020	46	0	0	25
2019	3	0	5	1
2018	18	1	6	18
2017	28	0	6	18
2016	5	0	0	0
2015	17	0	0	6
2014	13	0	2	3
2013	33	0	6	13
2012	5	0	1	3
2011	12	0	3	8
2010	6	0	2	6

Source: <https://www.sparetheair.org/understanding-air-quality/data-and-records/pm-data>

The City of Alameda took the following actions in response to smoky air days to protect employees and the public:

- September 11, 2020 -the City of Alameda moved all city employees inside to work because of very unhealthy air quality
- September 27 through October 2, 2020, was a continuous spare the air period. The City allowed at-risk employees to work inside, and masks were available for the public and the employees.
- June 22, 2021, the Clean Air center was opened at the Main Library
- August 30, 2021, the Clean Air center was opened at the Main Library

There are no established climate projections for increased risk of wildfire smoke; the existing projections focus on determining areas susceptible to wildfires themselves and not specifically the downwind impacts. Nonetheless, increases in air temperature and the frequency and severity of droughts are likely to result in an elevated risk of more intense, prolonged, and/or large-scale fires throughout California, which could create conditions like those experienced in November 2018.

During a poor air quality event, the Bay Area Air Quality Management District provides air monitoring data for several constituents, including ozone and PM_{2.5}, that track smoke impacts. **Figure 4-23** shows the level of health concern associated with each AQI category. **Figure 4-24** shows the U.S. Air Quality Index Activity Guide provides ways to protect your health when particle pollution reaches unhealthy levels. Local air quality forecasts can be found at visit www.airnow.gov.

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Figure 4-23 AQI Basics for Ozone and Particle Pollution

Air Quality Index	Who Needs to be Concerned?	What Should I Do?
Good (0-50)		It's a great day to be active outside.
Moderate (51-100)	Some people who may be unusually sensitive to particle pollution.	Unusually sensitive people: Consider reducing prolonged or heavy exertion. Watch for symptoms such as coughing or shortness of breath. These are signs to take it easier. Everyone else: It's a good day to be active outside.
Unhealthy for Sensitive Groups (101-150)	Sensitive groups include people with heart or lung disease, older adults, children and teenagers.	Sensitive groups: Reduce prolonged or heavy exertion. It's OK to be active outside, but take more breaks and do less intense activities. Watch for symptoms such as coughing or shortness of breath. People with asthma should follow their asthma action plans and keep quick relief medicine handy. If you have heart disease: Symptoms such as palpitations, shortness of breath, or unusual fatigue may indicate a serious problem. If you have any of these, contact your health care provider.
Unhealthy (151-200)	Everyone	Sensitive groups: Avoid prolonged or heavy exertion. Consider moving activities indoors or rescheduling. Everyone else: Reduce prolonged or heavy exertion. Take more breaks during outdoor activities.
Very Unhealthy (201-300)	Everyone	Sensitive groups: Avoid all physical activity outdoors. Move activities indoors or reschedule to a time when air quality is better. Everyone else: Avoid prolonged or heavy exertion. Consider moving activities indoors or rescheduling to a time when air quality is better.
Hazardous (301-500)	Everyone	Everyone: Avoid all physical activity outdoors. Sensitive groups: Remain indoors and keep activity levels low. Follow tips for keeping particle levels low indoors.

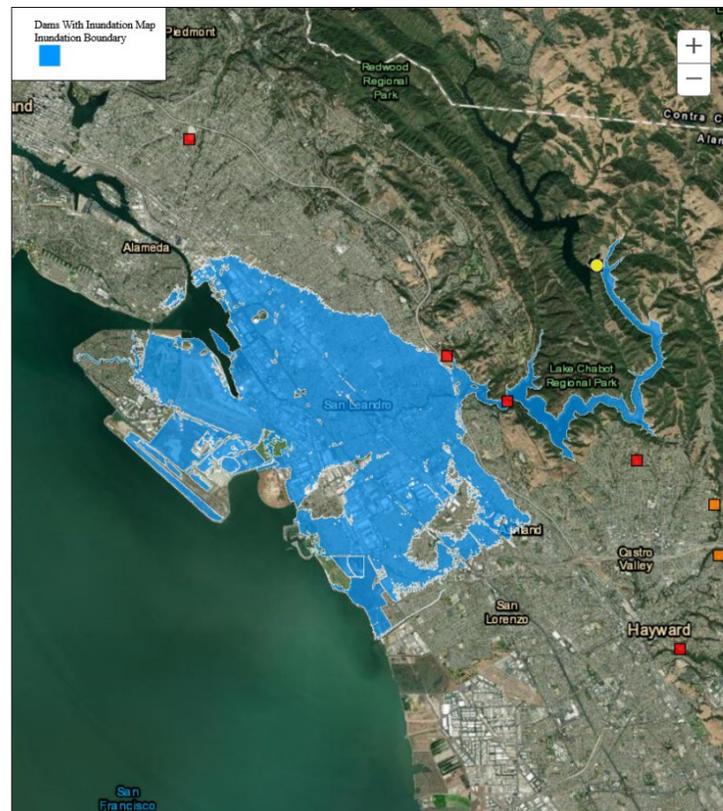
Figure 4-24 Air Quality Guide for Particulate Pollution

Public Safety Power Shut-offs (PSPS)

In recent years, power lines have been responsible for some of the most destructive wildfires in California history. In response, PG&E has begun to proactively cut power to (de-energize) electrical lines that may fail in certain weather conditions to reduce the likelihood that their infrastructure could cause or contribute to a wildfire. These shut-offs are called Public Safety Power Shut-offs (PSPS). A PSPS can leave downstream communities that rely on the de-energized power lines to be without power, causing hardships particularly for vulnerable and medically fragile populations. Because PSPS occur in response

Chabot Reservoir is a 10,350-acre-foot raw water storage facility operated by EBMUD in the cities of San Leandro, Oakland and Castro Valley.¹⁷ The 135-foot high earthen Chabot dam and outlet works structure underwent a seismic upgrade to improve the performance of the facility during a large earthquake. Construction was completed in 2017. In the unlikely event of complete failure of the dam structure, Corica Park Golf Course, Godfrey Park and some residential properties along Beach Road, Maitland Drive and Garden Road on Bay Farm Island could become inundated as shown on **Figure 4-25**. The main island of Alameda would not be impacted.

Figure 4-26 Figure New Upper San Leandro Dam Inundation Map



Upper San Leandro (USL) Reservoir is a 42,000-acre-foot reservoir located upstream from Chabot Reservoir about 8 miles from downtown Oakland.¹⁸ The USL Reservoir receives local runoff as well as imported Sierra Nevada water via the Mokelumne Aqueduct. Seismic evaluations concluded that the USL Dam Outlet Tower located in the Reservoir which conveys raw water to the USL Water Treatment Plant for distribution to EBMUD customers would sustain damage in a seismic event. The Tower was retrofitted to ensure safe operation of the structure in 2018. The earthen USL Dam was not determined to need seismic upgrades. In the unlikely event of complete failure of the dam structure, part of Bay Farm Island and the East Shore neighborhood on the Main Island could become inundated as shown on **Figure 4-26**.

¹⁷ <https://www.ebmud.com/about-us/construction-and-maintenance/construction-my-neighborhood/chabot-dam-upgrade/>

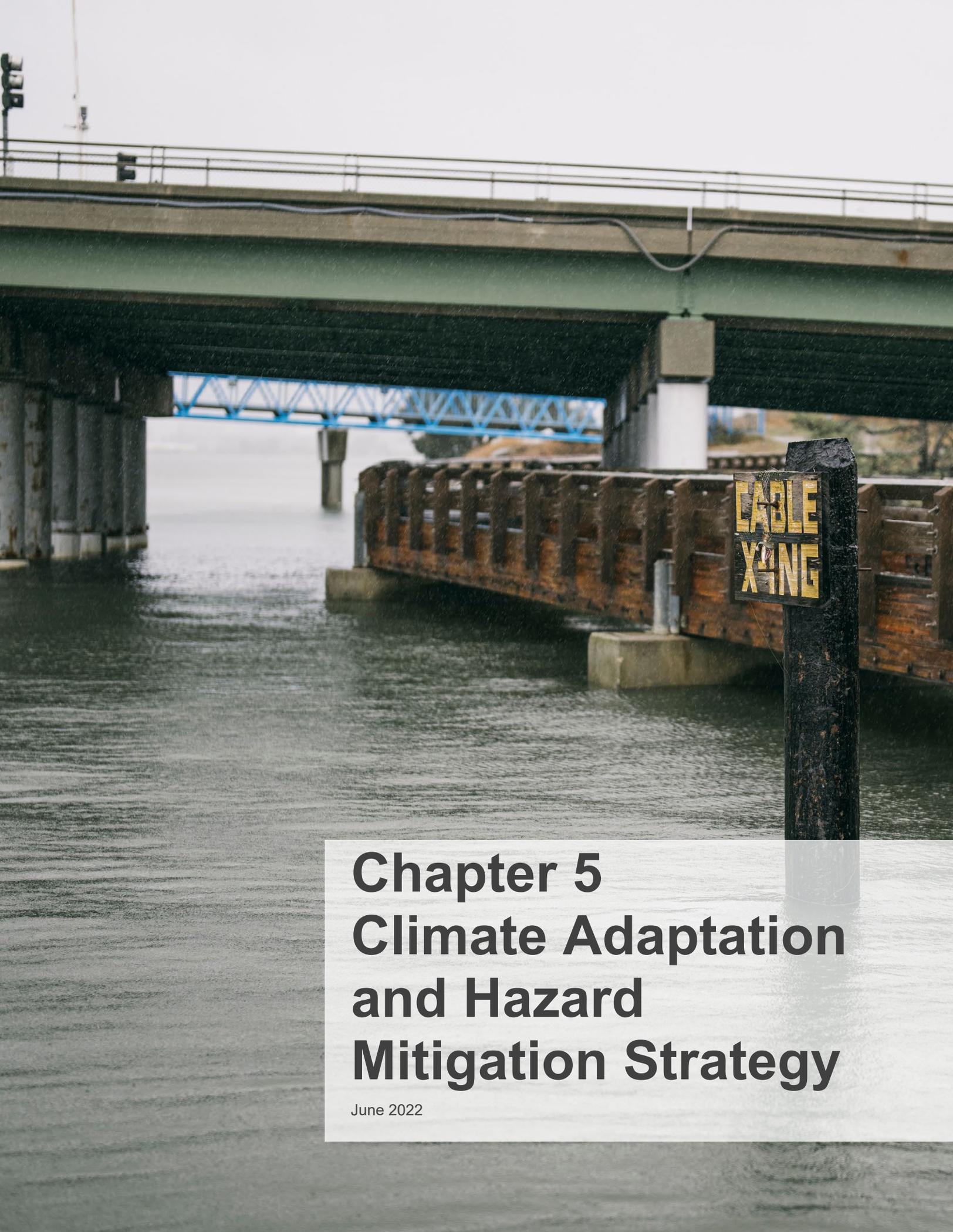
¹⁸ <https://www.ebmud.com/about-us/construction-and-maintenance/construction-my-neighborhood/upper-san-leandro-usl-dam-outlet-tower/>

Other Hazards Not Considered in this Plan

This plan focused on geologic and weather-related hazards impacting Alameda that can be in part addressed through upgrades to the physical environment. Hazards that are either not significant or don't fit within the scope of the plan are not included in our analysis. Many of these hazards are still addressed within the context of the City's emergency response planning efforts.

Lesser natural hazards for the City of Alameda include extreme cold and wind. While these hazards are important to plan for, and have occurred in Alameda, they present a much lower risk to life and property and the primary method to address them is through response planning, rather than pre-disaster mitigation. The record low temperature for Alameda was 26°F, set in December of 1972, during an unusual week-long cold snap below freezing.

Hazards caused by immediate human activity are not within the required scope of this Local Hazard Mitigation Plan. Such hazards include chemical spills, tanker spills, large urban fires, arson, pandemics, cyber-attacks, civil unrest, energy shortages, terrorism, and transportation incidents (airplane, truck, ship, ferry, pipeline and bus). However, the City learned through its citizen survey, conducted as a part of this update process, that the community is concerned about these potential issues and many are included in Alameda Emergency Response Plan. Also not included is accidental dredging damage to Alameda infrastructures in the Estuary and San Leandro Channel, including sewer, water, power, natural gas, communications, marinas, and transportation.



Chapter 5 Climate Adaptation and Hazard Mitigation Strategy

June 2022

Climate Adaptation and Hazard Mitigation Strategy Development

Development of the mitigation and climate adaptation strategy included identifying and analyzing existing capabilities and available mitigation measures to achieve the vision and goals. Mitigation and adaptation strategies include those that were in the previous plan, suggestions from the State of California Hazard Mitigation Plan, the City's General Plan and Climate Action and Resiliency Plan, public input, staff input, board and commission input, and other sources. Additional mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as the Plan is maintained over time.

Capabilities Assessment

The City of Alameda has a variety of capabilities for reducing our long-term vulnerability to hazards, including planning and regulatory, administrative and technical, financial, education and outreach. Our mitigation and adaptation strategy draws from and builds on these existing capabilities. The following capabilities are already in place and informed the City's climate adaptation and hazard mitigation planning process.

Planning and Regulatory

The following ordinances, policies, local laws, plans and programs guide and manage growth and development in Alameda.

- **General Plan (2021):** The General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. California State law requires that every city adopt and maintain an up to date, internally consistent general plan. Alameda is in the process of updating its General Plan. The General Plan addresses climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation.
- **Zoning Ordinance.** The Zoning Ordinance (Alameda Municipal Code Chapter 30) is a set of regulations that promote and protect the public health, safety, and general welfare of Alameda by guiding, controlling, and regulating future growth and development that occurs in the city. Zoning regulations apply to all new construction, building alterations, property line changes and most site construction work including some tree cutting and landscaping. The Zoning Ordinance will be updated following update of the City's General Plan.
- **Alameda Building Code.** All construction in California is regulated by building codes set forth by the California Department of Housing and Community Development. In addition, construction in Alameda must also comply with the Alameda Building Code (Alameda Municipal Code Chapter 13).
- **Capital Improvement Program (FY 21-23).** Alameda's Capital Improvement Program (CIP) aims to maintain and improve the City's aged public infrastructure as best it can with the resources available.

- **Storm Drain Master Plan (Conveyance and Pump Stations):** The City's recently completed master plans specifically address lack of capacity during 10-year and 25-year storms. While the plans were completed before the new preliminary FEMA floodplain maps were issued, they do address 18-inch and 55-inch sea level rise adaptations, which impact the same areas identified by FEMA as flood-prone. Rising groundwater levels are intricately linked with the City's storm drain system and lagoon operations. Future updates to this plan could consider the potential for a rising groundwater table, with increased investments on identifying areas with groundwater infiltration.
- **Sewer Master Plan:** This plan updates all pump stations to meet current capacity and prioritizes rehabilitation of aging sewer pipes with more flexible material known to withstand seismic and flooding hazards.
- **Transportation Master Plans (transportation plans addressing transit, bicycle, pedestrian, signals, goods movement, air quality, and other transportation needs):** The City Council approved the Transportation Choices Plan in 2018, which is a multimodal plan to improve access and safety, and is in the process of completing the Vision Zero Action Plan and the Active Transportation Plan. These plans encourage the flexibility of transportation by diversifying both routing and conveyance means. This will be useful during times when regular transportation is disrupted. These plans are updated on a five-year cycle. The next updates will specifically plan for resiliency and recovery during and after hazard events.
- **Master Infrastructure Plan for Alameda Point:** This document established the requirements and standards for the backbone infrastructure to support re-development and reuse of Alameda Point (the old Navy Base). The infrastructure improvements will create a seismically stable site that can adapt to the potential impacts of climate change such as sea level rise with initial development requirements at 36 inches elevation.
- **Emergency Operations Plan.** The 2019 City of Alameda Emergency Operations Plan (EOP) is the foundation for disaster response and recovery operations for the City of Alameda. The plan outlines how the City of Alameda government complies with and implements the requirements of the California Emergency Services Act to protect the lives and property of the community of the City of Alameda.
- **Floodplain Management Ordinance:** The ordinance includes provisions for residential and commercial construction in flood prone areas. The flood prone areas are generally defined by the FEMA Flood Insurance Rate Maps and base flood elevations. These provisions can be extended to include areas projected to be exposed by sea level rise and/or emergent groundwater.

Administrative and Technical

The city employs a professional staff of 470 (not including Alameda Municipal Power staff) that includes engineers, planners, attorneys, building officials and inspectors, administrative analysts, first responders, enforcement officers, and technicians who can all help to advance Alameda's mitigation and adaptation strategy. Staff coordinates across departments and agencies to implement to advance mitigation and adaptation planning efforts on behalf of the City.

In addition, several staff have within their job descriptions the specific responsibility for climate adaptation and hazard mitigation.

- In 2020, the City hired a full-time Sustainability and Resilience Manager to oversee implementation of the Climate Action and Resiliency Plan and Climate Adaptation and Hazard Mitigation Plan.
- The Fire Department employs a full-time Disaster Preparedness Coordinator/Emergency Manager to coordinate citywide disaster preparedness, response and recovery efforts.
- A staff engineer within Public Works is designated to act at the Flood Plain Manager.
- All inspectors, code enforcement officers, and planners have received Post Disaster Assessment Certification.

Fiscal

The City of Alameda has a variety of financial resources available to help fund mitigation activities. In addition, Alameda regularly pursues State, Federal and other grant opportunities to implement identified mitigation and adaptation projects. As a municipal agency, Alameda also has the ability to place revenue measures on the ballot to fund specific climate adaptation and hazard mitigation projects.

- **General Fund.** Sources of revenue for Alameda’s General Funds include property taxes, property transfer taxes, sales taxes, transient occupancy taxes (hotel tax), utility users’ tax, franchise fees, business license taxes, and departmental fees and charges for services. General funds are used to fund the day to day operations of the city.
- **Capital Budget.** The capital budget implements the Capital Improvement Program. The Capital Improvement Program totals approximately \$31.8 million and \$35.2 million for FYs 2021-22 and 2022-23, respectively. The capital budget is funded almost exclusively from restricted funds. The Sewer Fund is restricted to maintenance and replacement of City sewers. Transportation funds include Measure B/BB, Gas Tax and Vehicle Registration Fee. Transportation projects also are supplemented by the Development Impact Fee funds, which are paid for by new residential and commercial development, and an assortment of grant funding. The Urban Runoff and Water Quality and Flood Protection fees are for the maintenance and enhancement of the City’s stormwater infrastructure and various efforts to make stormwater pollution-free before it enters the Bay. The General Fund, though a small contributor to the overall capital budget historically, is one of the only funding sources that is not restricted and can support any public infrastructure expense.
- **HOME Program Special Revenue Fund.** The HOME program is a federal grant that finances housing projects in partnership with government, nonprofit, and private organizations. Home funding supports several programs that advance hazard mitigation.
 - **Soft Story Structural Assessment Grant.** The Soft Story Structural Assessment Grant for Rental Units Program to provide financial assistance to residential rental property owners to assess their soft story structure without passing the costs through to tenants. At least 51% of the units in the building must be occupied by low- and moderate-income households. Grants of up to \$5,000 are available to offset engineering fees required to produce a report acceptable to the Building Department for review.
 - **Rental Rehabilitation Program.** The Rental Rehabilitation Program provides loans at 2% interest to landlords who rehabilitate rental property in Alameda, including seismic retrofits. The majority (at least 51%) of the households in the structure must be low income, and the majority of the units must be two-bedrooms or larger with rents not in excess of HCD Payment Standards.

- **Housing Rehabilitation Program.** The Housing Rehabilitation Program helps low-income Alameda homeowners repair and improve their homes with low-interest loans that can be used to correct substandard and/or health and safety conditions (including lead-based paint hazards), to extend energy conservation, or to repair or replace major systems in danger of failure, including seismic retrofits. The maximum loan amount is \$50,000.

Education and Outreach

Alameda educates and informs the public about hazards and climate impacts and actions that can be taken to reduce their impacts in a variety of ways.¹

Alameda community members can opt in to AC Alert to receive important or emergency notifications from the City and County of Alameda. A total of 12,500 people in Alameda have subscribed to AC Alert as of April 2021. Regardless of opt-in, the City also has access to all AT&T and Comcast landline phone numbers and can send automated voice messages to those numbers. The City can also send, via Alameda County, Wireless Emergency Alerts (WEA) or IPAWS - Emergency Alert System (EAS) message that pushes the notification to all cell phones in the range of a selected wireless tower.

The City's Public Information Officer also maintains official social media accounts on Facebook, Twitter, Nextdoor and Instagram to educate and inform residents. In an emergency, important information may also be broadcast via public access television, channel 15 and the low power city radio notification for system, 1280 AM.

Alameda conducts a variety of education and outreach to community members on disaster preparedness, including:

- **Community Emergency Response Team (CERT).** The CERT program provides training to Alameda residents and employees of Alameda businesses to increase self-sufficiency in a disaster. Participants learn skills that will enable them to provide emergency assistance to their families, colleagues, and neighbors.
- **Tsunami awareness.** Alameda has conducted a number of community meetings focused on tsunami preparedness and evacuation in recent years with a special focus on the waterfront community and boaters and has installed tsunami hazard zone signs at the City's key gateways.

National Flood Insurance Program (NFIP) Participation

The City is a National Flood Insurance Program (NFIP) participant and intends to continue its participation. City of Alameda Municipal Code Chapter XX – Floodplain Management includes an automatic adoption clause for “all subsequent amendments and/or revisions” to the Flood Insurance Study (FIS) for Alameda County, California, and Incorporated Area dated August 3, 2009, with accompanying flood insurance rate maps (FIRMs) and flood boundary and floodway maps (FBFMs), dated August 3, 2009. In 2016 the City requested that the NFIP Specialist in Region 9 review the City's Municipal Code Chapter XX – Floodplain Management. On March 19, 2016, an email was sent to the City by the NFIP Specialist stating that she “reviewed your code and see no major problems with it. It has all

¹ see: <https://www.alamedaca.gov/Departments/Fire-Department/Disaster-Preparedness>

the minimum requirements. Your City will automatically adopt the new FIRMs when they officially become effective.” The provisions of Municipal Code Chapter XX as such apply to the revised Areas of Special Flood Hazard issued by FEMA in the 2018 FIRMs.

The City continues to educate residents about the FIRMs, flood insurance and flood preparedness. The City regulates new construction in Special Flood Hazard Areas, per Municipal Code Chapter XX – Floodplain Management, and administers any local requests for map updates, gives community assistance, and monitors activities. All residential buildings constructed, substantially improved, and/or reconstructed due to substantial damage within Alameda are required to be built in conformance with a 1-foot freeboard requirement above Base Flood Elevation, meaning to a minimum Elevation of 11 ft NAVD88 or higher. The City also continues to work with Homeowner Associations regarding shoreline dike improvements.

Community Rating System (CRS) Participation

In response to the 2018 FIRM release, the City joined FEMA’s voluntary Community Rating System (CRS) in 2019 - which encourages communities to go above and beyond minimum NFIP requirements. In exchange for participation in the CRS, communities receive an automatic discount on flood insurance premiums. Alameda is currently designated as a Class 8 community within CRS and homeowners receive a 10% discount on flood insurance accordingly. The City has investigated the possibility of participation as a Class 7 community and found that the level of outreach, documentation, and points required for the upgrade exceeds available staff capacity at this time.

Strategies for Location-Based Priority Flooding

Flooding is one of the greatest climate threats that Alameda faces. The CARP vulnerability assessment identified priority assets based on the risk posed by both temporary flooding due to storm surge/overland flooding and permanent inundation from sea level rise. Strategies and associated actions are presented in CARP and reproduced in **Tables 5-1 to 5-11** with the following time horizons: short- (< five years), mid- (five to 10 years), and long-term (> 10 years). Alameda is actively working to implement the strategies outlined below.

Specific information for each priority asset includes:

- Recommendations for short-, mid-, and long-term actions;
- Barriers and limitations to implementation;
- Site-specific considerations; and
- Case studies and examples, if available.

Recommendations are built on analyses of previous City studies, review of activities implemented in other municipalities, and guidance from state and federal entities on designing adaptation strategies for coastal flooding. The order of actions presented for each asset does not indicate higher or lower ranking. The City should identify the preferred approach(es) for each priority asset and proceed with feasibility and engineering studies to develop more detailed project designs. Strategies for location-based priority

flooding are outlined in the tables that follow. Additional site-specific considerations, case studies, limitations to implementation, and costs and benefits of adaptation are detailed in **Appendix H**.

Table 5-1 Adaptation Planning: Crown Beach

<p>Short-Term (<5 years)</p>	<p>ALL ALL 1 2 ALL</p>	<ul style="list-style-type: none"> • Coordinate with EBRPD on master planning for the site, including the public process. • Study the geomorphology of the beach. Study sand movement to predict where/how beach elevation will change over time and refine future strategies. • Study opportunities for Elsie Roemer salt marsh to migrate with sea level rise. Consider purchase of property as they become available. Fund native plant restoration to support long-term marsh health. • Increase current dune management. Dunes stabilize the beach and provide additional protection to the road. Strengthen and build existing dunes by further establishing native plants. Limit vehicular access to promote plant growth on the beach. • Continue current practice of annually redistributing sand down the beach (as needed). 	<p>CROWN BEACH</p> <p>Crown Memorial State Beach is a 2.5-mile sandy beach, owned by California State Parks and the City of Alameda. Operated and managed by EBRPD, the beach is a popular spot for recreation and provides wildlife habitat. It also serves as shoreline protection for Shoreline Drive, the adjacent community, and important infrastructure such as stormwater outfalls. Sand is not naturally transported to the beach, so it must be periodically redistributed and replenished as it erodes slowly over time or suddenly in a large storm.</p>
<p>Mid-Term (5–10 years)</p>	<p>3 ALL</p>	<ul style="list-style-type: none"> • Widen shoreline into the Bay. Consider opportunities to move the shoreline into the Bay at a more gradual slope to protect against erosion. • Develop long-term monitoring and trigger thresholds plan. After 2 to 3 feet of sea level rise, additional strategies may need to be considered and 10 years of lead time will be needed (for feasibility studies, funding, etc.). Thresholds can be developed to trigger exploration of additional strategies, such as adding jetties/groins, oyster reefs (integrated into existing eel grass), or cobble berms to further control erosion. 	<p>The map shows an aerial view of the Crown Beach area in Alameda, California. It includes labels for Washington Park, Robert W. Crown Memorial State Beach, BoardSports California, Alameda High School, and various streets like Central Ave, Encinal Ave, Grand St, Otis Dr, and Shore Line Dr. Four numbered callouts are present: 1 (yellow box) at the southern end of the beach; 2 (red box) along the shoreline near BoardSports California; 3 (green box) near the intersection of Shore Line Dr and Grand St; and 4 (yellow box) near the northern end of the beach, close to Washington Park.</p>
<p>Long-Term (>10 years)</p>	<p>4</p>	<ul style="list-style-type: none"> • Allow the beach to move inland. If the beach erodes, there may be opportunities to simply allow it to move inland given the amount of open space available in the park. 	<p>Google</p>

Table 5-2 Adaptation Planning: Eastshore Drive

<p>Short-Term (<5 years)</p>	<p>1</p> <p>2</p> <p>2</p>	<ul style="list-style-type: none"> • Hydrodynamically model the mudflats and future impacts of sea level rise. Assessing the full benefits that mudflats provide and their ability to adapt as water levels rise is needed to fill current information gaps. • Integrate adaptation between public pathway improvement projects and private parcels. Several public pathways are under consideration for improvement in this area. Selection criteria for park improvement projects could include potential for project to be integrated into broader flood protection improvements. • Build higher barriers that can be further built up over time. The City and homeowners should collaborate to clarify responsibility for maintenance of flood protection given parcel and jurisdictional boundaries, then begin developing barriers that protect against mid-century sea level rise and a 100-year flood. 	<p>EASTSHORE DRIVE</p> <p>Eastshore Drive is the easternmost road on Alameda Island. It runs north-south, providing access to the Eastshore and Fernside residential neighborhoods. Though there are several public pathways leading to the water along Eastshore Drive, the eastern waterfront as a whole primarily consists of private homes. The shoreline is currently protected by a combination of sloped riprap (pilled rock) and vertical bulkheads (walls) running along backyards. There are existing mudflats along the east side of Alameda Island. Mudflats provide many benefits, including wave attenuation and reduced erosion, and they serve as vital habitat for shore and water birds. FEMA recently determined that sections of the Eastshore neighborhood are within the 100-year flood zone. Inundation maps representing sea level rise and storm surge also indicate flood risk within this area.</p>
<p>Mid-Term (5–10 years)</p>	<p>1</p> <p>ALL</p>	<ul style="list-style-type: none"> • Mudflat augmentation. Add additional dredged sediment to the existing mudflats to help them maintain necessary elevation and structure as waters rise, ensuring they continue providing benefits. Support submerged aquatic vegetation in San Leandro Bay. • Develop long-term monitoring and trigger thresholds plan. Develop thresholds that trigger construction of higher levels of flood control. 	<p>An aerial photograph of the Eastshore Drive area on Alameda Island. The image shows a residential neighborhood with houses and streets. Lincoln Park is visible in the center. A purple shaded area along the waterfront indicates a flood risk zone. A blue circle with the number '2' is placed on the waterfront area, and another blue circle with the number '1' is placed in the water area. The Google logo is visible at the bottom of the image.</p>
<p>Long-Term (>10 years)</p>	<p>ALL</p> <p>2</p>	<ul style="list-style-type: none"> • Tidal neighborhoods. If property ownership changes in the coming decades in this area (transfer to developer or City), evaluate potential for floating neighborhoods proposed by the Resilient By Design “Estuary Commons” project. • Consider property purchase for migration/enhancement of mudflats for flood protection, pending findings of hydrodynamic model of mudflats with sea level rise. Extensive outreach and engagement would be conducted well in advance of implementing this strategy if it were to occur. 	

Table 5-3 Adaptation Planning: Shoreline Near Webster and Posey Tubes

<p>Short-Term (<5 years)</p>	<p>1 2 ALL ALL</p>	<ul style="list-style-type: none"> • Design and implement levee and seawall expansions to protect from a 100-year storm event using existing levees and seawalls. The City's initial conceptual drawings for this location identify areas that need to be raised/reconstructed. • Compile a comprehensive geospatial record of land ownership shoreline. • Establish memoranda of understanding as needed with private landowners. Ensure shoreline actions consider their needs and that they actively implement flood protection actions moving forward. • Develop evacuation plan for senior centers and other care facilities in affected area. 	<p>SHORELINE NEAR WEBSTER & POSEY TUBES</p> <p>A small segment of shoreline above the Webster and Posey Tubes at the north end of Mariner Square Drive is likely to overtop due to sea level rise at and beyond 36 inches. Overtopping at this location is linked to projected inundation that extends along Webster Street and nearby roads and into the Webster and Posey Tubes. The shoreline in this area is dominated by engineered levees and seawalls, as well as commercial buildings and residential facilities (e.g., the Oakmont Senior Center at Mariner Point), that occupy parcels very close to the current shoreline. Addressing shoreline overtopping in this location is likely to prevent flooding and inundation of critical roadways that provide access to/from Alameda Island.</p>
<p>Mid-Term (5-10 years)</p>	<p>3 ALL 4</p>	<ul style="list-style-type: none"> • Require flood-proofing for critical inland facilities like the Hazardous Materials Transfer Station. • Investigate options to modify existing public trail and open space to accommodate temporary flooding. Consider appropriate vegetation, stormwater management structures, and other natural water-tolerant features. • Expand existing levees and seawalls to address longer-term water levels. To address higher water levels beyond the FEMA 1% annual chance floodplain, the City should consider further elevating existing levees and seawalls to 13' NAVD88 and extending seawalls to the northwest. Public access for bicycles and pedestrians along the levee must be maintained or added. 	
<p>Long-Term (>10 years)</p>	<p>ALL</p>	<ul style="list-style-type: none"> • Develop long-term northern waterfront shoreline strategy. Investigate land use policy changes (zoning, building regulations, etc.), including "zoning overlays" in high-risk areas. Create regulations for new and redevelopment projects. Limit development within a certain distance from the shoreline. 	

Table 5-4 Adaptation Planning: Bay Farm Island Lagoon System 1 Outlet Gate and Seawall

<p>Short-Term (<5 years)</p>	<p>1</p> <ul style="list-style-type: none"> • Conduct a geotechnical study. Determine the structural condition of the existing shoreline to better understand long-term modifications that may be necessary. • Elevate existing seawall to provide immediate protection from storms and king tides. Implement recommendations from previous stormwater system assessments. A new 2' retaining wall built behind the existing seawall will make shoreline protections level with tidegate structure platform and adjacent shoreline. • Implement upgrades to HBI System 1 Pump Station identified in previous storm drain master planning efforts and lagoon studies. 	<p>BAY FARM ISLAND LAGOON SYSTEM 1 OUTLET GATE & SEAWALL</p> <p>At the north end of Bay Farm Island Harbor Bay Lagoon System 1 is a narrow, 100-foot long isthmus of land separating the lagoon from San Leandro Bay that can be considered a seawall. It is not a FEMA-certified seawall, and the underlying shoreline's structural competency is unknown. The seawall is not level with the adjacent shoreline, providing a conduit for floodwaters due to sea level rise and storm surge. Overtopping at this location has the potential to compromise the lagoon system, leading to flooding of neighborhoods throughout Bay Farm Island. The tide gate structure at this location is used to drain the lagoon system during low tide. A supplemental pump can also lower lagoon water levels if the tide gate is submerged.</p>
<p>Mid-Term (5–10 years)</p>	<p>2</p> <ul style="list-style-type: none"> • Investigate options for submerged aquatic vegetation (SAV) at this location. Bay Area assessments for natural shoreline feasibility identified San Leandro Bay and the canal as potential locations for SAV. • Begin design of large-scale shoreline modifications along the Bay Farm Island north shore. After 2 to 3 feet of sea level rise, additional strategies may need to be considered and 10 years of lead time will be needed (for feasibility studies, funding, etc.). Thresholds can be developed to trigger exploration of additional strategies such as elevating the existing shoreline or expanding it outwards into the Bay, as well as converting it into a living or horizontal levee. 	
<p>Long-Term (>10 years)</p>	<p>ALL</p> <ul style="list-style-type: none"> • Coordinate the approach to flooding across Bay Farm Island. Flooding on Bay Farm Island is connected to several locations of shoreline overtopping in both Alameda and Oakland. A coordinated approach to shoreline modifications is necessary to reduce the risk of flooding. 	

Table 5-5 Adaptation Planning: Veteran's Court Seawall

<p>Short-Term (<5 years)</p>	<p>1 2 3</p>	<ul style="list-style-type: none"> • Regrade and elevate road to convert Veteran's Court into a flood protection structure. Initial City conceptual designs call for elevating the roadway and retreating the cul-de-sac to Veteran's Memorial Park. A small 3' to 4' earthen berm would tie into existing ground near Island Drive, preventing water from flowing along the roadway and impacting other areas. • Repair/replace and elevate existing seawall. Implement recommendations from Bay Farm Island Technical Study, including raising existing shoreline structure to provide greater flood protection. • Enhance wave attenuation and erosion control features like submerged aquatic vegetation. This may provide some additional protection to the existing seawall. 	<p>VETERAN'S COURT SEAWALL</p> <p>A major source of potential flooding on Bay Farm Island is the Veteran's Court area. The shoreline along Veteran's Court is primarily a constructed seawall that is not engineered to meet FEMA requirements. Overtopping in this location may lead to inundation of adjacent neighborhoods at mid-century water levels—or inundation during very intense, current storm events—and will likely contribute to larger-scale flooding across Bay Farm Island at higher water levels. Addressing shoreline deficiencies at Veteran's Court is only part of a larger effort needed across Bay Farm Island, in both Alameda and Oakland.</p>
<p>Mid-Term (5–10 years)</p>	<p>ALL 4</p>	<ul style="list-style-type: none"> • Integrate activities at Veteran's Court seawall into broader Bay Farm Island flood control strategies. Flooding on Bay Farm Island originates from multiple locations, so any adaptations at an individual site should be part of a larger coherent approach for shoreline modifications across the island. • Investigate options to convert Veteran's Court area into a living levee. This would require either retreat away from Veteran's Court or encroachment into the canal, as well as a long-term management plan to maintain adequate levee elevation. 	
<p>Long-Term (>10 years)</p>	<p>5</p>	<ul style="list-style-type: none"> • Consider further removal of impervious surfaces. Short-term plans call for converting existing impervious surface into natural area to aid drainage. Long-term options could include converting Veteran's Court roadway into a shoreline park with pedestrian/bike access. Consider features like De-Pave Park as models for transitioning developed land to natural. 	

Table 5-6 Adaptation Planning: Bay Farm Island Touchdown and Towata Park

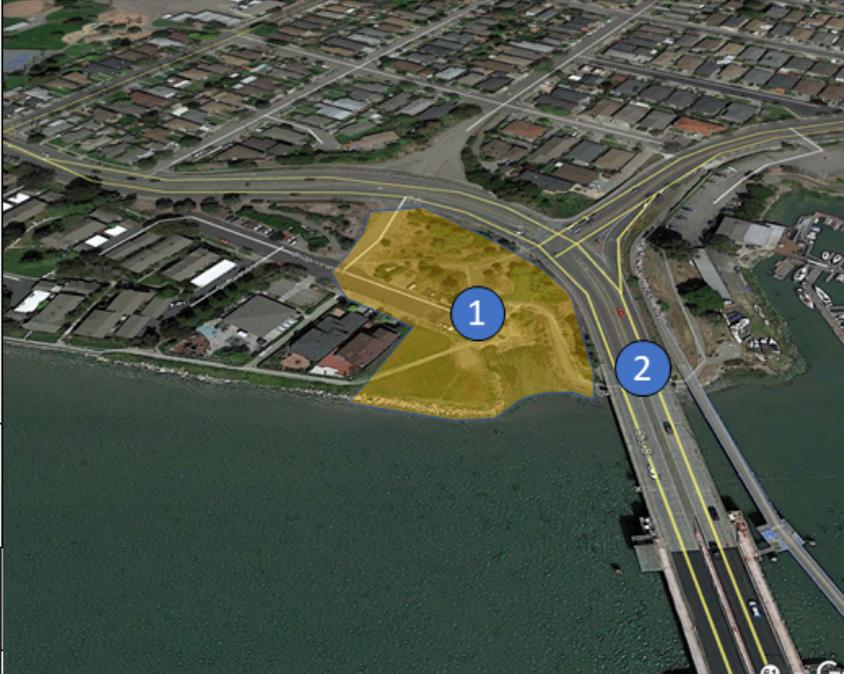
Short-Term (<5 years)	ALL	<ul style="list-style-type: none"> • Conduct inventory of existing shoreline protection structures. Determine ownership; where seawalls, riprap, and other protection structures are most deficient in elevation; and where repairs are most needed to guide immediate actions. 	<h3>BAY FARM ISLAND TOUCHDOWN AND TOWATA PARK</h3> <p>This stretch of shoreline provides flood protection to the adjacent residential area, Bridgeview Isle, and Krusi Park. The area of earliest concern is directly to the west of the bridge (on the Alameda Island side) by Towata Park, where overtopping begins at a total water level of 24 inches. At a total water level of 36 inches, homes in the Ravens Cove HOA and some nearby houses are impacted. At 48 inches, the flood area expands significantly. Today's shoreline is made up of seawalls and riprap. Towata Park is owned and managed by the City of Alameda Recreation and Parks Department. EBMUD has an easement in the area. The HOA appears to own part of the shoreline as well, though clarification is needed.</p> 
	ALL	<ul style="list-style-type: none"> • Carry out engineering study to determine alternative conceptual designs for improved shoreline protection. Study should include potential for beach creation along the fortified shoreline and expanded submerged vegetation restoration to reduce stress and wave runup on fortified shoreline. 	
	1	<ul style="list-style-type: none"> • Conduct focused study on adaptation measures available at Towata Park. Given that there is more space available at the park than along the homes, a design alternatives study may identify options besides a hardened shoreline in this area, such as a beach that integrates park improvements (e.g., kayak launch). 	
	2	<ul style="list-style-type: none"> • Assess bridge vulnerability. Include assessment of pilings, machinery rooms, motors, and vertical clearance. 	
Mid-Term (5-10 years)	ALL	<ul style="list-style-type: none"> • Repair/replace and elevate existing shoreline protection (based on study outcomes). Provide 100-year flood protection plus protection to mid-century sea level rise projections. 	
	ALL	<ul style="list-style-type: none"> • Develop long-term monitoring and trigger thresholds plan. Develop thresholds that trigger construction of higher levels of flood control. 	
Long-Term (>10 years)	ALL	<ul style="list-style-type: none"> • Consider local ordinance requiring or encouraging flood retrofits in this neighborhood. 	

Table 5-7 Adaptation Planning: SR260, Including Posey and Webster Tubes

<p>Short-Term (<5 years)</p>	<p>1 2 2</p>	<ul style="list-style-type: none"> • Address flooding at the Webster Tube exit and Posey Tube entrance. Road grading and floodwalls along the ramps to the tunnels can block overland flooding and reduce disruptions to tunnels. • Install saltwater-resistant pumps in the tubes. Current pumps are designed for stormwater only and are likely to be compromised if sea level rise or storm surge results in saltwater in the tunnels. • Implement flood-proofing for ventilation, electrical, and pumping infrastructure. Ensure long-term sustainability of tubes by protecting critical infrastructure from flooding. 	<p>SR260 INCLUDING POSEY & WEBSTER TUBES</p> <p>SR260, including the Webster and Posey Tubes, is a critical transportation corridor connecting Alameda and Oakland. It is owned and maintained by Caltrans. The City of Alameda has limited jurisdictional oversight of the roadway and tunnels but coordinates closely with Caltrans on tunnel projects. The route is used heavily by commuters and businesses, and it serves as a major commercial route connecting the Port of Oakland with storage facilities in Alameda. Despite the age of the Posey Tube (built in 1928; oldest underwater tunnel in the United States), seismic retrofits completed in 2004 helped rehabilitate the tunnel and increase its functional lifespan. Modifications to the tubes are likely necessary to protect them from floodwaters. Shoreline modifications in this area will be critical to preventing flooding in the tubes, but actions should still be implemented to prevent disruptions if shoreline flood protection structures fail.</p>
<p>Mid-Term (5–10 years)</p>	<p>3 3</p>	<ul style="list-style-type: none"> • Implement results of West End Bicycle and Pedestrian Crossing Feasibility and Design Study (Project 39 in TCP). The Caltrans District 4 Bike Plan (2018) lists a “new separated crossing” as a top tier project. • Increase Transportation Redundancy. The Alameda TCP outlines several projects, including water taxis, bike/pedestrian alternatives (Projects 37, 39), and other projects to increase transportation redundancy—e.g., a new BART connection (Project 35). 	

Table 5-8 Adaptation Planning: SR61/Doolittle Drive

<p>Short-Term (<5 years)</p>	<p>1</p> <ul style="list-style-type: none"> • Work with model airplane field to adapt/regrade the field. Some of the earliest flood risk to SR61 is at the intersection with Harbor Bay Parkway. The water would flow over the field before affecting the road. This could be prevented by regrading the field to prevent overtopping from Doolittle Pond. <p>2</p> <ul style="list-style-type: none"> • Support neighboring adaptation efforts. Past adaptation design efforts have proposed extending Arrowhead Marsh southward into the seaplane canal, as well as relocating Doolittle Drive westward (toward Earhart Drive) and raising it onto a horizontal levee. While such strategies represent a long-term effort taking place in Oakland, they could significantly reduce Bay Farm’s flood risk. The funding, multijurisdictional political will, and research to support this work need to start now. <p>3</p> <ul style="list-style-type: none"> • Study potential for mudflat augmentation or beach erosion to reduce overtopping of Doolittle Pond. <p>4</p>	<p>SR61/DOOLITTLE DRIVE</p> <p>SR61 is a state highway owned and maintained by Caltrans. The route runs from the intersection with SR112 near the Oakland Airport across Alameda and terminates at the intersection of Webster Street in Alameda, operating as an important corridor from the island of Alameda to Bay Farm Island, and to the airport and the City of Oakland. The route includes the Bay Farm Island Bridge (connecting Alameda Island and Bay Farm Island). Multiple AC Transit bus routes, including several serving transit-dependent communities, use SR61. The City of Alameda has designated SR61 south of Otis Drive as a primary evacuation route. While isolated segments of SR61 within the City of Alameda are at risk of flooding (near Veteran’s Court and the intersection of SR61 and Harbor Bay Parkway), major flood risk originates with overtopping of Doolittle Drive within the City of Oakland. There is a risk that water could overtop Doolittle Drive and then flood the airport, golf course, and finally nearby residential neighborhoods.</p>
<p>Mid-Term (5–10 years)</p>	<p>5</p> <ul style="list-style-type: none"> • Collaborate with Regional Water Quality Control Board on updates to the long-term flood protection plan contained within the Doolittle Landfill’s Waste Discharge Requirements (WDRs). WDRs are updates to ensure monitoring and management requirements remain appropriate to site conditions. A WDR update could provide an opportunity to discuss integration of site flood protection into broader shoreline adaptation efforts. 	
<p>Long-Term (>10 years)</p>	<p>6</p> <ul style="list-style-type: none"> • Explore opportunities to collaborate with the golf course on flood control. <p>7</p> <ul style="list-style-type: none"> • Explore converting roadways on the east side of the Bay Farm community into levees. 	

Table 5-9 Adaptation Planning: Critical and High-Use Roadways

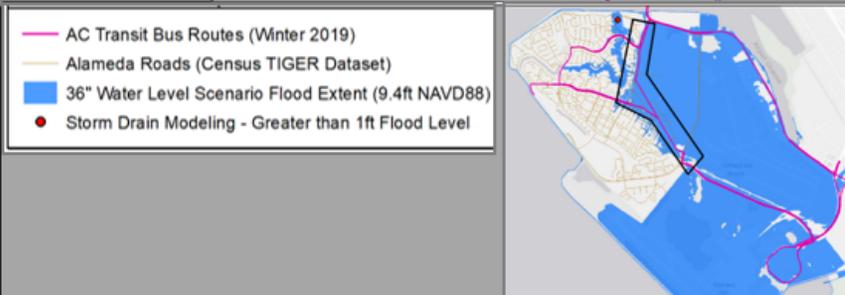
<p>Short-Term (<5 years)</p>	<p>ALL</p> <p>ALL</p> <p>ALL</p> <p>ALL</p>	<ul style="list-style-type: none"> • Address culvert and road drainage issues in areas identified as vulnerable to sea level rise and storm drain flooding (see maps to right). Expand consideration of transit-dependent communities in road project prioritization. • Investigate options for green infrastructure in road design, including permeable pavement, bioswales, and distributed small-scale stormwater best management practices where appropriate. Implement recommendations guidance and strategies in the City's Green Infrastructure Plan. • Support expanded WETA service at the Main Street Ferry Terminal and a new terminal in the Seaplane Lagoon. • Work with AC Transit to install bus shelters so riders are protected from the elements on rainy days or during heat waves. 	<p>CRITICAL & HIGH-USE ROADWAYS</p> <p>These are bundles of important roads in Alameda that private vehicles and public transit use. They are also important routes for emergency services. These roadways are defined in part based on the location of AC Transit bus routes that serve transit-dependent populations in Alameda, including Line 96, which serves Alameda Point (and the planned location of a Bus Rapid Transit stop). Although many roads in Alameda may be exposed to sea level rise and/or storm drain flooding, transit routes enable the City to ensure social equity when building resilience in Alameda. Maintaining a functioning and accessible transit system across the island also serves all residents that use transit for commuting and errands. Strategies suggested here often apply to many roads across the city. However, the CARP process indicates the importance of addressing issues along these key roads, which provide important services for transit-dependent communities in Alameda.</p>
<p>Mid-Term (5–10 years)</p>	<p>ALL</p> <p>ALL</p>	<ul style="list-style-type: none"> • Work with high-risk neighborhoods and AC Transit to develop a dynamic routing and notification system for buses during storm events. • Expand flood-proofing for bus stops, including elevating high-use stops in areas where floodwaters are likely and work with AC Transit to develop a community messaging system for rerouting of buses during flood events. 	
<p>Long-Term (>20 years)</p>	<p>ALL</p>	<ul style="list-style-type: none"> • Continue to implement shoreline modifications to prevent the flooding and disruption of key roadways and transit. The City can work with key partners like AC Transit, leaders in socioeconomically disadvantaged communities, and neighboring jurisdictions to study and implement transit system alternatives such as a greatly expanded ferry service that could reduce reliance on surface streets. 	

Table 5-10 Adaptation Planning: Storm Drain Pipes and Pump Stations

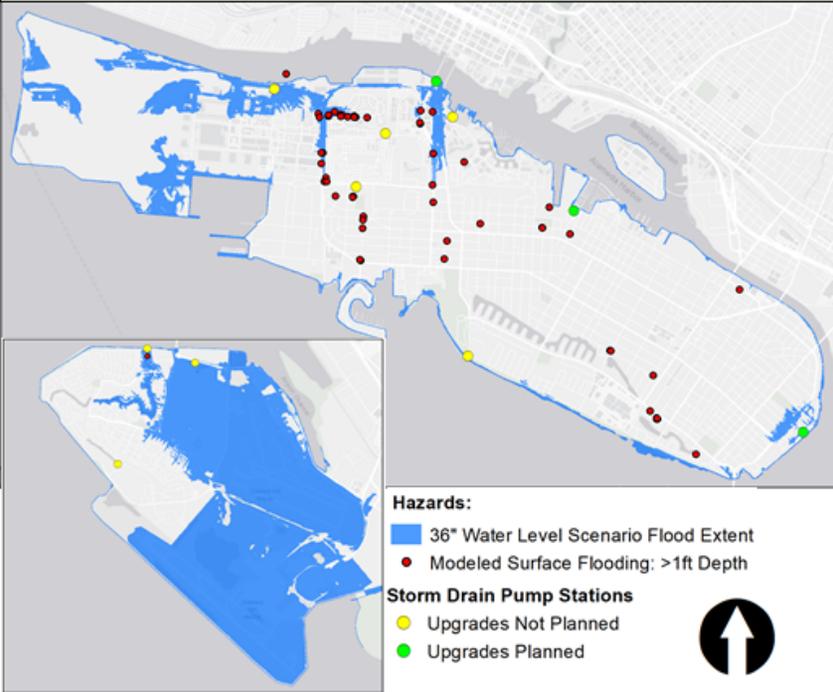
<p>Short-Term (<5 years)</p>	<p>ALL</p> <p>ALL</p> <p>ALL</p>	<ul style="list-style-type: none"> • Implement recommendations in City’s existing master planning efforts. Projects include major efforts like lagoon dredging and capacity upgrades at priority pump stations, including Arbor Street, Webster Street, and Central/Eastshore. • Consider projected future water levels when designing stormwater upgrades. Storm pipe and pump station design should consider projected water levels at the end of the design lifespan for an upgrade. Additional elements like flood-proofing should be considered for infrastructure with long useful lifespans. • Study groundwater and consider impacts on stormwater management. Consider the impact of stormwater alternatives such as under-drained treatment on capacity requirements for pump stations and pumps. Study potential increases in flow if stormwater is managed through alternatives to infiltration and incorporate findings in stormwater improvements. 	<p>STORM DRAIN PIPES & PUMP STATIONS</p> <p>Existing stormwater system planning has identified several important upgrades to the storm drain pipes and pump stations necessary to address current storms, which are likely to become more frequent with climate change. Without upgrading the system, runoff water may more frequently overtop the curb and threaten property and safety. It is crucial for the City to fund and implement stormwater pipe and pump stations projects already identified in master planning work. Sea level rise is likely to cause groundwater in Alameda to rise, exacerbating existing deficiencies in the stormwater system. At the same time, storm events and associated flooding can overwhelm stormwater infrastructure and lead to flooding throughout the system. A comprehensive approach to shoreline and stormwater system adaptation will ensure that Alameda is prepared for a future of increased flooding. Over the mid- and long-term, we will monitor groundwater levels and determine what impacts higher water levels have on stormwater management. We may need to consider large-scale efforts to manage groundwater levels.</p>
<p>Mid-Term (5–10 years)</p>	<p>ALL</p> <p>ALL</p>	<ul style="list-style-type: none"> • Continue to implement recommendations in City’s existing master planning efforts. Stormwater improvements beyond 5 years are tightly linked to shoreline improvements and other adaptation actions described throughout the CARP. • Periodically update storm drain models. At this time, it is unclear what capacity improvements or other upgrades might be needed beyond a 10-year planning horizon. Storm drain modeling will be revisited periodically and should begin to incorporate projected changes in storm intensity. 	 <p>Hazards:</p> <ul style="list-style-type: none"> ■ 36" Water Level Scenario Flood Extent ● Modeled Surface Flooding: >1ft Depth <p>Storm Drain Pump Stations</p> <ul style="list-style-type: none"> ● Upgrades Not Planned ● Upgrades Planned
<p>Long-Term (>10 years)</p>	<p>ALL</p>	<ul style="list-style-type: none"> • Comprehensive approach to shoreline and stormwater management. 	

Table 5-11 Adaptation Planning: Bayview Weir and Outfall

<p>Short-Term (<5 years)</p>	<p>ALL</p> <p>1</p> <p>2</p>	<ul style="list-style-type: none"> • Implement identified improvements from stormwater system master planning. Master planning efforts have identified the need for upgrades, including dredging and new flap gates. • Analyze the structure of the weir. Determine the structural characteristics of the weir to better understand geotechnical conditions and gather information necessary to design a pump station. • Monitor water levels at the outfall. Establish a system to monitor water levels at the outfall to track the length of time the outfall is exposed. This information can help determine how soon a new pump station is needed. 	<p>BAYVIEW WEIR & OUTFALL</p> <p>The Bayview weir and outfall are in need of repairs and/or replacement. The greatest vulnerability to the system is from sea level rise, which will eventually prevent the gravity-fed system from operating, necessitating the installation of an active pump station. Several information gaps need to be filled to determine the best approach to address deficiencies in the existing system. We can take a number of interim steps to address the vulnerability of the weir and outfall while securing funds for a new pump station. Over the longer term, it is necessary to fund and implement recommendations in existing master planning efforts for the stormwater system. Addressing vulnerabilities at this location is crucial to ensuring ongoing functionality of the lagoon system and to maintaining flood protection for homes adjacent to the lagoons.</p>
<p>Mid-Term (5–10 years)</p>	<p>1</p> <p>ALL</p>	<ul style="list-style-type: none"> • Install a new pump station. Begin planning, design, and permitting processes for a new pump station at the Bayview weir location. A pump station is needed at this site to ensure lagoon water levels can be maintained during storm events. Once the existing outfall is underwater for the majority of the day, it is no longer effective to control water levels through a gravity system. • Integrate weir and outfall upgrades with other modifications along Shoreline Drive. Implement recommendations from stormwater master planning efforts along Shoreline Drive to help better manage stormwater on the southern shore. 	
<p>Long-Term (>10 years)</p>	<p>ALL</p>	<ul style="list-style-type: none"> • Address shoreline issues in nearby areas. In the longer term, substantial inundation across Alameda Island could directly connect the Bay and the South Shore lagoon system. Shoreline modifications are necessary to prevent this inundation and maintain the long-term viability of the lagoon system. 	

Summary of Strategies

Completed and Ongoing Strategies

The City and community members have worked together for years to address certain aspects of risk such as strengthening structures and utilities, bolstering pre and post disaster communication systems and hiring City staff tasked specifically with increasing disaster readiness in Alameda. Accomplishments include:

- Building and Facilities
 - Require gas shut-off valves when a building is sold or a plumbing permit is obtained.
 - Require either fire sprinklers or smoke detectors in all developments.
 - Regulate construction in flood zones to comply with National Flood Insurance Program Community Rating System.
 - Retrofit or demolished 100% of Alameda's unreinforced masonry buildings.
 - Continuing implementation of the Soft-Story Ordinance requiring owners of soft-story apartment buildings to obtain a seismic evaluation of their building, notify all tenants and install an automatic gas shut-off valve.
 - Continuing implementation of the Wood Frame Buildings Ordinance to encourage the seismic retrofit of vulnerable single-family homes.
 - Require site-specific geotechnical investigations for development within liquefaction zones defined by the California Geological Survey.
 - Evaluated and retrofitted City buildings. The following buildings were either built to acceptable seismic standards, or retrofitted: City Hall, Police Station, Fire Station 1, 2, and 4, Main Library, West End Library, Bay Farm Library, Alameda Municipal Power Headquarters, Maintenance Service Center, Central Garage at City Hall, Parking Structure on Central/Oak, Godfrey Park Rec Center, Leydecker Park Recreation Center, Tillman Park Recreation Center, Carnegie Library, Bay Fairview Hall, and the Chuck Corica Golf Course Buildings.
 - Alameda Housing Authority completed a structural evaluation of its senior and low-income facilities and began implementation of the recommended projects
 - Replaced City-maintained landscaping with drought-tolerant, bay-friendly landscaping.
 - Continue to provide home upgrade grants to aid low-income owners and owners that rent to low-income tenants.
- Utility and Transportation Infrastructure
 - Seismic upgrade of Ballena Bridge
 - Repair of Veterans Wall and Walnut Street Retaining Wall.
 - 4X redundancy in emergency wi-fi communication systems.
 - Between FY15/16 and FY19/20, 14.7 miles of old clay sewer pipe was replaced with high-density plastic or PVC, materials demonstrated to better withstand shaking. 10.3 miles were replaced between FY10/11 and FY14/15
 - Storm culvert replacement and condition assessment of storm pipes for master planning purposes
- Networking, Planning, and Education
 - Developed tsunami inundation evacuation and emergency response plans.

- Mutual Aid Agreements and Compatibility with Fire and Police.
- Participation in Interoperable Communications System.

The following strategies have been completed since the 2016 Plan or are nearing completion:

- Constructed a new Emergency Operations Center and Fire Station #3 (Strategy I.A in 2016 Plan)
- Integrated Local Hazard Mitigation and other planning efforts and adopted CARP strategies into Local Hazard Mitigation Plan (Strategy III.C in 2016 Plan)
- Updated General Plan, including Health and Safety Element to align with the Climate Adaptation and Hazard Mitigation Plan (Strategy III.F in 2016 Plan)
- Conducted study of sea level rise impacts on water table in Alameda and potential contaminant mobilization (CARP strategy)
- Adopted and implemented new air quality / smoke response protocols for City staff and employees (CARP strategy)
- Raised stormwater fees to implement Storm Drain Master Plan (CARP Strategy)
- Upgraded air filtration system and installed A/C at the West End library to serve as a Cooling and Clean Air Center (strategy not previously identified)
- Developed draft Environmental Emergency Annex to the Emergency Operations Plan (strategy not previously identified)
- Purchased two water tenders are capable of drafting (pulling) water from the bay or other static water source to fill the tank or as a constant supply to fight fires (strategy not previously identified)
- Conducted awareness campaign on tsunamis, including Tsunami Preparedness week in March and to targeted groups such as the boating community and vulnerable community members (strategy not previously identified)
- Implemented additional drought mitigation measures to reduce municipal water consumption, including Increasing composting, reducing irrigation of decorative lawns (resulting in 3.6% reduction), turned off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converting decorative lawns at city facilities and some parks to drought tolerant landscape, prioritizing fixing pipe leaks, converting irrigation clocks to rain sensitive clocks (resulting in 15% reduction).
- Convened the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. Sub groups are focusing on adaptation of Doolittle Drive and Northern Shoreline near Posey/Webster Tubes (CARP strategies)

Strategies Provided by Key Partners

The table below shows owners of key infrastructure and facilities in Alameda and includes known mitigation actions. The individual agencies should be contacted directly for a complete list of hazard mitigation efforts.

Table 5-12 Key Partner Mitigation Strategies

Owner/Manager	Infrastructure Within City	Known Hazard Mitigation Efforts
East Bay Municipal Utility District (EBMUD)	<ul style="list-style-type: none"> ■ Potable, non-potable (irrigation), and fire suppression water supply system consisting of pipelines, pumping plants, flow/pressure control facilities, and storage tanks and reservoirs owned by EBMUD ■ Sanitary sewer transmission pipeline (wastewater interceptor) and pumping stations ■ Sewer and water connections under the Estuary and San Leandro Bay 	<ul style="list-style-type: none"> ■ Three new pipeline crossings are proposed to replace the existing pipeline crossings to ensure long-term reliability of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure. The environmental review process for the project is underway. Through this process, EBMUD will assess the impacts of the project and identify ways to reduce or eliminate the impacts with input from stakeholders and the community. ■ EMBUD has an ongoing program to replace aging and brittle water lines with more modern materials. ■ EBMUD is collaborating with the City on development of a Debris Management Plan and a Utility Staging Area. ■ EBMUD is bringing recycled water to the main island by 2023, enhancing our resilience to drought. ■ For more information about activities EBMUD is taking for earthquake readiness: https://www.ebmud.com/about-us/construction-and-maintenance/fire-safety-and-suppression/emergency-preparedness/
Pacific Gas and Electric (PG&E)	<ul style="list-style-type: none"> ■ Natural gas distribution system, including main pipelines, lateral pipelines and meters. ■ Electrical power feeds to Alameda Island under the Estuary. 	<ul style="list-style-type: none"> ■ PG&E has an ongoing program to replace aging pipelines with more modern materials, and to install new valves and pressure regulation facilities. ■ PG&E is considering replacement of the power feeds under the Estuary. ■ As a consequence of the San Bruno rupture, the National Transportation Safety Board (NTSB) has issued a number of recommendations to State and federal administrations and institutions to improve the

		<p>safety of pipeline networks as well as to upgrade the integrity management program and emergency response system. As a result, PG&E proposed a \$2.2 billion Pipeline Safety Enhancement Plan to modernize its gas transmissions operations over the next several years. As part of this plan, PG&E has installed approximately 13 SCADA units to remotely monitor and manage the pressure in gas transmission lines in the City of Alameda.</p> <ul style="list-style-type: none"> ■ Additionally, PG&E has created a First Responders Safety website, which provides secure access to maps and information about natural gas transmission lines, natural gas storage facilities, and shut-off valves.
AT&T, Comcast, and other telecoms	<ul style="list-style-type: none"> ■ Telecommunications aerial and underground conduits. Switching facilities. Cell towers. 	<ul style="list-style-type: none"> ■ Improvements are ongoing.
Caltrans	<ul style="list-style-type: none"> ■ Posey and Webster Tubes, Bay Farm Island (AKA San Leandro Channel) Bridge and Bike Bridge, Constitution Overpass, State Routes 61 and 260. 	<ul style="list-style-type: none"> ■ Seismic evaluation and retrofit of bridges <ul style="list-style-type: none"> — Posey and Webster Tubes – The tubes were retrofit to “no collapse” standard in 2003. Caltrans has no future plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system. — Bay Farm Island vehicular bridge – Built in 1953 and seismically retrofitted in 1997 to “no collapse” standard. City sent letter in 2007 requesting retrofit to “lifeline” standard; however, Caltrans has no future plans for retrofitting the bridge. — Bay Farm Island bike/pedestrian bridge – The bridge was built in 1996 and there are no plans for seismic retrofit work. — Constitution Way overcrossing – this bridge was built in 1985 and there are no plans for seismic retrofit work. ■ Temporary detour plans <ul style="list-style-type: none"> — Posey and Webster Tube: There is a current Traffic Management Plan that were used during the construction/refurbishment of the ventilation system, and when closing the tunnel. The detour plan may be

		<p>utilized, subject to Incident Commander discretion when an incident occurs.</p> <ul style="list-style-type: none"> — Roadway – State Routes 61 and 260: Detour plans may be activated as necessitated by an emergency, subject to Incident Commander discretion. Caltrans District Traffic Manager may be able to assist during the time of the incident. ■ Post-earthquake inspection of Caltrans bridges, roadways and tunnels will be conducted by Caltrans staff as necessary depending on the earthquake intensity and extent of damage.
County of Alameda	<ul style="list-style-type: none"> ■ Miller-Sweeney (Fruitvale), Park Street, and High Street Bridges. 	<ul style="list-style-type: none"> ■ The County retrofit all three bridges to “no collapse” standard from 2008 to 2011, and continues to maintain, operate and monitor these bridges.
Federal Government – Army Corps of Engineers	<ul style="list-style-type: none"> ■ Fruitvale Railroad Bridge 	<ul style="list-style-type: none"> ■ City staff is working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the abandoned rail bridge that is likely to collapse in a seismic event. In 2020, the Army Corps submitted a request for funding to prepare a "Disposition Study," which is a comprehensive analysis of the economic utility of the bridge, in light of federal purpose and benefit. Once funded and completed, the report would inform the Corps' decision on continued use, transfer or demolition. A subsequent funding request to execute that decision would then be submitted. City staff considered retrofitting the bridge; however, the construction, operation and maintenance costs of this former rail bridge exceed the City's financial abilities. ■ The City of Alameda would like to have the hazardous structure replaced with a new crossing for transit, bicycles and pedestrians.
Federal Government – Coast Guard and Navy	<ul style="list-style-type: none"> ■ Portions of Alameda Point, all of Coast Guard Island including bridge, Coast Guard Housing, Ready Reserve, Navy 	<ul style="list-style-type: none"> ■ The United States Coast Guard has completed a sea level rise vulnerability assessment and adaptation plan for Coast Guard Island, which looked holistically at the shoreline. The Coast Guard completed a design that segments the island into nine different adaptation areas with primarily

	Operations Reserve Center	natural measures on the east side and riprap/sheet pile replacement on the west side. The Coast Guard is completing the environmental process along with permitting.
East Bay Regional Park District (EBRPD)	<ul style="list-style-type: none"> The EBRPD manages the Robert Crown Memorial State Beach, the City's Shoreline Drive Park, and the Northern Territories area by the Veterans Affairs proposed building. EBRPD is responsible for major maintenance and upgrades; the City is responsible for storm drain maintenance. 	<ul style="list-style-type: none"> EBRPD recently completed restoration of Crown Beach, which has the indirect effect of protecting Shoreline Drive from storm erosion. EBRPD is currently (Late 2015) designing an inland extension of the groin at Park Street to decrease beach erosion there.
Housing Authority	<ul style="list-style-type: none"> The Housing Authority has 572 senior, disabled, and low income housing units. 	<ul style="list-style-type: none"> The Housing Authority has recently completed a comprehensive needs assessment at all properties. A capital improvements plan has been prepared to reduce risks to vulnerable populations. The plan includes management training, waterproofing work, communications systems, backup generators and other features.
Alameda Unified School District (AUSD)	<ul style="list-style-type: none"> The AUSD has 19 schools in Alameda, serving K through 12 grades, plus a special education preschool and an adult school. 	<ul style="list-style-type: none"> AUSD has completed seismic retrofits of the Historic Alameda High School and Kofman Auditorium. Lum Elementary school was closed in 2017 because of concerns about liquefaction risk on the campus.
American Red Cross (ARC)	<ul style="list-style-type: none"> Tasked with providing shelter operations and feeding during disasters. 	<ul style="list-style-type: none"> The ARC and the City are working on shelter agreements for sheltering locations within the City. The ARC is also working on shelter agreements with other organizations, including schools and churches, for additional sheltering locations. The ARC is working with other organizations to prepare for mass feeding needs. The ARC has a warehouse at Alameda Point with supplies (cots, food, etc.) for Bay Area sheltering needs.

<p>Medical Facilities</p>	<ul style="list-style-type: none"> ■ There are numerous medical facilities that provide services to vulnerable populations. <ul style="list-style-type: none"> — Alameda Hospital — Private Clinics — Alameda County Health — (Future) Veterans Administration Clinic — Pharmacies 	<ul style="list-style-type: none"> ■ Alameda Hospital is completing seismic retrofit of the west building, in compliance with SB1953.
<p>Water Emergency Transportation Authority (WETA)</p>	<ul style="list-style-type: none"> ■ WETA operates ferries that travel to three terminals within the City of Alameda. The landside portion of the ferry terminals is operated and maintained by the City; the water side portion is operated and maintained by WETA. 	<ul style="list-style-type: none"> ■ WETA built a maintenance facility and new ferry terminal on Alameda Point. ■ WETA is replacing and expanding the Main Street ferry terminal float. This project will design and construct terminal refurbishments and upgrades to maintain it in a state of good repair. WETA received a \$4,456,000 discretionary Federal Transit Administration Ferry Grant Program award in July 2020 to support this project.

Priority Climate Adaptation and Hazard Mitigation Strategies

The priority climate adaptation and hazard mitigation strategies below include those from the 2016 LHMP that were selected for continuation, adaptation strategies from the Climate Action and Resiliency Plan, strategies in the General Plan Safety Element, and new strategies identified by staff and community members. The strategies in the final Mitigation Plan are aligned with those in the General Plan Safety and Climate Conservation Elements. Each mitigation strategy listed in **Table 5-12** below is explained in greater detail at the end of this chapter.

Table 5-13 Climate Adaptation and Hazard Mitigation Strategies

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
Buildings			
B1. Solar Panels. Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill.	Earthquake Ground Shaking Wind/Storms	AMP	General Plan Policy CC-14
B2. Water Efficiency and Conservation. Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.	Drought	Planning, Building and Transportation Public Works Recreation and Parks	General Plan Policy CC-16
B3. Rising Groundwater. Prepare for the impacts of rising groundwater levels on private and public property.	Sea Level Rise	Planning, Building and Transportation Public Works	General Plan Policy CC-23, HS-35
B4. Seismic Retrofit for Private Buildings. Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled	Earthquake Ground Shaking Earthquake Liquefaction	Planning, Building and Transportation	General Plan Policy HS-13, Municipal Code Section 13-80.1 to 13-80.16 and 13-70.1 to 13-70.6
B5. Flood Insurance. Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Identify ways to increase Alameda's Community Rating to reduce flood insurance costs.	Flooding Sea Level Rise	Public Works	General Plan Policy HS-14, Municipal Code Section XX - Floodplain Management
B6. Flood Proofing for Existing Buildings. Implement programs to	Flooding	Planning, Building and Transportation	General Plan Policy HS-19

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
encourage flood-proofing retrofits to existing buildings and redevelopment in flood-prone areas.			
B7. Design for Flooding. Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas, and require all new development to design for sea level and associated groundwater rise based on the most current regional projections.	Flooding Sea Level Rise	Planning, Building and Transportation	General Plan Policies HS-22, LU-30, CC-20, CARP
B8. Building Codes for New Development. Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.	Earthquake Caused Fires Earthquake Ground Shaking	Planning, Building and Transportation	General Plan Policy HS-29
B9. Fire Prevention in Existing Properties. Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.	Earthquake Caused Fires	Fire	General Plan Policy HS-29
B10. Building and Infrastructure Standards. Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure.	Earthquake Ground Shaking Earthquake Liquefaction	Planning, Building and Transportation	General Plan Policy HS-10
B11. Cool/Green Buildings. Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.	Heat	Planning, Building and Transportation	General Plan Policy CC-34
B12. Sea Level Rise Protection. Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise.	Flooding Sea Level Rise	Planning, Building and Transportation Public Works	General Plan Policy CC-19

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
Infrastructure			
11. Critical Public Assets. Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater.	Earthquake Ground Shaking Liquefaction Flooding Sea Level Rise	Public Works AMP	General Plan Policy CC-22 and HS-12
12. Water Retention. Develop and maintain large and small areas to retain water within the city that may serve as areas of “retreat” during large storm events.	Flooding Sea Level Rise	Public Works	General Plan Policy CC-24
13. Urban Forest. Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects.	Heat	Public Works Recreation and Parks	General Plan Policy CC-26, CARP
14. Lagoons. Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City’s green infrastructure network and flood control system.	Flooding	Public Works	General Plan Policy CC-32
15. On-Island Generation. Support development of on-island solar power generation and on-island wind power with appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment.	Earthquake Ground Shaking Wind/Storms	AMP	General Plan Policy CC-4
16. Public Infrastructure Priorities. Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards,	Earthquake Ground Shaking Flooding Liquefaction Sea Level Rise	Planning, Building and Transportation Public Works	General Plan Policy HS-17, CARP

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
and prioritize projects for adaptation funding.			
17. Green Infrastructure. Require the use of “green infrastructure”, landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events.	Flooding Sea Level Rise	Public Works	General Plan Policy HS-23, CARP
18. Underground Utilities. Require new development to underground utilities to minimize disruption by fire or other natural disasters.	Earthquake Caused Fires	AMP	General Plan Policy HS-30, Underground Utility District Policy
19. Lifeline Standard Estuary Crossing. Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event.	Earthquake Ground Shaking Liquefaction	Public Works	General Plan Policy HS-11
110. Collaboration. Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.	Earthquake Caused Fires	Fire	General Plan Policy HS-27
Land Use			
L1. Groundwater Rise. Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable.	Sea Level Rise	Public Works	General Plan Policy HS-35
L2. Land Development. Require that new development reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise.	Sea Level Rise	Planning, Building and Transportation	General Plan Policy CC-20

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
L3. Resilient Rights-of-Way and Open Spaces. Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding.	Flooding	Planning, Building and Transportation	General Plan Policy HS-19
L4. Easements. Require the creation and maintenance of easements along drainage ways necessary for adequate drainage of normal or increased surface runoff due to storms.	Flooding	Planning, Building and Transportation Public Works	General Plan Policy HS-22
Emergency Response			
E1. Heat and Wildfire Smoke Emergencies. Create a network of clean air and cooling emergency shelters throughout Alameda.	Heat Wildfire Smoke	Library Public Works Recreation and Parks	General Plan Policy CC-25, CARP, Emergency Operations Plan
E2. Emergency Preparedness. Maintain emergency management and disaster preparedness as a top City priority.	All Hazards	Fire	General Plan Policy HS-1
E3. Tsunami Preparedness. Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations.	Tsunamis	Fire Planning, Building and Transportation	General Plan Policy HS-20
E4. Emergency Coordination. Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster	All Hazards	Fire	General Plan Policy HS-3

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
response communication technologies are compatible with other agency communication technologies.			
E5. Wildfire Smoke. Prepare for future wildfire smoke events.	Wildfire Smoke	Fire	General Plan Policy HS-61
E6. Emergency Response and Disaster Preparedness. Preserve access for emergency response vehicles to people and property and for evacuation.	Earthquake Ground Shaking Liquefaction Tsunamis	Planning, Building and Transportation Public Works	General Plan Policy ME-9
Communication, Community and Coordination			
C1. Public Communication. Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.	All Hazards	City Manager's Office Fire Police	General Plan Policy HS-4, Emergency Operations Plan
C2. Air Quality Alerts. Continue to partner with BAAQMD to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents.	Wildfire Smoke	Fire	General Plan Policy HS-65
C3. Regional Partnerships. Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies.	Drought Sea Level Rise	City Manager's Office Planning, Building and Transportation Public Works	General Plan Policy HS-16
C4. Collaboration. Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.	Earthquake Caused Fires	Fire	General Plan Policy HS-27
C5. Neighborhood Resilience Coordination. Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition	All Hazards	City Manager's Office	General Plan Policy CC-15

Strategy	Hazard(s) Addressed	Lead Department	Related Policy/ Plan
to climate friendly energy, water, and resource use.			
C6. Social Vulnerability. Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change.	All Hazards	All Departments	General Plan Policy CC-2
Studies and Plans			
S1. Adaptation Pathway Master Plan. Develop an adaptation pathway master plan. The plan will include additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels.	Sea Level Rise	City Manager's Office Community and Economic Development Planning, Building and Transportation Public Works	General Plan Policy CC-21, CARP
S2. Rising Groundwater. Prepare for the impacts of rising groundwater levels on private and public property.	Sea Level Rise	City Manager's Office Planning, Building and Transportation Public Works	General Plan Policy CC-23, HS-24, Groundwater Study
S3. Flood Hazard Maps. Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources.	Flooding	Planning, Building and Transportation	General Plan Policy HS-15

Equity Review of Strategies

An equity review was conducted for each of the mitigation and adaptation strategies. The equity review provides initial assessment of opportunities to enhance equity in the implementation of the strategies to ensure that every action put forward in this plan has a positive equity benefit and actively seeks to dismantle past harms. At later stages of planning, as strategies become specific projects with plans and budgets of their own, an equity framework will be used to guide the development of project specific implementation plans.

Prioritization of Strategies

The third and final step selected and prioritized the specific mitigation actions. The mitigation actions represent an unambiguous and functional plan for action and are considered to be the most essential outcome of the mitigation planning process.

In general, all mitigation strategies considered by the Planning Team can be classified under one of the following seven broad categories

- Long Range Planning (for example: master plans, climate action plans)
- Land Use Planning (ex: general plan, specific plan)
- Capital Planning (ex: capital improvement plan)
- Operations (ex: annual budgeting)
- Emergency and Hazard Planning (ex: emergency operations)
- Project Planning and Design (ex: private and public development projects)
- New Initiatives (ex: legislation, ballot measure)

The City incorporated six key factors in the prioritization of mitigation actions. These criteria are described below:

- **Support of goals and objectives.** Actions that support multiple goals and objectives are prioritized.
- **Funding availability.** Actions with secured funding are prioritized.
- **Hazards addressed.** Actions addressing the Plan's hazards of greatest concern (earthquake and flooding) are prioritized.
- **Public and political support.** Actions with public and political support are prioritized.
- **Adverse environmental impact.** Actions with low environmental impact are prioritized.
- **Environmental benefit.** Actions that provide an environmental benefit are prioritized.
- **Timeframe.** Actions that are ongoing, or that can be completed in the short-term, are prioritized.
 - Ongoing: Currently being funded and implemented under existing programs
 - Short-term: To be completed in 1-2 years
 - Long-term: To be completed in more than 2 years
- **Equity.** Strategies that address equity issues or promote equitable outcomes are prioritized.

Assignment of Strategies

Each mitigation strategy has a mitigation action plan presented in table format. Every proposed action is assigned to a specific local department or agency to assign responsibility and accountability and increase the likelihood of subsequent implementation. In addition to the assignment of a local lead department or

agency, an implementation time period or a specific implementation date or window has been assigned to each mitigation action to help assess whether actions are being implemented in a timely fashion. Resource availability will strongly influence the pace of achievements for those actions noted as currently unfunded.

Detailed Adaptation and Mitigation Strategies

Detailed information for each of the climate adaptation and hazard mitigation strategies is presented below in greater detail, including:

- Description
- Hazard(s) addressed
- Responsible city department or agency
- Related plan or policy
- Partners
- Priority
- Actions and activities completed
- Future actions and activities
- Potential Funding source
- Timeframe
- Equity considerations for implementation

B1. Solar Panels

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Wind/Storms
Strategy Type	Admin/Tech
Strategy Description	Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy CC-14
Key Partners	Planning, Building, and Transportation
Completed Actions	Distributed Energy Resources (DER) Plan • AMP has the ability and technology to safely integrate distributed energy resources into its distribution grid. Engineering staff has been evaluating various tools that lay the foundation to integrate software that will allow AMP to comprehensively determine the maximum amount of DER's on AMP's grid. This continuous process of development and implementation will last well into 2022. • Engineering and Operations (E&O) continuously approves, inspects, and interconnects new solar photovoltaic systems often coupled with battery storage.
Future Actions	AMP will develop an asset management plan to guide efficient expenditures. AMP is working on installing 2 MW solar facility at Doolittle Landfill interconnected into AMP's grid. Cost \$9.15M over 20 years; Timeline: 2023.
Potential Funding Source	General Fund, AMP rebate program
Timeframe	Ongoing
Equity Considerations for Implementation	Connect with AMP list of people who need continuous power for electric medical devices or refrigerated medicines to prioritize solar and battery resources.

B2. Water Efficiency and Conservation

Category	Buildings
Hazards Addressed	Drought
Strategy Type	Plans/Policy
Strategy Description	Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.
Actions	<p>a. Water Efficient Landscape Requirements. Maintain up-to-date water-efficient landscaping regulations and ordinances to reduce water use in both private and public landscapes that include healthy, drought tolerant soils, diverse native plant species, non-invasive drought tolerant/low water use plants, and high-efficiency irrigation systems. b. Water-Efficient Buildings. Require low-flow fixtures, such as low-flow toilets and faucets in new construction. c. Recycled and Reclaimed Water. Promote the production and usage of recycled and reclaimed water (sometimes called “grey water”) for potable and non-potable uses. d. Pesticides, Herbicides, and Fertilizers. Limit the use of pesticides, herbicides, and fertilizers throughout the city by fostering healthy soil practices, which include organic carbon amendments (e.g. compost and mulch) on all non-turf planting areas. e. Soil Health. Encourage soil health by promoting and educating the public about the benefits of organic carbon soil amendments that improve water retention in local landscapes. f. EBMUD. Work with EBMUD to improve effectiveness of water conservation programs and increase drought awareness. g. City Buildings. Implement water-saving technologies at all City-owned buildings and post visible signage to educate visitors to those buildings.</p>
Lead Department	Planning, Building and Transportation Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-16
Key Partners	EBMUD
Completed Actions	Increased composting, reduced irrigation of decorative lawns (resulting in 3.6% reduction), turned off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converted decorative lawns at city facilities and some parks to drought tolerant landscape, prioritized fixing pipe leaks, converted irrigation clocks to rain sensitive clocks (resulting in 15% reduction).
Future Actions	Converting City Hall’s lawn to drought tolerant landscape in 2022.
Potential Funding Source	EBMUD, HMGP, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Provide benefits for drought-resistant landscapes that support lower income communities.

B3. Rising Groundwater

Category	Buildings
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Prepare for the impacts of rising groundwater levels on private and public property.
Actions	a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-23, HS-35
Key Partners	
Completed Actions	- Completed and published a report, titled "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise" - Incorporated groundwater rise in the 2022 Climate Adaptation and Hazard Mitigation Plan.
Future Actions	Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	

B4. Seismic Retrofit for Private Buildings

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Earthquake Liquefaction
Strategy Type	Plans/Policy
Strategy Description	Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled
Actions	<p>a. Soft Story Program. Continue to implement and expand the City's Soft Story Program including mandatory requirements for substantially improving the seismic performance of multi-family wood frame residential buildings with open ground floor parking or commercial spaces known as soft stories. b. Wood Framed Building Program. Continue to implement and expand the City's Wood Framed Building Program, including requirements for substantially improving the seismic performance of one- and two story wood frame residential buildings with vulnerable "cripple walls". c. Non-ductile Concrete Buildings. Identify, evaluate and retrofit non-ductile concrete residential and nonresidential buildings that are vulnerable to collapse in earthquakes. d. Chimneys. Encourage owners to remove or rebuild masonry or stone chimneys vulnerable to collapse in earthquakes. e. Incentives. Develop incentives and assistance to help property owners make their homes and businesses more earthquake-safe. Pursue a variety of funding sources, such as grants, low-interest loans, tax credits and zoning waivers and density bonuses, to assist residents and businesses with seismic upgrades. Provide exemptions from City zoning requirements, such as off-street parking and/or common open space to facilitate the retrofitting of vulnerable privately-owned buildings. f. Shoreline Property Management. Require owners of shoreline properties, to the extent feasible, to inspect, maintain, and repair the perimeter slopes to withstand earthquake ground shaking, consolidation of underlying bay mud, and wave erosion. g. Cool/Green Buildings. Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-13, Municipal Code Section 13-80.1 to 13-80.16 and 13-70.1 to 13-70.6
Key Partners	Community and Economic Development
Completed Actions	<p>Continue to implement and expand the 2009 soft-story ordinance outlining mandatory compliance requirements for substantially improving the seismic performance of certain residential buildings. The buildings targeted are wood frame condos and apartment buildings with 5 or more dwelling units, permitted for construction prior to December 17, 1985, in which the ground floor has a soft, weak, or open-fronted construction such as a carport. As a result of the ordinance, the City produced an inventory of potential soft story buildings and notified owners, owners were required to evaluate affected buildings and if found to be potentially hazardous, issue written and posted warnings to tenants, and install an earthquake-actuated gas shutoff valve. The ordinance does not require retrofitting of any structural inadequacies found, but did offer permit and inspection fee reductions timely response. As of March 2015, 63 of an original 222 buildings remain on the List of Potentially Hazardous Soft-Story Buildings. These 63 buildings contain nearly 1,000 housing units that could be lost in an earthquake and should now be required to be seismically retrofitted. Continue to implement 2006 wood framed buildings ordinance that outlines voluntary minimum standards to substantially improve the seismic performance of one- to four-unit wood framed residential buildings with: - one and two stories, - continuous perimeter concrete foundations, and - wooden cripple walls less than 4 feet high. The retrofits are voluntary. Incentives include waiving the requirements for plans prepared by a licensed architect or engineer, and waiving of the requirement to</p>

simultaneously upgrade plumbing, mechanical, electrical and life/safety systems that are not a hazard to life or property, but which might be out of compliance with current building codes. Residential Seismic Strengthening Plans and building code guidance are posted on the City website at <http://alamedaca.gov/community-development/building/seismic-retrofit>. The California Earthquake Authority (CEA) also offers retrofit grants for these projects. The City should work to raise awareness about the need for

Future Actions Seek funding to support retrofit of vulnerable soft-story buildings. Encourage residents through a variety of means to apply for CEA Brace and Bolt Program.

Potential Funding Source HMGP, CEA Brace and Bolt Program, CDBG

Timeframe Short-term

Equity Considerations for Implementation Prioritize buildings that are most at risk for earthquake damage/pose a safety threat. Reach out to tenants and building owners through multiple channels and provide translated materials.

B5. Flood Insurance

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Financial
Strategy Description	Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Identify ways to increase Alameda's Community Rating to reduce flood insurance costs.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-14, Municipal Code Section XX - Floodplain Management
Key Partners	City Council Community and Economic Development FEMA Planning, Building, and Transportation
Completed Actions	City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. City widened enforcement of floodplain management requirements regulating new construction in Special Flood Hazard Areas to include the additional properties added to the flood zone as a result of the FIRM map revision. The Community Rating System (CRS) is a voluntary program implemented by FEMA that encourages cities to take certain steps to reduce flood exposure through public information, mapping, regulations, flood damage reduction, warning, and response. As an incentive, insurance rates for individual policy holders are decreased by a percentage for creditable activities. The City joined CRS in October 2019 as a Class 8 community.
Future Actions	The City must recertify its CRS status every year and provide supportive documentation. Maintain City participation in the National Flood Insurance Program, thereby allowing citizens benefits of reduced flood insurance rates. Work with HOAs concerning possible dike improvements. Continue to educate residents about floods and preparedness. Continue to enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, administer any local requests for map updates, give community assistance, and monitor activities.
Potential Funding Source	Urban Runoff Fund
Timeframe	City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. Ongoing implementation continues for building and construction standards for properties designated in flood zone.
Equity Considerations for Implementation	

B6. Flood Proofing for Existing Buildings

Category	Buildings
Hazards Addressed	Flooding
Strategy Type	Plans/Policy
Strategy Description	Implement programs to encourage flood-proofing retrofits to existing buildings and redevelopment in flood-prone areas.
Actions	<p>a. Flood Proofing. Amend local codes and by-laws to mandate flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. b. Risk Prioritization. Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades. c. Assistance. Alameda should identify options to help low-income households and other vulnerable residents pay for flood retrofits. d. Building Code. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-19
Key Partners	
Completed Actions	Completed Alameda Master Infrastructure Plan which requires the Adaptive Reuse Area to be designed to address 24-inches of sea level rise (plus required freeboard) and additional sea level rise in future years beyond 24 inches through adaptive management strategies.
Future Actions	
Potential Funding Source	HMGP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	Consider the impact of floodproofing requirements on undeserved populations and identify options to help low-income households and other vulnerable residents pay for flood retrofits.

B7. Design for Flooding

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas, and require all new development to design for sea level and associated groundwater rise based on the most current regional projections. (See also Policies LU-30 and CC-20).
Actions	<p>a. Waterfront Setbacks. Require new development to provide adequate setbacks along waterfront areas for the future expansion of seawalls and levees to adapt to sea level rise. b. Data. Update maps and publish open data that display these risks clearly as soon as new data or guidelines are created, such as a digital elevation model, sea level and groundwater risks, or the latest risk tolerance guidance provided by the State of California. c. Building Codes. Amend local codes to require flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels. d. Risk Prioritization. Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades. e. Assistance. Adopt fee waiver or small grant programs to help low-income households and other vulnerable residents pay for flood retrofits.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policies HS-22, LU-20, CC-20, CARP
Key Partners	
Completed Actions	Completed Alameda Master Infrastructure Plan which requires the Adaptive Reuse Area to be designed to address 24-inches of sea level rise (plus required freeboard) and additional sea level rise in future years beyond 24 inches through adaptive management strategies.
Future Actions	
Potential Funding Source	Private developers

Timeframe Ongoing

**Equity
Considerations
for
Implementation**

B8. Building Codes for New Development

Category	Buildings
Hazards Addressed	Earthquake Caused Fires Earthquake Ground Shaking
Strategy Type	Plans/Policy
Strategy Description	Require new development to comply with the City's current Electrification, Fire, Seismic, and Sprinkler Codes.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-28
Key Partners	
Completed Actions	
Future Actions	City of Alameda continues to enforce the City's Building Code
Potential Funding Source	Private developers, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

B9. Fire Prevention in Existing Properties

Category	Buildings
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Plans/Policy
Strategy Description	Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.
Actions	a. Electrification. Encourage existing properties to convert natural gas fueled space heating, water heating, clothes drying and cooking appliances to electric to minimize the risk of fires and improve indoor air quality.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-29
Key Partners	AMP
Completed Actions	Alameda Municipal Power provides rebates and incentives for building electrification and will be rolling out new ones in the coming years.
Future Actions	In 2022, staff is planning to develop an equitable building energy efficiency and electrification roadmap.
Potential Funding Source	General Fund, HMGP
Timeframe	Long-term
Equity Considerations for Implementation	Ensure that the transition to all-electric buildings includes residents in multi-unit housing, renters and low income tenants.

B10. Building and Infrastructure Standards

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Earthquake Liquefaction
Strategy Type	Admin/Tech
Strategy Description	Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure.
Actions	a. Functional Recovery Standard. Update the building code to ensure that all new buildings in Alameda are designed to a functional recovery standard so that they can continue to be used after an earthquake. b. No Collapse Standard. Ensure that all existing buildings meet a minimum no collapse standard.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-10
Key Partners	
Completed Actions	Included discussion of functional recovery in hazard mitigation plan update
Future Actions	Consider model codes and guidance on how to effectively implement functional recovery standards.
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

B11. Cool/Green Buildings

Category	Buildings
Hazards Addressed	Heat
Strategy Type	Plans/Policy
Strategy Description	Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy CC-34
Key Partners	
Completed Actions	- The Alameda Point Stormwater Management Plan requires installation of green roofs at Alameda Point. - City Council approved revisions to the Design Review ordinance in 2019 exempting green roof, cool roofs, and similar roof treatments from design review, provided the installation does not require modifying the existing roof form or pitch.
Future Actions	Consider ways to support green roof installation on existing buildings
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	Consider prioritizing and incentivizing cool/green roofs in heat island areas.

B12. Sea Level Rise Protection

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise.
Actions	<p>a. Flood Protection Maps. Work with regional agencies to regularly update the Climate Action and Resiliency Plan with projected inundation zones for years 2070 and 2100 consistent with the most up to date guidance from the Ocean Protection Council (OPC) for sea level rise in California. b. Contaminated Lands. Identify and map contaminated lands at risk of inundation from rising groundwater and flood inundation and identify actions to mitigate the risk of mobilizing contaminants. c. Land Planning. Prioritize areas of little or no flood risk for new flood-incompatible development (i.e. housing and commercial development) in new plans or zoning decisions. d. Shoreline Habitat and Buffer Lands. Identify, preserve, and restore existing undeveloped areas susceptible to sea level rise to reduce flood risk, enhance biodiversity, and improve water quality. Maintain and restore existing natural features (i.e. marsh, vegetation, sills, etc.) between new development and the shore to allow for marsh or beach migration. e. Conservation Easements. Consider use of conservation easements to maintain private lands for shoreline and beach migration. f. Nature Based Flood Control Systems. When designing new flood control systems where none currently exist, prioritize use of nature based flood control systems, such as horizontal levees, marsh lands, or beach restoration.</p>
Lead Department	Community and Economic Development Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-19
Key Partners	Veterans' Administration (for Alameda Nature Reserve)
Completed Actions	<p>- Hazard Mitigation Plan Update included the latest flood maps and OPC projections. - Completed "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise in Alameda" report which evaluates contaminated lands and groundwater rise projections - General Plan 2040 supports the development of the Nature Reserve and Government sub-district for wildlife habitat to preserve and protect the natural habitat in this area and protect endangered species and other wildlife and plant life that inhabit, make use of, or are permanently established within this area. - General Plan 2040 supports development of "DePave Park" to be consistent with the Public Trust and sensitive to the neighboring Alameda Nature Reserve. - General Plan 2040 considers establishment of a Marine Conservation Area within the submerged lands at the entrance of the Seaplane Lagoon.</p>
Future Actions	Seek grants for concept design of DePave Park
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

11. Critical Public Assets

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Flooding Liquefaction Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater.
Actions	a. Stormwater System. Identify funding sources to improve the public stormwater infrastructure and ensure it meets current needs and is prepared for the effects of sea level rise and climate change. b. Sewer System. Protect vulnerable wastewater systems and facilities to minimize disruption to the systems following ground shaking and extreme weather events. c. Electric System. Ensure electrical infrastructure is flood-proofed or elevated. Where possible, move assets out of the hazard zone. d. Transportation. Work with Caltrans and the Alameda County Transportation Commission to identify funding to adapt the regional and local roadways in Alameda.
Lead Department	AMP Public Works
Related Plan/Policy	General Plan Policy CC-22 and HS-12
Key Partners	CalISO Northern California Power Agency PG&E EBMUD
Completed Actions	- Initiated planning efforts for: - Bay Farm Island Northern Shoreline Adaptation Project - Northern Shoreline near Posey/Webster Tubes Project - State Route 61/Doolittle Drive
Future Actions	- Model potential impacts to utility infrastructure under future sea level rise scenarios. Implement wastewater resilience best practices for the City-owned sewer system by incorporating sea level rise projections into the City's next Sewer Management Plan. - Conduct comprehensive visual and functional test monitoring and asset condition assessment. Model potential impacts to utility infrastructure under future sea level and groundwater rise scenarios. - Raise and strengthen the foundation of Cartwright substation, install new seismically approved bus structures and seismically retrofit bus structures of the existing substation, and replace major equipment to withstand earthquakes. Continue evaluating local energy storage and other resiliency improvements to the electric system. - Seek funding to complete concepts for these three high-priority locations. - Initiate planning efforts for the remaining critical transportation facilities that are threatened by sea level rise or rising groundwater. - Conduct thorough review of all City buildings to determine any needed structural, mechanical or electrical seismic weaknesses. - Identify deficits and protection needed for City buildings subject to coastal flood hazards and local storm hazards. - For all critical City Buildings, consider responses needed to the secondary hazards of fire, temporary utility loss, and temporary access loss. - Address appropriate seismic, fire, and flood safety analysis based on current and future use for all City-owned facilities and structures. - Strengthen or replace City buildings in the identified prioritized order as funding is available. - Evaluate Alameda Point buildings as they are turned over to the City from the Navy. Have a plan to demolish them or make them habitable.
Potential Funding Source	Facility Maintenance Fund 706, HMGP, BRIC, AMP and City Capital Improvement Programs
Timeframe	Ongoing
Equity Considerations for Implementation	Possibly focus on buildings that incur a lot of public use so that improvements can be enjoyed by the maximum number of residents.

12. Water Retention

Category	Infrastructure
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Develop and maintain large and small areas to retain water within the city that may serve as areas of “retreat” during large storm events.
Actions	a. Alameda Nature Reserve. Support use and development of the 550 acre former US Navy airfields and runways as a Nature Reserve and area of wetlands that may serve as flood water retention area during major storm events. b. Corica Park. Support the use and development of the 330 acre golf complex as a recreation area and lagoon system that currently serves as a flood water retention area during major storm events. c. Public Participation. Encourage the public’s use of small-scale green infrastructure design standards, guidance, and typical details, as presented in the City’s Green Infrastructure Plan, for residential and garden projects.
Lead Department	Public Works
Related Plan/Policy	General Plan Policy CC-24
Key Partners	Northern California Power Agency
Completed Actions	- General Plan 2040 supports the development of the Nature Reserve and Government sub-district for wildlife habitat to preserve and protect the natural habitat in this area and protect endangered species and other wildlife and plant life that inhabit, make use of, or are permanently established within this area.
Future Actions	Educate the public about small-scale green infrastructure design for residential and garden projects.
Potential Funding Source	General Fund, EBMUD
Timeframe	Ongoing
Equity Considerations for Implementation	Consider targeting neighborhoods with high exposure to heat island effect and high percentage of impervious pavement

13. Urban Forest

Category	Infrastructure
Hazards Addressed	Heat
Strategy Type	Admin/Tech
Strategy Description	Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects.
Actions	<p>a. Tree Preservation. Continue to require and incent the preservation of large healthy non-invasive trees and vegetation. b. New Development and Parking Lots. Require ample tree plantings in new development and related parking lots. c. Strengthen Tree Replacement Requirement. Strengthen the tree replacement requirement for any protected trees removed due to new development or redevelopment. d. Prioritize Tree Planting. Invest in tree planting and maintenance, especially in low canopy areas and neighborhoods with under-served or under-represented communities. Resilient Urban Forest. Support the increase of the tree canopy in Alameda with drought tolerant, shade-producing, fire resistant tree species. f. Public Parks and Lands. Utilize public parks and public lands, such as Alameda Point, to significantly increase the urban forest. g. Maintain and Update the City's Master Tree Plan. Ensure an up-to-date, climate friendly Master Tree Plan that selects drought tolerant, shade-producing, fire resistant tree species adapted to Alameda's changing climate. This plan should include: » Design of new tree wells to allow better infiltration of stormwater; » Promotion of sidewalk gardens and other sidewalk landscaping; » Expansion of greenery in the public right-of-way and removal of impervious surfaces as feasible; » Strategies to reduce conflicts between trees, tree roots, and other public infrastructure such as sidewalks, overhead lines and street infrastructure; and » Identification of funding for both expansion and maintenance of the urban forest.</p>
Lead Department	Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-26, CARP
Key Partners	PG&E
Completed Actions	Secured funding from Council to update and expand the Master Tree Plan as and Urban Forest Plan.
Future Actions	Develop RFP and scope of work and procure consultant
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	Focus on expanding urban forest in underserved neighborhoods and those with high social vulnerability.

14. Lagoons

Category	Infrastructure
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy CC-32
Key Partners	EBMUD
Completed Actions	The FY-19-21 Capital Improvement Program includes an item for lagoon maintenance and dredging of the lagoons
Future Actions	Future projects may consider additional maintenance needs for the lagoons and adaptation to address projected sea level rise.
Potential Funding Source	Capital Budget, HMGP
Timeframe	Ongoing
Equity Considerations for Implementation	

15. On-Island Generation

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Wind/Storms
Strategy Type	Admin/Tech
Strategy Description	Support development of on-island solar power generation and on-island wind power with appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy CC-4
Key Partners	Planning, Building, and Transportation
Completed Actions	- AMP offers and Eligible Renewable Generation (ERG) plan, a special rate plan for new renewable generation customers that went into effect on December 31, 2016. - In 2021, 92 customers completed rooftop solar installations.
Future Actions	With City approval, the Doolittle community solar project will also start construction in 2022.
Potential Funding Source	AMP funds
Timeframe	Ongoing
Equity Considerations for Implementation	The elderly and disabled may rely on continuous power for medical devices and other uses and this project will help improve the reliability of the grid to protect those vulnerable populations.

16. Public Infrastructure Priorities

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Flooding Liquefaction Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards, and prioritize projects for adaptation funding.
Actions	a. Shoreline Facilities Program. Implement a program for Resilient Shoreline Facilities, including performing appropriate seismic, storm, flooding and other safety analyses based on current and future use for all City-owned shoreline facilities, including dikes, shore protection (rip rap), lagoon sea walls, storm water outfalls, marinas and protective marshlands. b. Location-Based Priority Flooding. Design and permit shovel-ready adaptation projects at areas of location-based priority flooding. Include considerations of rising groundwater surface and the potential for contaminant mobilization into analysis of priority flooding locations.
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-17, CARP
Key Partners	Caltrans FEMA
Completed Actions	Posey/Webster Tubes: Initiated schematic design and project cost estimate for the Northern Shoreline Adaptation project near the Posey/Webster Tubes in coordination with Caltrans. Submitted a grant application to Caltrans' Sustainable Transportation Planning Grant in February 2021, which was not successful. Doolittle Drive: Initiated a recurring quarterly meeting with Caltrans and the Port of Oakland to coordinate State Route 61 improvements, which include Doolittle Drive. Requested Caltrans to add short-term adaptation strategies to its pavement preservation project, which is expected for construction in 2024. Requested the Port of Oakland to consider adaptation strategies that benefit not only its North Field but also State Route 61/Doolittle Drive, the SF Bay Trail and the adjacent shoreline habitat Bay Farm Island Northern Shoreline/Veterans Court Area: Partial funding of Vet's Ct project in FY2020-21 Budget Submitted a grant application titled "Bay Farm Island Northern Shoreline Adaptation Project" to the State Coastal Conservancy's Proposition 68 Climate Adaptation Funds in June 2021.
Future Actions	Bay Farm Island Northern Shoreline/Veterans Court Area: Secure grant funding to complete the concept phase for \$500,000 to analyze existing conditions and alternatives and to develop a project concept with community member and stakeholder involvement that is approved by City Council, and includes up to 30 percent design drawings. Posey/Webster Tubes: Work with Caltrans, City of Oakland and other key stakeholders to create a project concept that combats flooding and sea level rise for the entire Oakland-Alameda Estuary, including this area near the Posey/Webster Tubes. Doolittle Drive: Coordinate with Caltrans, Port of Oakland, East Bay Regional Park District, the City of Oakland and ABAG/Bay Trail on both short-term and long-term adaptation solutions. Seek additional funding to implement adaptation projects for Doolittle Drive.
Potential Funding Source	Proposition 68 Climate Adaptation Grant, Caltrans Sustainable Communities Grant, HMGP, BRIC
Timeframe	Long-term
Equity Considerations	Working with the City of Oakland and all key stakeholders for the Oakland-Alameda estuary to ensure an equitable project solution in

**for
Implementation** that what happens in one part of the shoreline impacts other parts.

17. Green Infrastructure

Category	Infrastructure
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Require the use of “green infrastructure”, landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-23, CARP
Key Partners	Planning, Building and Transportation
Completed Actions	GI Plan submitted to Water Board in September 2019. Performed active municipal oversight of development project planning approvals and permitting review to ensure Green Infrastructure features in necessary public and private projects. Met or exceeded GI Plan's 2020 Benchmark values for numbers of completed GI Projects and total redeveloped acres subject to GI features benefits. Promoted GI Plan as a community resource for small-scale project planning. Provided feedback to draft General Plan Update to strengthen Green Infrastructure-related Policies/Objectives.
Future Actions	Await Water Board's feedback and/or regulatory direction on modifications to City's GI Plan. Continue planning and permitting development project oversight to promote inclusion of Green Infrastructure project features in public and private projects.
Potential Funding Source	Capital Budget, Private Developers
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure communities are on board with new upgrades and that green infrastructure benefits all communities in Alameda.

18. Underground Utilities

Category	Infrastructure
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Plans/Policy
Strategy Description	Require new development to underground utilities to minimize disruption by fire or other natural disasters.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy HS-30, Underground Utility District Policy
Key Partners	Planning, Building and Transportation
Completed Actions	- AMP established the Underground Utility Districts (UUDs) through a City Ordinance. Any overhead utility facilities within the UUD must be converted to underground facilities. - The Otis/Broadway District is planned for construction 2022-2025
Future Actions	AMP plans to recommend that the City Council approve additional undergrounding projects from the list of recommendations received from the district nominating board (DNB). This list includes the following areas: - Webster Street - all crossings - Central Avenue to Pacific Avenue including Eagle Avenue - West of Constitution Way; and along Central Avenue from Eighth Street to Webster Street. - Broadway - Buena Vista Ave to Clement Ave - Fernside Boulevard from Encinal Avenue to High Street, including lines on Lincoln Park access road - Park Street - San Jose Avenue to Otis Drive
Potential Funding Source	2% of AMP's electric revenue are put into the Underground Utility District Fund (UUDF)
Timeframe	Ongoing
Equity Considerations for Implementation	

19. Lifeline Standard Estuary Crossing

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Liquefaction
Strategy Type	Admin/Tech
Strategy Description	Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-11
Key Partners	Alameda County
Completed Actions	
Future Actions	- Work with Alameda County to upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake.
Potential Funding Source	Alameda County, HMGP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	

I10. Collaboration

Category	Infrastructure
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Admin/Tech
Strategy Description	Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.
Actions	a. Shutoff Protocol. Establish a local protocol to shut off natural gas supply through shutoff valves on gas meters in the highest risk neighborhoods. b. EBMUD. Develop emergency water storage facilities to provide drinking water to EBMUD customers as well as fight fires in the event an earthquake disrupts the water supply to Alameda. c. Portable Fire Fighting System. Acquire the capability to use Bay water to fight fires using a system compatible with the ones in nearby cities like San Francisco and Berkeley.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-27
Key Partners	EBMUD PG&E
Completed Actions	- Owners of identified soft-story buildings were required to install an earthquake-actuated gas shut-off valve on the building to reduce the likelihood of natural gas fire ignitions in earthquakes. - Automatic gas shut-off valves are required any time a permit is issued for gas piping, whenever a property is sold or has a transfer of title. - To date, approximately 2,794 permits have been issued for gas shut-off valves in the city - Alameda has purchased two water tenders to use Bay water for firefighting.
Future Actions	Replace the water tenders every 8-10 years
Potential Funding Source	General Fund, Private Owners
Timeframe	Ongoing
Equity Considerations for Implementation	

L1. Groundwater Rise

Category	Land Use
Hazards Addressed	Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-35
Key Partners	
Completed Actions	Published "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise in Alameda" report in 2020.
Future Actions	Implement priority actions in the report.
Potential Funding Source	General Fund, HGMP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	Consider vulnerable communities exposed to contaminated sites for priority action.

L2. Land Development

Category	Land Use
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Require that new development reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise.
Actions	a. Assessment. Require new development proposed in areas of flood risk to assess flood risk and incorporate specific groundwater and sea level rise mitigation strategies. b. Mitigation. Require new development to incorporate design features to mitigate 50 years of the Ocean Protection Council's Medium-High Risk Aversion, high emissions scenario of sea level rise in addition to a 100 year storm in the initial design and funding mechanisms to pay for later adaptation improvements to address future sea level and groundwater increases above that level. Projects that include new seawalls where none currently exist shall evaluate the off-site impact of the new walls on adjacent and nearby communities. c. Nature Based Design. Require new development to incorporate low impact development design strategies and stormwater management systems, such as engineered landscapes, vegetated areas, or cisterns that mimic nature by soaking up and storing water, to manage and protect the quantity and quality of stormwater runoff.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy CC-20
Key Partners	
Completed Actions	- Floodplain ordinance requires special design requirements for new construction in the floodplain and in coastal high hazard areas. - 2040 General Plan recommends following California's Ocean Protection Council 2018 Sea-Level Rise Guidance. - Green Infrastructure Plan includes requirements for low impact development
Future Actions	Future updates of the General Plan will explore and consider more fully this 50-year climate scenario and its implications for Alameda.
Potential Funding Source	Private developers
Timeframe	Ongoing
Equity Considerations for Implementation	

L3. Resilient Rights-of-Way and Open Spaces

Category	Land Use
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-19
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	Capital Improvement Program, General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

L4. Easements

Category	Land Use
Hazards Addressed	Flooding
Strategy Type	Plans/Policy
Strategy Description	Require the creation and maintenance of easements along drainage ways necessary for adequate drainage of normal or increased surface runoff due to storms.
Actions	
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-22
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

E1. Heat and Wildfire Smoke Emergencies

Category	Emergency Response
Hazards Addressed	Heat Wildfire Smoke
Strategy Type	Admin/Tech
Strategy Description	Create a network of clean air and cooling emergency shelters throughout Alameda.
Actions	a. Partnerships. Identify and partner with large HVAC equipped building owners to establish a network of facilities that are able to open to the public during heat waves and smoke events during the day. b. Incentives. Incentivize building owners to upgrade or install HVAC systems to provide more safe places during heat waves and times with dangerous air quality levels. c. City Facilities. Evaluate options to upgrade or otherwise retrofit HVAC systems and buildings to be able to maintain temperatures below 78 degrees Fahrenheit and adequately filter air pollutants when at capacity.
Lead Department	Library Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-25, CARP, Emergency Operations Plan
Key Partners	
Completed Actions	West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center
Future Actions	Evaluate need for additional Clean Air and Cooling Centers
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled.

E2. Emergency Preparedness

Category	Emergency Response
Hazards Addressed	All Hazards
Strategy Type	Admin/Tech
Strategy Description	Maintain emergency management and disaster preparedness as a top City priority.
Actions	a. Update Emergency Operations Plan. Maintain and update the recommendations and standards established in the City of Alameda's Emergency Operations Plan as the guide for disaster planning in Alameda. b. Training. Maintain training programs to ensure that City personnel are sufficiently prepared to respond to an emergency and staff the Emergency Operations Center. c. Facilities. Identify and publicize essential emergency facilities in the City, including shelters, evacuation routes, and emergency operation staging areas, and take the necessary actions to ensure that they will remain operational following a disaster. d. Exercises. Conduct periodic emergency response exercises to test the effectiveness of local preparedness response, recovery, and mitigation procedures.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-1
Key Partners	
Completed Actions	- Completed Environmental Emergency Plan Annex draft. Draft plan added as an Annex to the Basic Emergency Operation Plan (EOP) once approved. - EOC training exercises on a City, County, Regional and State level. Training for emergency repair, traffic control, evacuations, shelter in place, crowd control, emergency medical aid, grant reimbursement, etc. - Education of City Employees about personal emergency preparedness and mitigation.
Future Actions	
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

E3. Tsunami Preparedness

Category	Emergency Response
Hazards Addressed	Tsunamis
Strategy Type	Admin/Tech
Strategy Description	Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations.
Actions	a. Awareness. Develop a public information campaign to educate the public about tsunami risks and evacuation procedures, with special emphasis on access and functional needs populations and maritime communities. b. Evacuation Emergency Annex. Include and maintain an Evacuation Emergency Annex in the Emergency Operations Plan that includes a strategy for tsunami evacuation. c. Signs. Place tsunami inundation zone and evacuation route signs. d. Vertical Evacuation. Assess vertical evacuation options. e. Drills. Conduct tsunami evacuation training and drills with schools. f. Partner. Partner with Caltrans, Alameda County, AC Transit, the City of Oakland and Port of Oakland to plan for tsunami evacuation. g. Tsunami Ready. Become recognized as a Tsunami Ready community by the National Weather Service.
Lead Department	Fire Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-20
Key Partners	Caltrans Alameda County City of Oakland Port of Oakland AC Transit CGS CalOES NOAA National Tsunami Hazard Mitigation Program USGS
Completed Actions	Sign placement and general public tsunami education. With the number of marinas in Alameda, there will be a targeted component of the education program towards tsunami impacts in the maritime communities.
Future Actions	In 2022-23, staff is planning to: - Complete a tsunami emergency annex - Become a TsunamiReady city - Participate in Tsunami Preparedness week in March and encourage residents to sign up for AC Alert - Create a special emergency contact list of marinas in Alameda
Potential Funding Source	USGS/CalOES and Public Works funds
Timeframe	Ongoing
Equity Considerations for Implementation	Provide education programs and signs in various languages depending on community need. Ensure education program outlines evacuation plan for those who do not have access to personal transportation.

E4. Emergency Coordination

Category	Emergency Response
Hazards Addressed	All Hazards
Strategy Type	Admin/Tech
Strategy Description	Coordinate local emergency preparedness efforts with the Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies.
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-3
Key Partners	
Completed Actions	- Alameda Municipal Power is a signatory on two mutual aid agreements: California Utility Emergency Association (CUEA) and Northern California Power Agency (NCPA) - Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters. - Working Relationships and Lifeline Committee Meetings with Caltrans, County, Coast Guard, Ready Reserve, Port of Oakland, San Leandro, Utilities, FEMA, and Other Agencies. - Membership in CalWARN Mutual Aid for City-run and independent utilities that provide water and wastewater.
Future Actions	
Potential Funding Source	General Fund, Assistance provided or received during an emergency will be reimbursed with state or federal funding if it is a declared emergency.
Timeframe	Ongoing
Equity Considerations for Implementation	

E5. Wildfire Smoke

Category	Emergency Response
Hazards Addressed	Wildfire Smoke
Strategy Type	Admin/Tech
Strategy Description	Prepare for future wildfire smoke events.
Actions	<p>a. Shelters. Work with local organizations and institutions to provide for public, clean air, temporary shelters, such as the Alameda Free Library, at locations throughout the City. b. Vulnerable Communities. Strengthen protocols and procedures for identifying and notifying the most vulnerable residents to wildfire smoke of shelter locations and other potential support. c. Indoor Air Quality. Facilitate and expedite efforts by local property owners and businesses to improve indoor air quality and filtration systems. d. Outdoor Air Quality. Continue to work with regional and local organizations and businesses to reduce local sources of air pollutants.</p>
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-61
Key Partners	
Completed Actions	<p>- Adopted and implement new air quality / smoke response protocols for City staff and employees. - West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center. - Utilize AC Alert to notify residents about unsafe air quality.</p>
Future Actions	
Potential Funding Source	General Fund, Capital Improvement Program
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled.

E6. Emergency Response and Disaster Preparedness

Category	Emergency Response
Hazards Addressed	Earthquake Ground Shaking Liquefaction Tsunamis
Strategy Type	Admin/Tech
Strategy Description	Preserve access for emergency response vehicles to people and property and for evacuation.
Actions	<p>a. Emergency Response Planning. Include emergency response needs in all transportation planning, the design of new facilities, and modifications to existing facilities. Establish and sign designated evacuation routes, and provide ongoing education and outreach to ensure that Alameda is evacuation ready. Continue to work with AC Transit and WETA to ensure coordinated services in the event of the need for evacuation. b. Outreach. Educate the community on disaster preparedness using an all-hazard approach to emergency response. c. Miller-Sweeney Bridge. Upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake. d. Fruitvale Rail Bridge Hazard. Remove or seismically upgrade the abandoned Fruitvale Rail Bridge which poses a seismic hazard to the city's Miller-Sweeney Bridge. Consider replacing the hazardous structure with crossing for transit, bicycles and pedestrians.</p>
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy ME-9
Key Partners	Alameda County Public Works Agency
Completed Actions	Coordinated with AC Transit on the locations of vulnerable populations in the City of Alameda including skilled nursing facilities, adult day care and child care facilities. Participated in Bay Area Urban Areas Security Initiative trainings.
Future Actions	Continue working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the adjacent abandoned Fruitvale rail bridge. Draft letter to Alameda County requesting upgrade to Miller-Sweeney Bridge. Continue coordination with WETA and AC Transit, and will participate in Bay Area emergency response training exercises.
Potential Funding Source	HMGP, BRIC, General Fund
Timeframe	Long-term
Equity Considerations for Implementation	Ensure continuity of service for transit- dependent populations.

C1. Public Communication

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.
Actions	a. Volunteers. Maintain community based emergency preparedness training programs targeted to neighborhoods and business groups, such as Community Emergency Response Teams and outreach and coordination with Voluntary Organizations Active in Disasters (VOAD) and other community based programs. b. Education. Prepare and/or make available public education and awareness materials in multiple languages on all aspects of emergency preparedness, including the type and extent of hazards in the community, measures to reduce the likelihood of damage and injury, provisions for emergency supplies, steps to take immediately after a disaster, and the location of shelters and medical facilities. c. Targeted Communication. Engage Alamedans using a wide range of tools, languages and strategies to communicate about all types of health threats and planning, with a special emphasis on the most vulnerable people who are least likely to know about or be able to adapt to various threats. d. Resilience Hubs. Promote resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.
Lead Department	City Manager's Office Fire Police
Related Plan/Policy	General Plan Policy HS-4, Emergency Operations Plan
Key Partners	Alameda County
Completed Actions	The City of Alameda in partnership with Alameda County Office of Emergency Services (OES) uses AC Alert as the County-wide mass notification system to alert community members of weather related issues, as well as posting to social media, and the city website. Resilience Hub pilot with the MakerFarm at Alameda Point is underway.
Future Actions	Encourage the public to opt-in to AC Alert and follow the City on social media. Learn lessons from resilience hub pilot program and identify opportunities for new resilience hub locations. Consider connecting resilience hubs with CERT teams. Promote Cool Block program to neighborhood leaders.
Potential Funding Source	General Fund, Cool City Challenge
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure that all community members, including those who are non-English speaking and those without cell phones, receive key communications from city/local officials before, during, and after a disaster event. Investigate options for disseminating emergency alerts through key community leaders to increase their reach in disadvantaged communities. Ensure participation by all neighborhoods in Alameda and that resilience hubs are rooted in the neighborhoods they serve.

C2. Air Quality Alerts

Category	Communication, Community and Coordination
Hazards Addressed	Wildfire Smoke
Strategy Type	Outreach/Education
Strategy Description	Continue to partner with BAAQMD to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents.
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-65
Key Partners	
Completed Actions	
Future Actions	- Continue to encourage residents to sign up for AC Alert to receive emergency notifications
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C3. Regional Partnerships

Category	Communication, Community and Coordination
Hazards Addressed	Drought Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies.
Actions	a. Funding and Partnerships. Develop partnerships with local, regional, and state agencies to expedite adaptation projects and ensure a healthy watershed that protects and restores water quality, habitat and community vitality along San Leandro Bay and the Oakland-Alameda Estuary.
Lead Department	City Manager's Office Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-16
Key Partners	
Completed Actions	Convened the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. Sub groups are focusing on adaptation of Doolittle Drive and Northern Shoreline near Posey/Webster Tubes (CARP strategies)
Future Actions	Launch development of a coordinated and inclusive future-looking subregional organizational structure and action plan with shared vision and needs assessment to accelerate sea level rise adaptation in alignment with the BayAdapt Joint Platform.
Potential Funding Source	Regional, state and federal grants, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C4. Collaboration

Category	Communication, Community and Coordination
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Admin/Tech
Strategy Description	Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-27
Key Partners	
Completed Actions	
Future Actions	Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters.
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C5. Neighborhood Resilience Coordination

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use.
Actions	a. Electrification. Offer blocks or neighborhoods assistance in electrifying their homes through incentives that reflect the savings to taxpayers and ratepayers from being able to remove or shut off the natural gas infrastructure on their block. b. Flooding. Include tailored planning and support for communities testing various flooding adaptation strategies. c. Priorities. Prioritize block and neighborhood-driven priorities while selecting a broad range of interventions to test to maximize the City's ability to learn from each pilot project.
Lead Department	City Manager's Office
Related Plan/Policy	General Plan Policy CC-15
Key Partners	
Completed Actions	Resilience Hub pilot with the MakerFarm at Alameda Point is underway.
Future Actions	- Consider applying for Cool City Challenge, which awards \$1 million to implement a climate moonshot strategy to become a carbon neutral city by 2030. As part of the application process, Alameda will commit to becoming carbon neutral by 2030 with no offsets, a moonshot team will recruit 25 partner organizations to partner in the Cool City Challenge and 200 cool block leaders who are ready to work with their neighbors to make positive change. The award could bring significant resources to help Alameda achieve its CARP goals around decarbonizing transportation and buildings. - Consider connecting resilience hubs with CERT teams. - Support the development of resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.
Potential Funding Source	General Fund, Cool City Challenge
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure that resilience hubs exist in all neighborhoods in Alameda and they are rooted in the neighborhoods they serve.

C6. Social Vulnerability

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change.
Actions	<p>a. Equity. Ensure opportunities for leadership and actions to benefit Alameda’s low-income individuals, seniors, youth, people of color, gender, sexual orientation, people experiencing homelessness, individuals with disabilities, and socio-economically disadvantaged communities from environmental and climate change impacts. b. Environmental Justice. Ensure the equitable treatment and full involvement of all people when considering actions to reduce the adverse impacts of climate change on residents regardless of age, culture, ethnicity, gender, sexual orientation, race, socioeconomic status, or geographic location. Prioritize actions that will reverse historic policies of racial discrimination and exclusion. c. Assessments. Utilize Alameda’s Social Vulnerability Assessment in the Climate Action and Resiliency Plan or similar tool to identify neighborhoods and specific groups with high levels of social vulnerability in order to prioritize locations for action and improvements.</p>
Lead Department	All
Related Plan/Policy	General Plan Policy CC-2
Key Partners	
Completed Actions	Developed Social Vulnerability Assessment for CARP
Future Actions	- Update Social Vulnerability Assessment with 2020 Census - Develop equity toolkit to prioritize equity in the development and implementation of policies
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Review equity considerations in the development of project and policy proposals.

S1. Adaptation Pathway Master Plan

Category	Studies and Plans
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Develop an adaptation pathway master plan. The plan will include additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels.
Actions	Develop sea level and groundwater rise adaptive strategies for different areas of the City for public discussion and evaluation, including but not limited to: avoidance/planned retreat, enhanced levees, setback levees to accommodate habitat transition zones, buffer zones, beaches, expanded tidal prisms for enhanced natural scouring of channel sediments, raising and flood-proofing structures, and/or provisions for additional flood water pumping stations, and inland detention basins to reduce peak discharges.
Lead Department	City Manager's Office Community and Economic Development Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-24, CARP
Key Partners	
Completed Actions	
Future Actions	Seek planning grants. Initiate and complete planning effort with City Council approval. Implement plan with future funding needed.
Potential Funding Source	General Fund, grants
Timeframe	Adaptation strategies that reduce the burden of sea level rise from impacted community members. Ensure sea level rise preventative measures do not disturb shoreline ecosystems Focus new housing developments away from shorelines Prioritize communities most at risk for effects of sea level rise
Equity Considerations for Implementation	Incorporate social vulnerability assessment into adaptation pathway considerations

S2. Rising Groundwater

Category	Studies and Plans
Hazards Addressed	Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Prepare for the impacts of rising groundwater levels on private and public property.
Actions	a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts. d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Lead Department	City Manager's Office Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-23, HS-24, Groundwater Study
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	

S3. Flood Hazard Maps

Category	Studies and Plans
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources.
Actions	a. Process. Create a regular process by which information is updated and released, identifying staff time and budget to ensure that this information is timely, accurate and accessible for all public and private decision-makers.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-15
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

B1. Solar Panels

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Wind/Storms
Strategy Type	Admin/Tech
Strategy Description	Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy CC-14
Key Partners	Planning, Building, and Transportation
Completed Actions	Distributed Energy Resources (DER) Plan • AMP has the ability and technology to safely integrate distributed energy resources into its distribution grid. Engineering staff has been evaluating various tools that lay the foundation to integrate software that will allow AMP to comprehensively determine the maximum amount of DER's on AMP's grid. This continuous process of development and implementation will last well into 2022. • Engineering and Operations (E&O) continuously approves, inspects, and interconnects new solar photovoltaic systems often coupled with battery storage.
Future Actions	AMP will develop an asset management plan to guide efficient expenditures. AMP is working on installing 2 MW solar facility at Doolittle Landfill interconnected into AMP's grid. Cost \$9.15M over 20 years; Timeline: 2023.
Potential Funding Source	General Fund, AMP rebate program
Timeframe	Ongoing
Equity Considerations for Implementation	Connect with AMP list of people who need continuous power for electric medical devices or refrigerated medicines to prioritize solar and battery resources.

B2. Water Efficiency and Conservation

Category	Buildings
Hazards Addressed	Drought
Strategy Type	Plans/Policy
Strategy Description	Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.
Actions	<p>a. Water Efficient Landscape Requirements. Maintain up-to-date water-efficient landscaping regulations and ordinances to reduce water use in both private and public landscapes that include healthy, drought tolerant soils, diverse native plant species, non-invasive drought tolerant/low water use plants, and high-efficiency irrigation systems. b. Water-Efficient Buildings. Require low-flow fixtures, such as low-flow toilets and faucets in new construction. c. Recycled and Reclaimed Water. Promote the production and usage of recycled and reclaimed water (sometimes called “grey water”) for potable and non-potable uses. d. Pesticides, Herbicides, and Fertilizers. Limit the use of pesticides, herbicides, and fertilizers throughout the city by fostering healthy soil practices, which include organic carbon amendments (e.g. compost and mulch) on all non-turf planting areas. e. Soil Health. Encourage soil health by promoting and educating the public about the benefits of organic carbon soil amendments that improve water retention in local landscapes. f. EBMUD. Work with EBMUD to improve effectiveness of water conservation programs and increase drought awareness. g. City Buildings. Implement water-saving technologies at all City-owned buildings and post visible signage to educate visitors to those buildings.</p>
Lead Department	Planning, Building and Transportation Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-16
Key Partners	EBMUD
Completed Actions	Increased composting, reduced irrigation of decorative lawns (resulting in 3.6% reduction), turned off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converted decorative lawns at city facilities and some parks to drought tolerant landscape, prioritized fixing pipe leaks, converted irrigation clocks to rain sensitive clocks (resulting in 15% reduction).
Future Actions	Converting City Hall’s lawn to drought tolerant landscape in 2022.
Potential Funding Source	EBMUD, HMGP, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Provide benefits for drought-resistant landscapes that support lower income communities.

B3. Rising Groundwater

Category	Buildings
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Prepare for the impacts of rising groundwater levels on private and public property.
Actions	a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-23, HS-35
Key Partners	
Completed Actions	- Completed and published a report, titled "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise" - Incorporated groundwater rise in the 2022 Climate Adaptation and Hazard Mitigation Plan.
Future Actions	Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	

B4. Seismic Retrofit for Private Buildings

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Earthquake Liquefaction
Strategy Type	Plans/Policy
Strategy Description	Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled
Actions	<p>a. Soft Story Program. Continue to implement and expand the City's Soft Story Program including mandatory requirements for substantially improving the seismic performance of multi-family wood frame residential buildings with open ground floor parking or commercial spaces known as soft stories. b. Wood Framed Building Program. Continue to implement and expand the City's Wood Framed Building Program, including requirements for substantially improving the seismic performance of one- and two story wood frame residential buildings with vulnerable "cripple walls". c. Non-ductile Concrete Buildings. Identify, evaluate and retrofit non-ductile concrete residential and nonresidential buildings that are vulnerable to collapse in earthquakes. d. Chimneys. Encourage owners to remove or rebuild masonry or stone chimneys vulnerable to collapse in earthquakes. e. Incentives. Develop incentives and assistance to help property owners make their homes and businesses more earthquake-safe. Pursue a variety of funding sources, such as grants, low-interest loans, tax credits and zoning waivers and density bonuses, to assist residents and businesses with seismic upgrades. Provide exemptions from City zoning requirements, such as off-street parking and/or common open space to facilitate the retrofitting of vulnerable privately-owned buildings. f. Shoreline Property Management. Require owners of shoreline properties, to the extent feasible, to inspect, maintain, and repair the perimeter slopes to withstand earthquake ground shaking, consolidation of underlying bay mud, and wave erosion. g. Cool/Green Buildings. Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-13, Municipal Code Section 13-80.1 to 13-80.16 and 13-70.1 to 13-70.6
Key Partners	Community and Economic Development
Completed Actions	<p>Continue to implement and expand the 2009 soft-story ordinance outlining mandatory compliance requirements for substantially improving the seismic performance of certain residential buildings. The buildings targeted are wood frame condos and apartment buildings with 5 or more dwelling units, permitted for construction prior to December 17, 1985, in which the ground floor has a soft, weak, or open-fronted construction such as a carport. As a result of the ordinance, the City produced an inventory of potential soft story buildings and notified owners, owners were required to evaluate affected buildings and if found to be potentially hazardous, issue written and posted warnings to tenants, and install an earthquake-actuated gas shutoff valve. The ordinance does not require retrofitting of any structural inadequacies found, but did offer permit and inspection fee reductions timely response. As of March 2015, 63 of an original 222 buildings remain on the List of Potentially Hazardous Soft-Story Buildings. These 63 buildings contain nearly 1,000 housing units that could be lost in an earthquake and should now be required to be seismically retrofitted. Continue to implement 2006 wood framed buildings ordinance that outlines voluntary minimum standards to substantially improve the seismic performance of one- to four-unit wood framed residential buildings with: - one and two stories, - continuous perimeter concrete foundations, and - wooden cripple walls less than 4 feet high. The retrofits are voluntary. Incentives include waiving the requirements for plans prepared by a licensed architect or engineer, and waiving of the requirement to</p>

simultaneously upgrade plumbing, mechanical, electrical and life/safety systems that are not a hazard to life or property, but which might be out of compliance with current building codes. Residential Seismic Strengthening Plans and building code guidance are posted on the City website at <http://alamedaca.gov/community-development/building/seismic-retrofit>. The California Earthquake Authority (CEA) also offers retrofit grants for these projects. The City should work to raise awareness about the need for

Future Actions Seek funding to support retrofit of vulnerable soft-story buildings. Encourage residents through a variety of means to apply for CEA Brace and Bolt Program.

Potential Funding Source HMGP, CEA Brace and Bolt Program, CDBG

Timeframe Short-term

Equity Considerations for Implementation Prioritize buildings that are most at risk for earthquake damage/pose a safety threat. Reach out to tenants and building owners through multiple channels and provide translated materials.

B5. Flood Insurance

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Financial
Strategy Description	Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Identify ways to increase Alameda's Community Rating to reduce flood insurance costs.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-14, Municipal Code Section XX - Floodplain Management
Key Partners	City Council Community and Economic Development FEMA Planning, Building, and Transportation
Completed Actions	City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. City widened enforcement of floodplain management requirements regulating new construction in Special Flood Hazard Areas to include the additional properties added to the flood zone as a result of the FIRM map revision. The Community Rating System (CRS) is a voluntary program implemented by FEMA that encourages cities to take certain steps to reduce flood exposure through public information, mapping, regulations, flood damage reduction, warning, and response. As an incentive, insurance rates for individual policy holders are decreased by a percentage for creditable activities. The City joined CRS in October 2019 as a Class 8 community.
Future Actions	The City must recertify its CRS status every year and provide supportive documentation. Maintain City participation in the National Flood Insurance Program, thereby allowing citizens benefits of reduced flood insurance rates. Work with HOAs concerning possible dike improvements. Continue to educate residents about floods and preparedness. Continue to enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, administer any local requests for map updates, give community assistance, and monitor activities.
Potential Funding Source	Urban Runoff Fund
Timeframe	City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. Ongoing implementation continues for building and construction standards for properties designated in flood zone.
Equity Considerations for Implementation	

B6. Flood Proofing for Existing Buildings

Category	Buildings
Hazards Addressed	Flooding
Strategy Type	Plans/Policy
Strategy Description	Implement programs to encourage flood-proofing retrofits to existing buildings and redevelopment in flood-prone areas.
Actions	<p>a. Flood Proofing. Amend local codes and by-laws to mandate flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. b. Risk Prioritization. Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades. c. Assistance. Alameda should identify options to help low-income households and other vulnerable residents pay for flood retrofits. d. Building Code. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-19
Key Partners	
Completed Actions	Completed Alameda Master Infrastructure Plan which requires the Adaptive Reuse Area to be designed to address 24-inches of sea level rise (plus required freeboard) and additional sea level rise in future years beyond 24 inches through adaptive management strategies.
Future Actions	
Potential Funding Source	HMGP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	Consider the impact of floodproofing requirements on undeserved populations and identify options to help low-income households and other vulnerable residents pay for flood retrofits.

B7. Design for Flooding

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas, and require all new development to design for sea level and associated groundwater rise based on the most current regional projections. (See also Policies LU-30 and CC-20).
Actions	<p>a. Waterfront Setbacks. Require new development to provide adequate setbacks along waterfront areas for the future expansion of seawalls and levees to adapt to sea level rise. b. Data. Update maps and publish open data that display these risks clearly as soon as new data or guidelines are created, such as a digital elevation model, sea level and groundwater risks, or the latest risk tolerance guidance provided by the State of California. c. Building Codes. Amend local codes to require flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels. d. Risk Prioritization. Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades. e. Assistance. Adopt fee waiver or small grant programs to help low-income households and other vulnerable residents pay for flood retrofits.</p>
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policies HS-22, LU-20, CC-20, CARP
Key Partners	
Completed Actions	Completed Alameda Master Infrastructure Plan which requires the Adaptive Reuse Area to be designed to address 24-inches of sea level rise (plus required freeboard) and additional sea level rise in future years beyond 24 inches through adaptive management strategies.
Future Actions	
Potential Funding Source	Private developers

Timeframe Ongoing

**Equity
Considerations
for
Implementation**

B8. Building Codes for New Development

Category	Buildings
Hazards Addressed	Earthquake Caused Fires Earthquake Ground Shaking
Strategy Type	Plans/Policy
Strategy Description	Require new development to comply with the City's current Electrification, Fire, Seismic, and Sprinkler Codes.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-28
Key Partners	
Completed Actions	
Future Actions	City of Alameda continues to enforce the City's Building Code
Potential Funding Source	Private developers, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

B9. Fire Prevention in Existing Properties

Category	Buildings
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Plans/Policy
Strategy Description	Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.
Actions	a. Electrification. Encourage existing properties to convert natural gas fueled space heating, water heating, clothes drying and cooking appliances to electric to minimize the risk of fires and improve indoor air quality.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-29
Key Partners	AMP
Completed Actions	Alameda Municipal Power provides rebates and incentives for building electrification and will be rolling out new ones in the coming years.
Future Actions	In 2022, staff is planning to develop an equitable building energy efficiency and electrification roadmap.
Potential Funding Source	General Fund, HMGP
Timeframe	Long-term
Equity Considerations for Implementation	Ensure that the transition to all-electric buildings includes residents in multi-unit housing, renters and low income tenants.

B10. Building and Infrastructure Standards

Category	Buildings
Hazards Addressed	Earthquake Ground Shaking Earthquake Liquefaction
Strategy Type	Admin/Tech
Strategy Description	Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure.
Actions	a. Functional Recovery Standard. Update the building code to ensure that all new buildings in Alameda are designed to a functional recovery standard so that they can continue to be used after an earthquake. b. No Collapse Standard. Ensure that all existing buildings meet a minimum no collapse standard.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-10
Key Partners	
Completed Actions	Included discussion of functional recovery in hazard mitigation plan update
Future Actions	Consider model codes and guidance on how to effectively implement functional recovery standards.
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

B11. Cool/Green Buildings

Category	Buildings
Hazards Addressed	Heat
Strategy Type	Plans/Policy
Strategy Description	Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy CC-34
Key Partners	
Completed Actions	- The Alameda Point Stormwater Management Plan requires installation of green roofs at Alameda Point. - City Council approved revisions to the Design Review ordinance in 2019 exempting green roof, cool roofs, and similar roof treatments from design review, provided the installation does not require modifying the existing roof form or pitch.
Future Actions	Consider ways to support green roof installation on existing buildings
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	Consider prioritizing and incentivizing cool/green roofs in heat island areas.

B12. Sea Level Rise Protection

Category	Buildings
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise.
Actions	<p>a. Flood Protection Maps. Work with regional agencies to regularly update the Climate Action and Resiliency Plan with projected inundation zones for years 2070 and 2100 consistent with the most up to date guidance from the Ocean Protection Council (OPC) for sea level rise in California. b. Contaminated Lands. Identify and map contaminated lands at risk of inundation from rising groundwater and flood inundation and identify actions to mitigate the risk of mobilizing contaminants. c. Land Planning. Prioritize areas of little or no flood risk for new flood-incompatible development (i.e. housing and commercial development) in new plans or zoning decisions. d. Shoreline Habitat and Buffer Lands. Identify, preserve, and restore existing undeveloped areas susceptible to sea level rise to reduce flood risk, enhance biodiversity, and improve water quality. Maintain and restore existing natural features (i.e. marsh, vegetation, sills, etc.) between new development and the shore to allow for marsh or beach migration. e. Conservation Easements. Consider use of conservation easements to maintain private lands for shoreline and beach migration. f. Nature Based Flood Control Systems. When designing new flood control systems where none currently exist, prioritize use of nature based flood control systems, such as horizontal levees, marsh lands, or beach restoration.</p>
Lead Department	Community and Economic Development Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-19
Key Partners	Veterans' Administration (for Alameda Nature Reserve)
Completed Actions	<p>- Hazard Mitigation Plan Update included the latest flood maps and OPC projections. - Completed "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise in Alameda" report which evaluates contaminated lands and groundwater rise projections - General Plan 2040 supports the development of the Nature Reserve and Government sub-district for wildlife habitat to preserve and protect the natural habitat in this area and protect endangered species and other wildlife and plant life that inhabit, make use of, or are permanently established within this area. - General Plan 2040 supports development of "DePave Park" to be consistent with the Public Trust and sensitive to the neighboring Alameda Nature Reserve. - General Plan 2040 considers establishment of a Marine Conservation Area within the submerged lands at the entrance of the Seaplane Lagoon.</p>
Future Actions	Seek grants for concept design of DePave Park
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

11. Critical Public Assets

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Flooding Liquefaction Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater.
Actions	a. Stormwater System. Identify funding sources to improve the public stormwater infrastructure and ensure it meets current needs and is prepared for the effects of sea level rise and climate change. b. Sewer System. Protect vulnerable wastewater systems and facilities to minimize disruption to the systems following ground shaking and extreme weather events. c. Electric System. Ensure electrical infrastructure is flood-proofed or elevated. Where possible, move assets out of the hazard zone. d. Transportation. Work with Caltrans and the Alameda County Transportation Commission to identify funding to adapt the regional and local roadways in Alameda.
Lead Department	AMP Public Works
Related Plan/Policy	General Plan Policy CC-22 and HS-12
Key Partners	CalISO Northern California Power Agency PG&E EBMUD
Completed Actions	- Initiated planning efforts for: - Bay Farm Island Northern Shoreline Adaptation Project - Northern Shoreline near Posey/Webster Tubes Project - State Route 61/Doolittle Drive
Future Actions	- Model potential impacts to utility infrastructure under future sea level rise scenarios. Implement wastewater resilience best practices for the City-owned sewer system by incorporating sea level rise projections into the City's next Sewer Management Plan. - Conduct comprehensive visual and functional test monitoring and asset condition assessment. Model potential impacts to utility infrastructure under future sea level and groundwater rise scenarios. - Raise and strengthen the foundation of Cartwright substation, install new seismically approved bus structures and seismically retrofit bus structures of the existing substation, and replace major equipment to withstand earthquakes. Continue evaluating local energy storage and other resiliency improvements to the electric system. - Seek funding to complete concepts for these three high-priority locations. - Initiate planning efforts for the remaining critical transportation facilities that are threatened by sea level rise or rising groundwater. - Conduct thorough review of all City buildings to determine any needed structural, mechanical or electrical seismic weaknesses. - Identify deficits and protection needed for City buildings subject to coastal flood hazards and local storm hazards. - For all critical City Buildings, consider responses needed to the secondary hazards of fire, temporary utility loss, and temporary access loss. - Address appropriate seismic, fire, and flood safety analysis based on current and future use for all City-owned facilities and structures. - Strengthen or replace City buildings in the identified prioritized order as funding is available. - Evaluate Alameda Point buildings as they are turned over to the City from the Navy. Have a plan to demolish them or make them habitable.
Potential Funding Source	Facility Maintenance Fund 706, HMGP, BRIC, AMP and City Capital Improvement Programs
Timeframe	Ongoing
Equity Considerations for Implementation	Possibly focus on buildings that incur a lot of public use so that improvements can be enjoyed by the maximum number of residents.

12. Water Retention

Category	Infrastructure
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Develop and maintain large and small areas to retain water within the city that may serve as areas of “retreat” during large storm events.
Actions	a. Alameda Nature Reserve. Support use and development of the 550 acre former US Navy airfields and runways as a Nature Reserve and area of wetlands that may serve as flood water retention area during major storm events. b. Corica Park. Support the use and development of the 330 acre golf complex as a recreation area and lagoon system that currently serves as a flood water retention area during major storm events. c. Public Participation. Encourage the public’s use of small-scale green infrastructure design standards, guidance, and typical details, as presented in the City’s Green Infrastructure Plan, for residential and garden projects.
Lead Department	Public Works
Related Plan/Policy	General Plan Policy CC-24
Key Partners	Northern California Power Agency
Completed Actions	- General Plan 2040 supports the development of the Nature Reserve and Government sub-district for wildlife habitat to preserve and protect the natural habitat in this area and protect endangered species and other wildlife and plant life that inhabit, make use of, or are permanently established within this area.
Future Actions	Educate the public about small-scale green infrastructure design for residential and garden projects.
Potential Funding Source	General Fund, EBMUD
Timeframe	Ongoing
Equity Considerations for Implementation	Consider targeting neighborhoods with high exposure to heat island effect and high percentage of impervious pavement

13. Urban Forest

Category	Infrastructure
Hazards Addressed	Heat
Strategy Type	Admin/Tech
Strategy Description	Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects.
Actions	<p>a. Tree Preservation. Continue to require and incent the preservation of large healthy non-invasive trees and vegetation. b. New Development and Parking Lots. Require ample tree plantings in new development and related parking lots. c. Strengthen Tree Replacement Requirement. Strengthen the tree replacement requirement for any protected trees removed due to new development or redevelopment. d. Prioritize Tree Planting. Invest in tree planting and maintenance, especially in low canopy areas and neighborhoods with under-served or under-represented communities. Resilient Urban Forest. Support the increase of the tree canopy in Alameda with drought tolerant, shade-producing, fire resistant tree species. f. Public Parks and Lands. Utilize public parks and public lands, such as Alameda Point, to significantly increase the urban forest. g. Maintain and Update the City's Master Tree Plan. Ensure an up-to-date, climate friendly Master Tree Plan that selects drought tolerant, shade-producing, fire resistant tree species adapted to Alameda's changing climate. This plan should include: » Design of new tree wells to allow better infiltration of stormwater; » Promotion of sidewalk gardens and other sidewalk landscaping; » Expansion of greenery in the public right-of-way and removal of impervious surfaces as feasible; » Strategies to reduce conflicts between trees, tree roots, and other public infrastructure such as sidewalks, overhead lines and street infrastructure; and » Identification of funding for both expansion and maintenance of the urban forest.</p>
Lead Department	Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-26, CARP
Key Partners	PG&E
Completed Actions	Secured funding from Council to update and expand the Master Tree Plan as and Urban Forest Plan.
Future Actions	Develop RFP and scope of work and procure consultant
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	Focus on expanding urban forest in underserved neighborhoods and those with high social vulnerability.

14. Lagoons

Category	Infrastructure
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy CC-32
Key Partners	EBMUD
Completed Actions	The FY-19-21 Capital Improvement Program includes an item for lagoon maintenance and dredging of the lagoons
Future Actions	Future projects may consider additional maintenance needs for the lagoons and adaptation to address projected sea level rise.
Potential Funding Source	Capital Budget, HMGP
Timeframe	Ongoing
Equity Considerations for Implementation	

15. On-Island Generation

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Wind/Storms
Strategy Type	Admin/Tech
Strategy Description	Support development of on-island solar power generation and on-island wind power with appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy CC-4
Key Partners	Planning, Building, and Transportation
Completed Actions	- AMP offers and Eligible Renewable Generation (ERG) plan, a special rate plan for new renewable generation customers that went into effect on December 31, 2016. - In 2021, 92 customers completed rooftop solar installations.
Future Actions	With City approval, the Doolittle community solar project will also start construction in 2022.
Potential Funding Source	AMP funds
Timeframe	Ongoing
Equity Considerations for Implementation	The elderly and disabled may rely on continuous power for medical devices and other uses and this project will help improve the reliability of the grid to protect those vulnerable populations.

16. Public Infrastructure Priorities

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Flooding Liquefaction Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards, and prioritize projects for adaptation funding.
Actions	a. Shoreline Facilities Program. Implement a program for Resilient Shoreline Facilities, including performing appropriate seismic, storm, flooding and other safety analyses based on current and future use for all City-owned shoreline facilities, including dikes, shore protection (rip rap), lagoon sea walls, storm water outfalls, marinas and protective marshlands. b. Location-Based Priority Flooding. Design and permit shovel-ready adaptation projects at areas of location-based priority flooding. Include considerations of rising groundwater surface and the potential for contaminant mobilization into analysis of priority flooding locations.
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-17, CARP
Key Partners	Caltrans FEMA
Completed Actions	Posey/Webster Tubes: Initiated schematic design and project cost estimate for the Northern Shoreline Adaptation project near the Posey/Webster Tubes in coordination with Caltrans. Submitted a grant application to Caltrans' Sustainable Transportation Planning Grant in February 2021, which was not successful. Doolittle Drive: Initiated a recurring quarterly meeting with Caltrans and the Port of Oakland to coordinate State Route 61 improvements, which include Doolittle Drive. Requested Caltrans to add short-term adaptation strategies to its pavement preservation project, which is expected for construction in 2024. Requested the Port of Oakland to consider adaptation strategies that benefit not only its North Field but also State Route 61/Doolittle Drive, the SF Bay Trail and the adjacent shoreline habitat Bay Farm Island Northern Shoreline/Veterans Court Area: Partial funding of Vet's Ct project in FY2020-21 Budget Submitted a grant application titled "Bay Farm Island Northern Shoreline Adaptation Project" to the State Coastal Conservancy's Proposition 68 Climate Adaptation Funds in June 2021.
Future Actions	Bay Farm Island Northern Shoreline/Veterans Court Area: Secure grant funding to complete the concept phase for \$500,000 to analyze existing conditions and alternatives and to develop a project concept with community member and stakeholder involvement that is approved by City Council, and includes up to 30 percent design drawings. Posey/Webster Tubes: Work with Caltrans, City of Oakland and other key stakeholders to create a project concept that combats flooding and sea level rise for the entire Oakland-Alameda Estuary, including this area near the Posey/Webster Tubes. Doolittle Drive: Coordinate with Caltrans, Port of Oakland, East Bay Regional Park District, the City of Oakland and ABAG/Bay Trail on both short-term and long-term adaptation solutions. Seek additional funding to implement adaptation projects for Doolittle Drive.
Potential Funding Source	Proposition 68 Climate Adaptation Grant, Caltrans Sustainable Communities Grant, HMGP, BRIC
Timeframe	Long-term
Equity Considerations	Working with the City of Oakland and all key stakeholders for the Oakland-Alameda estuary to ensure an equitable project solution in

**for
Implementation** that what happens in one part of the shoreline impacts other parts.

17. Green Infrastructure

Category	Infrastructure
Hazards Addressed	Flooding Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Require the use of “green infrastructure”, landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-23, CARP
Key Partners	Planning, Building and Transportation
Completed Actions	GI Plan submitted to Water Board in September 2019. Performed active municipal oversight of development project planning approvals and permitting review to ensure Green Infrastructure features in necessary public and private projects. Met or exceeded GI Plan's 2020 Benchmark values for numbers of completed GI Projects and total redeveloped acres subject to GI features benefits. Promoted GI Plan as a community resource for small-scale project planning. Provided feedback to draft General Plan Update to strengthen Green Infrastructure-related Policies/Objectives.
Future Actions	Await Water Board's feedback and/or regulatory direction on modifications to City's GI Plan. Continue planning and permitting development project oversight to promote inclusion of Green Infrastructure project features in public and private projects.
Potential Funding Source	Capital Budget, Private Developers
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure communities are on board with new upgrades and that green infrastructure benefits all communities in Alameda.

18. Underground Utilities

Category	Infrastructure
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Plans/Policy
Strategy Description	Require new development to underground utilities to minimize disruption by fire or other natural disasters.
Actions	
Lead Department	AMP
Related Plan/Policy	General Plan Policy HS-30, Underground Utility District Policy
Key Partners	Planning, Building and Transportation
Completed Actions	- AMP established the Underground Utility Districts (UUDs) through a City Ordinance. Any overhead utility facilities within the UUD must be converted to underground facilities. - The Otis/Broadway District is planned for construction 2022-2025
Future Actions	AMP plans to recommend that the City Council approve additional undergrounding projects from the list of recommendations received from the district nominating board (DNB). This list includes the following areas: - Webster Street - all crossings - Central Avenue to Pacific Avenue including Eagle Avenue - West of Constitution Way; and along Central Avenue from Eighth Street to Webster Street. - Broadway - Buena Vista Ave to Clement Ave - Fernside Boulevard from Encinal Avenue to High Street, including lines on Lincoln Park access road - Park Street - San Jose Avenue to Otis Drive
Potential Funding Source	2% of AMP's electric revenue are put into the Underground Utility District Fund (UUDF)
Timeframe	Ongoing
Equity Considerations for Implementation	

19. Lifeline Standard Estuary Crossing

Category	Infrastructure
Hazards Addressed	Earthquake Ground Shaking Liquefaction
Strategy Type	Admin/Tech
Strategy Description	Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-11
Key Partners	Alameda County
Completed Actions	
Future Actions	- Work with Alameda County to upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake.
Potential Funding Source	Alameda County, HMGP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	

I10. Collaboration

Category	Infrastructure
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Admin/Tech
Strategy Description	Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.
Actions	a. Shutoff Protocol. Establish a local protocol to shut off natural gas supply through shutoff valves on gas meters in the highest risk neighborhoods. b. EBMUD. Develop emergency water storage facilities to provide drinking water to EBMUD customers as well as fight fires in the event an earthquake disrupts the water supply to Alameda. c. Portable Fire Fighting System. Acquire the capability to use Bay water to fight fires using a system compatible with the ones in nearby cities like San Francisco and Berkeley.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-27
Key Partners	EBMUD PG&E
Completed Actions	- Owners of identified soft-story buildings were required to install an earthquake-actuated gas shut-off valve on the building to reduce the likelihood of natural gas fire ignitions in earthquakes. - Automatic gas shut-off valves are required any time a permit is issued for gas piping, whenever a property is sold or has a transfer of title. - To date, approximately 2,794 permits have been issued for gas shut-off valves in the city - Alameda has purchased two water tenders to use Bay water for firefighting.
Future Actions	Replace the water tenders every 8-10 years
Potential Funding Source	General Fund, Private Owners
Timeframe	Ongoing
Equity Considerations for Implementation	

L1. Groundwater Rise

Category	Land Use
Hazards Addressed	Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable.
Actions	
Lead Department	Public Works
Related Plan/Policy	General Plan Policy HS-35
Key Partners	
Completed Actions	Published "The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise in Alameda" report in 2020.
Future Actions	Implement priority actions in the report.
Potential Funding Source	General Fund, HGMP, BRIC
Timeframe	Long-term
Equity Considerations for Implementation	Consider vulnerable communities exposed to contaminated sites for priority action.

L2. Land Development

Category	Land Use
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Require that new development reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise.
Actions	a. Assessment. Require new development proposed in areas of flood risk to assess flood risk and incorporate specific groundwater and sea level rise mitigation strategies. b. Mitigation. Require new development to incorporate design features to mitigate 50 years of the Ocean Protection Council's Medium-High Risk Aversion, high emissions scenario of sea level rise in addition to a 100 year storm in the initial design and funding mechanisms to pay for later adaptation improvements to address future sea level and groundwater increases above that level. Projects that include new seawalls where none currently exist shall evaluate the off-site impact of the new walls on adjacent and nearby communities. c. Nature Based Design. Require new development to incorporate low impact development design strategies and stormwater management systems, such as engineered landscapes, vegetated areas, or cisterns that mimic nature by soaking up and storing water, to manage and protect the quantity and quality of stormwater runoff.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy CC-20
Key Partners	
Completed Actions	- Floodplain ordinance requires special design requirements for new construction in the floodplain and in coastal high hazard areas. - 2040 General Plan recommends following California's Ocean Protection Council 2018 Sea-Level Rise Guidance. - Green Infrastructure Plan includes requirements for low impact development
Future Actions	Future updates of the General Plan will explore and consider more fully this 50-year climate scenario and its implications for Alameda.
Potential Funding Source	Private developers
Timeframe	Ongoing
Equity Considerations for Implementation	

L3. Resilient Rights-of-Way and Open Spaces

Category	Land Use
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding.
Actions	
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-19
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	Capital Improvement Program, General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

L4. Easements

Category	Land Use
Hazards Addressed	Flooding
Strategy Type	Plans/Policy
Strategy Description	Require the creation and maintenance of easements along drainage ways necessary for adequate drainage of normal or increased surface runoff due to storms.
Actions	
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-22
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Long-term
Equity Considerations for Implementation	

E1. Heat and Wildfire Smoke Emergencies

Category	Emergency Response
Hazards Addressed	Heat Wildfire Smoke
Strategy Type	Admin/Tech
Strategy Description	Create a network of clean air and cooling emergency shelters throughout Alameda.
Actions	a. Partnerships. Identify and partner with large HVAC equipped building owners to establish a network of facilities that are able to open to the public during heat waves and smoke events during the day. b. Incentives. Incentivize building owners to upgrade or install HVAC systems to provide more safe places during heat waves and times with dangerous air quality levels. c. City Facilities. Evaluate options to upgrade or otherwise retrofit HVAC systems and buildings to be able to maintain temperatures below 78 degrees Fahrenheit and adequately filter air pollutants when at capacity.
Lead Department	Library Public Works Recreation and Parks
Related Plan/Policy	General Plan Policy CC-25, CARP, Emergency Operations Plan
Key Partners	
Completed Actions	West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center
Future Actions	Evaluate need for additional Clean Air and Cooling Centers
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled.

E2. Emergency Preparedness

Category	Emergency Response
Hazards Addressed	All Hazards
Strategy Type	Admin/Tech
Strategy Description	Maintain emergency management and disaster preparedness as a top City priority.
Actions	a. Update Emergency Operations Plan. Maintain and update the recommendations and standards established in the City of Alameda's Emergency Operations Plan as the guide for disaster planning in Alameda. b. Training. Maintain training programs to ensure that City personnel are sufficiently prepared to respond to an emergency and staff the Emergency Operations Center. c. Facilities. Identify and publicize essential emergency facilities in the City, including shelters, evacuation routes, and emergency operation staging areas, and take the necessary actions to ensure that they will remain operational following a disaster. d. Exercises. Conduct periodic emergency response exercises to test the effectiveness of local preparedness response, recovery, and mitigation procedures.
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-1
Key Partners	
Completed Actions	- Completed Environmental Emergency Plan Annex draft. Draft plan added as an Annex to the Basic Emergency Operation Plan (EOP) once approved. - EOC training exercises on a City, County, Regional and State level. Training for emergency repair, traffic control, evacuations, shelter in place, crowd control, emergency medical aid, grant reimbursement, etc. - Education of City Employees about personal emergency preparedness and mitigation.
Future Actions	
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

E3. Tsunami Preparedness

Category	Emergency Response
Hazards Addressed	Tsunamis
Strategy Type	Admin/Tech
Strategy Description	Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations.
Actions	a. Awareness. Develop a public information campaign to educate the public about tsunami risks and evacuation procedures, with special emphasis on access and functional needs populations and maritime communities. b. Evacuation Emergency Annex. Include and maintain an Evacuation Emergency Annex in the Emergency Operations Plan that includes a strategy for tsunami evacuation. c. Signs. Place tsunami inundation zone and evacuation route signs. d. Vertical Evacuation. Assess vertical evacuation options. e. Drills. Conduct tsunami evacuation training and drills with schools. f. Partner. Partner with Caltrans, Alameda County, AC Transit, the City of Oakland and Port of Oakland to plan for tsunami evacuation. g. Tsunami Ready. Become recognized as a Tsunami Ready community by the National Weather Service.
Lead Department	Fire Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-20
Key Partners	Caltrans Alameda County City of Oakland Port of Oakland AC Transit CGS CalOES NOAA National Tsunami Hazard Mitigation Program USGS
Completed Actions	Sign placement and general public tsunami education. With the number of marinas in Alameda, there will be a targeted component of the education program towards tsunami impacts in the maritime communities.
Future Actions	In 2022-23, staff is planning to: - Complete a tsunami emergency annex - Become a TsunamiReady city - Participate in Tsunami Preparedness week in March and encourage residents to sign up for AC Alert - Create a special emergency contact list of marinas in Alameda
Potential Funding Source	USGS/CalOES and Public Works funds
Timeframe	Ongoing
Equity Considerations for Implementation	Provide education programs and signs in various languages depending on community need. Ensure education program outlines evacuation plan for those who do not have access to personal transportation.

E4. Emergency Coordination

Category	Emergency Response
Hazards Addressed	All Hazards
Strategy Type	Admin/Tech
Strategy Description	Coordinate local emergency preparedness efforts with the Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies.
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-3
Key Partners	
Completed Actions	- Alameda Municipal Power is a signatory on two mutual aid agreements: California Utility Emergency Association (CUEA) and Northern California Power Agency (NCPA) - Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters. - Working Relationships and Lifeline Committee Meetings with Caltrans, County, Coast Guard, Ready Reserve, Port of Oakland, San Leandro, Utilities, FEMA, and Other Agencies. - Membership in CalWARN Mutual Aid for City-run and independent utilities that provide water and wastewater.
Future Actions	
Potential Funding Source	General Fund, Assistance provided or received during an emergency will be reimbursed with state or federal funding if it is a declared emergency.
Timeframe	Ongoing
Equity Considerations for Implementation	

E5. Wildfire Smoke

Category	Emergency Response
Hazards Addressed	Wildfire Smoke
Strategy Type	Admin/Tech
Strategy Description	Prepare for future wildfire smoke events.
Actions	<p>a. Shelters. Work with local organizations and institutions to provide for public, clean air, temporary shelters, such as the Alameda Free Library, at locations throughout the City. b. Vulnerable Communities. Strengthen protocols and procedures for identifying and notifying the most vulnerable residents to wildfire smoke of shelter locations and other potential support. c. Indoor Air Quality. Facilitate and expedite efforts by local property owners and businesses to improve indoor air quality and filtration systems. d. Outdoor Air Quality. Continue to work with regional and local organizations and businesses to reduce local sources of air pollutants.</p>
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-61
Key Partners	
Completed Actions	<p>- Adopted and implement new air quality / smoke response protocols for City staff and employees. - West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center. - Utilize AC Alert to notify residents about unsafe air quality.</p>
Future Actions	
Potential Funding Source	General Fund, Capital Improvement Program
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled.

E6. Emergency Response and Disaster Preparedness

Category	Emergency Response
Hazards Addressed	Earthquake Ground Shaking Liquefaction Tsunamis
Strategy Type	Admin/Tech
Strategy Description	Preserve access for emergency response vehicles to people and property and for evacuation.
Actions	<p>a. Emergency Response Planning. Include emergency response needs in all transportation planning, the design of new facilities, and modifications to existing facilities. Establish and sign designated evacuation routes, and provide ongoing education and outreach to ensure that Alameda is evacuation ready. Continue to work with AC Transit and WETA to ensure coordinated services in the event of the need for evacuation. b. Outreach. Educate the community on disaster preparedness using an all-hazard approach to emergency response. c. Miller-Sweeney Bridge. Upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake. d. Fruitvale Rail Bridge Hazard. Remove or seismically upgrade the abandoned Fruitvale Rail Bridge which poses a seismic hazard to the city's Miller-Sweeney Bridge. Consider replacing the hazardous structure with crossing for transit, bicycles and pedestrians.</p>
Lead Department	Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy ME-9
Key Partners	Alameda County Public Works Agency
Completed Actions	Coordinated with AC Transit on the locations of vulnerable populations in the City of Alameda including skilled nursing facilities, adult day care and child care facilities. Participated in Bay Area Urban Areas Security Initiative trainings.
Future Actions	Continue working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the adjacent abandoned Fruitvale rail bridge. Draft letter to Alameda County requesting upgrade to Miller-Sweeney Bridge. Continue coordination with WETA and AC Transit, and will participate in Bay Area emergency response training exercises.
Potential Funding Source	HMGP, BRIC, General Fund
Timeframe	Long-term
Equity Considerations for Implementation	Ensure continuity of service for transit- dependent populations.

C1. Public Communication

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.
Actions	a. Volunteers. Maintain community based emergency preparedness training programs targeted to neighborhoods and business groups, such as Community Emergency Response Teams and outreach and coordination with Voluntary Organizations Active in Disasters (VOAD) and other community based programs. b. Education. Prepare and/or make available public education and awareness materials in multiple languages on all aspects of emergency preparedness, including the type and extent of hazards in the community, measures to reduce the likelihood of damage and injury, provisions for emergency supplies, steps to take immediately after a disaster, and the location of shelters and medical facilities. c. Targeted Communication. Engage Alamedans using a wide range of tools, languages and strategies to communicate about all types of health threats and planning, with a special emphasis on the most vulnerable people who are least likely to know about or be able to adapt to various threats. d. Resilience Hubs. Promote resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.
Lead Department	City Manager's Office Fire Police
Related Plan/Policy	General Plan Policy HS-4, Emergency Operations Plan
Key Partners	Alameda County
Completed Actions	The City of Alameda in partnership with Alameda County Office of Emergency Services (OES) uses AC Alert as the County-wide mass notification system to alert community members of weather related issues, as well as posting to social media, and the city website. Resilience Hub pilot with the MakerFarm at Alameda Point is underway.
Future Actions	Encourage the public to opt-in to AC Alert and follow the City on social media. Learn lessons from resilience hub pilot program and identify opportunities for new resilience hub locations. Consider connecting resilience hubs with CERT teams. Promote Cool Block program to neighborhood leaders.
Potential Funding Source	General Fund, Cool City Challenge
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure that all community members, including those who are non-English speaking and those without cell phones, receive key communications from city/local officials before, during, and after a disaster event. Investigate options for disseminating emergency alerts through key community leaders to increase their reach in disadvantaged communities. Ensure participation by all neighborhoods in Alameda and that resilience hubs are rooted in the neighborhoods they serve.

C2. Air Quality Alerts

Category	Communication, Community and Coordination
Hazards Addressed	Wildfire Smoke
Strategy Type	Outreach/Education
Strategy Description	Continue to partner with BAAQMD to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents.
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-65
Key Partners	
Completed Actions	
Future Actions	- Continue to encourage residents to sign up for AC Alert to receive emergency notifications
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C3. Regional Partnerships

Category	Communication, Community and Coordination
Hazards Addressed	Drought Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies.
Actions	a. Funding and Partnerships. Develop partnerships with local, regional, and state agencies to expedite adaptation projects and ensure a healthy watershed that protects and restores water quality, habitat and community vitality along San Leandro Bay and the Oakland-Alameda Estuary.
Lead Department	City Manager's Office Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-16
Key Partners	
Completed Actions	Convened the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. Sub groups are focusing on adaptation of Doolittle Drive and Northern Shoreline near Posey/Webster Tubes (CARP strategies)
Future Actions	Launch development of a coordinated and inclusive future-looking subregional organizational structure and action plan with shared vision and needs assessment to accelerate sea level rise adaptation in alignment with the BayAdapt Joint Platform.
Potential Funding Source	Regional, state and federal grants, General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C4. Collaboration

Category	Communication, Community and Coordination
Hazards Addressed	Earthquake Caused Fires
Strategy Type	Admin/Tech
Strategy Description	Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements
Actions	
Lead Department	Fire
Related Plan/Policy	General Plan Policy HS-27
Key Partners	
Completed Actions	
Future Actions	Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters.
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	

C5. Neighborhood Resilience Coordination

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use.
Actions	a. Electrification. Offer blocks or neighborhoods assistance in electrifying their homes through incentives that reflect the savings to taxpayers and ratepayers from being able to remove or shut off the natural gas infrastructure on their block. b. Flooding. Include tailored planning and support for communities testing various flooding adaptation strategies. c. Priorities. Prioritize block and neighborhood-driven priorities while selecting a broad range of interventions to test to maximize the City's ability to learn from each pilot project.
Lead Department	City Manager's Office
Related Plan/Policy	General Plan Policy CC-15
Key Partners	
Completed Actions	Resilience Hub pilot with the MakerFarm at Alameda Point is underway.
Future Actions	- Consider applying for Cool City Challenge, which awards \$1 million to implement a climate moonshot strategy to become a carbon neutral city by 2030. As part of the application process, Alameda will commit to becoming carbon neutral by 2030 with no offsets, a moonshot team will recruit 25 partner organizations to partner in the Cool City Challenge and 200 cool block leaders who are ready to work with their neighbors to make positive change. The award could bring significant resources to help Alameda achieve its CARP goals around decarbonizing transportation and buildings. - Consider connecting resilience hubs with CERT teams. - Support the development of resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.
Potential Funding Source	General Fund, Cool City Challenge
Timeframe	Ongoing
Equity Considerations for Implementation	Ensure that resilience hubs exist in all neighborhoods in Alameda and they are rooted in the neighborhoods they serve.

C6. Social Vulnerability

Category	Communication, Community and Coordination
Hazards Addressed	All Hazards
Strategy Type	Outreach/Education
Strategy Description	Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change.
Actions	<p>a. Equity. Ensure opportunities for leadership and actions to benefit Alameda’s low-income individuals, seniors, youth, people of color, gender, sexual orientation, people experiencing homelessness, individuals with disabilities, and socio-economically disadvantaged communities from environmental and climate change impacts. b. Environmental Justice. Ensure the equitable treatment and full involvement of all people when considering actions to reduce the adverse impacts of climate change on residents regardless of age, culture, ethnicity, gender, sexual orientation, race, socioeconomic status, or geographic location. Prioritize actions that will reverse historic policies of racial discrimination and exclusion. c. Assessments. Utilize Alameda’s Social Vulnerability Assessment in the Climate Action and Resiliency Plan or similar tool to identify neighborhoods and specific groups with high levels of social vulnerability in order to prioritize locations for action and improvements.</p>
Lead Department	All
Related Plan/Policy	General Plan Policy CC-2
Key Partners	
Completed Actions	Developed Social Vulnerability Assessment for CARP
Future Actions	- Update Social Vulnerability Assessment with 2020 Census - Develop equity toolkit to prioritize equity in the development and implementation of policies
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	Review equity considerations in the development of project and policy proposals.

S1. Adaptation Pathway Master Plan

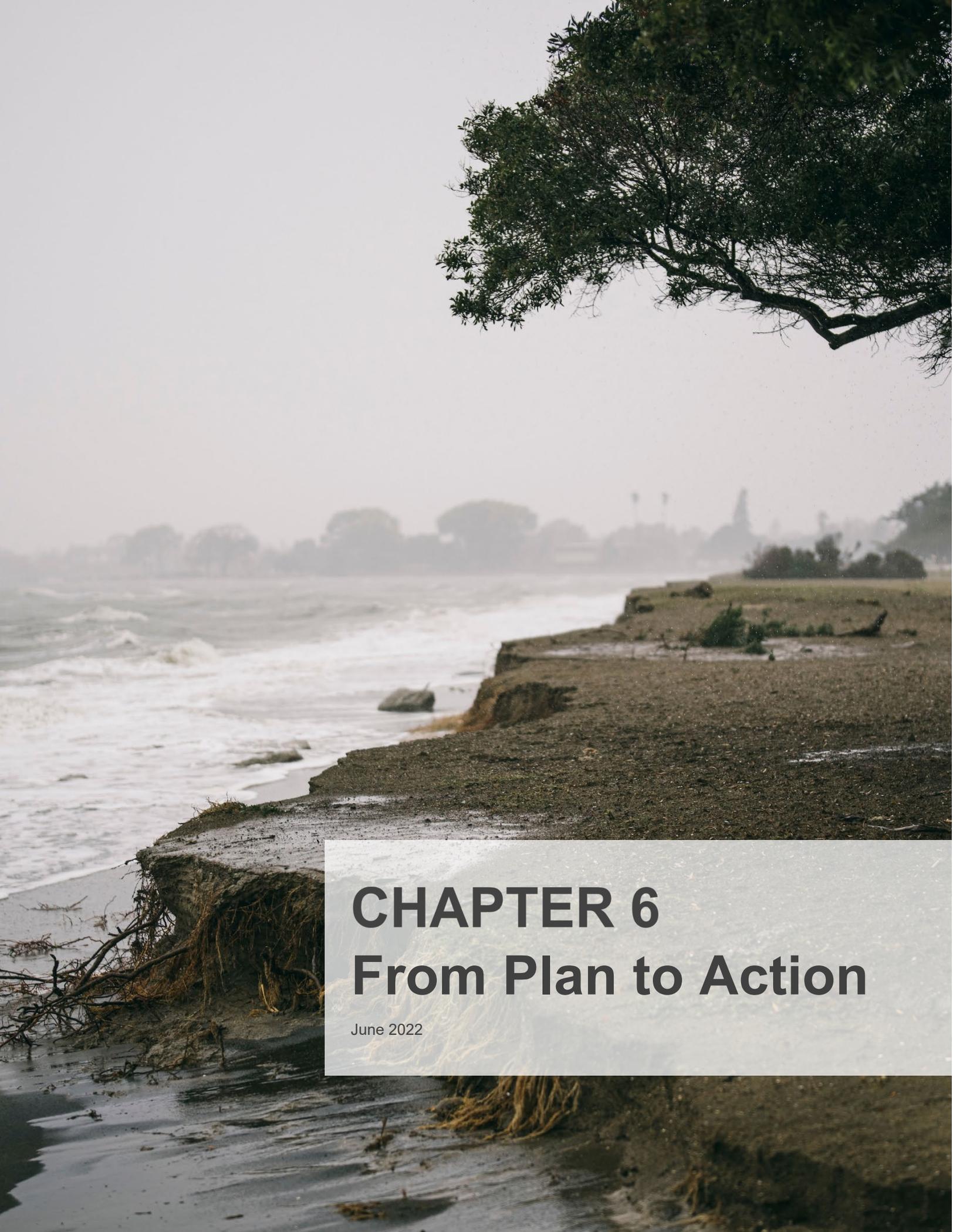
Category	Studies and Plans
Hazards Addressed	Sea Level Rise
Strategy Type	Plans/Policy
Strategy Description	Develop an adaptation pathway master plan. The plan will include additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels.
Actions	Develop sea level and groundwater rise adaptive strategies for different areas of the City for public discussion and evaluation, including but not limited to: avoidance/planned retreat, enhanced levees, setback levees to accommodate habitat transition zones, buffer zones, beaches, expanded tidal prisms for enhanced natural scouring of channel sediments, raising and flood-proofing structures, and/or provisions for additional flood water pumping stations, and inland detention basins to reduce peak discharges.
Lead Department	City Manager's Office Community and Economic Development Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy HS-24, CARP
Key Partners	
Completed Actions	
Future Actions	Seek planning grants. Initiate and complete planning effort with City Council approval. Implement plan with future funding needed.
Potential Funding Source	General Fund, grants
Timeframe	Adaptation strategies that reduce the burden of sea level rise from impacted community members. Ensure sea level rise preventative measures do not disturb shoreline ecosystems Focus new housing developments away from shorelines Prioritize communities most at risk for effects of sea level rise
Equity Considerations for Implementation	Incorporate social vulnerability assessment into adaptation pathway considerations

S2. Rising Groundwater

Category	Studies and Plans
Hazards Addressed	Sea Level Rise
Strategy Type	Admin/Tech
Strategy Description	Prepare for the impacts of rising groundwater levels on private and public property.
Actions	a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts. d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.
Lead Department	City Manager's Office Planning, Building and Transportation Public Works
Related Plan/Policy	General Plan Policy CC-23, HS-24, Groundwater Study
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Short-term
Equity Considerations for Implementation	

S3. Flood Hazard Maps

Category	Studies and Plans
Hazards Addressed	Flooding
Strategy Type	Admin/Tech
Strategy Description	Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources.
Actions	a. Process. Create a regular process by which information is updated and released, identifying staff time and budget to ensure that this information is timely, accurate and accessible for all public and private decision-makers.
Lead Department	Planning, Building and Transportation
Related Plan/Policy	General Plan Policy HS-15
Key Partners	
Completed Actions	
Future Actions	
Potential Funding Source	General Fund
Timeframe	Ongoing
Equity Considerations for Implementation	



CHAPTER 6

From Plan to Action

June 2022

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. This chapter provides a roadmap for how the public will remain engaged in the plan, how the plan will be integrated into other planning processes and how it will be maintained and updated over time. The plan will undergo a comprehensive revision and update before the expiration of this 5-year plan.

Continued Public Involvement

Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time. The most appropriate and meaningful opportunities for the general public to be involved in the maintenance and implementation of the Plan is during the five-year plan review process. However, the City also intends to do hazard mitigation outreach and education during the interim periods, which may promote a more engaged citizenry for the five-year update process. The public can review the plan and provide input and feedback during the five-year plan maintenance period at <https://www.alamedaca.gov/hazardmitigationplan>.

As demonstrated in **Appendix B**, the City was diligent and successful in providing public involvement opportunities during this five-year plan review process through multiple methods. However, despite our efforts, we know that we missed certain segments of the population, particularly minorities, youth, and the disabled. These are important voices to be part of the conversation and represent some of the populations most likely to be significantly impacted by the hazards described in this plan. As we design outreach and education opportunities going forward, we must consider additional ways to reach these populations. Considerations may include partnering more closely with Mastick Senior Center, audio programs for the visually impaired, materials translated into multiple languages, flyers to tenants, and engagement with the schools.

Integration into Other Planning Processes

Information from the 2016 plan was integrated into other planning processes, including the 2040 General Plan Safety and Climate Conservation Elements, 2019 Emergency Operations Plan, and the Capital Improvement Program. As City departments and regional agencies update various plans they will incorporate the data and strategies from this plan into their planning processes. The construction of new infrastructure or completion of mitigation programs will also be tracked for inclusion in the subsequent update of the plan. Information from the current plan may be integrated into the following plans as they are updated:

Emergency Operations Plan. The Local Hazard Mitigation Plan is a key component of the City's Emergency Operations Plan (EOP) of 2019. The EOP addresses the City's planned response to emergency situations. The objective of the EOP is to coordinate the personnel, facilities, and other resources of the City into an efficient organization capable of responding to any emergency, disaster, or planned event. The key mitigation effort of the EOP is to have planning, strategies, personnel assignments, and training in place before a disaster strikes, so that the response and recovery can be effective and professional. The City's EOP includes discussions of the National Incident Management System (NIMS) to establish the chain of command, the Standardized Emergency Management System (SEMS) to identify functions and responsibilities, Incident Command (IC), mutual aid, functioning of the Emergency Operations Center (EOC), and ongoing training.

Capital Improvement Program (CIP). The most recent CIP, for FY 19-21, aims to maintain and improve our City's aged public infrastructure as best it can with the resources available. The CIP has one budget

for each of the main infrastructures, such as sanitary sewer piping, city buildings, street resurfacing, etc. Concurrently, the Public Works Department is developing short- and long-term master plans for each infrastructure, to best spend the limited dollars to address both new needs and the drawdown of deferred maintenance. This more flexible budget also allows for reprioritization as serious maintenance needs become apparent.

Master Plans. Master plans have been developed, or are in the final stages of development. All of these have been developed to best meet the needs of the users, within the projected CIP budget. Some address hazard mitigation, more specifically:

- **General Plan:** The City completed a comprehensive update of the General Plan in 2021. The Health and Safety element has been updated coincident with this plan so that the information is consistent between the two documents. This plan will be adopted as an appendix to the General Plan Safety Element in compliance with AB 2140. As the Climate Adaptation and Hazard Mitigation plan is updated, amendments to the General Plan will also be made as necessary to ensure consistency between the two plans.
- **Climate Action and Resiliency Plan (2019):** The Climate Action and Resiliency Plan is a long-term plan to reduce Alameda's Greenhouse Gas emissions that cause climate change through equitable improvements to transportation, buildings, energy use, and waste management and adapt to the impacts of climate change, such as rising seas and increasing extreme heat and smoke days.
- **City-Owned Buildings Facility Assessment:** The City completed a study on the highest maintenance needs for existing city buildings. This included the immediate needs of code deficits, ADA issues, damage repair, normal wear and tear (paint, carpet, etc.) and deferred maintenance. The study did not include a seismic review of each building. This will be done in future revisions of the Plan. Other than the golf course buildings, no city buildings have been identified within the 100-year flood plain.
- **Storm Drain Master Plan (Conveyance and Pump Stations):** The City's master plans specifically address lack of capacity during 10-year and 25-year storms. While the plans were completed before the new FEMA floodplain maps were issued, they do address 18-inch and 55-inch sea level rise adaptations, which impact the same areas identified by FEMA as flood-prone.
- **Sewer Master Plan:** This plan updates all pump stations to meet current capacity and prioritizes rehabilitation of aging sewer pipe with more flexible material known to withstand seismic and flooding hazards.
- **Transportation Master Plans** (transportation plans addressing transit, bicycle, pedestrian, signals, goods movement, air quality, and other transportation needs): City Council approved the Transportation Choices Plan in 2018, which has goals to reduce solo driving and increasing the share of other modes with the primary objectives of safety, equity, and reducing greenhouse gases, including improved evacuation. In December 2021, City staff will request City Council approval of the Vision Zero Action Plan that includes specific actions and policy changes to increase street safety in Alameda. In 2022, City staff will request City Council approval of the Active Transportation Plan, which will update the existing Pedestrian Plan (2009) and Bicycle Master Plan (2010). All these plans encourage the flexibility of transportation by diversifying both routing and conveyance means. This will be useful during times when regular transportation is disrupted.

- **Master Infrastructure Plan for Alameda Point:** This document established the requirements and standards for the backbone infrastructure to support redevelopment and reuse of Alameda Point (the old Navy Base). The infrastructure improvements will create a seismically stable site that can adapt to the potential impacts of climate change.
- **City of Alameda Underground Utility District (UUD)**

Keeping the Plan Current

Plan Monitoring and Evaluation

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time.

The Sustainability and Resilience Manager in the City Manager's Office will be charged with providing an annual report on an annual basis within the five-year cycle. The annual report will be provided to the public, relevant boards and commissions, and to the City Council at a public meeting in conjunction with the Climate Action and Resiliency Plan annual report.

The responsible agency assigned to each mitigation strategy will be responsible for tracking and reporting on each of their actions. The annual report will include a table that tracks progress of the mitigation strategies as well as an evaluation of the plan's effectiveness. This evaluation may include an assessment of whether there have been changes in the political climate, if there have been any hazard events that require revision to the risk assessment or mitigation strategies, or changes to the plan's goals or objectives. The evaluation will determine whether there have been any changes that necessitate a plan modification. Any modifications to the plan will be submitted to CalOES and FEMA.

Plan Update Process

Per federal regulations, this plan must be updated every five years. The Sustainability and Resilience Manager will ensure that a complete review and update of the Plan, including the hazard analysis and mitigation strategy, is completed before the expiration of the current Plan. The plan update process will follow much the same process as followed in the 2022 update. The General Plan will also be amended as necessary to maintain consistency with the Climate Adaptation and Hazard Mitigation Plan.



Appendix A Planning Process

June 2022



City of Alameda, California
Local Hazard Mitigation and Adaptation Plan
MEETING AGENDA
Planning Team Meeting

May 26, 2021
11:00 – 12:00 PM
Zoom Meeting

Attendees

Danielle Mieler, Sustainability and Resilience Manager	Jane Chisaki, Library
Cpt. Sharon Oliver, Fire	Robert Vance, Public Works
Gail Payne, Planning Building, and Transportation	Luke Connolly, Community Development
Amy Wooldridge, Recreation and Parks	Andrew Nowacki, Public Works
Lt. Ryan DeRespini, Police	Carolyn Hogg, IT
Erin Smith, Public Works	Stephanie Shipe, AHA

Agenda

1. What is a Mitigation Plan and why is it important?
2. Plan purpose and link to other plans
3. Updates from previous plan
4. Review and agree on update process and schedule
5. Establish planning team roles and responsibilities
6. Develop an outreach strategy
7. Additional questions and needs

Next meeting: June 23, 2021



City of Alameda, California
Local Hazard Mitigation and Adaptation Plan
MEETING AGENDA
Planning Team Meeting

June 23, 2021
11:00 – 12:00 PM
Zoom Meeting

Attendees

Danielle Mieler, Sustainability and Resilience Manager	Carolyn Hogg, IT
Andrew Nowacki, Public Works	Amy Wooldridge, Parks and Rec
Gail Payne, Planning Building, and Transportation	Robert Vance, Public Works
Cpt. Sharon Oliver, Fire	Andrew Thomas, Planning, Building and Transportation
Stephanie Shipe, Alameda Housing Authority	Chelette Quiambao (Alameda Housing Authority)
Lt. Ryan DeRespini, Police	
Jane Chisaki, Library	

Agenda

1. Convene and introductions
2. Review draft chapters (attached)
 - Asset inventory
 - Hazard characterization
 - Flood and sea level rise detailed risk assessment
3. Review detailed asset inventory
4. Review existing mitigation strategies and request updates
5. New mitigation strategies to include
6. Review community outreach strategy and survey questions

Next meeting: July 21, 2021



City of Alameda, California
Local Hazard Mitigation and Adaptation Plan
MEETING AGENDA
Planning Team Meeting

July 21, 2021
11:00 – 12:00 PM
Zoom Meeting

Attendees

Danielle Mieler, Sustainability and Resilience Manager	Carolyn Hogg, IT
Andrew Nowacki, Public Works	Amy Wooldridge, Parks and Rec
Gail Payne, Planning Building, and Transportation	Robert Vance, Public Works
Cpt. Sharon Oliver, Fire	Andrew Thomas, Planning, Building and Transportation
Stephanie Shipe, Alameda Housing Authority	Chelette Quiambao (Alameda Housing Authority)
Lt. Ryan DeRespini, Police	
Jane Chisaki, Library	

Agenda

1. Convene and introductions
2. Review draft chapters (attached)
 - Seismic Risk Assessment
 - Hazard Mitigation and Climate Adaptation Strategy
3. Review existing mitigation strategies and identify new strategies
4. Outreach strategy
 1. Schedule
 2. Website
 3. Community survey – finalize and publicize

Next meeting: August 25, 2021



City of Alameda, California
Local Hazard Mitigation and Adaptation Plan
MEETING AGENDA
Planning Team Meeting

August 25, 2021
11:00 – 12:00 PM
Zoom Meeting

Attendees

Danielle Mieler, Sustainability and Resilience Manager	Jane Chisaki, Library
Andrew Thomas, Planning, Building and Transportation	Robert Vance, Public Works
Gail Payne, Planning Building, and Transportation	Greg McFann, Building Official
Cpt. Sharon Oliver, Fire	Andrew Nowacki, Public Works
Stephanie Shipe, Alameda Housing Authority	

Agenda

1. Review draft chapters (attached)
 - Executive Summary
 - Ch 1. Introduction
 - Ch 2. Planning Process
 - Ch 6. From Plan to Action
2. Mitigation Strategies
 1. Ask for communities to help us prioritize projects for an infrastructure bond
3. Outreach strategy
 - Community survey results
 - Who are we not hearing from? What do we need to do to reach those folks?
 - Table at Farmers Market
 - Poster board at library. Have TV screen at main and branches.
 - Display maps at the library for people to go look at specific hours. Put them on easels and set them up in the Café space. Café not opening until late December.
 - Lydecker Park Rec Room – ask Amy

- Alameda Point Collaborative posters in office space
- Map, blurb on what it is, QR code to link to website
- Graphic designer, Jose Fernandez
- 1. AHA Townhall meetings
- Virtual Open House tentative dates
 - Thursday, September 16, 6-7 pm
 - Wednesday, September 22, 12-1 pm
 - Tuesday, September 28, 7-8 pm
- 4. Other updates
 - 1. [Biden Administration Commits Historic \\$3.46 Billion in Hazard Mitigation Funds to Reduce Effects of Climate Change](#)

Next meeting: September 22, 2021

Danielle Mieler

Subject: Canceled: Mitigation Planning Team Meeting
Location: <https://alamedaca-gov.zoom.us/j/81259195424?pwd=Z2x1bTZxQmR6clFCdzV1Z1lyRjRuUT09>

Start: Wed 9/22/2021 11:00 AM

End: Wed 9/22/2021 12:00 PM

Show Time As: Free

Recurrence: Monthly

Recurrence Pattern: the fourth Wednesday of every 1 month(s) from 11:00 AM to 12:00 PM

Meeting Status: Not yet responded

Organizer: Danielle Mieler

Required Attendees: Lisa Maxwell; Nicolas Procos; Rick Zombeck; Jane Chisaki; Carolyn Hogg; Ryan Derespini; Yushi Chen; 'Stephanie Shipe'; Zazo, Kirsten; Gerry Beaudin; Erin Smith; Andrew Thomas; Andrew Nowacki; Robert Vance; Gail Payne; Greg McFann; Amy Wooldridge; Sharon Oliver; Matthew Gerry

Optional Attendees: Jodi Owens; Chelette Quiambao

Importance: High

I don't think there is a need for the Planning Team to meet this month. In lieu of a meeting, I'll send some updates on where we are in the process below. Let me know if you have any questions or comments.

- The [Draft Climate Adaptation and Hazard Mitigation Plan](#) has been posted online on the plan webpage
- I am hosting public meetings this month on September 16, 22 and 28
- Over 600 people have responded to our [community survey](#) for the plan
- We distributed postcards with information about the plan and community meetings. CASA volunteers helped distribute some of the postcards to doorsteps in one of our vulnerable neighborhoods around Woodstock Park.
- We are planning for a number of upcoming board and commission meetings:
 - Sept 27: Planning Board
 - Oct 13: Commission on Persons with Disabilities
 - Oct 18: Public Utility Board (tentative)
 - Oct 27: Transportation Commission
 - Oct 28: Social Service and Human Relations Board
 - Oct 28: Alameda Collaborative for Children, Youth and their Families
 - Nov 4: Historical Advisory Board
- I'll be working on additional outreach opportunities with our new CivicSpark Fellow Yushi Chen and I welcome her to the team!
- Following public comment, I'll be making revisions to the plan and submitting to CalOES and FEMA for review. Once we receive approval, pending adoption from FEMA we will bring the plan to Council for final approval.

Thanks,
Danielle



City of Alameda, California
Local Hazard Mitigation and Adaptation Plan
MEETING AGENDA
Planning Team Meeting

October 27, 2021
11:00 – 12:00 PM
Zoom Meeting

Attendees

Danielle Mieler, Sustainability and Resilience Manager	Jane Chisaki, Library
Andrew Thomas, Planning, Building and Transportation	Robert Vance, Public Works
Gail Payne, Planning Building, and Transportation	Greg McFann, Building Official
Amy Wooldridge, Recreation and Parks	Andrew Nowacki, Public Works
Yushi Chen, CivicSpark Fellow	Carolyn Hogg, IT

Agenda

1. Community Outreach updates
 - Website
 - Social media
 - Community Survey – summary of results
 - Postcards and flyers – doorsteps, City Hall, libraries
 - Emails
 - Community Meetings
 - Farmers' Market
 - Board and Commission meetings
2. Review new proposed strategies
 - **Upgrade Cartwright substation.** Raise and strengthen the foundation of Cartwright substation, install new seismically approved bus structures and seismically retrofit bus structures of the existing substation, and replace major equipment to withstand the force of the maximum credible earthquake.
 - **Local energy storage.** Continue evaluating local energy storage and other resiliency improvements like microgrids.
 - **Solar plus storage.** Continue the successful program of working with customers who want to install solar plus storage.
 - **Hazardous Fruitvale Rail Bridge.** Continue working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the adjacent abandoned Fruitvale rail bridge that is likely to collapse in

a seismic event and poses a life safety hazard to the adjacent Miller Sweeney bridge.

- **Clean Air and Cooling Centers.** Upgrade air filtration and install heat pump furnaces or A/C to prepare city buildings to serve as clean air and cooling centers to serve the public on hot or smoky days.
- **Strengthen Community Resilience.** Coordinate with nonprofit, community, and faith-based organizations to build strong social networks in neighborhoods, especially those exhibiting characteristics that make them more vulnerable, such as Alameda Point and Alameda Landing. Develop community-led education and outreach campaigns designed for specific local populations on the risks of sea level rise and storm events.
- **One to Four Unit Wood Framed Buildings Program (revised).** Educate residents about the City's Wood Frame Building Program, which includes voluntary requirements for substantially improving the seismic performance of one- and two-story wood frame residential buildings with vulnerable "cripple walls". *Encourage residents with 1-4 unit buildings to take advantage of the California Earthquake Authority's Earthquake Brace and Bolt Program grants and other financial assistance programs. Identify additional incentives and policies such as time of sale notifications and conduct outreach.*
- **Emergency Alert Sirens.** Consider rehabilitating emergency alert sirens to provide better access for people who don't have AC Alert and those who can't interact with/don't have a cell phone.
- **Community Emergency Response Teams (CERT).** Encourage participation in CERT and make CERT neighborhood based and identify neighbors with access and functional needs who need support and should be checked on in an emergency
- **Resilience Hubs.** Support the development of resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.

3. Alignment with Safety Element

- Adopt Mitigation Plan as part of Safety Element – allows Legislature to provide for a state share of local costs to exceed 75% of total state eligible costs un CA Disaster Assistance Act
- SB 99 - upon the next revision of the housing element on or after January 1, 2020, cities must review and update the safety element to include information identifying residential developments in hazard areas that do not have at least 2 emergency evacuation routes.
- AB 747 - Upon the next revision of a local hazard mitigation plan on or after January 1, 2022, cities required to review and update the safety element as necessary to identify evacuation routes and their capacity, safety, and viability

under a range of emergency scenarios. The bill would authorize a city or county that has adopted a local hazard mitigation plan, emergency operations plan, or other document that fulfills commensurate goals and objectives to use that information in the safety element to comply with this requirement by summarizing and incorporating by reference that other plan or document in the safety element.

4. Next steps

- Complete final draft plan and submit to CalOES by Thanksgiving
- Respond to CalOES comments and submit to FEMA
- Council adoption following FEMA approval

5. Other updates

Next meeting: November 17, 2021



Appendix B Public Outreach

June 2022

Around the Island: Future disasters and what the City is doing to reduce their impact

Alameda Journal

November 19, 2021

The City of Alameda's award-winning Climate Action & Resiliency Plan sets the ambitious goal of reducing dangerous carbon emissions by 50 percent below the level they were in 2005 by 2030, through equitable improvements in transportation, buildings, energy use, and waste management.

The City is now updating its Climate Adaptation & Hazard Mitigation Plan, which addresses the hazards of earthquakes, floods, sea level and groundwater rise, tsunamis, heat, smoke, power outages, and dam failure inundation. To help share this work with you, I talked with Danielle Mieler, the City's Sustainability and Resilience Manager. Here's a summary of the draft plan, with more information online at www.alamedaca.gov/hazardmitigationplan.

What hazards are of the greatest concern for Alameda residents and businesses?

Earthquakes and sea level rise are the two hazards with the highest likelihood for consequences in Alameda. We know that an earthquake could occur at any time on a nearby fault and would result in significant damage to many of Alameda's older buildings and infrastructure.

Sea level rise is a slower-moving disaster, but its consequences for Alameda are huge. We anticipate that without significant efforts to curb greenhouse gas emissions, water levels could be 3.5 feet higher than they are today by 2070 and reach 6 to 7 feet by 2100. This would cause significant permanent flooding of our shoreline while rising groundwater will cause flooding in the interior of the island.

What is the City doing to prepare for these disasters?

As an island community, preparing for disasters is a citywide priority. We've prepared buildings with seismic retrofits, requiring gas shut-off valves, and upgrading air filtration systems at our libraries and the Mastick Senior Center to serve as Cooling/Clean Air Centers on hot and smoky days.

We've prepared our infrastructure, including evaluating and upgrading all estuary crossings, upgrading the Ballena Bridge, constructing a new Emergency Operations Center and Fire Station #3, and purchasing two water tenders capable of pulling water from the Bay to fight fires.

We've prepared policies that regulate construction in flood zones, require owners of soft-story apartment buildings to have their buildings seismically evaluated with automatic gas shut-off valves installed (so far 164 of 222 apartment buildings in Alameda have been retrofitted), and we continue to provide home upgrade grants to low-income property owners and property owners that rent to low-income tenants.

We've prepared plans including tsunami inundation evacuation and emergency response plans, an update to the Health and Safety Element of the General Plan, and the draft Climate Adaptation & Hazard Mitigation Plan, with more than 40 strategies to prepare Alameda for disasters.

What can residents do to prepare their homes and families for disasters?

To help prevent damage and keep your household safe, secure movable items in your space, secure or remove brick chimneys, anchor gas appliances, store food and water, and subscribe to AC Alerts, which is how the City will contact you in an emergency, at www.acalert.org. Homeowners can also apply for a seismic retrofit grant at www.earthquakebracebolt.com.

What about in the event of a tsunami in Alameda?

Alameda's most significant tsunami risk comes from distant earthquakes (for example, off the coast of Alaska), which would not damage the transportation network here in Alameda. Recently updated tsunami maps show that while the probability of a tsunami impacting Alameda is low, the risk of damage could be high. If there is a tsunami with the need to evacuate residents, the City and Alameda County will work together to issue warnings that alert the public about what to do to stay safe.

We know that Central Avenue is the highest point in Alameda, and community members would be encouraged to walk or bicycle to the center part of the main island or drive/bike beyond I-880. Community members west of Grand Street would exit through the tubes, and east of Grand Street would exit over Park Street, Miller-Sweeney (Fruitvale), and the High Street Bridge. Bay Farm Island would exit via Doolittle or Ron Cowan Parkway by car or bus. Community members on Bay Farm Island can also bicycle or walk to the main island. A small tsunami could be caused by a local earthquake. If community members feel a strong earthquake, they should immediately evacuate the beaches and marinas and move inland.

Please visit the website to learn more and to sign up to stay engaged in this work at www.alamedaca.gov/hazardmitigationplan.

City of Alameda Climate Adaptation and Hazard Mitigation Plan

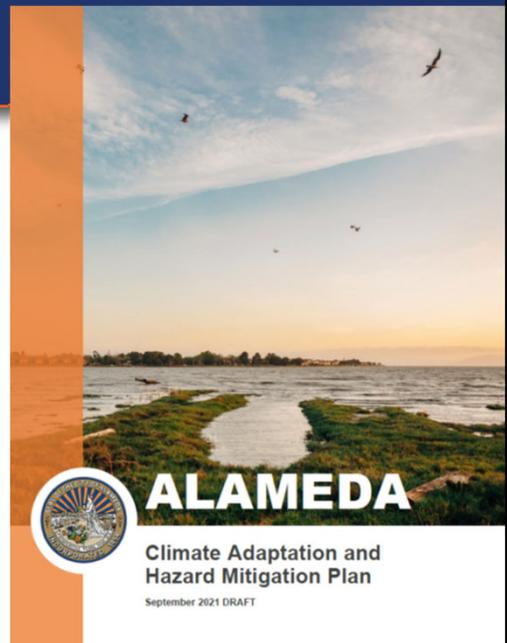
Community Meeting
September 2021



1

Climate Adaptation and Hazard Mitigation Plan

- Addresses natural and climate induced hazards that impact the City of Alameda
- Lays out a strategy for mitigating natural hazards and adapting to a changing climate.
- Success of the plan closely tied with our ability to meet CARP goals to reduce greenhouse gas emissions



ALAMEDA

Climate Adaptation and
Hazard Mitigation Plan

September 2021 DRAFT

2

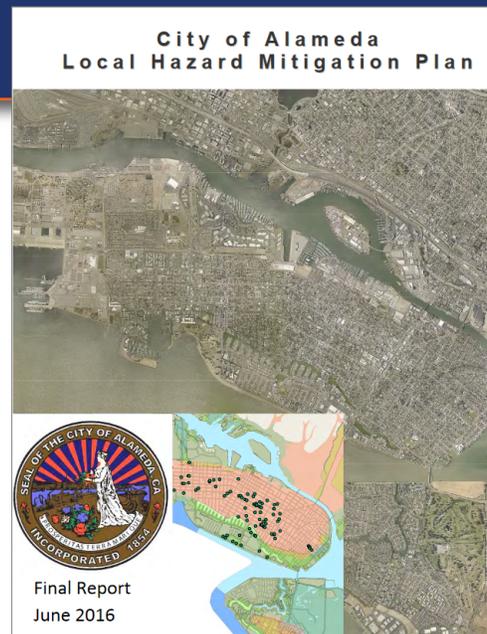
Benefits of an Approved Plan

- Create a more disaster-resistant and resilient community
- Eligibility for hazard mitigation assistance programs
- Eligibility for points under the National Flood Insurance Programs Community Rating System (CRS)
- Eligibility for waiver of the 6.25% local match for Public Assistance money after a disaster (if adopted as part of the General Plan Safety Element).



Current Plan

- Local Hazard Mitigation Plan
FEMA Approved November 2016
- Must be updated every 5 years



Alignment with Other Plans

- General Plan Safety Element
- Climate Action and Resiliency Plan (CARP)
 - Adaptation chapter
- Emergency Management Plan



Natural Hazards Considered

Hazard	Likelihood	Consequence
Earthquakes	Likely	Catastrophic
Flooding from storms	Likely	Moderate to Catastrophic
Sea level rise	Likely	Catastrophic
Tsunamis	Possible	Moderate to Catastrophic
Heat	Likely	Moderate
Drought	Likely	Moderate
Wildfire-related hazards (smoky air, PSPS)	Likely	Moderate
Dam breach inundation	Unlikely	Moderate

Hazards NOT considered in the plan

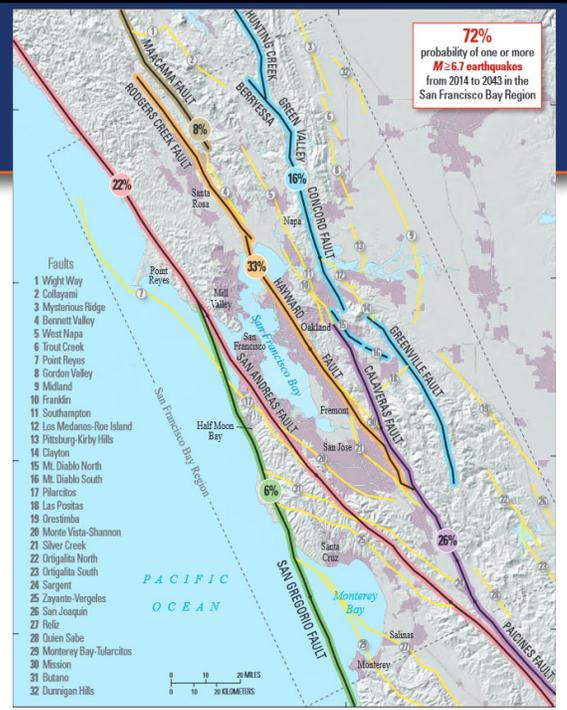
- Pandemics
- Terrorism
- Cold weather
- Large urban fires (except related to earthquakes)
- Energy shortages
- Hazardous materials release



Earthquakes



7



Soft-Story Buildings

- 70% of 5+ unit buildings voluntarily retrofitted
- 63 buildings with ~1,000 units remain vulnerable
 - Grants available for low income owners/tenants
- Include 3-4 unit buildings: up to 850 more with 3,000 units



8

Single Family Homes and Duplexes

- “cripple wall” or living spaces over garage vulnerable to damage in earthquakes
- 10,600 pre-1980 single family homes
- 600-900 retrofitted or completed basement digouts
- California Earthquake Authority’s **Brace and Bolt Program** provides grants to retrofit single-family homes and duplexes –
 - **Opens October 27, 2021**



9

Newly constructed buildings

- Buildings built to modern building codes (after early 1990s) are designed to protect lives and not collapse in a major earthquake.
 - Does NOT ensure buildings will be safe to re-occupy.
- An additional 1% in construction cost to build new buildings to a “functional recovery standard” could increase the availability of homes and businesses by 75-95% following a major earthquake.



10

Chimneys and Gas Shut-off Valves

- Chimneys can break off at the roofline and fall inside or outside the house, potentially damaging the structure and injuring or killing occupants
- 2,794 permits issued for gas shut-off valves
 - Required at time of sale, title transfer, with plumbing permit
- New construction required to be gas-free starting in 2021, with some exceptions.



Highlighted Earthquake Strategies

B1. Soft-Story Buildings Program*	Expand the City's Soft Story Program to include mandatory retrofit requirements
B2. Wood Framed Buildings Program*	Educate residents about the City's Wood Frame Building Program to substantially improve the seismic performance of one- and two-story wood frame residential buildings. Encourage residents to take advantage of the California Earthquake Authority's Earthquake Brace and Bolt Program grants and other financial assistance programs.
B3. Resilient City Buildings*	Strengthen and rehabilitate City-owned buildings
B8. Concrete Buildings	Develop a program to identify, evaluate and require seismic retrofits of non-ductile concrete and tilt up residential and nonresidential buildings that are vulnerable to collapse in earthquakes.
N3. Disaster Debris Plan and Agreement	Complete the City's Disaster Debris Plan for review by the California Office of Emergency Services (CalOES), and establish relationships with contractors and haulers who will be able to bid on very short notice if needed.
N4. Emergency Fuel Agreements	Work with FEMA to arrange for emergency fuel delivery and generators at key locations. Work with local fuel suppliers to ensure fuel delivery during emergency events. Consider developing microgrids to provide some level of continuous power during outages and emergencies.
I5. Mutual Aid Utility Repair Agreements	Participate in and foster in General Mutual Aid Agreements.

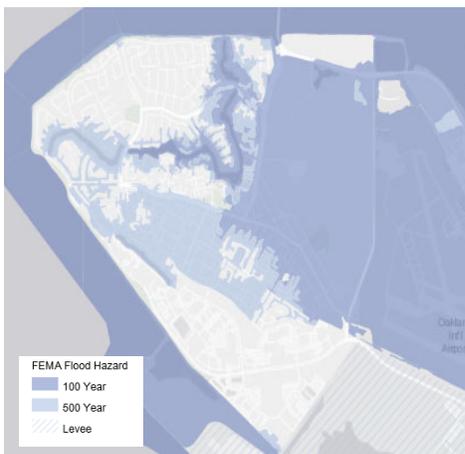


Floods



13

Floods

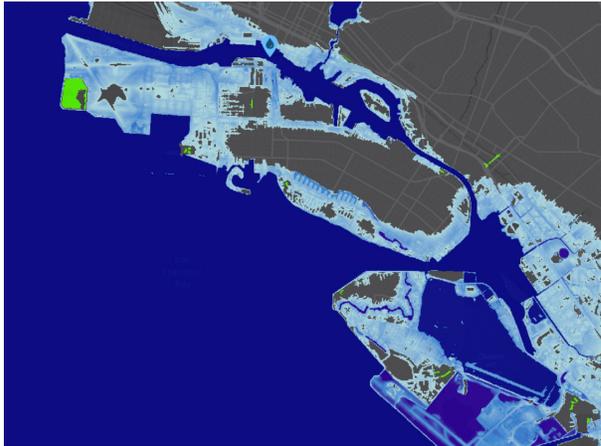


- FEMA published flood insurance rate maps (FIRMS) in 2018
 - ~2,000 properties and at least 1,100 buildings mapped within the 100-yr flood zone
- Alameda is currently designated as a Class 8 community within CRS and homeowners receive a 10% discount on flood insurance
- 10 flood loss claims in Alameda since 1970 with \$30,865 in losses.

14



Sea Level Rise



Plan for at least 3.5' of sea level rise by 2070 in addition to 100-year storm (3.5')

- OPC 2018 “Medium-High Risk Aversion, high emissions” scenario



Groundwater Rise

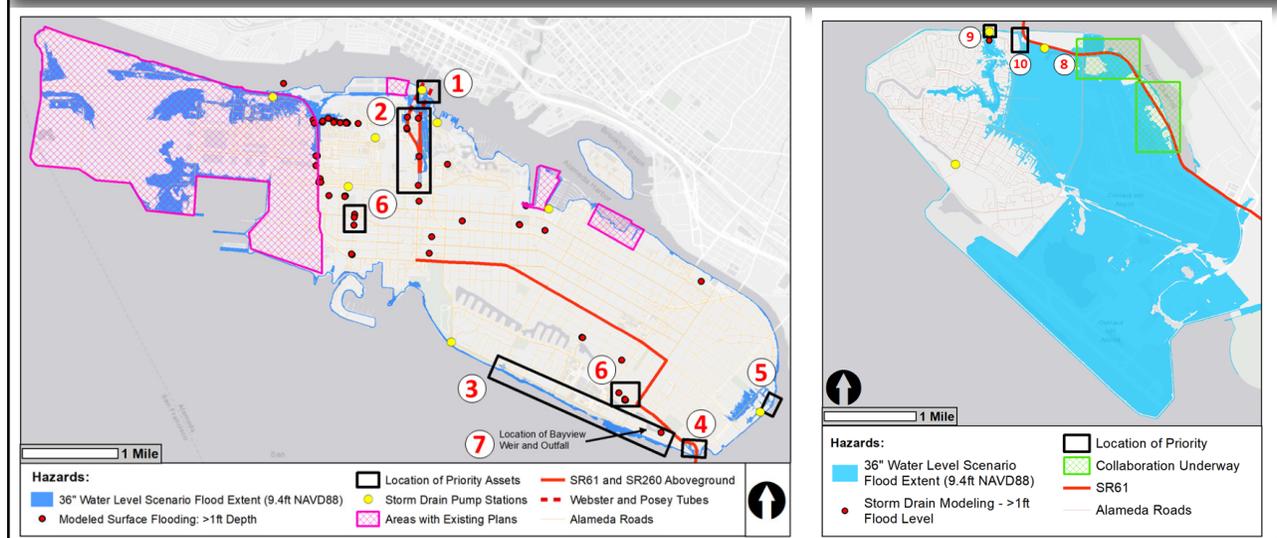


Figure 4.4 Emergent Groundwater with 36" of Sea Level Rise

N6. Incorporate Groundwater Study in the Climate Action and Resiliency Plan	Include information about rising groundwater surface and the potential for contaminant mobilization into CARP analysis of priority locations for adaptation.
N7. Refine Groundwater Model	Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model



Priority Flooding Locations



Highlighted Flood/SLR Strategies

B4. National Flood Insurance Program*	Continue the City's participation in the National Flood Insurance Program
B5. Community Rating System*	Continue participation in Community Rating System (CRS) as a Class 8 community
B6. Resilient Shoreline Facilities	Make shoreline facilities more resilient to earthquake, storm and sea level rise hazard to maintain functionality and to protect inland facilities, community vitality and recreational opportunities.
I1. Resilient Sanitary Sewer Service	Protect vulnerable wastewater system and facilities to minimize disruption to the systems following ground shaking and extreme weather events.
I2. Resilient Stormwater Conveyance Service	Rehabilitate the existing storm system conveyances and pump stations to increase capacity and resilience during storms, high tides, sea level rise, seismic events, and power outages, thereby decreasing the chance of flooding of nearby streets, utilities, and buildings.
I3. Reduced Stormwater Runoff	Modify urban landscaping requirements and increase permeable surfaces to reduce stormwater runoff, thereby decreasing the chances of flooding and system overloading.
I4. Resilient Electrical Service	Protect vulnerable electric systems and facilities and build resiliency so disruption to the system is minimized following ground shaking, extreme weather events and wildfires.
I7. Northern Shoreline on Bay Farm Island Adaptation	Develop shovel-ready shoreline project at Veterans Court seawall.



Highlighted Flood/SLR Strategies

18. Doolittle Drive Adaptation	Work with Caltrans, Port of Oakland, City of Oakland, East Bay Regional Parks District and other key stakeholders create project concept to mitigate flooding and sea level rise, to provide additional capacity for tsunami evacuation, and to enhance adjacent shoreline habitat with nature-based solutions and recreational opportunities on the San Francisco Bay Trail.
19. Northern Shoreline near Posey/Webster Tubes Adaptation	Work with Caltrans, City of Oakland and other key stakeholders to create a project concept that combats flooding and sea level rise in the Oakland-Alameda Estuary.
110. Shovel-ready Adaptation projects	Design and permit shovel-ready adaptation projects at areas of location-based priority flooding.
N13. Citywide Sea Level Rise Adaptation Plan	Develop a comprehensive citywide sea level rise adaptation strategy for Alameda identifying the range of shoreline protection, groundwater management, land use, and building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels and fill critical information gaps related to shoreline condition, jurisdiction and approach to ensure uniform protection for the city and to create additional shovel-ready adaptation projects or programs.



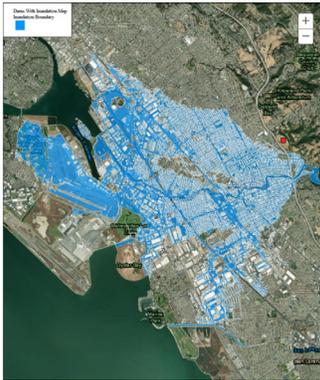
Tsunami



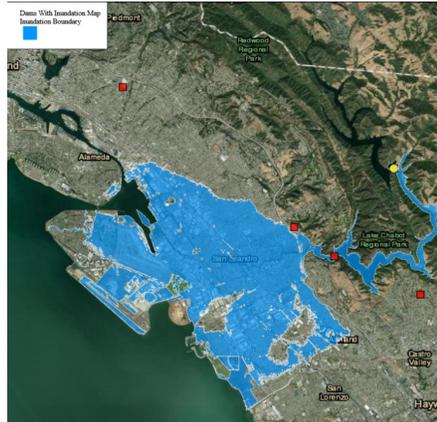
N5. Tsunami Inundation Zone and Evacuation Route Sign Placement	Reduce the risk tsunami inundation presents to Alameda community members with sign placement.
N8. Tsunami Evacuation Planning	Partner with City of Oakland and Port of Oakland to plan for tsunami evacuation
N9. Tsunami Education	Conduct tsunami evacuation training and drills with schools
N10. Tsunami Ready	Become a Tsunami Ready city
N11. Emergency Transportation Planning*	Continue to work with AC Transit and WETA to ensure coordinated services in the event of the need for evacuation.



Dam Failure



Chabot Dam Inundation Map

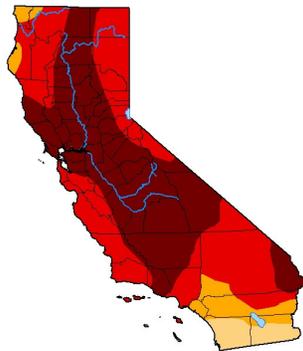


Upper San Leandro Dam Inundation Map

- Owned by EBMUD
- Chabot dam underwent seismic retrofit in 2017
- The earthen USL Dam was evaluated and not determined to need seismic upgrades
- Complete failure and inundation highly unlikely

Drought

U.S. Drought Monitor California



August 24, 2021
(Released Thursday, Aug. 26, 2021)
Valid 8 a.m. EDT

Intensity:
 None
 D0 Abnormally Dry
 D1 Moderate Drought
 D2 Severe Drought
 D3 Extreme Drought
 D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <http://droughtmonitor.unl.edu/About.aspx>

Author:
Curtis Riganti
National Drought Mitigation Center

USDA
droughtmonitor.unl.edu

- More frequent and severe droughts anticipated
- The 2013–2016 drought resulted in the most severe moisture deficit in 1,200 years.
- The primary impact in Alameda loss of, or decreased health of, trees
- Currently “Exceptional Drought” conditions
- Gov Newsome has called for 15% reductions in water use; in July customers had cut 1.8%
- Alameda will continue water conservation programs and drought resistant landscaping programs.



Heat, Smoky Air and PSPS

- Extreme heat events expected to increase in both severity due to climate change.
- Wildfires becoming increasingly frequent and intense.
- Smoke from wildfires occurring outside the region increasingly impact public health in Alameda
- Alameda has not yet been affected by PSPS outage, but could be in the future
- Alameda will continue working with Alameda County on community outreach during emergencies.



Clean Air and Cooling Centers





The West End Library is Preparing for Climate Change

New AC and Air Filtration

The library is currently upgrading its air conditioning and filtration systems. With this upgrade the library can serve as a cooling and clean air center on hot and smoky days.

Cooling Center Location

With the library's air conditioning and air filtration upgrades it can serve as a cooling and clean air center on hot days and offer the public some time away from the heat.

Electric Heating Units

The library has switched its gas powered furnace and water heater to electric. This change helps meet the city's Green House Gas reduction goals and lessens the need for natural gas.

Learn the Benefits of Switching to Electric!

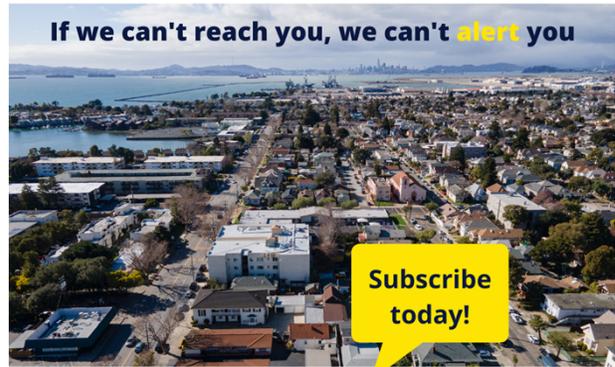


Scan this QR code or visit
<https://www.alamedamp.com/164/Rebates-Incentives>
to learn the benefits of switching your home to electric!



Personal Preparedness Resources

- Learn which hazards impact you at myhazards.caloes.ca.gov/
 - Join the [Community Emergency Response Team](#)
 - Check if your apartment is listed as a [soft-story building](#)
 - [Secure movable items](#) in your space, including furniture, appliances, water heaters
 - [Secure or remove brick chimneys](#)
 - [Prevent natural gas leaks](#)
 - Consider earthquake and flood insurance
- Visit: alamedaca.gov/hazardmitigationplan



www.acgov.org/emergencysite

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Next Steps

- Review draft plan at alamedaca.gov/hazardmitigationplan
- Email your comments and questions by **Nov 4** to: dmieler@alamedaca.gov
- Take the community survey tinyurl.com/6ebxfhj
- Boards and Commissions
 - Sept 27: Planning Board
 - Oct 13: Commission on Persons with Disabilities
 - Oct 18: Public Utilities Board
 - Oct 27: Transportation Commission
 - Oct 28: Social Service and Human Relations Board
 - Oct 28: Alameda Collaborative for Children, Youth and their Families
 - Nov 4: Historical Advisory Board
- City Council adoption following FEMA provisional approval



Discussion Questions

- What hazards most concern you?
- What preparedness steps would you most like to take next? What assistance do you need?
- What do you think are the most important steps for the City to take to prepare for future hazards?



27

Unreinforced Masonry (URM) Buildings

- 100% required URM buildings retrofitted or demolished
- 10 additional buildings voluntarily retrofitted or are being upgraded as part of redevelopment
- Residential structures <5 units, buildings with low occupancy, warehouses exempted
- Retrofits designed to “reduce the risk of loss of life or injury”, but many will still sustain damage in future earthquakes



Retrofitted URM building



28

Utilities and Infrastructure

- Buried infrastructure susceptible to damage from liquefaction
- May take weeks to months to restore service in some locations

29



San Leandro Bay/Oakland-Alameda Estuary Adaptation Working Group

30



Possible funding options

- Stormwater fee
- Grants
- Revenue measure





Subscribe to updates from City of Alameda

Email Address e.g.
name@example.com

Share Bulletin



Share your thoughts on Alameda's Climate Adaptation and Hazard Mitigation Plan

City of Alameda sent this bulletin at 09/09/2021 08:28 AM PDT

Having trouble viewing this email? [View it as a Web page.](#)



Share your thoughts on Alameda's Climate Adaptation and Hazard Mitigation Plan!



The City of Alameda is in the process of drafting its Climate Adaptation and Hazard Mitigation Plan and we want to hear from you!

The Climate Adaptation and Hazard Mitigation Plan:

- describes the natural and climate hazards that impact Alameda's people, buildings, businesses and assets;
- identifies our vulnerability to those hazards, and;
- describes actions to reduce our risk from these hazards.

The Federal Emergency Management Agency (FEMA) requires local governments to update their Local Hazard Mitigation Plan every five years. This plan updates both Alameda's [2016 Local Hazard Mitigation Plan](#) and the adaptation chapter of the [2019 Climate Action and Resiliency Plan \(CARP\)](#).

Take the online survey.

The [community survey](#) is open through September 30. Let your friends and neighbors know!

Review the draft plan.

The [draft plan](#) is available online. Please send your comments and questions to dmieler@alamedaca.gov.

Come to a virtual community meeting.

Come share your opinions and comments on the draft Plan at one of three virtual community meetings:

- Thursday, September 16, 6-7 pm

- Wednesday, September 22, 12-1 pm
- Tuesday, September 28, 7-8 pm

[Find the Zoom and phone access information here.](#)

Contact us

dmieler@alamedaca.gov

<https://www.alamedaca.gov/HazardMitigationPlan>

You are receiving this because you either responded to the Hazard Mitigation and Climate Adaptation community survey, or you are signed up for the General Resilience mailing list.

Stay Connected with the [City of Alameda](#):



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Meeting tonight on Alameda's Climate Adaptation and Hazard Mitigation Plan

City of Alameda sent this bulletin at 09/16/2021 09:52 AM PDT



Virtual community meeting tonight

The first community meeting on the draft Climate Adaptation and Hazard Mitigation Plan is tonight. Come share your opinions and comments on the draft Plan at one of three virtual community meetings:

- Thursday, September 16, 6-7 pm
- Wednesday, September 22, 12-1 pm
- Tuesday, September 28, 7-8 pm

[Find the Zoom and phone access information here.](#)

Take the online survey

The [community survey](#) is open through September 30. Please respond and let your friends and neighbors know!

Review the draft plan

The [draft plan](#) is available online. Please send your comments and questions to dmieler@alamedaca.gov.

Prepare your family and business

It's everyone's responsibility to be prepared for disasters. Take action today to

prepare your family and business for disasters.

- [Learn which hazards impact you](#). Enter an address to view earthquake, flood, and tsunami hazards in the vicinity.
- [Join CERT](#), The Community Emergency Response Team and learn disaster-related skills.
- Subscribe to [AC ALERT](#) to receive important or emergency notifications from the City and County of Alameda.
- Retrofit your home. The [California Earthquake Authority](#) provides up to \$3,000 grants for qualified retrofits.
- Check if your apartment is listed as a [soft-story building](#) that is vulnerable to damage in an earthquake.
- [Secure movable items](#) in your space, including furniture, appliances, water heaters
- [Secure or remove brick chimneys](#).
- [Prevent natural gas leaks in your home](#).
- Consider [earthquake insurance](#) for homeowners, condo owners, and renters.

About the Plan

The City of Alameda is in the process of drafting its Climate Adaptation and Hazard Mitigation Plan to prepare for hazards facing the city, including: earthquakes, floods, sea level rise, tsunamis, heat, drought, smoky air, PSPS outages, and dam failure inundation.

The Climate Adaptation and Hazard Mitigation Plan:

- describes the natural and climate hazards that impact Alameda's people, buildings, businesses and assets;
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The Federal Emergency Management Agency (FEMA) requires local governments to update their Local Hazard Mitigation Plan every five years. This plan updates both Alameda's [2016 Local Hazard Mitigation Plan](#) and the adaptation chapter of the [2019 Climate Action and Resiliency Plan \(CARP\)](#).

Contact us

dmieler@alamedaca.gov

<https://www.alamedaca.gov/HazardMitigationPlan>

You are receiving this because you either responded to the Climate Adaptation and Hazard Mitigation community survey or you are signed up for the Resilience mailing list.

TONIGHT: Last Community Meeting for Climate Adaptation and Hazard Mitigation Plan

City of Alameda sent this bulletin at 09/27/2021 10:23 AM PDT



Last virtual community meeting tonight

The last virtual community meeting for the draft Climate Adaptation and Hazard Mitigation Plan is tonight. Come share your opinions and comments on the draft plan tonight, September 27th at 7pm. [Find the Zoom and phone access information here.](#)

Take the online survey

The [community survey](#) about disaster preparedness is open through September 30th. Please respond and let your friends and neighbors know!

Attend a board and commission meeting

Staff will present the draft plan and receive feedback at several upcoming board and commission meetings. Meeting agendas and zoom links can be found [here](#).

- Sept 22: Planning Board
- Oct 13: Commission on Persons with Disabilities
- Oct 18: Public Utilities Commission

- Oct 27: Transportation Commission
- Oct 28: Social Service and Human Relations Board
- Oct 28: Alameda Collaborative for Children, Youth and their Families
- Nov 4: Historical Advisory Board

Review the draft plan

[The draft plan is available online.](#) Please send your comments and questions to dmieler@alamedaca.gov.

Prepare your family and business

It will take everyone working together to respond to the challenge of climate change and natural hazards and promote a healthier and more sustainable Alameda.

The City of Alameda's highest priority is the safety of its residents, but when disaster strikes being personally prepared will lessen the impact on your family. As a resident, there is a lot you can do now to prepare for disasters!

- [Learn which hazards impact you.](#) Enter an address to view earthquake, flood, and tsunami hazards in the vicinity.
- [Join CERT](#), The Community Emergency Response Team and learn disaster-related skills to help your neighbors.
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dmieler@alamedaca.gov

<https://www.alamedaca.gov/hazardmitigationplan>

You are receiving this because you either responded to the Climate Adaptation and Hazard Mitigation Plan community survey, or you are signed up for the [Environment, Sustainability and Climate Action mailing list](#).

CORRECTION: Last Community Meeting for Climate Adaptation and Hazard Mitigation Plan

City of Alameda sent this bulletin at 09/27/2021 10:43 AM PDT



Correction: Last virtual community meeting TOMORROW

CORRECTION: The last virtual community meeting for the draft Climate Adaptation and Hazard Mitigation Plan is tomorrow. Come share your opinions and comments on the draft plan tomorrow, September 28th at 7pm. [Find the Zoom and phone access information here.](#) There is no community meeting tonight as previously stated. There is however a Planning Board meeting on the draft plan tonight at 7pm. [You can find details and how to join the Planning Board meeting here.](#) Questions? email dmieler@alamedaca.gov or call 510-747-4713.

Take the online survey

The [community survey](#) about disaster preparedness is open through September 30th. Please respond and let your friends and neighbors know!

Attend a board and commission meeting

Staff will present the draft plan and receive feedback at several upcoming board and commission meetings. Meeting agendas and zoom links can be found [here](#).

- Sept 27: Planning Board
- Oct 13: Commission on Persons with Disabilities
- Oct 18: Public Utilities Commission
- Oct 27: Transportation Commission
- Oct 28: Social Service and Human Relations Board
- Oct 28: Alameda Collaborative for Children, Youth and their Families
- Nov 4: Historical Advisory Board

Review the draft plan

[The draft plan is available online](#). Please send your comments and questions to dmieler@alamedaca.gov.

Prepare your family and business

It will take everyone working together to respond to the challenge of climate change and natural hazards and promote a healthier and more sustainable Alameda.

The City of Alameda's highest priority is the safety of its residents, but when disaster strikes being personally prepared will lessen the impact on your family. As a resident, there is a lot you can do now to prepare for disasters!

- [Learn which hazards impact you](#). Enter an address to view earthquake, flood, and tsunami hazards in the vicinity.
- [Join CERT](#), The Community Emergency Response Team and learn disaster-related skills to help your neighbors.
- Subscribe to [AC ALERT](#) to receive important or emergency notifications from the City and County of Alameda.
- Check if your apartment is listed as a [soft-story building](#) that is vulnerable to damage in an earthquake.
- [Secure movable items](#) in your space, including furniture, appliances, water heaters
- [Secure or remove brick chimneys](#).
- [Prevent natural gas leaks in your home](#).
- Consider [earthquake insurance](#) for homeowners, condo owners, and renters.

About the plan

The City of Alameda is in the process of drafting its Climate Adaptation and Hazard Mitigation Plan to prepare for hazards facing the city, including: earthquakes, floods, sea level rise, tsunamis, heat, drought, smoky air, PSPS outages, and dam failure inundation.

The Climate Adaptation and Hazard Mitigation Plan:

- describes the natural and climate hazards that impact Alameda's people, buildings, businesses and assets;
- identifies our vulnerability to those hazards, and;

- describes actions to reduce our risk from these hazards.

The Federal Emergency Management Agency (FEMA) requires local governments to update their Local Hazard Mitigation Plan every five years. This plan updates both Alameda's [2016 Local Hazard Mitigation Plan](#) and the adaptation chapter of the [2019 Climate Action and Resiliency Plan \(CARP\)](#).

Contact us

dmieler@alamedaca.gov

<https://www.alamedaca.gov/hazardmitigationplan>

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Sustainability and Resilience News

City of Alameda sent this bulletin at 10/28/2021 01:32 PM PDT

Having trouble viewing this email? [View it as a Web page.](#)



Sustainability and Resilience News



photo credit: Maurice Ramirez

Earthquake Retrofit Rebates



Get up to \$3,000 to strengthen your foundation

Earthquake Brace + Bolt (EBB) helps homeowners lessen the potential for damage during an earthquake. Sign up by **December 1** to receive a grant of up to \$3,000 for a seismic retrofit. [Earthquake Brace + Bolt](#) is open to owner-occupied single-family residences and small multifamily buildings (2-4 units) in Alameda and other eligible zip codes. Qualifying applicants will be entered into a lottery for the funding. For the first time, additional grant funding will also be available to households whose annual incomes are at or below \$72,080. Sign up [online](#) or by calling (877) 232-4300.



Alameda's [Residential Rehabilitation Program](#) also provides grants for low income homeowners to upgrade their home for earthquakes and other health and safety conditions, remediate lead-based paint hazards, extend energy conservation measures, and/or to repair or replace major systems in danger of failure.

Share your thoughts on Alameda's Climate Adaptation and Hazard Mitigation Plan

The City of Alameda is planning for flooding, sea level rise, earthquakes and other natural and climate-induced hazards. The draft [Climate Adaptation and Hazard Mitigation Plan](#) is available online. Please send your comments and questions to dmieler@alamedaca.gov or attend an upcoming board or commission meeting:

- Social Services and Human Relations Board, 7pm TONIGHT
- Historical Advisory Board, 7pm on November 4th

[Find meeting agendas and zoom link here.](#)

Go Solar with SunShares



Did you know that with home battery storage, you can keep the lights on even during power outages? And did you know that with solar panels and electrification, you can heat your water, charge your car, and cook your meals using your own solar electricity?

Join us for the Bay Area SunShares Webinar on November 8th @5:30pm! Register [here](#) to attend and visit

www.bayareasunshares.org to learn more about clean energy options. Explore additional rebates and incentives for AMP customers [here](#).

If you're thinking about going solar + storage, Bay Area SunShares makes it easy and affordable to take action. SunShares works in partnership with pre-vetted local solar installers to provide a 15% discount on solar and a 10% discount on battery storage.

Contact us

dmieler@alamedaca.gov

<https://www.alamedaca.gov/resiliency>

You are receiving this because you either responded to the Hazard Mitigation and Climate Adaptation community survey, or you are signed up for the Environment, Sustainability and Climate Action mailing list.

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CITY OF ALAMEDA & YOUR HOME

ARE **VULNERABLE TO** :

阿拉米达市和您
的家容易受到以
下天灾的**影响**：

CITY OF ALAMEDA & YOUR HOME

ARE **VULNERABLE TO** :

EARTHQUAKES
FLOODS
TSUNAMIS

地震
洪水
海啸

EARTHQUAKES
FLOODS
TSUNAMIS

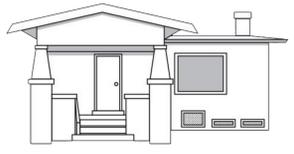
LEARN ABOUT
WHAT THE CITY IS DOING &
WHAT YOU CAN DO IN
YOUR OWN HOME

了解**市政府正在**
做的事情以及
您**在自己家中**
可以做的事情

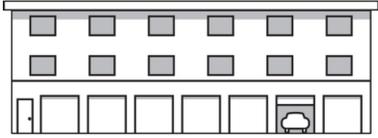
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WHAT YOU CAN DO IN
YOUR OWN HOME



EARTHQUAKE VULNERABLE STRUCTURES:



Home with crawl space/
raised foundation

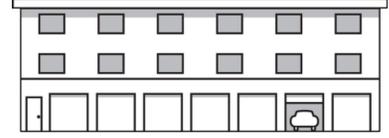


Soft story building

容易因地震而损结构:

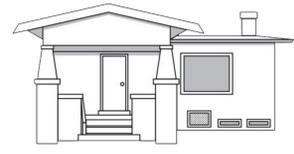


地板下面有供电线或
水管等通过的槽隙空
间的房屋

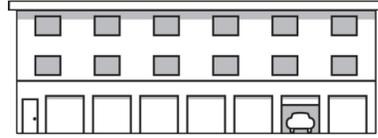


软层建筑

EARTHQUAKE VULNERABLE STRUCTURES:



Home with crawl space/
raised foundation



Soft story building

PREPARE FOR EARTHQUAKES, FLOODS, AND TSUNAMIS

- Learn hazards specific to your address, visit myhazards.caoes.ca.gov
- Learn to strengthen your home, visit californiaresidentialmitigationprogram.com
- Apply for earthquake retrofit grant starting Oct. 27, visit earthquakebracebolt.com
- Subscribe to AC Alert, visit acgov.org/emergencysite
- Consult your insurance about earthquake and flood insurance
- Learn your tsunami evacuation route

Learn about City of Alameda's Climate Adaptation and Hazard Mitigation Plan.
Visit www.alamedaca.gov/HazardMitigationPlan

为地震、洪水和 海啸做好准备

- 了解您所在地区的具体伤害，请访问 myhazards.caoes.ca.gov
- 了解如何加固您的房屋，请访问 californiaresidentialmitigationprogram.com/?locale=zh
- 从10月27日开始申请防地震改造补助，请访问 earthquakebracebolt.com/Chinese
- 订阅 AC 警报 (AC Alert)，请访问 acgov.org/emergencysite
- 咨询您的保险商关于地震和洪水保险的情况
- 了解您的海啸疏散路线

了解阿拉米达市的气候适应和灾害缓解计划。请访问 www.alamedaca.gov/HazardMitigationPlan

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**CITY OF ALAMEDA &
YOUR HOME**

ARE VULNERABLE TO :

**EARTHQUAKES
FLOODS
TSUNAMIS**

**LA CIUDAD DE ALAMEDA
Y SU HOGAR SON
SUSCEPTIBLES DE
SUFRIR:**

**SISMOS
INUNDACIONES
TSUNAMIS**

**CITY OF ALAMEDA &
YOUR HOME**

ARE VULNERABLE TO :

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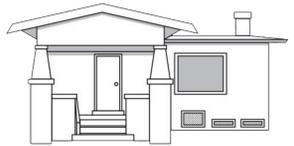
**LEARN ABOUT
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WHAT YOU CAN DO IN
YOUR OWN HOME**

**CONOZA LO QUE LA CIUDAD
ESTÁ HACIENDO Y LO QUE
USTED PUEDE HACER EN SU
HOGAR**

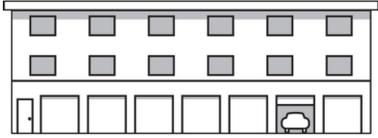
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EARTHQUAKE VULNERABLE STRUCTURES:



Home with crawl space/
raised foundation

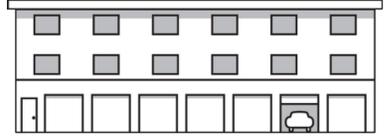


Soft story building

ESTRUCTURAS VULNERABLES ANTE SISMOS:

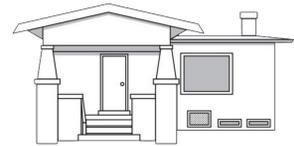


Hogares con semisótanos

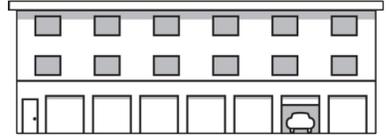


Edificación de piso
blando

EARTHQUAKE VULNERABLE STRUCTURES:



Home with crawl space/
raised foundation



Soft story building

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- Learn your tsunami evacuation route

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Visit

www.alamedaca.gov/HazardMitigationPlan

PREPÁRESE PARA TERREMOTOS, INUNDACIONES Y TSUNAMIS

- Para conocer los riesgos específicos de su dirección, visite myhazards.caoes.ca.gov
- Para conocer cómo fortalecer su hogar, visite californiaresidentialmitigationprogram.com/?locale=es
- Solicite una subvención para actualización contra sismos a partir del 27 de octubre en earthquakebracebolt.com/Espanol
- Suscríbese a AC Alerta (AC Alert) en acgov.org/emergencysite
- Consulte a su proveedor de seguro sobre seguros contra sismos e inundaciones
- Conozca su ruta de evacuación de tsunami

Conozca el Plan de adaptación climática y mitigación de riesgos de la Ciudad de Alameda.

Visite

www.alamedaca.gov/HazardMitigationPlan

PREPARE FOR EARTHQUAKES, FLOODS, AND TSUNAMIS

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Visit

www.alamedaca.gov/HazardMitigationPlan



Alameda is updating its Climate Adaptation and Hazard Mitigation Plan and needs your input!

The Climate Adaptation and Hazard Mitigation Plan outlines steps to improve Alameda's resilience to natural and climate change related hazards.

We need your input for the plan to be successful!

Use the QR codes on the back to learn more about the plan and take a quick 5 minute survey to help shape the Plan.

**Scan this QR code to learn more about
the Climate Adaptation and Hazard
Mitigation Plan**

**And get Involved by attending a virtual
community meeting:**

**Thursday, September 16, 6-7 pm
Wednesday, September 22, 12-1 pm
Tuesday, September 28, 7-8 pm**



**Scan this QR code to
take the survey**



For more info, open the camera app on your device and hover over the QR code or
visit www.alamedaca.gov/HazardMitigationPlan



Appendix C Community Survey

June 2022

2021 Hazard Mitigation and Adaptation Plan

Your input will help shape Alameda's Hazard Mitigation and Climate Adaptation Plan.

1. Which hazards are you most concerned about in Alameda? (select up to 5)

- Drought
- Earthquake
- Extreme heat
- Flood
- Sea level rise
- Severe storm
- Tsunami
- Smoky air and power outages from wildfires
- Dam breach inundation
- Rising groundwater
- Other

2. How prepared do you feel you and your household are for disasters?

3. What actions have you taken to prepare for disasters? (check all that apply)

- Stored at least 3 days of emergency food and water
- Purchased flood insurance (if in the flood zone)
- Floodproofing (installed sewer backflow valves, elevated furnace, water heaters, electric panels)
- Installed sump pump

- Purchased homeowners/renters earthquake insurance
- Seismic retrofit (with shear walls and foundation bolts)
- Removed brick chimney
- Installed gas shutoff valve
- Braced water heater
- Secured heavy furniture to the wall
- Installed alternate power supply
- Taken CERT training
- None of the above
- Other

5. What is your relationship to Alameda?

- I live in Alameda
- I work, but don't live, in Alameda
- I visit Alameda to shop or dine, but I don't live in Alameda

If you live in Alameda, what neighborhood do you live in?

- West End
- East End
- Central
- Southshore
- BayFarm
- Alameda Point
- Other

6. If you live in Alameda, do you own or rent your residence?

- Own
- Rent
- Not applicable

What is your race and/or ethnicity? (check all that apply)

- American Indian or Alaska Native

- Asian
- Native Hawaiian or other Pacific Islander
- Black or African American
- White
- Hispanic or Latino

Please provide your email if you would like to receive updates about the Hazard Mitigation and Climate Adaptation Plan update.

Please complete the following:

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Appendix D Detailed Asset Inventory

June 2022

Asset Inventory

The following table provides a list of buildings and open space owned by the City of Alameda, as well as other non-city owned buildings that serve critical community functions. The table describes the recovery priority for each building, based on its post-disaster importance for restoring community function. Information is also provided on the seismic retrofit status of each building, if known.

Recovery Priority:

- Critical = Life/Safety issues or needed for recovery within 1 week
- High = Needed for 90% recovery within one month, especially for vulnerable populations
- Moderate = Quick recovery would benefit City's overall recovery, especially for vulnerable populations, but alternatives available
- Low = Needed for property owner's recovery, but alternative available

Soft-Story Buildings

The following table provides a list of buildings identified as soft-story and are vulnerable to damage Alameda's Soft-Story Hazard Reduction Program and have not been seismically retrofitted.

	2050 CENTRAL AVE	2060 SANTA CLARA AVE
	1515 CHESTNUT ST	2241 SANTA CLARA AVE
	1531 CHESTNUT ST	2318 SANTA CLARA AVE
	2045 CLINTON AVE	1557 SHERMAN
	895 LAFAYETTE ST	2019 SHORE LINE DR
	753 LINCOLN AVE	2051 SHORE LINE DR
	2224 LINCOLN AVE	1538 ST CHARLES ST
	1417 NINTH ST	1850 THAU WAY
	431 PACIFIC AVE	1522 VERDI ST
3250 BRIGGS AVE	1583 PACIFIC AVE	1526 VERDI ST
1500 ALAMEDA AVE	1179 PARK AVE	1534 VERDI ST
2128 ALAMEDA AVE	1182 PARK AVE	1548 WEBSTER ST
1455 BAY ST	1190 PARK AVE	424 WHITEHALL
3215 BRIGGS AVE	400 PARK ST	1808-12 CENTRAL AVE
3224 BRIGGS AVE	1364 PARK ST	2149 OTIS DR
3228 BRIGGS AVE	1825 POGGI ST	2225 OTIS DR
470 BUENA VISTA AVE	1152 REGENT ST	
520 BUENA VISTA AVE	2153 SAN ANTONIO AVE	
434 CENTRAL AVE	2236 SAN ANTONIO AVE	
600 CENTRAL AVE	2209 SAN JOSE AVE	
724 CENTRAL AVE	2210 SAN JOSE AVE	
831 CENTRAL AVE	2215 SAN JOSE AVE	
1704 CENTRAL AVE	2236 SAN JOSE AVE	
1715 CENTRAL AVE	2246 SAN JOSE AVE	
1732 CENTRAL AVE	410 SANTA CLARA AVE	
2026 CENTRAL AVE	722 SANTA CLARA AVE	
2037 CENTRAL AVE	757 SANTA CLARA AVE	
2043 CENTRAL AVE	1815 SANTA CLARA AVE	

Alameda Asset Inventory



Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
City Bldg	Animal Shelter	1590 Fortmann	Police/Friends of AAS	Animal Shelter	Critical	No data
City Bldg	Chochenyo Park Bandstand	2430 Encinal Ave	Rec & Park	Bandstand, RR	Low	No data
City Bldg	Maintenance Service Center	1616 Fortmann	Public Works	Corp Yard & Offices	Critical	Elec/Mech retrofit in 2012, no other data
City Bldg	Alameda Municipal Power Office Bldg & Warehouse	2000 Grand St	Alameda Municipal Power	Corp Yard, Offices, MAN Core Site	Critical	Modern construction
City Bldg	Emergency Ops Ctr	1809 Grand St	Fire	EOC	Critical	Modern construction
City Bldg	Fire Station 3	1625 Buena Vista Ave	Fire	Fire Sta & Residence	Critical	Modern construction
City Bldg	Fire Station 1	2401 Encinal Ave	Fire	Fire Sta & Residence	Critical	Reinforced masonry, no data
City Bldg	Fire Station 2	635 Pacific Ave	Fire	Fire Sta & Residence	Critical	Stucco, no data
City Bldg	Fire Station 4	2595 Mecartney Rd	Fire	Fire Sta & Residence	Critical	Modern construction
City Bldg	Fire Station 5, Building 6	950 W Ranger Ave	Fire	Fire Sta only	Critical	Day use only, 1940s concrete bldg, closed in 2009
City Bldg	Building 522, Fire Dept Conf Rm	431 Stardust Place	Fire	Gov't Office	Low	No data
City Bldg	City Hall West	950 West Mall Sq	City Hall	Gov't Offices	Critical	Concrete bldg, elec/mech retrofit 2012, no other data
City Bldg	Recreation & Park Administration Building	2226 Santa Clara Ave	Rec & Park	Gov't Offices	Critical	No data
City Bldg	Central Garage (at City Hall)	2263 Santa Clara Ave	City Hall	Gov't Offices, garage	High	Inspected approx 2010, found to be OK
City Bldg	City Hall	2263 Santa Clara Ave	City Hall	Gov't Offices, MAN Core Site	Critical	Repaired after tower lost in 1906. Electro/Mechanical retrofits 2012.
City Bldg	Grand Marina Harbormaster's Office	end of Grand St	Planning/Bldg/Dev	Harbormaster Bldg	High	No data
City Bldg	Bay Farm Library	3221 Mecartney Rd	Library	Library	High	Assessed and found OK in 2007
City Bldg	Main Library	1550 Oak St	Library	Library	High	Modern construction
City Bldg	West End Library	788 Santa Clara Ave	Library	Library	High	Retrofit in 2007
City Bldg	Golf Misc Bldgs (6 or more)	1 Clubhouse Memorial Dr	Golf	Maint Bldgs	Low	No data
City Bldg	Albert H. Dewit "O" Club	641 West Redline	Rec & Park	Meeting Hall	High	1940s building, no data
City Bldg	Grandview Pavilion	300 Island Dr	Rec & Park	Meeting Hall	High	Modern construction
City Bldg	Veterans Memorial Building	2203 Central Ave	Rec & Park	Meeting Hall	High	Concrete Bldg, no data
City Bldg	Parking Structure	1401 Oak St (approx)	Public Works	Parking Structure	High	Modern construction
City Bldg	Police Station	1555 Oak St	Police	Police & Jail	Critical	Modern construction, elec/mech upgrades 2012
City Bldg	Jim's on the Course	1 Clubhouse Memorial Dr	Golf	Pro Shop, Clubhouse, Restaurant	Low	No data
City Bldg	Bayport Park Rec Center	301 Jack London	Rec & Park	Rec Center	High	Owned by AUSD, operated by City
City Bldg	Godfrey Rec Center	281 Beach Rd	Rec & Park	Rec Ctr	High	Modern construction
City Bldg	Krusi Rec Center	900 Mound St	Rec & Park	Rec Ctr	High	Modern construction. Built in 2020
City Bldg	Leydecker Rec Ceter	3225 Mecartney Rd	Rec & Park	Rec Ctr	High	Modern construction
City Bldg	Longfellow Rec Center	520 Lincoln Ave	Rec & Park	Rec Ctr	High	No data
City Bldg	McKinley Rec Center	2165 Buena Vista Ave	Rec & Park	Rec Ctr	High	No data
City Bldg	Tillman Rec Center	220 Aughinbaugh Wy	Rec & Park	Rec Ctr	High	Modern Construction
City Bldg	Washington Rec Center	740 Central Ave	Rec & Park	Rec Ctr	High	No data
City Bldg	Woodstock Rec Center	351 Cypress Ave	Rec & Park	Rec Ctr	High	No data
City Bldg	Littlejohn Rec Center	1401 Pacific Ave	Rec & Park	Rec Ctr , Day Care	High	No data
City Bldg	Franklin Rec Center and Pool	1432 San Antonio Ave	Rec & Park	Rec Ctr, Outdoor Pool	High	No data
City Bldg	Harrison Ctr and Lincoln Park Pool	1450 High St	Rec & Park	Rec Ctr, Pool bldg	High	No data
City Bldg	Alameda Point Gym	1101 West Redline Ave	Rec & Park	Rec Ctr, unused pool	High	1940s building, no data
City Bldg	Building 2 Storage	Bldg 2 Alameda Pt	City Hall	Record storage	Low	No data
City Bldg	Alameda Municipal Power Central Storage	1828 Grand St	Alameda Municipal Power	Records Storage	Low	No data
City Bldg	MSC City Garage	2000 Grand St	Public Works	Repair Garage	Critical	No data
City Bldg	Golf Driving Range Shop and assoc bldgs	1 Clubhouse Memorial Dr	Golf	Retail	Low	No data
City Bldg	Golf Pro Shop	1 Clubhouse Memorial Dr	Golf	Retail	Low	No data
City Bldg	Mastick Senior Center	1155 Santa Clara Ave	Rec & Park	Senior Center	Critical	Former school, no other data. Designated Fresh Air and Cooling Center
City Bldg	Bldg behind Carnegie (old library annex)	1429 Oak St	Planning/Bldg/Dev	Unoccupied bldg	Low	Need for retrofit identified in 1990s
City Bldg	Carnegie Library	2264 Santa Clara	Planning/Bldg/Dev	Unoccupied bldg	Low	Seismically upgraded in 2001
City Bldg	Other City Bldgs on Alameda Point	Various	Alameda Point	Various	Low	No data
City Open Space	Grand Street Boat Ramp	North End of Grand	Rec & Park	Boat Ramp	High	N/A

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
City Open Space	Encinal Boat Launch Facility	S. end Central Ave	Rec & Park	Dock, RR	High	Fully rebuilt and reopened in 2020
City Open Space	Main St Dog Park	Main St & Navy Way	Rec & Park	Dog Park	Low	N/A
City Open Space	Washington Dog Park AKA Alameda Dog Park	1200 Eighth St (approx)	Rec & Park	Dog Park	Low	N/A
City Open Space	Chuck Corica Golf Courses	1 Clubhouse Memorial Dr	Golf	Golf Course, RR	Low	N/A
City Open Space	Elsie Romer Bird Sanctuary	S. of Bayview	EBRPD/State	Open space	Low	N/A
City Open Space	Estuary Park	230 Mosley Ave	Rec & Park	Open space	Low	N/A
City Open Space	Portola Triangle	S. of Portola	Rec & Park	Open space	Low	N/A
City Open Space	City-owned portions of Alameda Point	Various	Alameda Point	Open space	Low	N/A
City Open Space	Alameda Landing Waterfront Park (future)	5th Street near Mitchelle	Rec & Park	Park	Low	n/a
City Open Space	Alameda Point Neighborhood Park (future)	Orion St. and Coronado Ave.	Rec & Park	Park	Low	n/a
City Open Space	Alameda Point Waterfront Park (future)	Seaplane Lagoon	Rec & Park	Park	Low	n/a
City Open Space	Thompson Field	2165 Buena Vista Ave	AUSD	Park	Low	N/A
City Open Space	Bill Osborne Model Airplane Field	Doolittle Dr	Rec & Park	Park	Low	N/A
City Open Space	Cityview Skatepark	1177 West Redline Ave	Rec & Park	Park	Low	N/A
City Open Space	Franklin Park	1432 San Antonio Ave	Rec & Park	Park	Low	N/A
City Open Space	Godfrey Park	281 Beach Rd	Rec & Park	Park	Low	N/A
City Open Space	Chochenyo Park	2430 Encinal Ave	Rec & Park	Park	Low	N/A
City Open Space	Jean Sweeny Park	S. of Atlantic	Rec & Park	Park	Low	N/A
City Open Space	Krusi Park	900 Mound St	Rec & Park	Park	Low	N/A
City Open Space	Lexington Fields AKA Alameda Point Soccer Fields	Lexington	Rec & Park	Park	Low	N/A
City Open Space	Leydecker Park	3225 Mecartney Rd	Rec & Park	Park	Low	N/A
City Open Space	Linear Park	~2001 Main St	Rec & Park	Park	Low	N/A
City Open Space	Littlejohn Park	1401 Pacific Ave	Rec & Park	Park	Low	N/A
City Open Space	Longfellow Park	520 Lincoln Ave	Rec & Park	Park	Low	N/A
City Open Space	Main St Soccer Field	~1900 Main St	Rec & Park	Park	Low	N/A
City Open Space	Marina Cove Waterfront Park	1591 Clement Ave	Rec & Park	Park	Low	N/A
City Open Space	Marina Village Shoreline Park	N. of Independence	Rec & Park	Park	Low	N/A
City Open Space	McKinley Park	2165 Buena Vista Ave	Rec & Park	Park	Low	N/A
City Open Space	Neptune Park	2301 Webster St	Rec & Park	Park	Low	N/A
City Open Space	Rittler Park	1400 Otis Dr	Rec & Park	Park	Low	N/A
City Open Space	Scout Park	Powell St	Rec & Park	Park	Low	N/A
City Open Space	Tilman Park	220 Aughinbaugh Wy	Rec & Park	Park	Low	N/A
City Open Space	Towata Park	3315 Bridgeway Isle	Rec & Park	Park	Low	N/A
City Open Space	Veterans Park	Veterans Ct	CHBIOA	Park	Low	N/A
City Open Space	Bayport Park	301 Jack London	Rec & Park	Park, RR	Low	N/A
City Open Space	BFI Shoreline Park near Brunswick	2801 Seaview Parkway	Rec & Park	Park, RR	Low	N/A
City Open Space	BFI Shoreline Park near Oldcastle	2801 Seaview Parkway	Rec & Park	Park, RR	Low	N/A
City Open Space	BFI Shoreline Park on HBI	2801 Seaview Parkway	Rec & Park	Park, RR	Low	N/A
City Open Space	Harrington Field	3400 Oleander Ave	Rec & Park	Park, RR	Low	N/A
City Open Space	Lincoln Park	1450 High St	Rec & Park	Park, RR	Low	N/A
City Open Space	Washington Park	740 Central Ave	Rec & Park	Park, RR	Low	N/A
City Open Space	Woodstock Park	351 Cypress Ave	Rec & Park	Park, RR	Low	N/A
City Open Space	Hornet Field	W. Hornet Ave	Rec & Park	Park, RR?	Low	N/A
City Open Space	Multi Purpose Fields	W. Red Line Ave	Rec & Park	Park, RR?	Low	N/A
City Open Space	City Parking Lots	Various	Public Works	Parking Lot	Moderate	N/A
City Transp	Grand Marina Boat Slips	end of Grand St	Planning/Bldg/Dev	Boat Slips	Low	No data
City Transp	Ballena Bridge	Ballena Blvd	Public Works	Bridge	Critical	Retrofit 2008 to "lifeline" standard
City Transp	Grand Bridge	Grand St	Public Works	Bridge	Critical	Unknown
City Transp	Harbor Bay Ferry Terminal - Land side	Mecartney Rd	Private/Public Works	Parking lot, RR	Critical	N/A
City Transp	Main Street Ferry Terminal - Land side	2990 Main St	Public Works	Parking lot, RR	Critical	N/A
City Transp	Seaplane Lagoon Ferry Terminal - Land side		Public Works	Parking lot, RR	Critical	Modern construction. Completed in 2021
City Transp	Public Streets	Various	Public Works	Streets	High	N/A

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
City Utility	Building 14 MPOE	1801 Viking	Alameda Municipal Power	AMP & AT&T Telecom Demarc	Critical	No data
City Utility	Fiber core site	1 Clubhouse Memorial Parkway	Alameda Municipal Power	Municipal Area Network (MAN) Core Site	Critical	No data
City Utility	Street Lights	Various	Public Works	Safety and Security	Moderate	NA
City Utility	City Hall West Building 2 Telecom MPOE	1025 W Midway	Alameda Municipal Power & City	Telecom Demarc	Critical	No data
City Utility	Wireless Telecom (Cell, wifi)	various	IT?	Towers	Critical	No data
City Utility	Doolittle Landfill	N. of Doolittle Dr	Public Works	Utility - Landfill	Critical	No info (leakage and burning unit)
City Utility	Sanitary Sewer Pump Stations (37)	Various	Public Works	Utility Bldg	Critical	Currently retrofitting all (see Pump Station upgrade schedule)
City Utility	Storm Drain Pump Stations (10)	Various	Public Works	Utility Bldg	Critical	No data
City Utility	Webster SDPS	2400 Webster St	Public Works	Utility Bldg	Critical	
City Utility	Bayport SDPS	455 Willie Stargell Ave	Public Works	Utility Bldg	Critical	Generator
City Utility	Southshore Lagoon SDPS		Public Works	Utility Bldg	Critical	
City Utility	Arbor SDPS	1535 Buena Vista Ave	Public Works	Utility Bldg	Critical	
City Utility	Golf Course SDPS		Public Works	Utility Bldg	Critical	
City Utility	Eastshore SDPS	Eastshore Dr	Public Works	Utility Bldg	Critical	
City Utility	3rd St SDPS	Ralph Appezatto Memorial Dr	Public Works	Utility Bldg	Critical	
City Utility	Main St SDPS	Main St	Public Works	Utility Bldg	Critical	
City Utility	Northside/Marina Village SDPS	1300 Marina Village Parkway	Public Works	Utility Bldg	Critical	Generator
City Utility	HBI Lagoon 1 Pump North	Ratto Rd	Public Works	Utility Bldg	Critical	
City Utility	Cartwright Substation	90 Atlantic Ave	Alameda Municipal Power	Utility Bldg & Yard	Critical	No data
City Utility	Jenny Substation	2179 Clement Av	Alameda Municipal Power	Utility Bldg & Yard	Critical	No data
City Utility	City Hall West Building 2 Telecom Switch Sta	1025 W Midway	Alameda Municipal Power	Utility Bldg, MAN Core Site	Critical	No data
City Utility	Sanitary Sewer Pipes	Various	Public Works	Utility Lines	Critical	No data
City Utility	Storm Dain Pipes and Culverts	Various	Public Works	Utility Lines	Critical	No data
City Utility	Power Lines, Overhead and Underground	Various	Alameda Municipal Power	Utility Lines	Critical	No data
City Utility	Street Lights on Signal Poles	Various	Public Works	Utility Poles	Critical	NA
City Utility	Signals and Interconnects	Various	Public Works	Utility Poles and Lines	Critical	NA
City Utility	Alameda West Lagoon Bayview Weir Structure	Various	Public Works	Utility Structure	Critical	No data
City Utility	HBI Lagoon I & II Pumps, Gates & Weirs	Various	Public Works	Utility Structure	Critical	No data
City Utility	East Transfer Station	2000 High St	Alameda Municipal Power	Utility Yard	Critical	No data
City Utility	West Transfer Station	Webster Tube at Estuary	Alameda Municipal Power	Utility Yard	Critical	No data
Non-City Bldg	Golden House Adult Dev. Center	Address on File w City	Private	Adult Day Care	High	No data
Non-City Bldg	Rythmix Culture Works	Blanding	Private	Art House	Moderate	No data
Non-City Bldg	Altarena Playhouse	High Street	Private	Art House	Moderate	No data
Non-City Bldg	Alameda Head Start - Sue Matheson Center	670 West Midway	AHS	Child Day Care	High	No data
Non-City Bldg	AUSD Woodstock Child Development Center	190 Singleton Ave	AUSD	Child Day Care	High	No data
Non-City Bldg	Child Day Care and Family Day Care Centers (Addresses on file w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	ABC Preschool	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Bayside Montessori Association	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Child Education Center-Kathleen Seabolt	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Child Unique Montessori School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Fuzzy Caterpillar	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	ICRI of Alameda Child Care Center	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Jean Wonderful Child Care	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Kiddie KAlameda Municipal Powerus Cooperative Play School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Kindercare Learning Center	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Little Seeds Childrens Center	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Luna's Montessori Bilingual School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Lynn Chen	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Marriann Cassidy	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Park Avenue Child Care	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Peter Pan Learning Center	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Peter Pan Preschool/Infant Center	Address on File w City	Private	Child Day Care	Moderate	No data

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
Non-City Bldg	Rising Star Montessori School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Rising Star School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Small Size big Mind Preschool & Infant Ctr	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Son Rise Preschool	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Son-Light Preschool	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Star Bright Child Care	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Sugar and Spice	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Sui Ying Feng	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Suzhen Zhen	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	The Child Unique Montessori School	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Tiny Treasures Preschool	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Veronica Carraza	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Wee Care Preschool and Child Care	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Xiulan Wu and Huilian Shangguan	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Yanhong Li	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Yanyi Ma	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Zazueiro Cucchiara	Address on File w City	Private	Child Day Care	Moderate	No data
Non-City Bldg	Althea Riley-Franklin	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Anita Stevens	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Catherine Cook	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Chang Zhu	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Chikako Narahara	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Colleen Bang	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Elizabeth Rollins-Rucker	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Elizabeth Rollins-Rucker	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Esguerra	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Fredeswinda Wilkins	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Illuminada Dela Cruz	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Ivette Fagel	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Janette Howard	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Jian Li	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Josephine Esguerra	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Josephine Quale	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Las Semillas Coop School	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Lourdes Curry	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Marva Lyons	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Norma Washington-Palmer	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Rachel Rodrigues	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Roberta Meno	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Rosemarie & Alan Sapalicio	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Sandra Reyes	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Shaosun Zhu	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Shu Fang Huang	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Sun-Mui Chow	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Tenisha Tatom	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Veronica Carraza	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	Wenyan Shi	Address on File w City	Private	Family Day Care	Moderate	No data
Non-City Bldg	College of Alameda	555 Atlantic Ave	Peralta Colleges	College, Day Care	High	No data
Non-City Bldg	Golden Age of Channing II	Address on File w City	Housing Authority	Elder Care	High	No data
Non-City Bldg	Sunset Home for the Elderly	Address on File w City	Housing Authority	Elder Care	High	No data
Non-City Bldg	Waters Edge Lodge	Address on File w City	Housing Authority	Elder Care	High	No data
Non-City Bldg	Autumn Residential Care Home	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Bay Harbour Residential Care Home	Address on File w City	Private	Elder Care	High	No data

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
Non-City Bldg	Elders Inn on Webster	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Golden Age Bayside II	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Golden Age of Sweet Rd	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Goldencare Assisted Living, Inc	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Sandcreek Lodge	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Sea Breeze Care Home, Inc	Address on File w City	Private	Elder Care	High	No data
Non-City Bldg	Alameda Food Bank	650 W Ranger Ave	Alameda Food Bank	Food Bank	Critical	No data
Non-City Bldg	Waters Edge	Address on File w City	Private	Health Care Facility	High	No data
Non-City Bldg	Alameda Hospital	2070 Clinton Ave	Alameda Hospital	Hospital	High	No data
Non-City Bldg	Jack Capon Villa	Address on File w City	Private	Housing for People with Dev. Disabilities	Moderate	No data
Non-City Bldg	Alameda Elder Services	Address on File w City	Housing Authority	Housing Offices	High	No data
Non-City Bldg	All buildings on Coast Guard Island	Coast Guard Island	US Coast Guard	Military Base	Critical (some)	No data
Non-City Bldg	All Coast Guard Housing	Singleton	US Coast Guard	Military Housing	Low	No data
Non-City Bldg	Alameda Museum	2324 Alameda Ave	Private	Museum	Moderate	No data
Non-City Bldg	Alameda Naval Air Museum	2151 Ferry Point	Private	Museum	Moderate	No data
Non-City Bldg	Hornet Museum	707 W. Hornet Ave	Private	Museum	Moderate	No data
Non-City Bldg	Pinball Museum	1510 Webster St	Private	Museum	Moderate	No data
Non-City Bldg	Meyer's House & Garden Museum	2021 Alameda Av	Alameda Museum	Museum	Moderate	No data, built 1897
Non-City Bldg	Alameda County Municipal Ct	Shoreline	Alameda County	Offices	Critical	No data
Non-City Bldg	US Post Office	Southshore	USPS	Post Office	Critical	No data
Non-City Bldg	American Red Cross Regional Warehouse	650 W Ranger Ave	American Red Cross	Regional Warehouse	Critical	No data
Non-City Bldg	63 Soft Story Buildings	Various - See Map	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	3250 BRIGGS AVE	Privately Owned	Commercial	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1500 ALAMEDA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2128 ALAMEDA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1455 BAY ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	3215 BRIGGS AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	3224 BRIGGS AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	3228 BRIGGS AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	470 BUENA VISTA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	520 BUENA VISTA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	434 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	600 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	724 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	831 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1704 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1715 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1732 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2026 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2037 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2043 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2050 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1515 CHESTNUT ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1531 CHESTNUT ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2045 CLINTON AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	895 LAFAYETTE ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	753 LINCOLN AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2222 LINCOLN AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1417 NINTH ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	431 PACIFIC AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1583 PACIFIC AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1179 PARK AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
Non-City Bldg	Soft Story Building	1182 PARK AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1190 PARK AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	400 PARK ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1364 PARK ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1825 POGGI ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1152 REGENT ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2153 SAN ANTONIO AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2236 SAN ANTONIO AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2209 SAN JOSE AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2210 SAN JOSE AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2215 SAN JOSE AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2236 SAN JOSE AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2246 SAN JOSE AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	410 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	722 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	757 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1815 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2060 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2241 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2318 SANTA CLARA AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1557 SHERMAN ST	ST	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2019 SHORE LINE DR	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2051 SHORE LINE DR	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1538 ST CHARLES ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1850 THAU WAY	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1522 VERDI ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1526 VERDI ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1534 VERDI ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1548 WEBSTER ST	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	424 WHITEHALL RD	RD	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	1808-12 CENTRAL AVE	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2149 OTIS DR	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	Soft Story Building	2225 OTIS DR	Privately Owned	Residence	Moderate	Soft Story needs retrofit
Non-City Bldg	ALAMEDA ADULT SCHOOL	401 Pacific Ave	AUSD	School	High	No data
Non-City Bldg	ALAMEDA HS, Emma Hood Swim Ctr	2201 Encinal Ave	AUSD	School	High	No data
Non-City Bldg	BAY FARM ELEM & MS	200 Auginbaugh	AUSD	School	High	No data
Non-City Bldg	EARHART ELEMENTARY	400 Packet Landing Dr	AUSD	School	High	No data
Non-City Bldg	EDISON ELEMENTARY	2700 Buena Vista	AUSD	School	High	No data
Non-City Bldg	FRANKLIN ELEMENTARY	1433 San Antonio Ave	AUSD	School	High	No data
Non-City Bldg	HENRY HAIGHT ELEMENTARY	2025 Santa Clara Ave	AUSD	school	High	No data
Non-City Bldg	LINCON MIDDLE SCHOOL	1250 Fernside Blvd	AUSD	school	High	No data
Non-City Bldg	OTIS ELEMENTARY	3010 Filmore St	AUSD	School	High	No data
Non-City Bldg	PADEN ELEMENTARY	444 Central Ave	AUSD	School	High	No data
Non-City Bldg	RUBY BRIDGES ELEMENTARY	351 Jack London	AUSD	School	High	No data
Non-City Bldg	ENCINAL HS & Pool, Jr. Jets MS, Ala. CLC, NEA CLC	210 Central Ave	AUSD	School	High	No data
Non-City Bldg	St Joseph Notre Dame Schools	Address on File w City	Catholic Chuch	School	High	No data
Non-City Bldg	St. Barnabas School	Address on File w City	Catholic Chuch	School	High	No data
Non-City Bldg	St. Joseph Elementary School	Address on File w City	Catholic Chuch	School	High	No data
Non-City Bldg	Alameda Chinese Christian School	Address on File w City	Private	School	High	No data
Non-City Bldg	Saint Philip Neri Catholic Elementary	Address on File w City	Catholic Chuch	School	High	No data
Non-City Bldg	Island HS, Cal Safe Infant Care, Head Start	1900 Third St	AUSD	School, Child Day Care	High	No data
Non-City Bldg	MAYA LIN ELEM	825 Taylor	AUSD	School, Day Care	High	No data
Non-City Bldg	Woodstock Ctr, Various Schools & Child Care	500 Pacific Ave	AUSD	School, Day Care	High	No data

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
Non-City Bldg	LUM ELEMENTARY/WOOD MIDDLE	420 Grand St	AUSD	School, Unoccupied	Low	No data
Non-City Bldg	China Clipper Plaza	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Eagle Village	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Esperanza	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Lincoln House	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Parrot Gardens	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Parrot Village	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Rosefield Village	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Sherman House	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Stanford house	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	No data
Non-City Bldg	Shinsei Gardens	<i>Address on File w City</i>	Private	Section 8 Housing	Moderate	No data
Non-City Bldg	The Breakers at Bayport	<i>Address on File w City</i>	Private	Section 8 Housing	Moderate	No data
Non-City Bldg	The Park Alameda	<i>Address on File w City</i>	Private	Section 8 Housing	Moderate	No data
Non-City Bldg	Eagle Village	<i>Address on File w City</i>	Housing Authority	Section 8 Housing	High	Modern construction, all-electric
Non-City Bldg	Independence Plaza Senior Housing	<i>Address on File w City</i>	Housing Authority	Senior Housing	High	No data
Non-City Bldg	Anne B. Diament Senior Plaza	<i>Address on File w City</i>	Housing Authority	Senior Section 8 Housing	High	No data
Non-City Bldg	Lincoln Willow Apartments	<i>Address on File w City</i>	Housing Authority	Senior Section 8 Housing	High	No data
Non-City Bldg	Senior Condominiums (various)	<i>Address on File w City</i>	Housing Authority	Senior Section 8 Housing	High	No data
Non-City Bldg	Alameda Care Center	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	Bay View Nursing & Rehab Center	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	CROWN BAY NURSING&REBAB CENTER	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	Marina Garden Nursing Center	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	South Shore Convalescent Hospital	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	The Waters Edge	<i>Address on File w City</i>	Private	Skilled Nursing	High	No data
Non-City Bldg	All non-City Alameda Point Buildings	Various	US Navy	Various	Low	No data
Non-City Bldg	Non-Ductile Concrete Buildings built before 1980	<i>Draft List on File w City</i>	Public and Private	Various	Moderate	No data
Non-City Bldg	Crab Cove Visitors Center	McKay Ave	EBRPD/State	Visitors Center	Moderate	No data
Non-City Bldg	All other residences		Public and Private		Low	
Non-City Bldg	All other commercial/industrial/institutional		Public and Private		Moderate	
Non-City Open Space	Crown/Shoreline Beach	McKay Ave	EBRPD/State	Beach, RR	High	N/A
Non-City Open Space	Crown Beach Park	McKay Ave	EBRPD/State	Park, RR	High	N/A
Non-City Transp	Bay Farm Island Vehicle Bridge	Doolittle Dr/Otis Dr	Caltrans	Bridge	Critical	Built in 1953 and seismically retrofitted in 1997. City sent letter in 2007 requesting retrofit to "lifeline" standard; however, Caltrans has no future plans for retrofitting the bridge.
Non-City Transp	Bay Farm Island Bike/Ped Bridge	Doolittle Dr/Otis Dr	Caltrans	Bridge	Low	Built in 1996 and there are no future plans for seismic retrofit work.
Non-City Transp	Fruitvale RR Bridge	Tilden Way	Army Corps of Engineers	Bridge	Low	Needs to be retrofitted to "no collapse" or removed.
Non-City Transp	Fruitvale Miller Sweeney Bridge	Tilden Way	Alameda County	Bridge	Critical	Retrofitted in 2011 to "No collapse".
Non-City Transp	High St Bridge	High Street	Alameda County	Bridge	Critical	Retrofitted in 2009 to "No collapse"
Non-City Transp	Park St Bridge	Park St	Alameda County	Bridge	Critical	Retrofitted in 2008 to "No collapse"
Non-City Transp	Harbor Bay Ferry Terminal - Water side	Mecartney Rd	WETA	Dock, RR	Critical	No data
Non-City Transp	Main Street Ferry Terminal - Water side	2990 Main St	WETA	Dock, RR	Critical	No data
Non-City Transp	Ballena Isle Marina	Ballena Blvd	City, Onshore private?	Docks, slips	Low	No data
Non-City Transp	Other Marinas?	Various	City, Onshore private?	Docks, slips	Low	No data
Non-City Transp	Fortman Marina	Grand St	City, Onshore private	Docks, slips, bldg	Low	No data
Non-City Transp	Posey/Webster Tubes, incl ventilation buildings	Webster, Constitution	Caltrans	Tubes	Critical	2003 Retrofit to No Collapse: "Minimum Performance Level" to withstand a maximum credible earthquake of 7.25 Richter scale on the Hayward fault with no collapse of the tubes or portal buildings and no loss of life. However, significant damage is expected and it is likely that the tube would be closed to public traffic after the seismic event for evaluation, repair, and possibly permanent closure. (letter from Stanley Gee, Caltrans, "retrofitcaltransattached" March 25, 2002). Caltrans has no future plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system.
Non-City Transp	Constitution Way Overcrossing	Constitution Way	Caltrans	Bridge	Moderate	Bridge was built in 1985 and there are no future plans for seismic retrofit work.
Non-City Utility	Main Island Drain - BFI - sewer	Near BFI bridge	EBMUD	Estuary xing	Critical	No info, drains BFI to Main Island

Type	Facility Name	Address	City Department or Owner	Function	Recovery Priority	Seismic Retrofit/Notes
Non-City Utility	Main Island Drain - West - sewer	Near Marina Village	EBMUD	Estuary xing	Critical	No info
Non-City Utility	Main Island Feed - BFI- water	At BFI bridge	EBMUD	Estuary xing	Critical	In environmental phase to replace, as of Aug 2015
Non-City Utility	Main Island Feed - East - water	Extension of Broadway	EBMUD	Estuary xing	Critical	In environmental phase to replace, as of Aug 2015
Non-City Utility	Main Island Feed - West - recycled water	Near tubes	EBMUD	Estuary xing	Critical	Proposed for 2017
Non-City Utility	Main Island Feed - West - water	Near Marina Village	EBMUD	Estuary xing	Critical	In environmental phase to replace, as of Aug 2015
Non-City Utility	Main Island Feed - BFI - gas	Near Doolittle	PG&E	Estuary xing	Critical	Not sure if it exists, or its status
Non-City Utility	Main Island Feed - BFI - power	Near Doolittle	PG&E	Estuary xing	Critical	Not sure if it exists, or its status
Non-City Utility	Main Island Feed - East - power	Near Park St	PG&E	Estuary xing	Critical	On PG&Es radar
Non-City Utility	Main Island Feed - Oakland - gas	Near Park St ?	PG&E	Estuary xing	Critical	On PG&Es radar
Non-City Utility	Main Island Feed - West - power	Near tubes	PG&E	Estuary xing	Critical	On PG&Es radar
Non-City Utility	Main Island Feed - Telecom	various	various	Estuary xing	Critical	No info
Non-City Utility	Alameda West Lagoon Intake	Shoreline Dr	AWLHOA	Pump & Line	High	No data
Non-City Utility	Telecom Lines	Various	Various Telecoms	Utility Lines	Critical	No data
Non-City Utility	Gas Lines	Various	PG&E	Utility Lines	Critical	No data
Non-City Utility	Sewer Trunk Lines	Various	EBMUD	Utility Lines	Critical	No data
Non-City Utility	Water Lines	Various	EBMUD	Utility Lines	Critical	No data
Non-City Utility	Alameda West Lagoon Willow Weir Structure	Willow St	AWLHOA	Utility Structure	High	No data



Appendix E Detailed Earthquake Risk Assessment

June 2022

This appendix provides detailed assessment of how existing and future people, economy, buildings and infrastructure that may be impacted by an earthquake in Alameda. This appendix describes the vulnerability of the assets to damage in earthquakes and the consequences on the community of such damage.

The anticipated damages and disruptions are based on a magnitude 7.0 earthquake on the Hayward Fault, roughly similar to the scenario evaluated in the USGS HayWired scenario.¹ The earthquake has its epicenter in Oakland and strong shaking results in severe impacts throughout the greater Bay Area. Such an earthquake would result in strong shaking that will trigger surface fault rupture, liquefaction, landslides, fires, and severe impacts throughout the entire Bay Area. While landslides and fault rupture will not directly impact Alameda, all of these secondary hazards will cause significant disruption and damage to buildings, utilities, transportation and communication networks, and fuel supply. The HayWired scenario represents an earthquake with approximately a 150-year return period; one that has about a 20% chance of occurring in the next 30 years. While the impacts of this scenario are severe, it does not represent the worst-case earthquake by any means. By comparison, most newer buildings today are designed to protect the safety of occupants in earthquake shaking with approximately a 975-year return period, or a 2% change of occurring in any 50-year period.

This appendix details the impact of such an earthquake on these systems and the people and economy serving Alameda. The assets covered in this chapter are characterized in detail in **Chapter 3** and the earthquake hazard is characterized in **Chapter 4** of the Plan.

The People of Alameda

Across the San Francisco Bay region, more than 750,000 people could be displaced from their homes in a major earthquake.² Many studies have shown that socially disadvantaged groups such as persons of color, low income residents and persons with disabilities are disproportionately impacted by natural disasters. These populations may have more difficulty evacuating from their homes in an earthquake and more difficulty recovering after an event. Persons with disabilities may be reliant on electricity for medical equipment and refrigeration of medication that can be lost during floods and winter storms. Disaster-related damages can also disrupt social and economic services for disadvantaged populations. Housing affordability is an existing challenge for many Alameda residents that can exacerbate poor outcomes for residents following an earthquake and hinder community recovery. A 2016 study found that disadvantaged populations are more likely to live in housing that may be damaged in an earthquake and less able to prepare, respond and recover from an earthquake.³ Without proactive public policy and support, these residents are more likely to be permanently displaced from Alameda following an earthquake. This study found that the neighborhoods most likely to have communities at risk in fragile housing are Central Alameda, Southshore and along the Northern Shoreline.

¹ Detweiler, S.T., and Wein, A.M., eds., 2017, The HayWired earthquake scenario: U.S. Geological Survey Scientific Investigations Report 2017–5013, <https://doi.org/10.3133/sir20175013>.

² Detweiler, S.T., and Wein, A.M., eds., 2018, The HayWired earthquake scenario—Engineering implications: U.S. Geological Survey Scientific Investigations Report 2017–5013–I–Q, 429 p., <https://doi.org/10.3133/sir20175013v2>.

³ ABAG and BCDC, 2015, *Stronger Housing, Safer Communities*, www.adaptingtorisingtides.org/project/stronger-housing-safer-communities-strategies-for-seismic-and-flood-risks/.

Alameda Economy

The major Hayward fault earthquake contemplated in the USGS HayWired scenario will result in an estimated \$44.2 billion losses to the California Gross State Product (4.2% of California projected GSP) in the first six months following the earthquake.⁴ Alameda County will be the hardest hit county with a 13.8% loss in county Gross Regional Product and an estimated 15 percent loss in jobs. The study estimates that GSP losses could be reduced by 42% with resilience measures such as deploying portable cellular sites, supply chain workarounds, more efficient use of resources like water and employee overtime, and pre-earthquake business continuity planning. Alameda County would experience a recession lasting 5 to 10 years due to significant employment and population losses. Small businesses and minority owned businesses will be particularly hard hit and a shortage of construction workers could lead to a deeper and longer recession as rebuilding is postponed.

Buildings

Alameda has an extensive inventory of buildings that are vulnerable to damage in earthquakes. Many of these buildings are also vulnerable to flood and tsunami damage. Damage to homes, businesses, community facilities, and their associated infrastructure represents a serious socioeconomic threat to the city. Older buildings were not designed to withstand the earthquake shaking or liquefaction. Seismic retrofits are usually designed to prevent catastrophic collapse and harm to occupants, but typically does not ensure that a building will be repairable. Damage to community services like shelters, hospitals, and elderly care facilities can disproportionately impact vulnerable populations, including those who are ill, immobile, elderly, or economically disadvantaged.

All building contents are vulnerable to flooding and violent earth shaking. More importantly, many buildings lose function temporarily until they are deemed safe or are rebuilt. Depending upon the building, this loss of service may include emergency services, sheltering and gathering, commerce, education, medical care, daycare, elder care, government, and recreation. Short term and long-term recovery of the City depends upon quick restoration of these services.

Earthquake Vulnerable Building Types

Certain types of buildings are more susceptible to the shaking and ground disturbances of earthquakes. Older buildings constructed before modern building codes are generally not designed to withstand earthquake shaking. These buildings can sustain significant damage and even collapse in earthquakes, killing and injuring occupants and displacing residents and businesses for a long time. The HayWired study estimates that most Alameda Census tracts, particularly those in the liquefaction zone will experience extensive or complete damage to 20 percent or more of their total building area, with several tracts at risk from such damage from post-earthquake fires.⁵

Buildings subject to violent shaking can also dislodge asbestos or encapsulated (abated) asbestos, lead paint, and other hazardous materials. Broken plumbing can discharge sewage. Broken gas lines and damaged electrical wiring can spark fires and present health and safety hazards. Older houses, especially Victorian-era houses, were built without fire blocking, which means that fire can easily spread up walls and through ceilings to other parts of the house and to neighboring properties. Other hazards in

⁴ Detweiler, S.T., and Wein, A.M., eds., 2018.

⁵ Detweiler, S.T., and Wein, A.M., eds., 2018.

buildings from earthquake shaking include falling piping, shelving, and goods. Limited insurance coverage will be available to recover these losses and will prolong the recovery period.

The following sections describes the most common types of earthquake vulnerable buildings in Alameda: soft-story buildings, homes with cripple walls or house over garage, unreinforced masonry buildings, and nonductile concrete buildings. Newer buildings are also designed to protect lives, but may not be re-occupiable following a major earthquake.

Soft-story buildings

Buildings with soft-story, weak or open front walls are multi-story wood frame apartment buildings with an open or more flexible ground compared to the more rigid second floor.⁶ These two stories flex differently during violent ground shaking, resulting in damage to the building and sometimes collapse. A common soft-story building type is the apartment or business building with ground level parking (just pillars and open spaces) and traditional structures above. Soft-stories are also commonly found with businesses that have large expanses of glass for a first-floor storefront and a more traditional structure on the second story.



Figure E-1 Soft-Story Apartment Building in Alameda

In 2009, the City of Alameda established a wood-frame soft-story program under Ordinance 2989, *Earthquake Hazard Reduction in Existing Wood Frame Residential Structures with Soft-Story, Weak, or Open Front Walls*.⁷ Alameda's mandatory wood-frame soft-story program applies to existing buildings that have the following characteristics:

⁶ <https://homequakequiz.org/housing-types/multi-family-homes#17>

⁷ <http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373444&dbid=0&repo=CityofAlameda&cr=1>

- Wood-frame construction
- Permitted for construction prior to December 17, 1985
- Five or more dwelling units
- Ground floor containing parking or similar open floor or basement space causing soft, weak, or open lines where there exist one or more levels above.

Based on these criteria, the City established an inventory of potentially hazardous soft-story buildings under the ordinance and notified the owners and residents of such buildings.

Owners of buildings listed on the inventory were required to submit to the City a structural seismic adequacy analysis to determine potential hazards to the structure and describe what would be necessary to remedy any identified weaknesses. 209 buildings were determined to have seismic vulnerabilities based on an engineering analysis

Owners were not required to retrofit their buildings, however to date, 146 buildings have completed a seismic retrofit. Buildings retrofitted in accordance with the ordinance will have their seismic performance substantially improved, but will not necessarily prevent all earthquake damage. The retrofit strengthens the portion of the structure that is most vulnerable to earthquake damage but may not address other structural issues.

63 multi-family buildings containing approximately 1,000 units remain on the list of potentially hazardous soft-story buildings. Three buildings contain more than 50 units each. Some buildings contain retail spaces on the ground floor frequented by members of the public. The status of soft-story buildings and number of units is shown in **Table E-1**. The retrofitted soft-story buildings are shown in light blue and unretrofitted buildings are shown in dark blue in **Figure E-2** (there are no soft-story buildings west of Main St or on Bay Farm Island). The addresses are listed in **Appendix D** and on the City's website.⁸

Table E-1 Alameda's Soft-Story Building Inventory

Description	Number of Buildings	Residential Units
Designated Soft Story	209	~4,500
Retrofitted	146	~3,500
Not retrofitted	63	~1,000

⁸ <https://www.alamedaca.gov/Departments/Planning-Building-and-Transportation/Building/Seismic-Retrofit/Potential-Soft-Story-Buildings>



Figure E-2 Designated Soft-Story Buildings in Alameda

The City of Alameda’s Soft Story Structural Assessment Grant provides up to \$5,000 for structural assessment of potential soft-story buildings with more than 51% of units occupied by low- and moderate-income households.⁹ These property owners are also eligible for the Rental Rehabilitation Loan Program for the retrofit of buildings determined to be soft-story structures. The program provides loans at 2% interest to landlords who rehabilitate rental property in Alameda.

While Alameda’s soft-story ordinance specifically addresses buildings with more than 5 residential units, soft-story conditions can exist in residential buildings with fewer than 5 units as well. If the definition of soft-story buildings were expanded to include 3-to-4-unit buildings built before 1985, approximately 850

⁹ <https://www.alamedaca.gov/Departments/Community-Development/Community-Housing-Resources>

additional residential buildings with nearly 3,000 units could be added to the potentially soft-story list.¹⁰ Single family homes with soft-story conditions are covered in the following section.

Damage to soft-story apartment buildings would have significant consequences to renters and vulnerable populations in Alameda. Occupants could be injured in an earthquake and loss of housing units would exacerbate Alameda’s housing shortage and further limit the availability of these naturally occurring affordable housing units. Many vulnerable residents could be permanently displaced.

Homes with Cripple Walls and House Over Garage

A “cripple wall” is a low height wall often found in the ground floor basement or crawlspace in Victorian-era and older homes in Alameda. These buildings can generally be identified by stairs leading to the front door. Cripple walls tend to be damaged during violent ground shaking because they do not have proper sheathing on the interior side of the walls and there are fewer interior walls than in the story above to



Figure E-3 Single Family Home with Cripple Wall in Alameda

resist lateral earthquake forces. The cripple walls are also not tied to the foundation or the first floor above and they can slide off their foundation as the ground shakes under them. Depending on the severity of the earthquake, damage to these kinds of buildings can range from minor facade and glass damage to total loss.

Alameda homes that have an attached garage with living space above that lacks interior walls may be unable to support the living space above in an earthquake.¹¹ In an earthquake, the garage walls may lean

¹⁰ Alameda County Assessor’s Parcel Data, 2018

¹¹ <https://homequakequiz.org/housing-types/single-family-homes#21>

or collapse, putting occupants in the living space above at risk from serious harm and the home can become uninhabitable.

Alameda has an estimated 10,600 pre-1980 single family homes that could be damaged in an earthquake.¹² In 2006, the City of Alameda adopted Ordinance 2950 to establish minimum standards for seismic retrofitting of cripple wall buildings.¹³ The California Earthquake Authority's Brace and Bolt Program provides grants to retrofit cripple wall homes.¹⁴ Approximately 600 homes are believed to have been retrofitted to appropriate standards.¹⁵ In addition, many homeowners in Alameda excavate and dig out their basement as a way to add additional space to their homes. This work includes adding shear walls, bolts and tie downs to the portion of the basement walls above ground (the cripple wall). This work, while not formally a seismic retrofit, does have the effect of reducing the potential for earthquake losses of this type of building. There may be 50 to 300 permitted basement digouts in Alameda.

Alameda is a town of historic homes that contribute to the unique character of the neighborhoods and much of this character could be lost by damaged cripple wall buildings or post-earthquake fires. Many homes will need to be rebuilt or substantially repaired and few will have adequate insurance or the financial resources to cover losses. Home damage or destruction can result in significant social and financial costs, potentially displacing many people. The city will face a loss of property tax revenue. Displaced residents face significant challenges, especially among socially vulnerable populations and renters, who have limited capacity to address deficiencies in their buildings and rely on landlords to make changes. Retrofitted homes may still be damaged in earthquakes, but by keeping the building attached to the foundation and preventing collapse of the cripple wall, the damage should be repairable and the home may remain habitable.

Unreinforced Masonry Buildings

Unreinforced masonry (URM) buildings are older buildings built entirely with brick or stone with wood frame floors and roofs that are vulnerable to catastrophic collapse in even minor earthquakes. In Alameda, many URMs are historic buildings located in the Park and Webster commercial corridors and can have retail with offices or residential units in upper stories. URM buildings also tend to be car repair garages and industrial buildings. URM buildings may have bricks that can be visible on both the outside and inside walls. If every 5th or 6th row of bricks has a different width (because it has been turned perpendicular), this indicates that the wall is likely a structural brick wall, not just a decorative siding.¹⁶ URMs may also have thick window sills due to thicker walls (more common in stone buildings, but may also be seen in brick buildings).

¹² Alameda County Assessor's Parcel Data, 2018

¹³ <http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373396&dbid=0&repo=CityofAlameda&cr=1>

¹⁴ <https://www.earthquakeauthority.com/Prepare-Your-House-Earthquake-Risk/Brace-and-Bolt-Grants/CEA-Policyholder-Brace-Bolt-Grants/About-CEA-BB>

¹⁵ Alameda permit database, 2021

¹⁶ <https://homequakequiz.org/housing-types/multi-family-homes#56>



Figure E-4 Retrofitted Unreinforced Masonry Building in Alameda

In 1991, the City of Alameda passed Ordinance 2573 to reduce the risk of death or injury from the effects of earthquakes on URMs.¹⁷ The ordinance required URM building owners to brace any parapet walls and anchor walls to the roofline that are parallel to and adjacent to a public sidewalk or to an adjacent lower building. In addition, the masonry and mortar joints were to be tested and replaced if they were found to lack adequate strength.

As a result of this requirement, all of the City’s 74 identified URMs have been retrofitted or demolished. An estimated 10 additional buildings that did not fall within the scope of the ordinance have also been retrofitted or are being upgraded as part of redevelopment efforts, such as the Del Monte building.

The required retrofit standards were designed to “reduce the risk of loss of life or injury” from damage to these buildings. Despite these beneficial retrofits, many retrofitted URMs will still sustain damage in future earthquakes and falling bricks can be lethal to occupants and pedestrians on the sidewalk. Damaged buildings may be closed for a long time to complete repairs or not be economically feasible to repair. A map of retrofitted URMs is shown in **Figure E-5** (there are no URMs west of Webster St. or on Bay Farm Island).

Residential structures containing five or fewer dwelling units, buildings with low occupancy, and those used as warehouses were exempted from the requirements of the ordinance, and many of these buildings remain vulnerable to damage or collapse in earthquakes.

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https://library.municode.com/ca/alameda/codes/code_of_ordinances?nodeId=CHXIIIBUHO_ARTXVIIIIEAHAREEXUN_MABEWABU



Figure E-5 Map of Retrofitted URM Buildings in Alameda

Nonductile Concrete Buildings

Non-ductile concrete buildings are concrete structures, built before 1980, contain brittle concrete elements (columns, beams, walls and connections). Nonductile concrete buildings are vulnerable to significant damage or collapse in earthquakes resulting in fatalities. A survey was completed of these buildings by volunteers as part of a statewide study for the Concrete Coalition. The objective of the survey was to get a total number of these buildings, not a definitive inventory like the City has for soft-story or URM buildings. The survey was based on external observations made by volunteers and therefore is not definitive. However, it is estimated that the City has between 140 and 150 non-ductile concrete

buildings.¹⁸ Many of the buildings identified were one story and contained many shear walls that would be less vulnerable to earthquake damage. Alameda does not currently require evaluation or retrofit of nonductile concrete buildings. These buildings are typically used for commercial office buildings and retail. Many nonductile concrete buildings are airplane hangars located at the former Naval Air Station and are undergoing renovations that include seismic retrofit or will be demolished as part of the Alameda Point redevelopment. Alameda does not currently require structural evaluation or retrofit of nonductile buildings.

Chimneys

Masonry or stone chimneys in older homes are also a falling hazard in earthquakes. The chimney can break off at the roofline and fall inside or outside the house, potentially damaging the structure and injuring or killing occupants. The taller and more flexible the chimney, the more likely it is to fail. Chimneys exterior to the house and separate from the structure. Some owners will attempt to brace the chimney against the roof; however, this will not prevent the chimney from falling. Falling chimneys are one of the most common issues in an earthquake. The most effective solution is to entirely rebuild the chimney with a new code-compliant chimney.¹⁹ Chimneys can also be removed above the firebox and capped at the roofline or replaced with a new code-complaint chimney above the firebox. Alameda does not currently inspect chimneys for potential earthquake damage or require chimney mitigation.

Newly Constructed Buildings

Newer buildings built to modern building codes (after the early 1990s) are designed to protect lives and not collapse in a major earthquake, but they do not ensure buildings will be safe to re-occupy. Significant damage to newer housing stock would add to the disruptions and lengthy recovery expected from a major earthquake. An additional 1% in construction cost to build new buildings to a “functional recovery standard” could increase the availability of homes and businesses by 75 to 95% following a major earthquake.²⁰ Recommendations for implementation of this concept are laid out in a recent NIST-FEMA Special Publication for improving the post-earthquake reoccupancy and functional recovery of the nation’s building stock.²¹

City-Owned Buildings

Some of the City’s most important buildings were vulnerable to earthquake shaking because they were constructed with the building standards that pre-dated current knowledge about earthquake dynamics. Most city buildings have been seismically retrofitted or have been constructed to more modern standards.

- City Hall was retrofitted in 1997. The original 120-foot clock tower was removed after it sustained damage in the 1906 earthquake.
- The Carnegie Library closed in 1998 and remains vacant, however seismic retrofitting was completed in 2001. A new library was constructed on Oak St in 2006.

¹⁸ EERI Concrete Coalition, 2011. https://www.eeri.org/images/archived/wp-content/uploads/Concrete_Coalition_Final_0911.pdf

¹⁹ https://sfgov.org/sfc/sites/default/files/ESIP/FileCenter/Documents/13436-ATC-119_TaskA.4.g_ChimneyMitigation.pdf

²⁰ Detweiler, S.T., and Wein, A.M., eds., 2018.

²¹ https://www.fema.gov/sites/default/files/documents/fema_p-2090_nist_sp-1254_functional-recovery_01-01-2021.pdf

- Fire Station No. 3 was abandoned in 2001. A new fire station and Emergency Operations Center was constructed to replace Fire Station No. 3 at Grand and Buena Vista in 2017.
- The West End library was seismically retrofitted in 2007.

Other buildings were assessed and determined to be seismically safe. One concern are the 1940s era residences and hangars on Alameda Point, the former Alameda Naval Air Station, that would be subject to earthquake shaking, liquefaction, ground settlement, and flooding. The Alameda Point Master Infrastructure Plan addresses areas of redevelopment where buildings will be constructed to modern day seismic standards and reuse areas where retrofit work may be needed. This redevelopment is currently underway and many buildings have or will soon undergo rehabilitation.

Critical Services

Alameda Unified School District (AUSD) has seismically evaluated and upgraded a number of its school facilities in accordance with AB 300 and the Field Act. AUSD has seismically retrofitted several buildings at the historic Alameda High School and permanently closed Lum Elementary in response to seismic safety concerns. Private schools are not subject to the seismic safety provisions of the Field Act, however

Newly constructed emergency response facilities such as police and fire stations are required to be designed to higher seismic design standards than most other buildings because of the importance that they be immediately usable following an earthquake. In 2017, the City of Alameda completed construction of a new Fire Station 3 to replace the one located at 1709 Grand Street, which was deemed seismically unsafe and obsolete in the year 2000. The new fire station was constructed on the same site, and in conjunction with, an Emergency Operations Center (EOC).

Alameda Hospital is currently undergoing a \$25 million seismic retrofit project of the hospital's west wing that is required by state law to remain licensed as a hospital with emergency room services. The Alfred E. Alquist Hospital Facilities Seismic Safety Act (SB 1953) requires that hospitals complete any necessary seismic retrofits to guarantee they can remain open in a major earthquake by 2030. The project will be completed by October 2021.

Alameda is home to a number of other facilities that serve and/or house vulnerable populations, such as daycares, elder cares, medical offices and clinics, and others. These buildings are critical to a healthy and vibrant city. Damage to these critical care facilities can disproportionately impact vulnerable populations, including those who are ill, immobile, elderly or economically disadvantaged. The location of these facilities can change from year to year and there are no regulatory requirements that require these services to be located in seismically safe buildings, thereby making targeted building mitigation efforts challenging. The City does maintain a listing of current locations as this is critical information for effective disaster response.

Land Use

A significant portion of Alameda is in a liquefaction zone and all land use types (commercial, transportation/utilities, residential, open space, shoreline, municipal, institutional) are subject to liquefaction and strong shaking. As groundwater rises, a growing proportion of city land may be at risk of liquefaction in an earthquake. Existing and future land uses planning needs to incorporate strategies to protect residents and businesses out of harm's way from both liquefaction and other hazards such as sea level rise, flooding and tsunamis. This involves important decisions about how to modify existing land use,

where development opportunities still exist, and how to design new development and redevelopment that can adapt to future conditions. Land use decisions must also consider the interests of vulnerable populations and engage with those groups to ensure land use policies are equitable. Land use policies are an important avenue to creating a resilient and equitable Alameda.

Utilities

Stormwater and Sewer Systems

In earthquakes, pump station components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. Liquefaction is extremely damaging to pipe networks, especially older more brittle pipes.

Drinking Water System

Liquefaction damage will be a serious concern for drinking water pipes as well. Estimates are that EBMUD will experience about 1,800 breaks and 3,900 leaks in the 4,162 miles of pipe network within its service area.²² An average East Bay customer would lose water for an estimated six weeks and some will lose service for as long as six months. Water supply outages will impede fighting post-earthquake fires. These service disruptions will be reduced as EBMUD continues to implement its old, brittle pipe.

Electric System

A strong earthquake will likely have a significant negative impact on AMP's distribution system and the regional grid, including widespread structure and equipment failures. Electrical substation components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. The Cartwright substation located near Woodstock Park is particularly vulnerable to earthquake damage, including foundation damage, the bus structures and equipment. Hardening of system components and regular inspections and maintenance can reduce the impacts of earthquakes on the electric grid.

Natural Gas System

The greatest risks to the energy system are liquefaction and other impacts to buried infrastructure, including corrosion of pipes. PG&E completed a vulnerability assessment that included the natural gas system but was not specific to Alameda. This assessment lays the foundation for PG&E to identify strategies to address key threats, but the City has limited control over the natural gas infrastructure within Alameda

Natural gas infrastructure is subject to damage and disruption in areas with liquefaction. Natural gas lines can also rupture in earthquakes when buildings are damaged or when natural gas appliances topple. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake, it took about 30 days to repair damaged lines in the San Francisco Marina. In a future earthquake, restoration of the

²² Detweiler, S.T., and Wein, A.M., eds., 2018.

natural gas system can take up to six months because of the time it will take to integrity test the lines prior to repressurizing and the number of qualified personnel required to relight pilot lights.²³

Broken lines can create fires if ignited until the fuel supply is exhausted. An estimated 25 percent of post-earthquake fire ignitions may be natural gas related.²⁴ **Figure E-6** shows a map of estimated fire ignitions within fire station primary response areas following the hypothetical magnitude 7.0 mainshock of the USGS HayWired scenario.²⁵ Green indicates a small likelihood of ignition and dark red indicates five or more ignitions per area. The length of the Hayward Fault ruptured in the scenario is shown on the map. According to the scenario, Alameda could have more than 11 simultaneous fire ignitions in this scenario. Responding to these fires will be complicated by the fact that Alameda is extremely likely to be without water supply following an earthquake and fire departments in other cities will not be able to respond with mutual aid given that 352 ignitions are anticipated in Alameda County, with 198 becoming conflagrations (multi-block fires).

²³ City and County of San Francisco, 2020. San Francisco Lifelines Restoration Performance Project. <https://onesanfrancisco.org/sites/default/files/inline-files/Lifelines%20Restoration%20Performance%20Report%20Final-03-02-21.pdf>

²⁴ Detweiler, S.T., and Wein, A.M., eds., 2018.

²⁵ Detweiler, S.T., and Wein, A.M., eds., 2018.

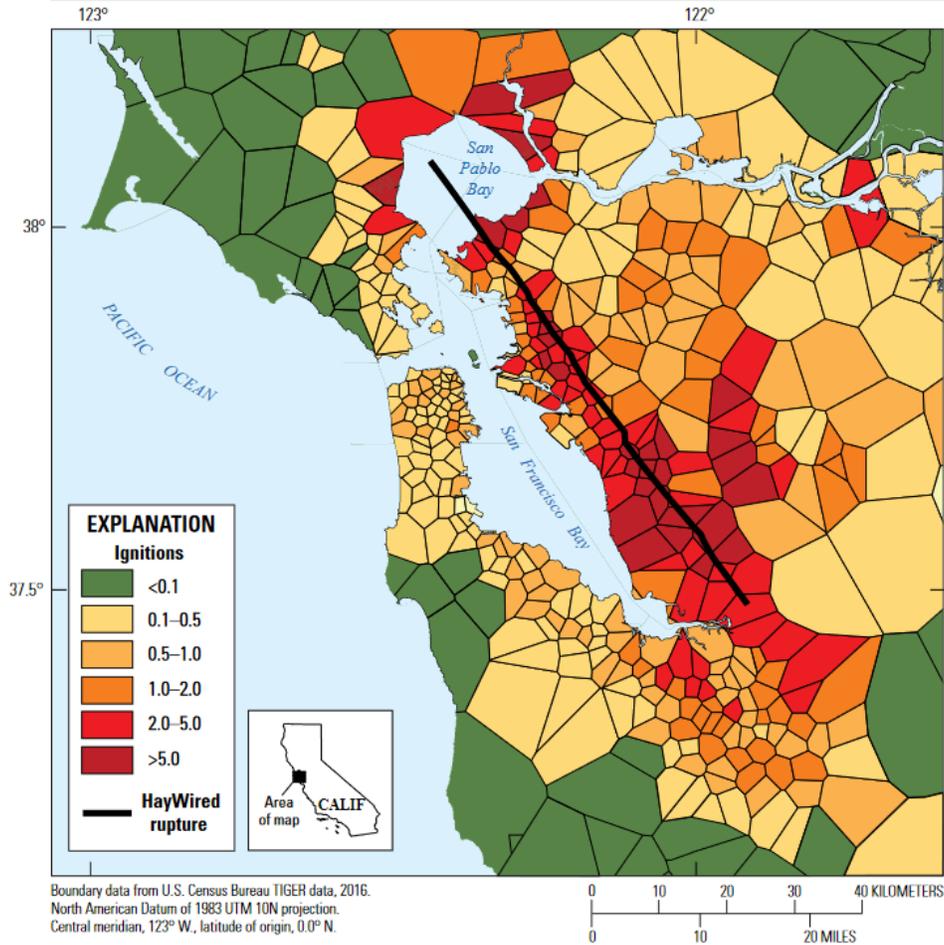


Figure E-6 Estimated number of ignitions within fire station primary response areas in HayWired event

Given the dense urban nature of Alameda’s neighborhoods with wood frame construction and isolation as an island, preventing fires after earthquakes is extremely important. Owners of soft-story buildings were required to install an earthquake-actuated gas shut-off valve on the building to reduce the likelihood of natural gas fire ignitions in earthquakes.²⁶ Automatic gas shut-off valves are also required any time a permit is issued for gas piping, whenever a property is sold or has a transfer of title.²⁷ To date, approximately 2,794 permits have been issued for gas shut-off valves in the city.²⁸ **Figure E-7** shows the location of gas shut-off valves on buildings as of August 2021. Gas shut-off valves together with flexible gas lines to appliances inside the buildings, reduce the likelihood of fire ignitions when buildings shift and break gas pipes and appliances topple. However, seismically retrofitting buildings can prevent both the gas fires and damage to the building itself.

²⁶ <http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373444&dbid=0&repo=CityofAlameda&cr=1>

²⁷ https://www.alamedaca.gov/files/assets/public/departments/alameda/building-planning-transportation/ordinances/com_dev_-_bid_-_ord_-_gas_shut_off_valve.pdf

²⁸ Alameda permit database, 2021



Figure E-7 Gas Shut-off Valves installed on Alameda Buildings

Communications and Technology Systems

Reduced capacity and increased demand for cellular communication following an earthquake will result in degraded service. Loss of power will result in further outages once battery backup systems on cell towers run out in 4-12 hours.²⁹ Cellular communications systems face several vulnerabilities, including the number of cell sites that lack of permanent backup power (including an increasing number of small cell sites used to densify the network), damage to the fiber network from liquefaction and collocated infrastructure damage, and significant number of cell sites located on buildings vulnerable to damage in earthquakes. Deploying portable cell sites and timely delivery of fuel to back up generators can all aid in the recovery of the communications network.

²⁹ City and County of San Francisco, 2020.

Transportation

In an earthquake, transportation assets will be significantly impacted by shaking and liquefaction. Surface streets and ferry terminals are particularly susceptible to liquefaction damage. Bus lines in Alameda may be disrupted, but alternate routes will likely be available. Alameda’s biking and pedestrian network will provide resilience following an earthquake and allow continued local access even if certain streets are closed.

Bart’s core service between downtown Oakland and downtown San Francisco will be restored within 24 hours; however, the Fremont line and Berkeley Hills Tunnel are expected to sustain significant damage and be inoperable for many months.³⁰

Alameda’s four main bridges and two tunnels will provide critical connection to the region following an earthquake. All the connections off the island have been evaluated or upgraded to ensure that they will protect life safety in the event of a major earthquake, however they may not be usable for some time. A “no collapse” standard means that while the bridge will survive without loss of life, significant repairs or replacement may be necessary. Bridges upgraded to “lifeline” standards are designed to be nearly immediately usable following an earthquake. **Table E-2** summarizes the seismic performance of bridges and tubes in Alameda

Table E-2 Seismic Status of Bridges and Tubes in Alameda

Bridge/Tube	Owner	Year Built	Seismic Performance	Seismic Retrofit Notes
High Street bridge	Alameda County	1939	No collapse	Retrofitted to “no collapse” standard in 2009.
Park St bridge	Alameda County	1935	No collapse	Retrofitted to “no collapse” standard in 2008.
Miller-Sweeney bridge	Alameda County	1973	No collapse	Retrofitted to “no collapse” standard in 2011. City of Alameda has requested the bridge be upgraded to “lifeline” standard.
Fruitvale rail bridge	U.S. Army Corps of Engineers	1951	Collapse hazard	Rail bridge is a collapse hazard that poses a safety hazard to Miller-Sweeney Bridge. The City of Alameda is working with the Army Corps to fund the removal or rehabilitation of this public safety hazard.
Bay Farm Island vehicular bridge	Caltrans	1953	No collapse	Seismically retrofitted in 1997 to “no collapse” standard. City sent letter in 2007 requesting retrofit to “lifeline” standard; however, Caltrans needs to better understand liquefiable soils in the area before considering the request.
Bay Farm Island	Caltrans	1996	No collapse	Bridge is newer structures with modern seismic details. Does not

³⁰ City and County of San Francisco, 2020.

Bridge/Tube	Owner	Year Built	Seismic Performance	Seismic Retrofit Notes
bike/pedestrian bridge				meet criteria for further seismic evaluation by Caltrans.
Webster and Posey tubes	Caltrans	1928 (Posey) 1963 (Webster)	No collapse	The tubes were seismically retrofitted to “no collapse” standard in 2001. Caltrans has no future plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system.
Constitution Way overcrossing	Caltrans	1985	No collapse	Bridge is newer structures with modern seismic details. Does not meet criteria for further seismic evaluation by Caltrans.
Grand St bridge	City of Alameda	1958	Unknown	No record of seismic evaluation or retrofit
Ballena bridge	City of Alameda	1966	Lifeline	Retrofit in 2008 to “lifeline” standard

Fuel is a vital part of the transportation system. Fuel supply will be extremely limited following an earthquake due to likely damage of the oil refineries along the Carquinez Strait and in Richmond, the isolation of the Northern California fuel System and potential damage to the Kinder Morgan fuel pipeline in a Hayward fault earthquake.³¹ Power and telecom are needed for full restoration of traffic signals and SMART technology functions.

Shoreline, Natural, and Recreation Areas

Alameda has both engineered shorelines (primarily seawalls or levees and associated riprap and other armoring) and a variety of natural shoreline habitats. These natural shoreline protection systems are vulnerable to damage in earthquakes and are susceptible to liquefaction if they are not designed to resist liquefaction. Major economic impacts and property loss will result from damage to shoreline protection systems.

Public Health and Welfare

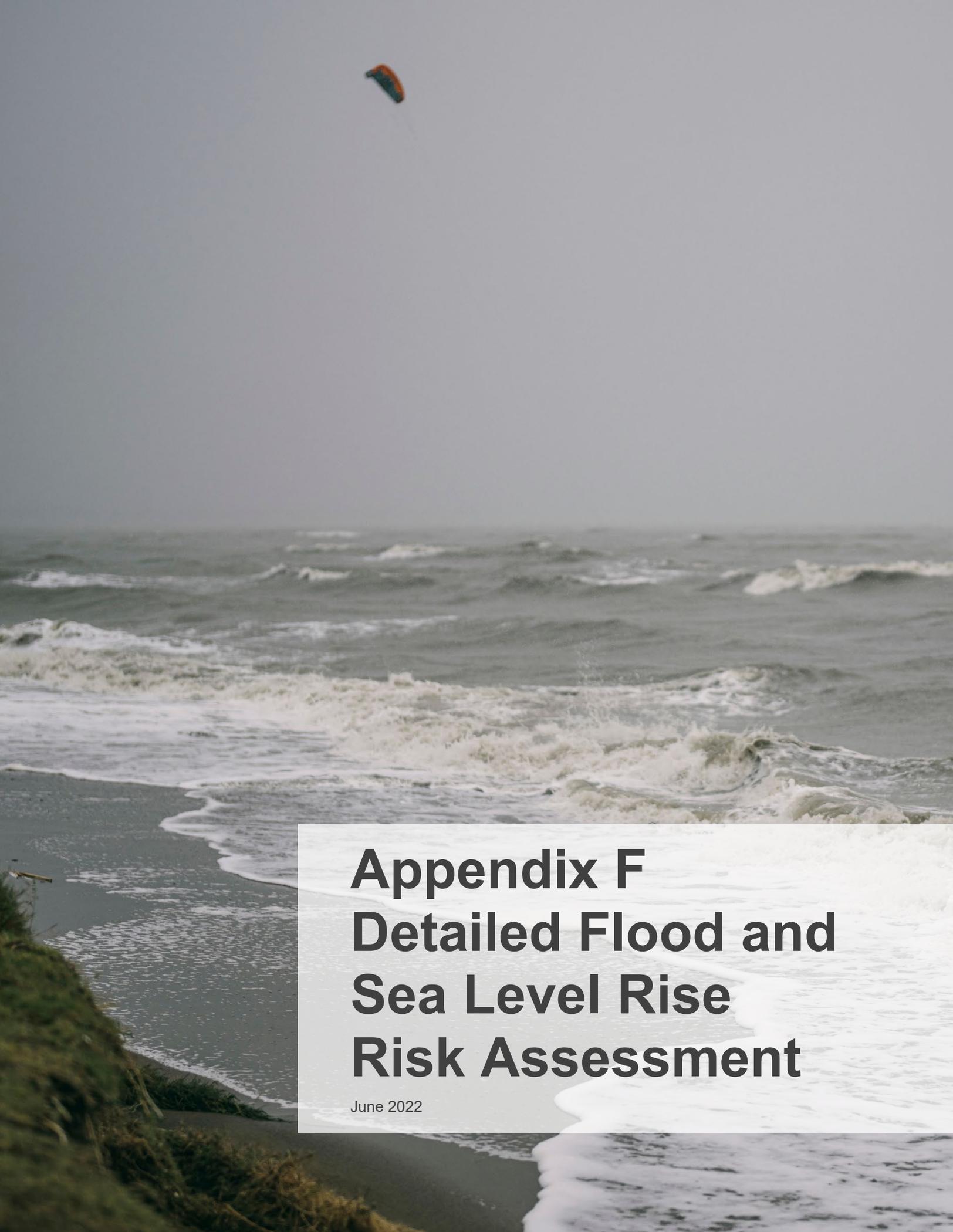
Earthquakes can have significant impacts on public health, the extent of which varies depending on geography, damage to residences, socioeconomic status, and other factors. Socially vulnerable populations are particularly at risk. Earthquakes can not only physically harm residents, but cause stress and harm to residents' wellbeing. Depending on the extent of damage, recovery from a major earthquake could take many years and will impact many aspects of residents' lives, from access to utilities, school closures, damage to homes or displacement, loss of employment, and loss of community. Some residents will bear these impacts more than others and have less ability to respond and recover themselves.

³¹ City and County of San Francisco, 2020.

Combined across the community, these individual stressors can have major impacts on public health and wellbeing, especially for residents who lack the resources and financial capacity to respond.

In New Zealand, following the Christchurch earthquake sequence of 2010/11, the Canterbury Wellbeing Index was designed to monitor wellbeing and track the progress of social recovery from the earthquakes.³² The Wellbeing Index draws from the data of many local and national agencies and incorporates information from the Canterbury Wellbeing Survey, which is conducted annually and provides an opportunity for residents to describe how they are feeling and their quality of life. The Survey also provides an opportunity for the local governments of the region to track recovery from the earthquakes in terms most important to residents and improve programs to better meet residents' needs. Following a major earthquake requiring a long recovery, tracking public health and welfare will be an important tool for protecting the wellbeing of Alamedans.

³² <https://www.cph.co.nz/your-health/canterbury-wellbeing-index/>



Appendix F Detailed Flood and Sea Level Rise Risk Assessment

June 2022

This appendix provides detailed assessment of how existing and future people, economy, buildings and infrastructure may be impacted by flooding and sea level rise in Alameda.

The People of Alameda

According to the United States Geological Survey (USGS) Hazard Exposure Reporting and Analytics (HERA) Tool (usgs.gov/apps/hera/floodTool.php) over 10,000 Alameda residents can be affected by the flood hazard resulting from a 100-year coastal storm event under a “maximum” hazard scenario (**Figure F-1**). Of those, approximately 1,700 are age 65 and older and 561 are under 5 years old. Additional populations and household types are shown in the table below for various flooding scenarios.

Many studies have shown that socially disadvantaged groups such as persons of color, low income residents and persons with disabilities are disproportionately impacted by natural disasters. These populations may have more difficulty evacuating in the event of a flood and more difficulty recovering after an event. Persons with disabilities may also be reliant on electricity for medical equipment and refrigeration of medication that can be lost during floods and winter storms. A 2016 study found that disadvantaged populations are more likely to live in housing that may be damaged in an earthquake and less able to prepare, respond and recover from a flood.¹

Table F-1 People of Alameda Affected by Depth of Flooding

Population	No. of People Affected at 100-yr Flood Event	No. of People Affected at 39.5-in Sea Level Rise	No. of People Affected at 100-yr Flood Event + 39.5-in Sea Level Rise
Total Residents	10,241	15,394	28,015
Over Age 65	1,758	2,625	4,632
Under Age 5	561	865	1,579
Hispanic or Latino	908	1,472	2,572
Asian	3,721	5,230	10,317
Black or African American	635	1,434	2,411
Institutionalized (group quarters)	118	145	546
Household Type	No. of Households Affected at 100-yr Flood Event	No. of Households Affected at 39.5-in Sea Level Rise	No. of Households Affected at 100-yr Flood Event + 39.5-in Sea Level Rise
Owner-Occupied	2,518	3,500	6,629
Renter-Occupied	1,668	2,721	4,643

¹ ABAG and BCDC, 2015, *Stronger Housing, Safer Communities*, www.adaptingtorisingtides.org/project/stronger-housing-safer-communities-strategies-for-seismic-and-flood-risks/.

Alameda Economy

The USGS HERA Tool also shows economic assets that are affected by the 100-year flood hazard under a “maximum” hazard scenario. Employee data shown was determined from the Infogroup Employer Database and reflect employee counts as of March 1, 2020. Businesses are described and grouped according to the North American Industry Classification System (NAICS). Parcel boundaries and their values (tax year 2019) are from the Homeland Infrastructure Foundation-Level Data (HIFLD) repository.

Table F-2. Economy of Alameda Affected by Depth of Flooding

Types of Employees Affected	No. of Employees Affected in 100-year Flood Event	No. of Employees Affected at 39.5-in Sea Level Rise	No. of Employees Affected at 100-yr Flood Event + 39.5-in Sea Level Rise
Total Employees	2,394	5,961	10,310
Government and Critical Facilities	404	919	2,573
Manufacturing	140	391	763
Natural Resources	3	3	5
Services	740	2,285	3,961
Trade	1,107	2,363	3,008
Parcel Values	Improved Parcel Value in 100-year Flood Event	Improved Parcel Value at 39.5-in Sea Level Rise	Improved Parcel Value at 100-yr Flood Event + 39.5-in Sea Level Rise
Both Improved and Land Values	\$1.7 Billion	\$2.6 Billion	\$5.3 Billion
Improved Parcels	\$1.2 Billion	\$1.8 Billion	\$3.6 Billion
Land	\$575.0 Million	\$857.6 Million	\$1.7 Billion
Building Replacement Value	Building Replacement Value in 100-year Flood Event	Building Replacement Value at 39.5-in Sea Level Rise	Building Replacement Value at 100-yr Flood Event + 39.5-in Sea Level Rise
Total Value Across All Uses	\$1.4 Billion	\$2,348,021,412	\$4.0 Billion
Residential Use	\$1.2 Billion	\$1.8 Billion	\$3.2 Billion
Commercial Use	\$186.6 Million	\$393.9 Million	\$578.4 Million
Educational Use	\$10.5 Million	\$22.3 Million	\$32.9 Million
Governmental Use	\$13.0 Million	\$42.6 Million	\$56.7 Million
Industrial Use	\$25.4 Million	\$63.5 Million	\$85.4 Million

Buildings

Buildings constructed in Alameda are not generally designed to withstand projected levels of flooding or saltwater exposure, yet Alameda's buildings are vulnerable to flooding from sea level rise, storm surge, major rainfall events, and other sources of flooding - such as water main breaks and groundwater intrusion.

All buildings are vulnerable to flooding, especially if they are slab-on-grade or have basements. Damage consists of direct damage by water, and later damage by mold. Additionally, all building contents below the flood line are vulnerable to flooding. If the flooding is relatively shallow, then carpet, sheetrock and paneling can be removed and replaced and mold abated. The building can then be returned to its former level of service. After flooding, many buildings lose function temporarily until they are deemed safe or are rebuilt. Depending upon the building, this loss of service may include emergency services, sheltering and gathering, commerce, education, medical care, daycare, elder care, government, and recreation. Short term and long-term recovery of the City depends upon quick restoration of these services.

Coastal Flood Vulnerable Buildings

Over 1,100 Alameda buildings are mapped within the current 100-year flood zone. The majority of buildings are privately owned homes, followed by commercial and industrial properties. There are however a handful of City-owned buildings as well (most City buildings are located away from the shoreline on higher ground and therefore not within the flood zone), This also holds true for future total water level scenarios involving sea level rise.

City-owned and privately-owned buildings vulnerable to coastal flooding at the current 100-year flood event, a future 36-inch sea level rise scenario, and a combined 100-year + 36-inch sea level rise scenario are listed in **Table F-3 and F-4** below. The depths of flooding listed were calculated by finding the approximate ground elevation at each location from City GIS contour data and then subtracting it from the total water level anticipated at each scenario.

City-Owned Buildings

There are eight City-owned buildings vulnerable to flooding at the 100-year flood event. On the main island these include the Fleet Vehicle Service Center on Grand Avenue, the O'Club building at Alameda Point, Alameda Point Gym, and Encinal Jr. Sr. High School (southern portion of property is in flood zone, buildings are not). All of these facilities are expected to have less than 1 ft of flooding at the 100-year flood event, and negligible flooding at a 36-inch sea level rise scenario. Additional City-owned properties are listed below these four that will be affected by the 100-year + 36-inch sea level rise scenario. These include City Hall West, Otis School, the Animal Shelter, and Alameda Community Learning Center. All main island buildings listed will have 1 ft or greater of flooding at the 100-year + 36-inch sea level rise scenario.

On Bay Farm Island, properties vulnerable to the 100-year event include the Chuck Corica Golf Course clubhouse building, the small building within Godfrey Park south of the golf course, the eastern-most building on the Earhart School property, and Bay Farm Island Library (library property is in flood zone, building is not). Of these four, only the clubhouse building and the Godfrey Park building may see significant flood depth at the 100-year event due to their low-lying ground elevation. A similar trend is predicted for the 36-inch sea level rise scenario. However, all four Bay Farm properties will be affected by

the 100-year + 36-inch sea level rise scenario and will experience 1 ft or greater of flooding at the 100-year + 36-inch sea level rise scenario.

Table F-3 City-Owned Coastal Flood Vulnerable Buildings and Depths of Flooding

City Building	Approx. Ground Elevation at Building (NAVD88)	Approx. Depth of Flooding at 100-yr Flood Event (Total Water Level = 10ft NAVD88)	Approx. Depth of Flooding at 36-in Sea Level Rise (Total Water Level = ~ 9.5ft NAVD88)	Approx. Depth of Flooding at 100-yr Flood Event + 36-in Sea Level Rise (Total Water Level = 13ft NAVD88)
Main Island:				
Fleet Vehicle Service Center	10 ft	Less than 1 ft	n/a	3 ft
O'Club (Alameda Point)	10 ft	Less than 1 ft	n/a	3 ft
Gym (Alameda Point)	10 ft	Less than 1 ft	n/a	3 ft
Encinal Jr. Sr. High School	11 ft	n/a	n/a	2 ft
City Hall West	12 ft	n/a	n/a	1 ft
Otis School	10 ft	n/a	n/a	3 ft
Animal Shelter	11 ft	n/a	n/a	2 ft
Alameda Community Learning Center	11 ft	n/a	n/a	2 ft
Bay Farm Island:				
Golf Course Clubhouse	2 ft	8 ft	7.5 ft	11 ft
Godfrey Park Building	5 ft	5 ft	4.5 ft	8 ft
Earhart School (One Building Only)	9.5 ft	Less than 1 ft	n/a	3.5 ft
Earhart School (Remainder of Property)	12 ft	n/a	n/a	1 ft
Bay Farm Island Library	11 ft	n/a	n/a	2 ft

Privately-Owned Buildings

Over 1,000 privately-owned buildings are considered vulnerable at these scenarios, split between the main island and Bay Farm Island. On the main island a mixture of building types are impacted in the northern shoreline flooding area, with a 100-year flood depth limited to 3 ft or less and a 36 in sea level rise event flood depth of 2.5 ft or less, due to land elevations in the 7 to 10 ft NAVD88 range. Along the eastern shoreline, the majority of affected private buildings are single-family homes in the Liberty Avenue and Fernside Boulevard neighborhoods that have a land elevation of 8 to 10 ft NAVD88 and therefore can expect 2 ft and 1.5 ft of flooding depth for the 100-year and 36 in sea level rise event respectively. The developed properties within Alameda Point's flooding area are largely similar in elevation to the eastern shoreline area and therefore can expect depths of 2 ft and 1.5 ft or less, respectively, for the 100-year

and 36 in sea level rise event, for the mixture of commercial, industrial, and residential properties impacted.

On Bay Farm Island, the lowest elevations in the City occur here, as low as 2 ft NAVD88 - and as such there is also the potential for the largest depth of flooding. In the Island and Maitland Drive areas, populated by mostly single family homes, a depth of flooding ranging between 0 to 8 ft, and 0 to 7.5 ft respectively for the 100-year event and 36 in sea level rise event is expected, depending on the exact elevation at a given home address. Along Lagoon System 1 North, where ground elevations are higher and the area is populated by single family homes and townhouses, flooding is expected to be 2 ft and 1.5 ft or less, respectively, for the 100-year and 36 in sea level rise events.

All locations listed are vulnerable to significant flooding from the 100-year + 36-inch sea level rise event, depths of which are shown in the far-right column.

Table F-4. Privately-Owned Coastal Flood Vulnerable Buildings and Depths of Flooding

Building Location within Given Flood Event	Majority Building Type	Approx. Range of Ground Elevations within Area (NAVD88)	Approx. Depth of Flooding Range at 100-yr Flood Event (Total Water Level = 10ft NAVD88)	Approx. Depth of Flooding Range at 36-in Sea Level Rise (Total Water Level = ~ 9.5ft NAVD88)	Approx. Depth of Flooding Range at 100-yr Flood Event + 36-in Sea Level Rise (Total Water Level = 13ft NAVD88)
Main Island:					
Northern Shoreline	Mixed	7 to 10 ft	0 to 3 ft	2.5 ft or Less	3 ft to 6 ft
Eastern Shoreline	Single Family Homes	8 to 10 ft	0 to 2 ft	1.5 ft or Less	3 ft to 5 ft
Alameda Point	Mixed	8 to 10 ft	0 to 2 ft	1.5 ft or Less	3 ft to 5 ft
Bay Farm Island:					
Island & Maitland Drive Areas	Single Family Homes	2 ft to 10 ft	0 to 8 ft	0 to 7.5 ft	3 ft to 11 ft
Lagoon System 1 North	Single Family & Townhouses	8 ft to 10 ft	0 to 2 ft	1.5 ft or Less	3 ft to 5 ft

Overland Flood Vulnerable Buildings

Overland flooding can occur due to various causes (rainfall, water main breaks, groundwater, etc.) and can happen anywhere, since all of Alameda is susceptible to these sources in one form or another. Therefore, all buildings within Alameda, public and private, are considered vulnerable to overland flooding in some form. The depth of flooding due to any of these causes would in all likelihood be less than what would occur due to a coastal flooding event, but exact conditions would depend on the individual event.

Critical Services

Alameda’s critical services—fire, police, emergency medical services (EMS), schools, hospitals—are vulnerable to flooding from sea level rise, storm surge, and major rainfall events, primarily due to access issues created by flood events and the resulting inability to provide services. Disruption directly to Alameda’s critical facilities or the transportation system on which they rely can exacerbate climate impacts because the public depends on these services most during emergencies. Schools are especially important to disadvantaged and vulnerable communities because they rely on these services for child care and meals. Critical services must have systems in place to communicate with the public, avoid becoming overtaxed, and keep their staff safe as they care for the public.

As shown in the above table of City-owned buildings vulnerable to flooding, there are no fire, police, EMS, or hospital facilities within the 100-year coastal flood zone in Alameda. However, there are two schools that are affected: Earhart School and Otis School. Otis School sits at the Base Flood Elevation and will not have flooding at the 100-year event or 36-inch sea level rise scenario. Earhart School on Bay Farm Island has one of the buildings on their campus that lies on the edge of the flood zone which passes through the property. This building will see less than 1ft of flooding at the 100-year event because topographically it is slightly lower than the Base Flood Elevation, and no flooding at the 36-inch sea level rise scenario. Both however will have significant depth of flooding at the combined flood/sea level rise scenario.

As detailed in the Transportation section below, all 3 major roadways that provide egress from Bay Farm Island to the main island and Oakland (via Doolittle Drive) will experience flooding to a different degree due to their varying elevations. This will make access by critical services nearly impossible in the event of a 100-year flood or events of greater depth due to impassible roadways.

Land Use

The broad types of land use in Alameda include residential, mixed-use, business, wildlife habitat, public parks/open space, public/institutional, commercial maritime/marinas, federal facilities, and general/maritime industry. On the main island, low and medium-density residential use stretches from the eastern shoreline to Main Street on the west side, while business and mixed-use occupies the northern shoreline and open space/public parks line the southern shores. On Alameda Point, mixed use, wildlife habitat, and open space are the largest uses. Low and medium-density residential dominates the developed area of Bay Farm Island, while the Chuck Corica Golf Course is the largest open space.

Table F-5 below shows the land uses most affected by the 100-year flood event or 36-inches of sea level rise.

Table F-5 Land Uses Most Affected by 100-Year Flood Event

Area of Island Impacted by 100-Year Flood Event or 36-Inches of Sea Level Rise	Land Uses Most Affected
Main Island:	
Northern Shoreline	#1: Business #2: Mixed-Use #3: Medium-Density Residential
Eastern Shoreline	Low-Density Residential
Alameda Point	#1: Mixed-Use #2: Wildlife Habitat #3: Open Space
Bay Farm Island:	
Island & Maitland Drive Areas	#1: Low-Density Residential #2: Medium-Density Residential
Lagoon System 1 North	#1: Low-Density Residential #2: Medium-Density Residential
Chuck Corica Golf Course	Open Space

Given Alameda’s exposure to a wide range of climate hazards, most notably sea level rise and storm surge flooding, existing and future land use planning needs to incorporate adaptation strategies to keep residents and businesses out of harm’s way. This involves important decisions about how to modify existing land use, where development opportunities still exist, and how to design new development and redevelopment that can adapt to future climate conditions. Land use policies are an important avenue to creating a resilient Alameda.

Utilities

Stormwater and Sewer Systems

Stormwater

The closed-system stormwater network located in the lower elevations of Alameda’s main island is composed of catch basins, manholes, and pipes and receives watershed drainage from the upper elevations of the island. Approximately 20% of the closed stormwater system is within the area impacted by either the current 100-year flood zone or a 36-inch sea level rise scenario.

Additionally, there are five stormwater pump stations located in the current 100-year flood zone: on the main island these include the Main Street, Webster Street, Northside, and Central/Eastshore stations, and on Bay Farm Island, Golf Course station is the only station. At the time of this writing, design of new elevated control panels for all but Northside is complete and preparing for bid. Panels are planned to be constructed at Elevation 13 ft NAVD88, which is above the elevation of the 100-year flood event plus 36-inches of sea level rise scenario (see far-right column). **Table F-6** shows the depth of flooding expected at the pump stations at different scenarios.

While the Golf Course station shows significant flooding potential at all scenarios due to its low-lying elevation, the extensive regrading of the golf course over the last few years has created a landscape of mounds that would in all likelihood alter the flood patterns experienced there. As discussed previously the FEMA FIRMs do not reflect the golf course grading on the FIRMs since the work is not FEMA accredited. Note that Golf Course station is one of the 4 stations mentioned above that will receive the new control panels elevated to 13 ft NAVD88.

Table F-6. Stormwater Pump Station Depths of Flooding

Stormwater Pump Station	Approx. Ground Elevation at Station (NAVD88)	Approx. Depth of Flooding at 100-year Flood Event (Total Water Level = 10ft NAVD88)	Approx. Depth of Flooding at 36-in Sea Level Rise (Total Water Level = ~ 9.5ft NAVD88)	Approx. Depth of Flooding at 100-yr Flood Event + 36-in Sea Level Rise (Total Water Level = 13ft NAVD88)
Main Street	9 ft	1 ft	0.5 ft	4 ft
Webster Street	9 ft	1 ft	0.5 ft	4 ft
Northside	9.5 ft	0.5 ft	n/a	3.5 ft
Central/Eastshore	9.5 ft	0.5 ft	n/a	3.5 ft
Bay Farm Island				
Golf Course	1 ft	9 ft	8.5 ft	12 ft

The City must address stormwater system vulnerabilities and deficiencies identified during previous storm drain (Storm Drain Master Plan, 2008) and sea level rise modeling. Given the criticality of addressing the stormwater system, it is highlighted as a priority asset.

Sewer

Floods can damage Alameda’s sanitary sewer system, particularly pump stations. Old, cracking pipe can also be infiltrated with rainwater or rising groundwater. This water then must be conveyed to the treatment plant, increasing the likelihood of partially treated effluent being discharged directly into the Bay. As part of a Federal Consent decree, the City of Alameda is replacing 2.6 miles of sanitary sewer main a year and making other improvements to reduce infiltration to the system.

Table F-7. City-Owned Stormwater and Wastewater Utilities Affected by Flooding

Utility	Quantity	Approx. % Exposed to Current 100-year Flood, Total Water Level = 10ft NAVD88	Approx. % Exposed to 36-in Sea Level Rise, Total Water Level = ~ 9.5ft NAVD88
Stormwater			
Storm Pipes and Cross Culverts	90 miles	20%	Less than 20%
Storm Manholes	2,058 each	20%	Less than 20%
Other Storm Structures (ex. Catch basins, outlets)	401 each	20%	Less than 20%
Storm Pump Stations	11 each	45%	45%
Storm Outfalls	227 each	100%	100%
Wastewater			
Sewer Mains	142 miles		
Sewer Manholes	3,122 each		
Sewer Pump Stations	42 each		

Drinking Water System

The linear footage of the drinking water system affected by the 100-year flood event is similar to that of the roadway network (see **Table F-9**, Transportation section) since EBMUD pipelines largely lie within city roadways. Floods have minimal consequences for water pipelines.

Electric System

The vulnerability assessment reviewed AMP electrical facilities and found none to be at immediate high risk of exposure to sea level rise or storm-event flooding. The greatest risks to the energy system are liquefaction and other impacts to buried infrastructure rather than flooding. Addressing flooding due to overtopping of the shoreline will provide some degree of protection of critical energy system infrastructure over the longer term but will not increase the resilience of buried infrastructure to seismic hazards such as liquefaction and groundwater rise.

One component of the electric system that might be affected indirectly by sea level rise and directly by earthquake is the Cartwright Substation at Alameda Point. The Cartwright Substation is a critical component of the existing electric system and is intended to remain in service. The substation provides local electric distribution to Alameda Point and portions of the surrounding areas to the east.

Increases in sea level will result in increased groundwater levels. Water enters the basement level of the Cartwright Substation through underground conduits and other penetrations. A sump pump is used intermittently to prevent the basement from flooding. Increased levels of groundwater will make it harder to prevent flooding of the substation’s basement which could lead to damage of electrical equipment on the main level.

Table F-8. Electrical Utilities

Utility	Amount	% Exposed to Current 100-yr Flood	% Exposed to 36-in Sea Level Rise
Alameda Municipal Power Overhead Distribution	86 pole miles	10	5
Alameda Municipal Underground Distribution	194 circuit miles	35	15
Alameda Municipal Power Overhead Transmission	6.8 pole miles	10	5
Alameda Municipal Power Underground Transmission	1.9 circuit miles	5	2

Natural Gas System

The linear footage of the natural gas system affected by the 100-year flood event is similar to that of the roadway network (see **Table F-9**, Transportation section) since natural gas pipelines largely lie within city roadways. Floods have minimal consequences for water pipelines. PG&E has completed a vulnerability assessment that included the natural gas system but was not specific to Alameda. This assessment lays the foundation for PG&E to identify strategies to address key threats, but the City has limited control over the natural gas infrastructure within Alameda.

Communications and Technology Systems

Building 2 on Alameda Point (telecom switch station) is a critical facility for AT&T telecommunications infrastructure on Alameda Point. The vulnerability assessment concluded that this facility is not directly exposed to sea level rise and flooding but may be vulnerable to rising temperatures because it lacks an internal climate control system. The Alameda Point MIP includes flood protection systems that could protect Building 2 and other telecom assets on Alameda Point, but it does not cover internal adaptations for specific buildings.

Transportation

Flooding of various areas and neighborhoods of Alameda has already been discussed. However, the routes needed to provide egress for these properties are also affected. **Table F-9** shows the major roadways and approximate linear footage of each within the current 100-year flood zone. This is similar to the total linear footage affected by a 36-inch sea level rise scenario as well, since the total water elevations for each are only 0.5 ft different. Major roadway exposure is quantified at approximately 32,700 linear feet. There are many side streets also affected that are not included in this estimate.

All major roadways within the 100-year flood zone are anticipated to flood at least 1 ft deep (less than 1 ft of floodwaters can render a road unpassable by vehicles). **Table F-10** shows the approximate maximal depth of flooding for each roadway. On the northern end of the main island, State Route 260 descends as it enters the Webster and Posey Tube Portals separately to pass under the Bay. At the top of the descent the elevations are approximately 10 ft and 9 ft NAVD88 respectively (note that the depth of flooding that will be ultimately reached within each tube at a given event will vary depending on the elevation that floodwaters reach on land as well as the duration of the flood event). On the east end, Fernside

Boulevard has approximately 1 ft depth of flooding at the 100-year event. And on Alameda Point, Main Street will see 3 ft of flooding at its lowest point.

The risk assessment section discussed Bay Farm Island’s particular vulnerability to flooding given its interconnected flood zone and multiple routes of egress that are affected. The 3 major roadways that provide egress from Bay Farm Island to the main island, and from Bay Farm Island to Oakland via Doolittle Drive are: Harbor Bay Parkway, Island Drive, and Doolittle Drive. Each will experience flooding to a different degree along their length due to varying elevations. At the 100-year event Harbor Bay Parkway will experience a 10 ft depth of flooding at its lowest point and Island Drive will experience 5 ft at its lowest, both definitely impassible. Doolittle Drive and Robert Davey Jr. Drive are on relatively higher ground and will experience 1 ft of flooding at their low points, on the verge of being passable. It is unknown how the grading changes on the golf course over the last few years will affect flooding on the surrounding streets during an actual event.

Table F-9. Length of Major City Roadways within 100-year Flood Zone

Major Roadways Impacted by Flooding (and Area of City) at 100-yr Flood Event	Approx. Linear Footage (LF) Affected at Current 100-yr Flood Event (Total Water Level = 10ft NAVD88)
Main Island:	
SR 260/Webster St. Leading to Posey Tube Portal Descent (Northern Shoreline)	3,000 LF
SR 260/Webster St Loop Leading to Webster Tube Portal Descent (Northern Shoreline)	600 LF
Fernside Blvd. (Eastern Shoreline)	2,000 LF
Main Street (Alameda Point)	5,700 LF
Bay Farm Island:	
Doolittle Drive	1,800 LF
Harbor Bay Parkway	6,100 LF
Island Drive	4,600 LF
Maitland Drive	4,400 LF
Mecartney Road	2,500 LF
Robert Davey Jr. Drive	2,000 LF
Total Major Roadway Exposure:	32,700 LF

Table F-10. City Roadways and Maximum Depth of Flooding at Their Low Points

Major Roadways Impacted by Flooding (Area of City) at 100-yr Flood Event	Approx. Lowest Ground Elevation within Flood Zone (NAVD88)	Approx. Maximum Depth of Flooding at Current 100-yr Flood Event (Total Water Level = 10ft NAVD88)	Approx. Maximum Depth of Flooding at 36-in Sea Level Rise (Total Water Level = ~ 9.5ft NAVD88)	Approx. Maximum Depth of Flooding at Current 100-yr Flood Event + 36-in Sea Level Rise (Total Water Level = 13ft NAVD88)
Main Island:				
SR 260/Webster St. at Beginning of Posey Tube Portal Descent (Northern Shoreline)	8 ft	2 ft	1.5 ft	5 ft
SR 260/Webster St Loop at Beginning of Webster Tube Portal Descent (Northern Shoreline)	9 ft	1 ft	0.5 ft	4 ft
Fernside Blvd. (Eastern Shoreline)	9 ft	1 ft	0.5 ft	4 ft
Main Street (Alameda Point)	7 ft	3 ft	2.5 ft	6 ft
Bay Farm Island:				
Doolittle Drive	9 ft	1 ft	0.5 ft	4 ft
Harbor Bay Parkway	0 ft	10 ft	9.5 ft	13 ft
Island Drive	5 ft	5 ft	4.5 ft	8 ft
Maitland Drive	3 ft	7 ft	6.5 ft	10 ft
Mecartney Road	6 ft	4 ft	3.5 ft	7 ft
Robert Davey Jr. Drive	9 ft	1 ft	0.5 ft	4 ft

Shoreline, Natural, and Recreation Areas

Alameda has a total of 23.6 miles of shoreline (excluding Coast Guard Island) consisting of both engineered shorelines (primarily seawalls or levees and associated riprap and other armoring) and natural shoreline. These shorelines attenuate waves and mitigate the impacts of storm events, and will also do so under future sea level rise conditions. In many areas, including the full perimeter of Bay Farm Island, they provide a protective distance between ocean waters and residential homes. They also provide a public access area for the public to enjoy the waterfront and is designated as the San Francisco Bay Trail for a large part of that.

Riprap is by far the most common type of shoreline used within the city. **Table F-11** illustrates the type and quantity of shorelines on Alameda’s main island and Bay Farm Island.

Table F-11. Shoreline Types, Perimeter Mileage, and Percentage of Each within Alameda

Shoreline Type	Perimeter Mileage	Percentage of Overall Shoreline Protection
Main Island:		
Rip Rap Revetment	10.27	51.3%
Bulkhead	4.21	21.0%
Residential Seawalls or Natural Shoreline Berm	1.32	6.6%
Beach	2.52	12.7%
Alameda Point Piles (N.W. Corner)	0.13	0.6%
Rip Rap Revetment (Ballena Isle)	1.56	7.8%
TOTAL MILEAGE:	20.01	100%
Bay Farm Island:		
Rip Rap Revetment	2.75	77.0%
Natural Shoreline	0.75	21.0%
Seawall	0.07	2.0%
TOTAL MILEAGE:	3.57	100%

On the main island, 59% of shoreline protection consists of riprap, including Ballena Isle. The largest presence of riprap occurs along the Alameda Point shoreline and Ballena Isle shoreline where exposure to the Bay’s wave effects is greatest. The Alameda Point shoreline is mainly within or adjacent to the 100-year VE Flood Zone (wave heights greater than or equal to 3 ft) that extends into the Bay, with a BFE = 12 ft NAVD88. Moving eastward along the southern shoreline, the BFE varies and reaches as high as 13 ft NAVD88 along the Ballena Isle perimeter and within crab cove, as the Zone designation shifts to AE (wave heights less than 3 ft). See **Figure F-1**.

Large diameter riprap is used along 77% of Bay Farm Island’s shoreline in order to buffer it from the impacts of wave action since it is directly exposed to the Bay’s wave effects from the south and west. As shown on **Figure F-2**, the southernmost portion of shoreline has the highest BFE within the City of Alameda, at 14 ft NAVD88 in elevation, and is in the VE Zone that extends out into the Bay. As you move northerly up the coastline and eastward, the BFE values decrease, and the flood zone changes from VE to AE as exposure to the Bay decreases.



Figure F-1. FEMA FIRM Showing VE and AE Flood Zones with Varying Base Flood Elevations and Wave Heights Around Alameda Point and the Southerly Shoreline of Alameda's Main Island

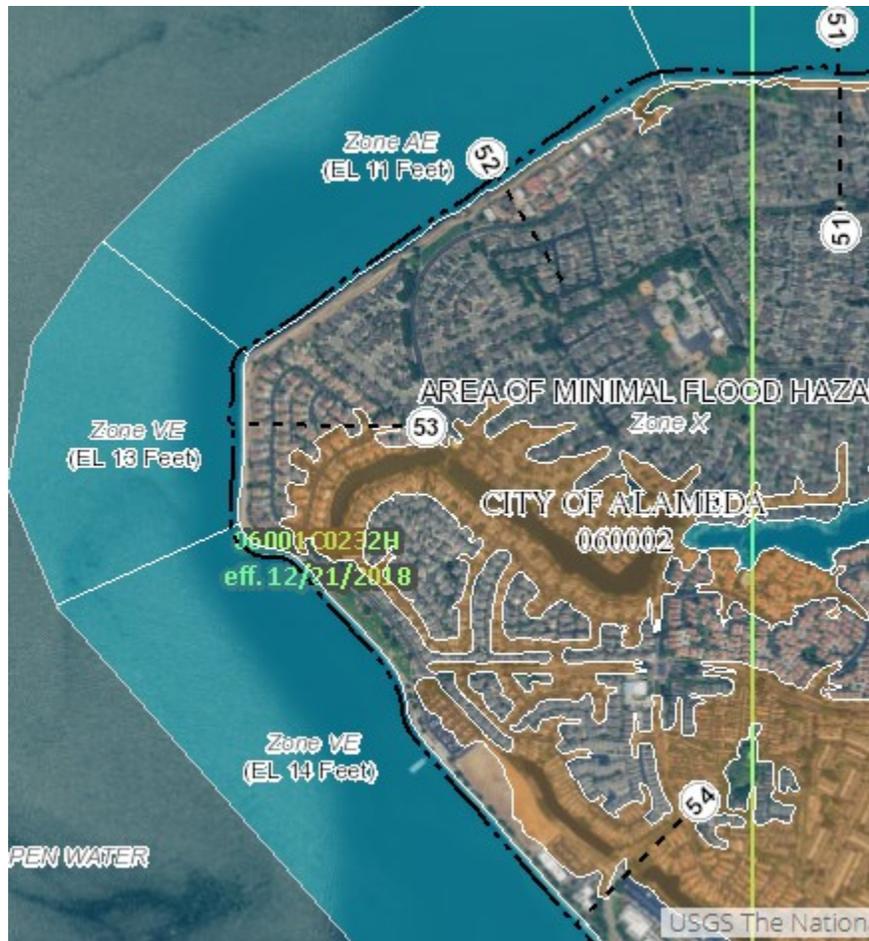


Figure F-2. FEMA FIRM Showing VE and AE Flood Zones with Varying Base Flood Elevations and Wave Heights Around Bay Farm Island's Shoreline

Although shoreline vulnerability depends on several factors including location and current stage of maintenance, all shorelines are vulnerable to flooding and erosion. There have been instances in the past when large storms disturbed the large-diameter riprap along the Bay Farm Island perimeter and replacement was needed. In 2006, large storms displaced the riprapped southern shoreline of Bay Farm Island near the airport and this area needed to be repaired.

When erosive issues are at play, the underlying berm fill material is eaten away and the integrity of the shoreline is compromised. With natural shoreline areas such as the northern shoreline of Bay Farm Island, the erosion is even more pronounced because there are not large boulders present to buffer the wave energy. In turn, the protective distance between homes and the waterfront is lessened and the potential for coastal flooding increased.

If erosion / flooding is relatively minimal in a riprap shoreline area, in most cases the shoreline can be restored using construction equipment and be replacing the riprap and regrading as needed. For natural shorelines such as the northern shoreline of Bay Farm Island, natural erosion-protection measures such as coconut fiber logs and erosion control matting secured with stakes have been used effectively in the past to repair eroded areas. The shoreline is then allowed to regrow to its former level of stability over time. Short term and long-term recovery of the shoreline may depend upon the speed of restoration.

Lowest Elevation Shoreline Areas

Thankfully, nearly all low points of the city's shoreline that are entry points for coastal flooding occur in AE Zones where the BFE is limited to 10 ft NAVD88, and therefore floodwaters would extend onto city land until they meet the ground contour at that same elevation. For this reason, nearly the entire city's land-based flooding has a BFE = 10 ft NAVD88.

The points of lowest elevation along the perimeter shoreline are the most vulnerable to coastal flooding because floodwaters would first enter here. The lowest elevation of shoreline on the main island is on Federal property, along the southern shoreline of Alameda Point, where it dips down as low as 7 ft NAVD88 in one area. Otherwise, the lowest elevations of shoreline on the main island are generally 9 ft NAVD88 or greater, as shown in Error! Reference source not found.. Both the northern shoreline and the eastern shoreline, primary overtopping location at Liberty Ave have concrete structures that extend higher in elevation than the shoreline behind them. The seawall along the northern shoreline has a top of wall elevation at approximately 10.5 ft NAVD88, and the concrete windrow has a top elevation at approximately 11 ft NAVD88. Despite the presence of these structures, the shorelines in these locations are still shown as coastal flood entry points on the FEMA FIRMS because the seawalls were not originally built to FEMA accreditation standards. This means that although they are currently in operation for flood prevention, FEMA does not consider them as barriers to the 100-year flood event and did not consider them when preparing the FIRMS. Consequently, the flood zone is shown as extending onto land to the 10 ft NAVD88 contour via the shoreline at both locations.

The Bay Farm Island perimeter shoreline has multiple points of entry for the 100-year flood event. The lowest locations are at the Lagoon System 1 North Outfall, Veterans Court, the model airplane field, and Doolittle Drive/SR 61. However, there are currently seawalls in two of these locations – the lagoon outfall and Veterans Court - that extend higher in elevation than the shoreline and provide some level of protection for these two shoreline areas. The seawall at the lagoon outfall has a top of wall elevation at approximately 11.5 ft NAVD88, and the seawall at Veterans Court has a top of wall elevation at approximately 9 ft NAVD88. In a similar fashion as described above for the northern and eastern shorelines, the shorelines at Veterans Court and the Lagoon System 1 North Outfall are still shown as coastal flood entry points on the FEMA FIRMS because the seawalls were not originally built to FEMA accreditation standards. Consequently, the flood zone is shown as extending onto land to the 10 ft NAVD88 contour via the shoreline at Veterans Court and the Lagoon System 1 North Outfall.

Error! Reference source not found. below shows the lowest perimeter shoreline locations and elevations, and how shorelines are affected by storm and anticipated sea level rise events, assuming no locations have effective floodwalls (as FEMA assumes on the FIRMS). It also summarizes the elevations of the unaccredited floodwalls/structures in Alameda for reference. Many of these shoreline locations are described in further detail in the description of Priority Coastal Inundation Locations in Chapter 5.

As shown in the table, the greatest depth of shoreline flooding in Alameda at the 100-year event theoretically occurs at Veterans Court, with 4 feet expected, assuming no seawall is present. However, the existing seawall does currently hold back tidal Bay waters on a daily basis and to a higher degree during king tide events, so practically speaking if the 100-year flood were to occur today and the wall functioned effectively, the flood depth over the top of the wall would be limited to 1 ft, because the top of the wall is at 9 ft NAVD88.

The tops of the other walls, along the northern and eastern shorelines as well as at the Lagoon System 1 North Outfall, are all higher than the 100-year base flood elevation, and therefore if they functioned effectively at the 100-year event then there would most likely be minimal flooding extending landward.

The table shows us that for the vast majority of the coastal flooding locations in Alameda, flooding is limited to 2 ft or less at the 100-year event along the shoreline, assuming no seawalls are present. For the 36-inch sea level rise scenario, flooding is even less. However, as described previously in the Buildings and Transportation sections flood depths will be greater in magnitude in areas of the city with low elevations as the flooding extends to those locations.

For a scenario of the 100-year flood event plus an additional 36-inches of sea level rise added on top of it for a total water elevation of 13 ft NAVD88, flood depths are substantial along the shoreline (far right column) assuming no seawalls are present.

Table F-12 Summary of Applicable Priority Coastal Flooding Locations

Shoreline Location	Flood Zone and BFE (NAVD88)	Type of Shoreline	Approx. Top Elevation of Unaccredited Seawall at Location, if Present (NAVD88)	Approx. Ground Elevation at Lowest Point (if Seawall is Present, then Behind/Landward of it) (NAVD88)	Approx. Depth of Flooding at Shoreline at Current 100-yr Flood Event Assuming No Seawall (Total Water Level = 10ft NAVD88)	Approx. Depth of Flooding at Shoreline at 36-in Sea Level Rise Assuming No Seawall (Total Water Level = ~ 9.5ft NAVD88)	Approx. Depth of Flooding at Shoreline at Current 100-yr Flood Event + 36-in Sea Level Rise Assuming No Seawall (Total Water Level = 13ft NAVD88)
Main Island:							
Crown Beach and Bird Sanctuary	AE, Varies between 11 & 12 ft	Beach/ Natural Shoreline	n/a	9.5 ft	0.5 ft	Less than 0.5 ft	3.5 ft
Eastern Shoreline Primary Overtopping Location At Liberty Ave	AE, 10 ft	Riprap and Concrete Windrow	11 ft	9 ft	1 ft	0.5 ft	4 ft
Northern Shoreline North of Tubes	AE, 10 ft	Concrete Seawall	10.5 ft	9.5	0.5 ft	Less than 0.5 ft	3.5 ft
Bay Farm Island Bridge Touchdown	AE, 10 ft	Riprap	n/a	9 ft	1 ft	0.5 ft	4 ft

Shoreline Location	Flood Zone and BFE (NAVD88)	Type of Shoreline	Approx. Top Elevation of Unaccredited Seawall at Location, if Present (NAVD88)	Approx. Ground Elevation at Lowest Point (if Seawall is Present, then Behind/Landward of it) (NAVD88)	Approx. Depth of Flooding at Shoreline at Current 100-yr Flood Event Assuming No Seawall (Total Water Level = 10ft NAVD88)	Approx. Depth of Flooding at Shoreline at 36-in Sea Level Rise Assuming No Seawall (Total Water Level = ~ 9.5ft NAVD88)	Approx. Depth of Flooding at Shoreline at Current 100-yr Flood Event + 36-in Sea Level Rise Assuming No Seawall (Total Water Level = 13ft NAVD88)
Alameda Point's Southern Shoreline on Federal Property	VE, 12 ft	Riprap	n/a	7 ft	3 ft	2.5	6 ft
Bay Farm Island:							
Lagoon System 1 North Outfall	AE, 10 ft	Concrete Seawall	11.5 ft	9.5 ft	0.5 ft	Less than 0.5 ft	3.5 ft
Veterans Court	AE, 10 ft	Concrete Seawall	9 ft	6 ft	4 ft	3.5 ft	7 ft
Model Airplane Field	AE, 10 ft	Natural Shoreline	n/a	8 ft	2 ft	1.5 ft	5 ft
Doolittle Drive / SR 61	AE, 10 ft	Riprap	n/a	8.5 ft	1.5 ft	1 ft	4.5 ft



Figure F-3. Seawall Along Northern Shoreline in Flood Zone



Figure F-4. Looking North Along Veterans Court Seawall at King Tide Event, January 2017



Figure F-5. Lagoon System 1 North Outfall Seawall at King Tide Event, January 2018

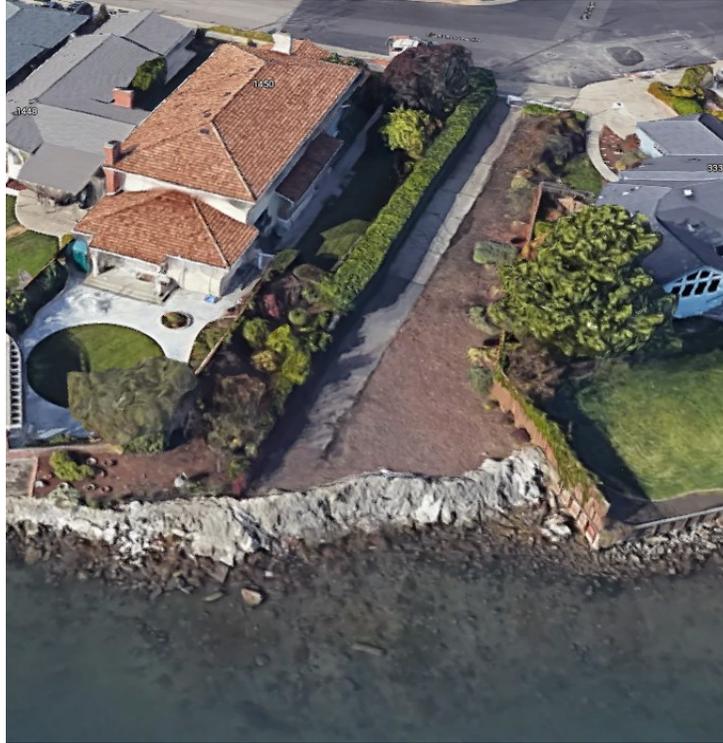


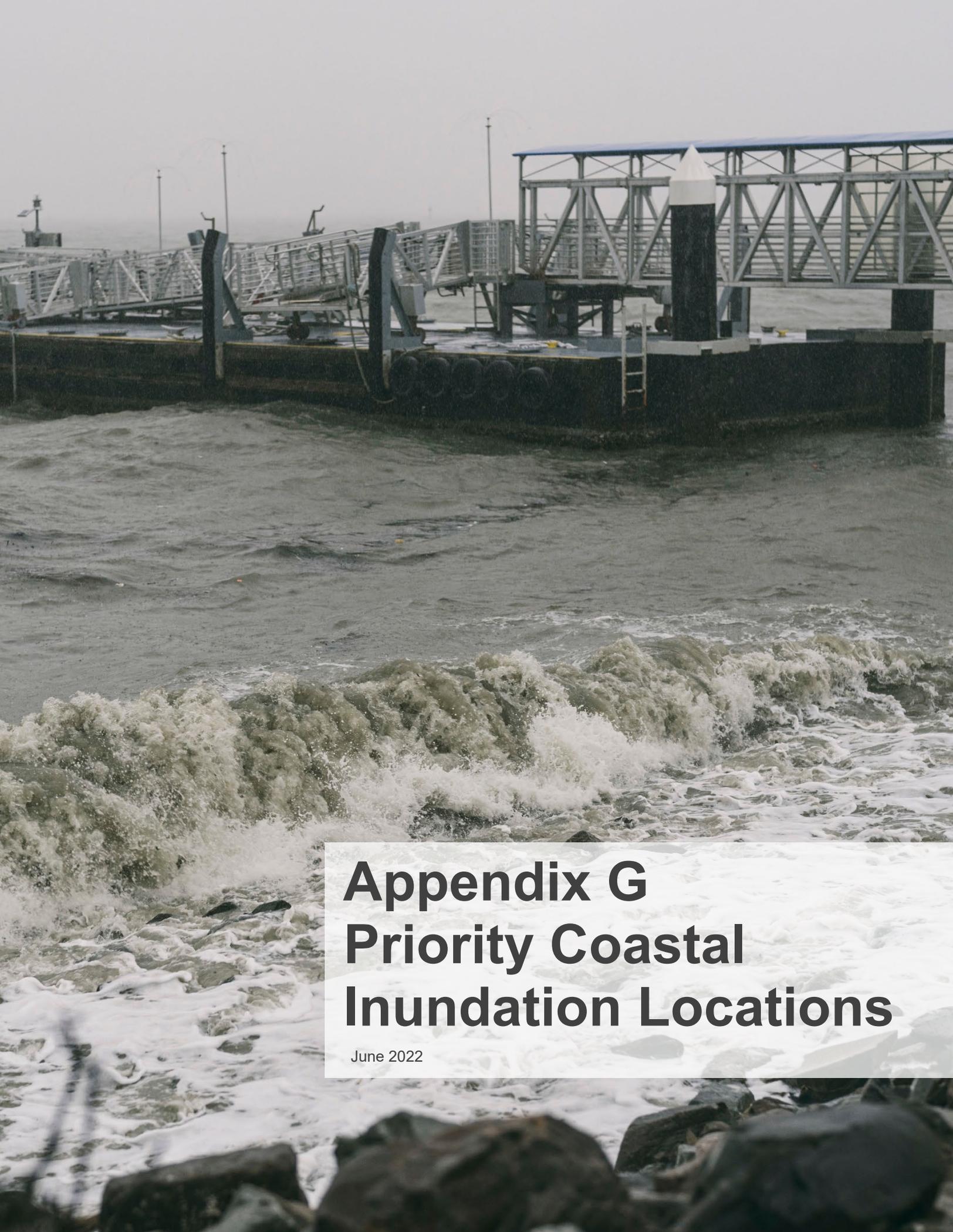
Figure F-6. Concrete Windrow at End of Liberty Avenue, East End

Contaminated Lands and Waste

The impact that sea level rise will have on contaminated sites is specific to the environmental conditions at each property. The types of contaminants and how they respond to changes in groundwater elevation, groundwater flow gradients, changes in geochemistry, and current site uses are just some of the parameters that would factor into how rising sea levels might impact these properties. Remedial action plans include pre-cleanup monitoring of environmental conditions to identify the contaminants that need to be addressed. Some remedial actions are short-term activities that include removing material from the property, while other remedial actions are more complex and can take decades to complete, such as pumping and treating contaminated groundwater. Remedial action plans also include implementing monitoring programs during and after remediation to verify the effectiveness of the remedial activity. These monitoring programs can assess the effect of changing environmental conditions on contaminants within a particular site. If, after the remedial action is complete, the property use is changed, or if the environmental conditions significantly change, the oversight agency can require additional environmental characterization of the property to verify that previous remedial activities are still effectively protecting human health and the environment.

Public Health and Welfare

Flooding can cause multiple public health impacts, such as mobilizing contaminants in soil (from hazardous waste sites), preventing access to safety, or preventing access to health care facilities due to flooded roads or public transit routes.



Appendix G Priority Coastal Inundation Locations

June 2022

The Priority Coastal Inundation Locations appendix is adopted from Alameda’s 2019 Climate Action and Resiliency Plan.

Priority Coastal Inundation Locations

The vulnerability assessment defined priority coastal inundation locations as those assets or areas exposed to flooding risk soonest and with greatest consequence. Locations with significant flooding at a total water level of 24 or 36 inches (above today’s high tide) were identified as at risk of sea level rise flooding “soon.” Following climate change projections from the State of California, which the OPC published in 2017 (Griggs et al., 2017), 36 inches of sea level rise can be expected between 2060 and 2070 when considering a high emissions scenario with medium to high risk aversion. A total water level of 36 inches is also equivalent to 50-year storm surge today. Alameda is implementing climate-smart planning, as outlined in AB 2800, the “Climate-Safe Path for All.” Therefore, as Alameda demonstrates leadership in GHG emissions reduction, the City should monitor global GHG emissions reduction trajectories and incorporate them into the planning process.

The following criteria¹ were used to identify location-based priority flooding assets:

Exposure assessment: Define the extent to which an asset experiences an impact. This includes considering the percent of an asset impacted as well as the probability of occurrence. The CARP vulnerability assessment was primarily concerned with exposure to flooding due to sea level rise and precipitation. Exposure in this assessment included both magnitude and timing (i.e., how much an asset is exposed to an impact and when exposure begins).

Sensitivity assessment: Determine the degree to which assets are affected by climate change impacts, including non-physical influences like governance. Sensitivity refers specifically to the asset itself, whereas consequence considers impacts to surrounding communities and assets.

Consequence assessment: Determine how impacts to the asset affect the surrounding community and assets, as well as Alameda more generally. Consider impacts to vulnerable communities as defined by a range of social vulnerability indicators.

Adaptive capacity assessment: Define the ability of assets, systems, or people to adjust to an adverse impact. Consider how changes in operations and/or minor physical improvements could increase the resilience of an asset to climate change.

Gap analysis: Consider assets and neighborhoods already addressed in existing City plans and commitments. Identify gaps to determine which assets are most critical to address. Determine the extent to which existing plans and commitments incorporate climate change.

The City has already evaluated sea level rise for select assets and projects. The CARP’s vulnerability assessment did not re-examine existing commitments to adaptation, but rather builds on and aligns with those actions underway. **Table G-1** summarizes the key vulnerable assets addressed in existing City plans and/or commitments.

¹ These components are adapted from the ART process, which considers exposure, sensitivity, and adaptive capacity as components of vulnerability. The ART process also defines risk as the combination of likelihood and consequence, with consequence contributing more to overall risk.

Table G-1. Key Vulnerable Assets in Existing City Plans and Commitments

Asset	Plan
Alameda Point Shoreline (including Main Street Ferry Terminal)	Alameda Point Master Infrastructure Plan (MIP) and Alameda Point Town Center and Waterfront Precise Plan
City Hall West	Alameda Point MIP
Northern Waterfront	Northern Waterfront Development Plans
Shoreline Drive	City's 2017–2019 Capital Budget
Veteran's Court Seawall	Storm Drain Master Plan 2008 (focus on capacity upgrades)
Storm Drain Pump Stations	Storm Drain Master Plan 2008
Sewer Pump Stations	Sewer System Management Plan 2017
State Route (SR) 260	Caltrans State Route 260 Transportation Concept Report (signed 2011, reaffirmed 2017)

The 11 priority flooding locations identified through this approach fall within three categories: shoreline, natural, and recreation areas; utilities; and transportation. A detailed map for each location showing 36, 48, and 52 inches of sea level rise, as well as a one-page description of exposure, sensitivity, consequence, and adaptive capacity, are included in Appendix H. These priority flooding locations are described further below.

In addition, this section summarizes the vulnerability assessment results for the climate change vulnerabilities broadly applied by sector in Alameda. Appendices G and H contain detailed vulnerability profiles that align with the planning framework developed by the ART Program. The profiles include vulnerability statements that consider the physical, functional, governance, and informational components of an asset that contribute to sensitivities to climate impacts. Key issues and vulnerabilities for each shoreline segment as well as adaptive capacity and potential consequences are identified.

Shoreline, Natural, and Recreation Areas

The vulnerability assessment identified critical points of overtopping along the shoreline of Alameda that, if addressed, could substantially reduce flooding and inundation threatening residents, businesses, parks, and key assets in Alameda. These segments are discrete locations along the shoreline that overtop at lower sea level rise scenarios (24 or 36 inches) and therefore should be addressed first to help protect other assets and increase the resilience of the shoreline to greater amounts of sea level rise.

Several other segments of the Alameda Point shoreline that are likely to be overtopped at 24 or 36 inches of sea level rise were not defined as high priority because they are already addressed through the approved Alameda Point MIP. The MIP established a framework for sea level rise protection and adaptation at Alameda Point based on the best available science. It also set forth a monitoring and financing program to periodically review the latest science, sea level rise estimates, and guidance from local, state, and federal regulatory agencies. Amendments to the MIP will be adopted as needed to reflect any notable conclusions from the ongoing monitoring. In fact, an MIP amendment will be adopted to consistently reflect the conclusions of the CARP along with the latest OPC sea level rise projections and guidance from 2018.

Transportation

Alameda relies heavily on functional bridges and tunnels to connect to the mainland, and a large population relies on transit systems to commute. The vulnerability assessment focused on those assets that transit-dependent populations most heavily use, such as roadways used by multiple AC Transit bus routes, as well as transportation assets that are essential corridors on and off the island. To help organize and simplify the results of the assessment, several transportation assets were bundled in the summaries presented below.

Note: Transportation assets are also sensitive to the effects of other climate hazards, particularly extreme heat, which can damage road surfaces and pose a hazard to workers. The summaries included here do not discuss heat specifically because Alameda is not expected to experience temperatures that can heavily impact transportation assets. While ferry access is essential on Alameda, the Main Street Ferry Terminal was not identified as a high vulnerability because the City already has plans to adapt the area to address flood risk at ferry access points.

Storm Utilities

Ensuring the long-term viability of utility systems in Alameda is important to maintaining a healthy and vibrant city. In particular, the stormwater system is critical for ensuring proper drainage to prevent roads and neighborhoods from flooding during storm events. The City has identified deficiencies in the stormwater system that need to be funded and addressed to prepare Alameda for the impacts of sea level rise and increased storm intensity and/or frequency. The vulnerability assessment identified additional threats facing the stormwater system that would not be resolved by capacity upgrades to the system.

Threats to the stormwater system include rising ocean levels, rising groundwater levels, and increased storm intensity and/or frequency. Gravity-fed components of the stormwater system are particularly vulnerable to rising ocean levels because outfalls can be blocked. Future pumps may be required in locations currently served by gravity-fed outfalls. Rising groundwater levels associated with sea level rise add more stress to the system overall and could potentially damage or reduce the functionality of subsurface infrastructure. Additional assessment of the risk posed by rising groundwater levels is needed as new information on groundwater, including modeling results, becomes available.

Table G-2 shows the 11 location-based priority flooding assets identified during the vulnerability assessment, two of which include various locations. **Figure G-1** shows their locations spatially on Alameda Island, while **Figure G-2** shows the flooding areas on Bay Farm Island.

Table G-2. Location-Based Priority Flooding Assets

Asset Category	Asset Name	ID for Figures 4-8 and 4-9	Exposure (Sea Level Rise) ^a	Exposure (25-Year Flood) ^b		Sensitivity ^c	Consequence ^d	Adaptive Capacity ^e	
Shoreline, Natural, and Recreation Areas	Shoreline Adjacent to Webster and Posey Tubes	1	Moderate (36")	None		Low	High	Moderate	
	Veteran's Court Seawall	10	Moderate (36")	None		High	Moderate	Moderate	
	Crown Beach and Bird Sanctuary	3	High (12")	None		High	Moderate	Moderate	
	Bay Farm Island Bridge Touch Down Area (Alameda Island side)	4	Low (>48")	None		Moderate	Moderate	Moderate	
	Eastshore Drive	5	Moderate (36")	None		Moderate	High	High	
	Bay Farm Island Lagoon System 1 Outlet Gate and Seawall	9	Moderate (36")	None		Moderate	Moderate	Moderate	
Utilities	Storm Drain Pipes and Pump Stations	Citywide	Moderate (36")		Varies		High	Moderate	Moderate
	Bayview Weir and Outfall	7	High (24")	None		High	High	High	
Transportation	SR260 and Posey/Webster Tubes	2	Moderate (36")	High (1 ft+ flood)		High	High	Low	
	Critical and High-Use Roadways (used by AC Transit)	6	Low (>48")	High (1 ft+ flood)		Moderate	High	Moderate	
	SR61/Doolittle Drive	8	Moderate (36")	High (1 ft+ flood)		Low	High	Moderate	

^a Exposure (sea level rise): Low= > MHHW+48"; Moderate=MHHW+36"; High=MHHW+12–24"

^b Exposure (25-year precipitation event): Low= <0.5 flood levels (above surface flooding); Moderate= 0.5–1ft flood levels; 1+ft flood levels

^c Sensitivity: Low= flood water recedes without major damage; Moderate= asset will be damaged by flooding (e.g., office), but equipment is not highly sensitive; High= asset is highly sensitive or already failing, and it provides sensitive habitat to protected species

^d Consequence: Low= minor/temporary precipitation-based flooding of residential neighborhood; Moderate= limited access to public services; High= restricted movement of emergency responders

^e Adaptive Capacity: Low= cannot adjust in place, and asset must be relocated or elevated; Moderate= major changes or replacement of existing asset are required; High: asset can adapt to new impacts given changes in operations and/or minor physical improvements

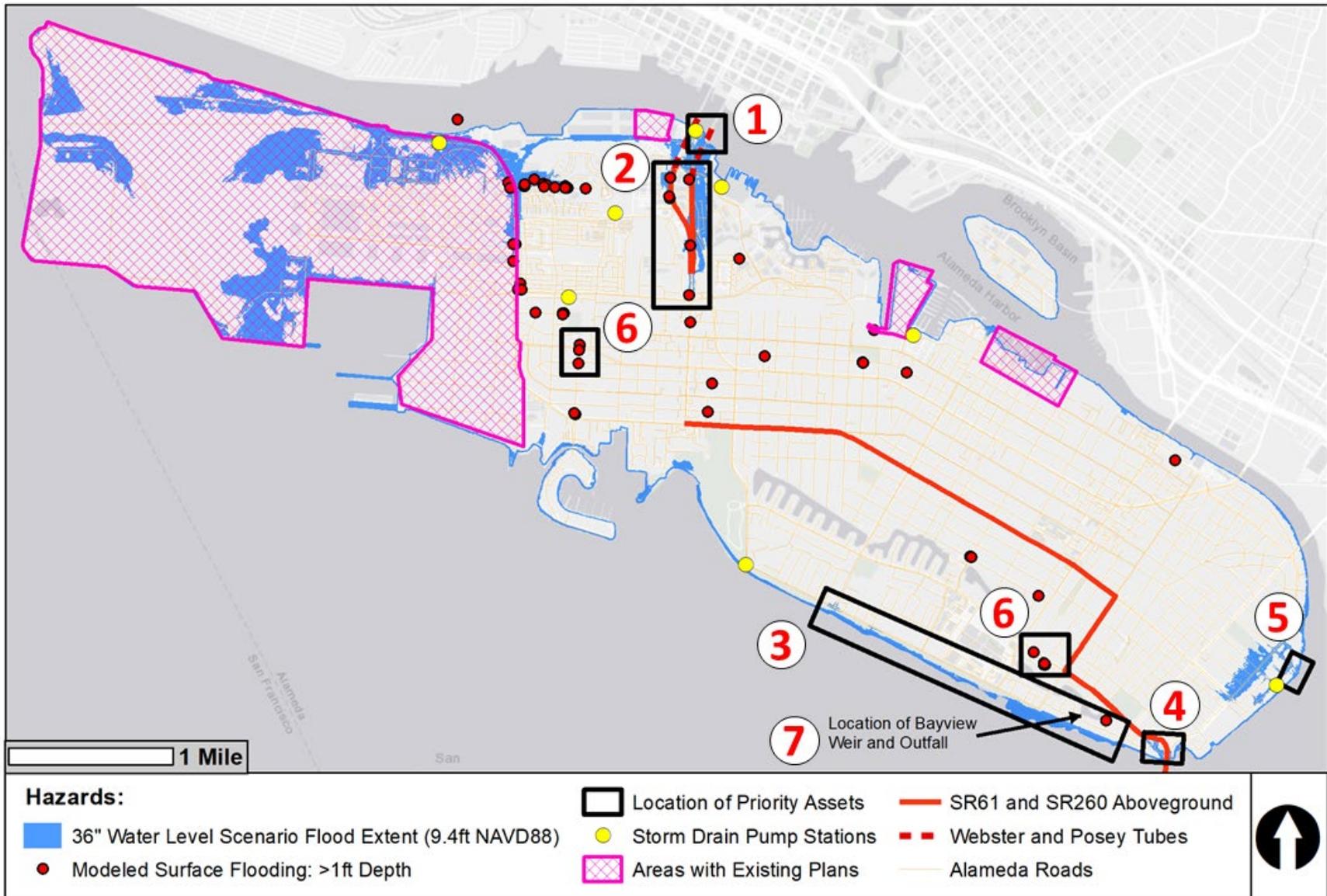


Figure G-1. Map showing the areas of location-based priority flooding on Alameda Island

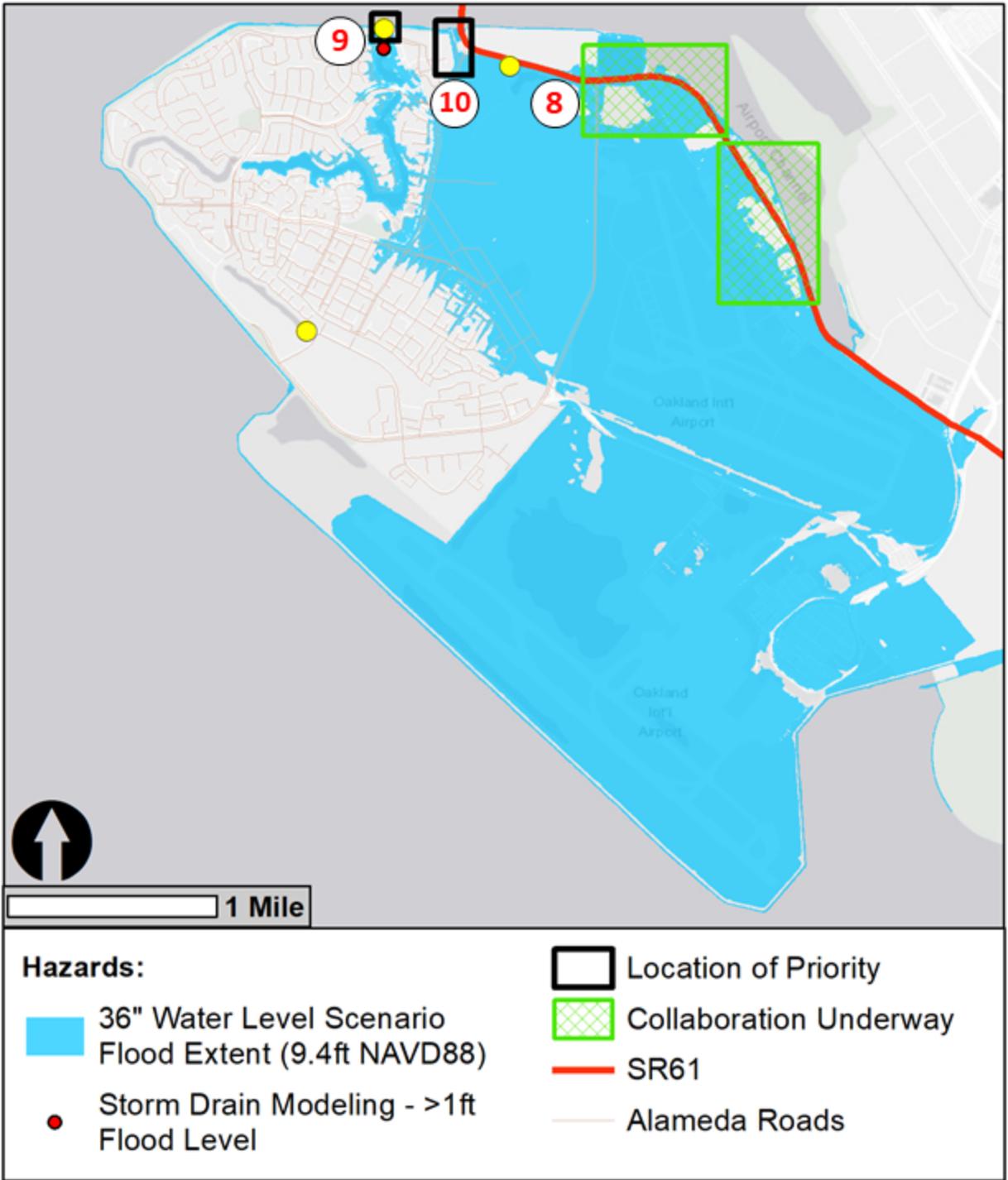


Figure G-2 Map showing the areas of location-based priority flooding on Bay Farm Island

Table G-3. Crown Memorial State Beach Vulnerability Summary

<p>Crown Memorial State Beach is a popular spot for recreation and education in Alameda. It has a pickleweed salt marsh that provides bird habitat in the Elsie Roemer Bird Sanctuary at the east end of the beach, as well as an eelgrass bed just offshore of the beach that provides juvenile fish habitat. Crown Beach and the bird sanctuary make up the majority of the natural shoreline on Alameda Island and are at substantial risk of erosion due to wave action and inundation from sea level rise.</p>	
Key Issue(s)	<ul style="list-style-type: none"> The narrow beach is vulnerable to sea level rise and storm surge flooding, as well as erosion due to wave action. It is backed by a road, housing, and shopping centers, giving it little capacity to migrate inland. Decisions on adaptation will involve the City (owns the land), East Bay Regional Parks District (EBRPD; manages the beach), and the community at large.
Exposure	<ul style="list-style-type: none"> Lower elevation portions of the sandy beach are currently susceptible to flooding at king tides. Large portions of the beach and bird sanctuary are inundated at 36" total water level, at which point small segments of Shoreline Drive also experience flooding originating at this location. At 48" total water level, nearly all of the beach and bird sanctuary are overtopped, leading to flooding of adjacent neighborhoods.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> The northern portion of the park is owned by California State Parks; the narrow southern part, including the beach and trail along Shoreline Drive, is owned by the City of Alameda. EBRPD has operating agreements and manages the entire area (bird sanctuary and beach) as one park. <p>Informational</p> <ul style="list-style-type: none"> There is limited information on the efficacy of existing groins to prevent beach erosion. EBRPD is working on a Crown Beach Master Plan update that will consider sea level rise; however, this work is currently on hold and it is unknown when it will proceed. <p>Functional</p> <ul style="list-style-type: none"> The beach and bird sanctuary provide flood protection to important roads (e.g., Shoreline Drive), residential neighborhoods, and commercial areas (e.g., South Shore Shopping Center). <p>Physical</p> <ul style="list-style-type: none"> The beach is not a natural structure and regular nourishment is needed. In 2013, sand was pumped in due to heavy erosion, and groins are used to keep sand in place. Several sensitive resources are present in this area, such as an eelgrass bed and salt marsh that provide nursery habitat and a food source for aquatic birds, including some threatened and endangered species.
Adaptive Capacity	<ul style="list-style-type: none"> The beach is very narrow and backed by a road, so there is limited capacity to migrate inland as the beach erodes and lower-elevation portions become permanently inundated. The sloping character of the beach and tidal flats offshore provide opportunities to adapt the shoreline through living or nature-based features.
Consequences	<ul style="list-style-type: none"> Social: The beach is very popular for recreation and educational programs, and it is one of only a small number of sandy beaches in the East Bay. Economic: Crown Beach is an important tourist destination. Although no fees are collected, tourism brings money to businesses in the area. Environment: Habitat in this area could be lost if the Elsie Roemer Bird Sanctuary is inundated and no adaptation action is taken.



 24" Water Level Scenario Flood Extent (8.4ft NAVD88)	 Storm Drain Pump Stations
 36" Water Level Scenario Flood Extent (9.4ft NAVD88)	 Sewer Pump Stations
 48" Water Level Scenario Flood Extent (10.4ft NAVD88)	 AC Transit Bus Routes (Winter 2019)
Asset Inventory (from 2016 LHMP)	
 Critical Recovery Priority (from LHMP)	 Other Recovery Priority (from LHMP)

0 0.15 0.3 Miles

NOTE: This map highlights the potential for inundation due to overtopping at other shoreline segments (Eastshore and bridge touchdown) to directly connect with the South Shore Lagoon System by 48" total water level. The lagoons will likely require active pumping before this scenario due to greater water depths at the outfall.

Table G-4. Eastshore Drive (Adjacent Shoreline) Vulnerability Summary

<p>Eastshore Drive is the easternmost, north-south-oriented road on Alameda Island, providing access to the Eastshore and Fernside neighborhoods. These residential neighborhoods have many homes with private docks in San Leandro Bay. Although there are several designated points of public access along Eastshore Drive, there are no extensive public trails or parks along the shoreline. Private homes dominate the eastern waterfront. The Federal Emergency Management Agency (FEMA) recently determined that sections of the Eastshore neighborhood are within the 1 percent annual chance floodplain.</p>	
Key Issue(s)	<ul style="list-style-type: none"> ■ The Eastshore area is a low-lying section of the city with a large residential area vulnerable to flooding from sea level rise and storm events. There is limited space for adaptation because homes are built out very close to the waterfront. A potentially complex collaboration with homeowners and related groups (e.g., homeowners' associations [HOAs]) will be necessary to agree upon shoreline protection measures due to ownership in this area.
Exposure	<ul style="list-style-type: none"> ■ Overtopping of existing shoreline structures in this area begins at 36" total water level, at which point floodwaters extend inland, inundating portions of Fernside Boulevard, the stormwater pump station serving this area, and areas as far inland as the fields near the Harrison Recreation Center. Initial shoreline overtopping is likely restricted to small sections of the shoreline (e.g., at the end of Liberty Drive), but more substantial shoreline overtopping occurs along the east shore at higher water levels, beginning as early as 48" total water level.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> ■ Substantial portions of the east shoreline are privately owned. Beginning in 2005, ownership transfers between the U.S. Army Corps of Engineers (USACE) and the City of Alameda, and then between the City and private landowners, resulted in individual property rights over submerged lands along the shore. Property owners will likely need to buy in to potential shoreline protection solutions, although the actual concrete seawall along properties in this area is part of City-owned parcels that are leased to homeowners. <p>Informational</p> <ul style="list-style-type: none"> ■ There is no known inventory of the condition of shoreline protection structures in this area beyond basic shoreline elevation data. <p>Functional</p> <ul style="list-style-type: none"> ■ Shoreline in this area protects residential communities and streets. <p>Physical</p> <ul style="list-style-type: none"> ■ Nearly all of the east shoreline of Alameda Island is heavily armored with engineered flood protection structures like seawalls and levees. The condition and quality of these structures determines their vulnerability to sea level rise and storm surge. ■ Environmental resources like submerged aquatic vegetation (SAV) are present throughout San Leandro Bay, including near the east shoreline of Alameda Island. These resources provide important habitat for aquatic species and some level of wave attenuation.
Adaptive Capacity	<ul style="list-style-type: none"> ■ There is very limited available space for constructing new shoreline structures, especially nature-based shorelines like living levees, which generally require a much larger footprint. Tidal flats along this stretch of shoreline may provide opportunities for some nature-based adaptation strategies. FEMA floodplain designation in this area may open funding opportunities to address shoreline issues.
Consequences	<ul style="list-style-type: none"> ■ Social: Overtopping of this shoreline may lead to flooding of the Eastshore and Fernside neighborhoods, where few homes are flood-proofed. ■ Environmental: Flooding of large residential areas could lead to the release of debris and invasive species into San Leandro Bay, where restoration of sensitive habitats is currently underway.

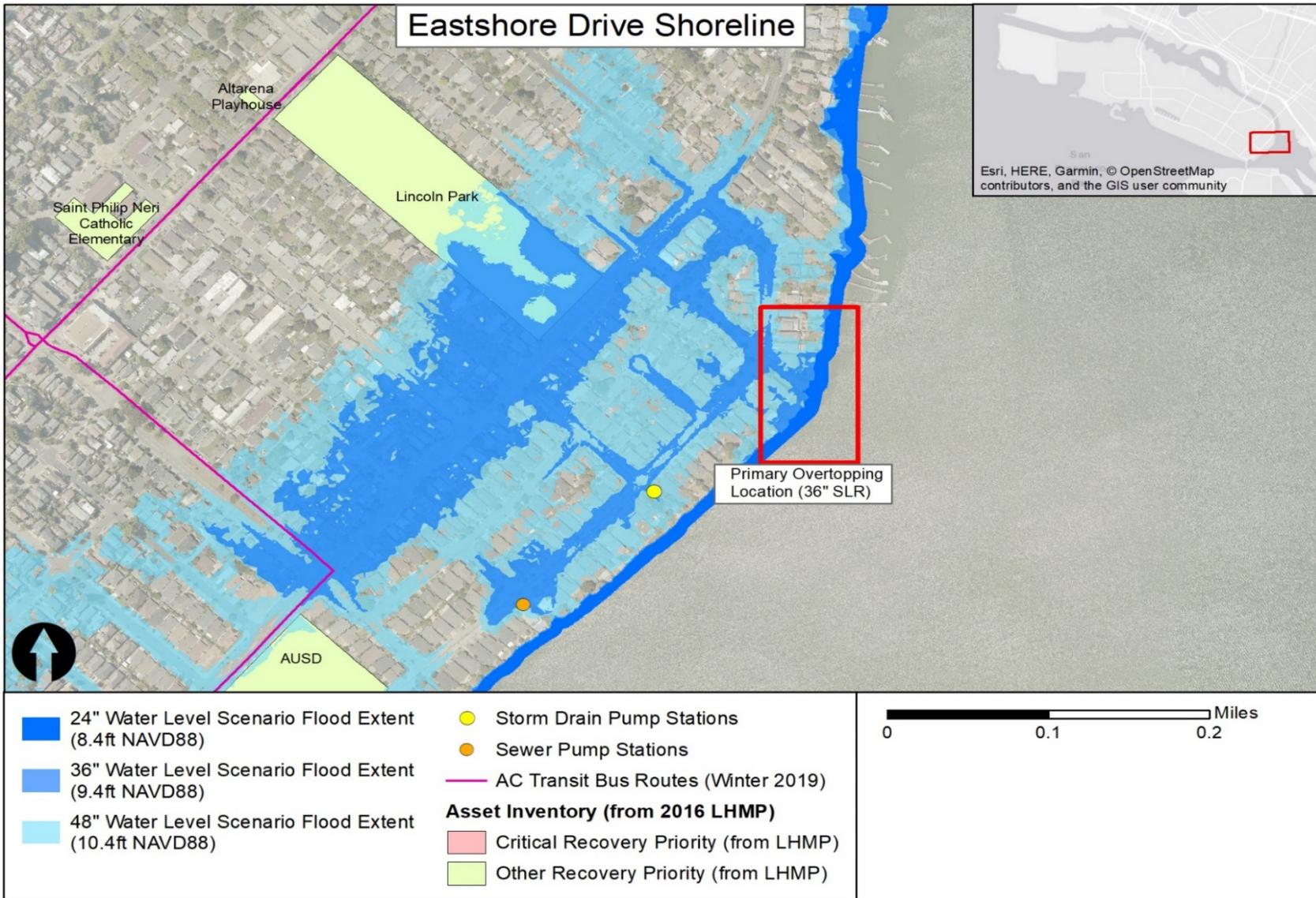


Table G-5. Shoreline Adjacent to Webster and Posey Tubes Vulnerability Summary

<p>The area of concern is the shoreline immediately adjacent to the Webster and Posey Tubes along the northern shore of Alameda Island. Numerous development projects are in the planning stage along the northern waterfront, and any long-term strategy to address flooding along the northern waterfront requires a coordinated approach across all new development projects and areas between. The shoreline in this area is lined with marinas, yacht brokerages, houseboats, and some shoreline public trails, and it is composed of a combination of levees and seawalls.</p>	
Key Issue(s)	<ul style="list-style-type: none"> Overtopping of the shoreline near the tubes leads to inundation of one of the most critical transportation corridors in Alameda, including Webster Street and the tubes themselves. The proximity of businesses along the northern shoreline will pose design challenges for shoreline modifications, which must maintain public access to the waterfront. Numerous sensitive assets in this area would be inundated if the shoreline overtops; many assets were recently added to the FEMA 1 percent annual chance floodplain.
Exposure	<ul style="list-style-type: none"> Shoreline overtopping begins at 36" total water level, at which point several buildings—such as the Oakmont of Mariner Point and Mariner Square Shopping Center—are at risk of inundation, as well as key assets like the Webster and Posey portals. Webster Street initial overtopping is restricted to a small (< 1,000-foot) section of shoreline in the immediate area, but more substantial shoreline overtopping occurs at higher water levels.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> The shoreline area is lined with private businesses that should be involved in managing shoreline protection at this site. There is limited City ownership of shoreline except public trails and open space, which are owned and managed by the Alameda Recreation and Parks Department. Any changes to shoreline public access would need to be designed in accordance with Bay Conservation and Development Commission (BCDC) requirements. <p>Informational</p> <ul style="list-style-type: none"> There is no known inventory of the condition of shoreline protection structures in this area beyond basic shoreline elevation data. <p>Functional</p> <ul style="list-style-type: none"> Shoreline protection in this area protects sensitive assets that house vulnerable populations, including several senior care centers and a daycare center. In addition, shoreline protection is needed to keep floodwaters from impacting Bay Ship and Yacht and the Hazardous Materials Transfer Station, which are both locations where hazardous materials could be mobilized. <p>Physical</p> <ul style="list-style-type: none"> Shoreline protection structures in this area suffer from erosion due to deferred maintenance.
Adaptive Capacity	<ul style="list-style-type: none"> There is opportunity to adapt this site by enhancing engineered structures (seawalls and levees) between the public path and the water. It is not clear if engineered structures can be adapted over time to provide sufficient protection for sea level rise beyond mid-century due to the characteristics of this shoreline and the height required to address end-of-century water levels (> 15 feet NAVD88).
Consequences	<ul style="list-style-type: none"> Social: Flooding near the tubes could disproportionately impact vulnerable communities, including many transit-dependent residents that live on and around Webster Street. Many AC Transit bus routes use the roads in this area, placing substantial burden on low-income and other vulnerable populations. Economic: Interruptions to the tubes would severely hamper goods movement from Alameda to the mainland. Environmental: Flooding of the Hazardous Materials Transfer Station and industrial facilities in this area could mobilize harmful substances.

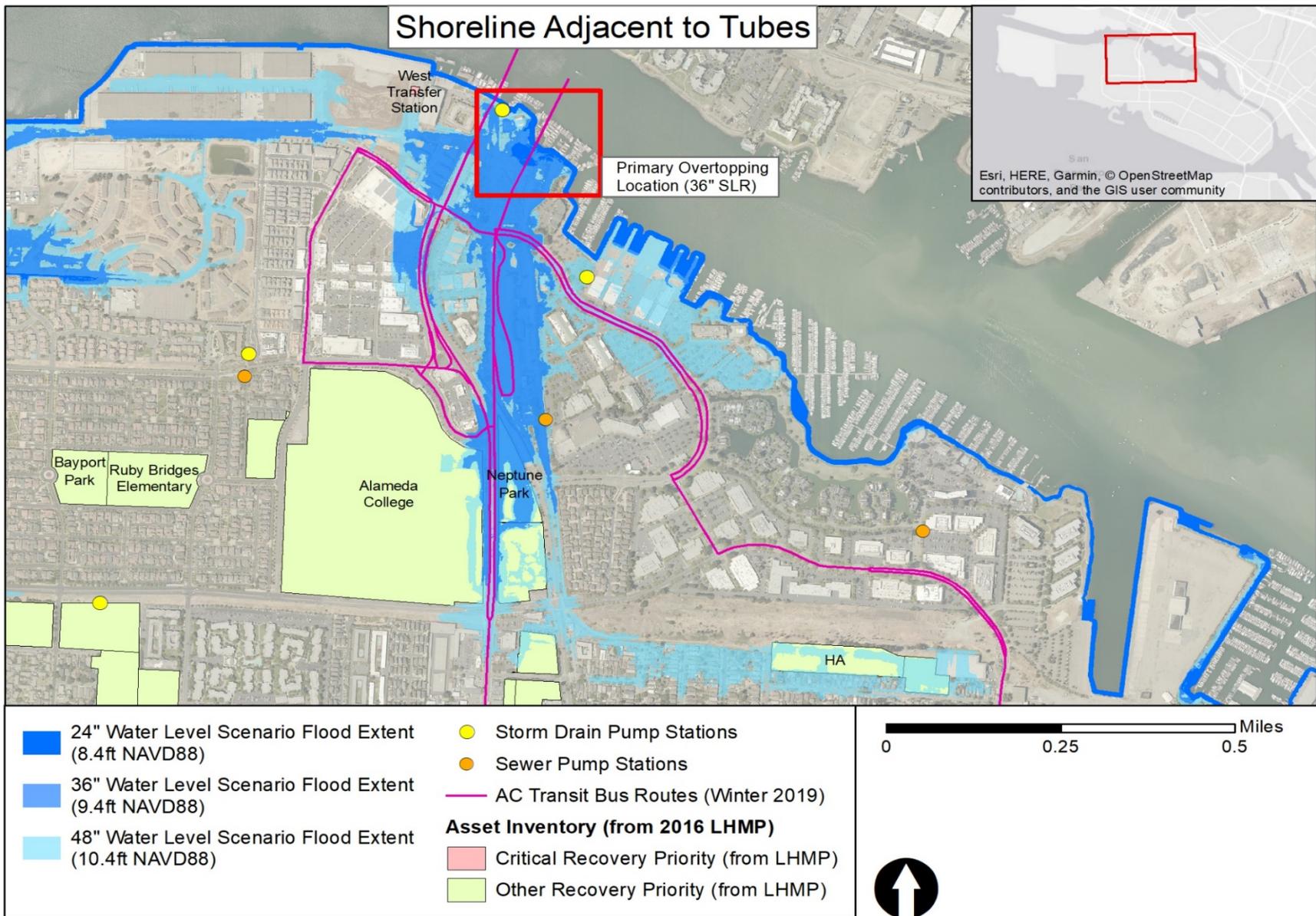


Table G-6. Bay Farm Island Bridge Touchdown and Towata Park Vulnerability Summary

<p>The stretch of shoreline near the Bay Farm Island Bridge touchdown on Alameda Island provides flood protection to the adjacent residential area, Bridgeview Isle, and Krusi Park. Overtopping at this location begins at 24” total water level but does not impact residential areas until 36” total water level. The current shoreline is composed of seawalls and riprap with a mix of City and Raven’s Cove HOA ownership. The City owns and maintains Towata Park at this location, which is impacted by flooding at 36” total water level.</p>	
<p>Key Issue(s)</p>	<ul style="list-style-type: none"> Shoreline protection structures in this area currently provide flood protection for surrounding roads, residential neighborhoods, and Krusi and Towata Parks. Floodwater originating in this area may merge with water derived from overtopping in other areas at higher water levels, leading to substantial inundation that is only addressed with shoreline modifications in several locations.
<p>Exposure</p>	<ul style="list-style-type: none"> Minor overtopping of the shoreline directly west of the bridge touchdown on Alameda Island begins at 24” total water level. At 36” total water level, Bridgeview Isle and some nearby houses are impacted. At 48” total water level and higher, the flood area expands significantly with several important streets and other assets impacted. Flooding at higher water levels could connect with the lagoons, leading to more widespread inundation.
<p>Sensitivity</p>	<p>Governance</p> <ul style="list-style-type: none"> Several jurisdictions have oversight of assets near the Bay Farm Island Bridge. The bridge itself is within the Caltrans Right of Way. The shoreline west of Towata Park is owned by the California Department of Parks and Recreation, while Towata Park is owned by the City. Information also suggests that the Raven’s Cove HOA may own parts of the shoreline in this area. Coordination among multiple agencies is necessary to address shoreline deficiencies in this area. <p>Informational</p> <ul style="list-style-type: none"> Beyond 48” total water level, multiple areas of shoreline overtopping could lead to flooding of large segments in southeastern Alameda Island, including around the South Shore Lagoons. Because the shoreline overtops at several locations in the same general area, it is not clear where the majority of floodwaters originate, making it challenging to prioritize actions. The lack of clear information on floodwater source suggests an integrated approach is necessary for this entire area. <p>Functional</p> <ul style="list-style-type: none"> Shoreline overtopping in this area leads to flooding along Otis Drive, Fernside Drive, and High Street, which all connect to the Bay Farm Island Bridge and are important connections between Alameda and Bay Farm Island. The bridge is also part of official evacuation routes in Alameda. <p>Physical</p> <ul style="list-style-type: none"> Eelgrass beds are present in the San Leandro Bay Inlet immediately near the Bay Farm Island Bridge. Any adaptation actions in this area need to avoid or mitigate impacts to eelgrass and should seek to enhance eelgrass habitat where possible.
<p>Adaptive Capacity</p>	<ul style="list-style-type: none"> Adaptation in this area will likely require strategies to be integrated and coordinated across multiple landowners and agencies because flooding over the longer term originates from multiple areas of shoreline overtopping.
<p>Consequences</p>	<ul style="list-style-type: none"> Social: Bay Farm Island Bridge is an important corridor for commuters, businesses, and emergency response. It is the only direct connection between the islands and blocked access would greatly disrupt daily life. Economic: Approximately 40,000 vehicles cross the bridge daily and disruptions would greatly impact the movement of goods and services. Environmental: Degradation of the adjacent tidal flat and marsh panne could negatively impact nearby SAV.

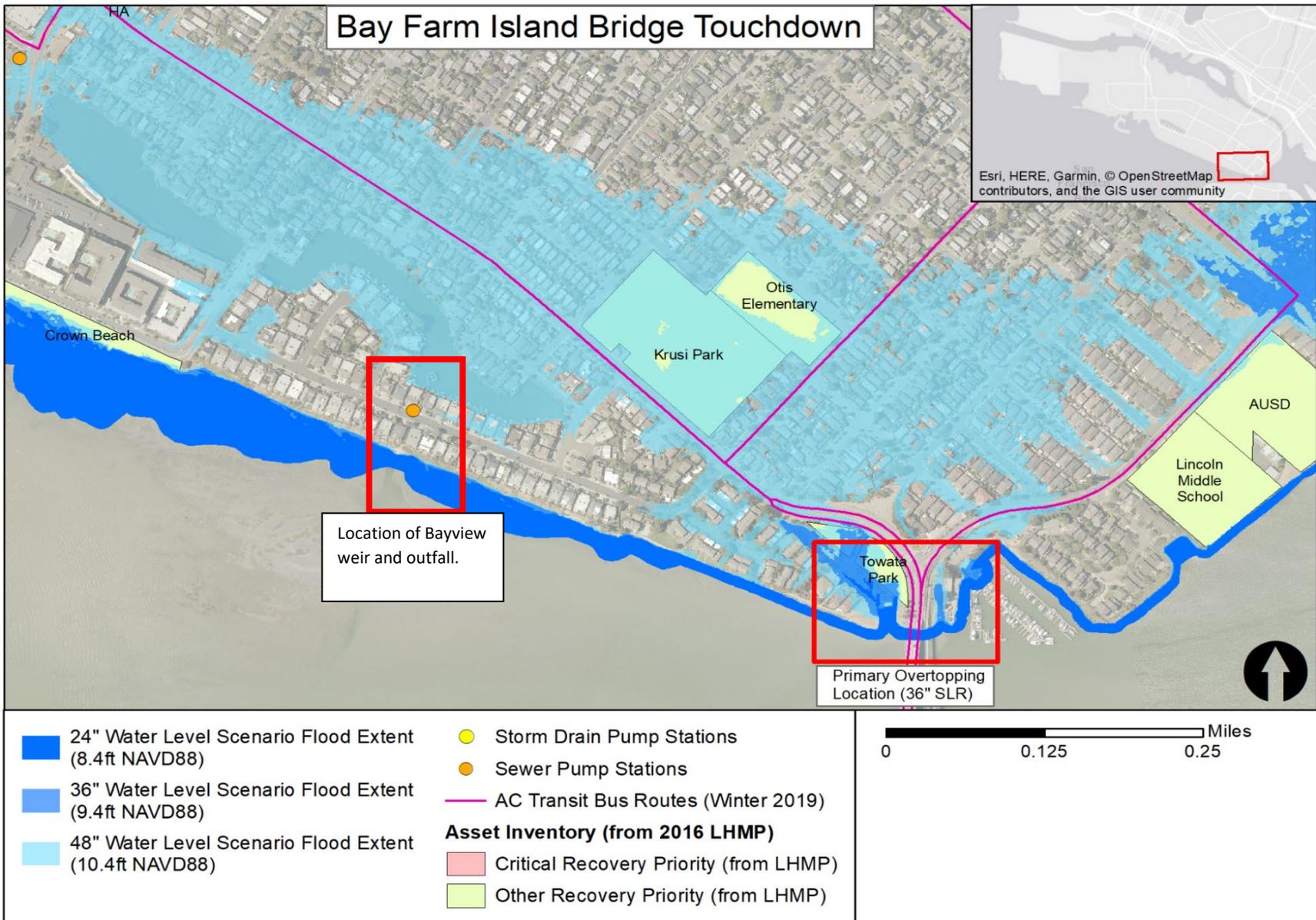
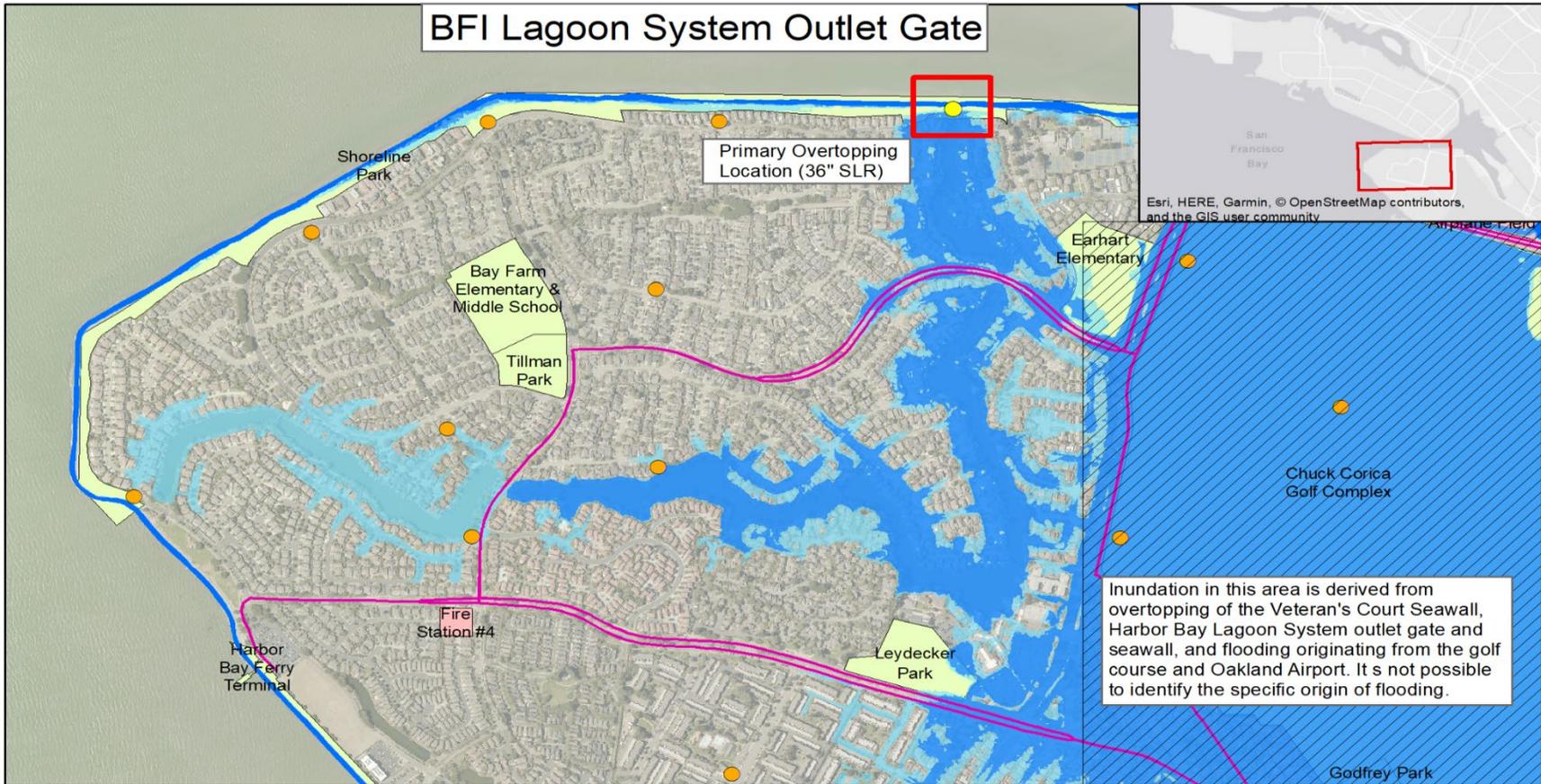


Table G-7. Bay Farm Island Lagoon System 1 North Outlet Gate and Seawall Vulnerability Summary

<p>The Bay Farm Island lagoon system draws water at the southern end and discharges it at the North Outlet Gate, located just west of Bay Farm Island Bridge. The shoreline at the outlet gate is a narrow isthmus of land that provides flood protection but is not a certified seawall or levee. The outlet gate is used to manage water levels in the lagoon through a passive tide gate system (currently inoperable) and an active pump. The shoreline in this area is a critical point of protection for the lagoon system and the homes that surround it.</p>	
Key Issue(s)	<ul style="list-style-type: none"> ■ The lagoon system is at risk of flooding due to issues at the outlet gate, including a slow pump that cannot rapidly lower water levels, an inoperable tide gate, and deficiencies in the seawall at that location. Overtopping of the shoreline in this area could inundate the lagoon system and lead to substantial flooding in surrounding neighborhoods.
Exposure	<ul style="list-style-type: none"> ■ Overtopping at the outlet gate seawall is likely at 36" total water level, potentially leading to overtopping of the banks of the lagoon and flooding of adjacent neighborhoods. Beyond 36" total water level, floodwaters originating at this location merge with floodwaters from elsewhere on Bay Farm Island, leading to substantial inundation across the island.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> ■ The City of Alameda assumed maintenance responsibility in 1993 for the dike at the outlet gate, although other entities—including the Harbor Bay Isle Owner’s Association—own the lagoon retaining walls and tide gate/pump structure. The City can modify the outlet gate and seawall to protect the lagoon system from flooding. Coordination with relevant Bay Farm Island organizations, including HOAs, is necessary to ensure the lagoon systems are resilient to climate change in the long term. Replacement of the seawall at this location will likely require permits or coordination with BCDC, USACE, and the California Department of Fish and Wildlife. <p>Informational</p> <ul style="list-style-type: none"> ■ There is limited information on the structural condition of the outlet pipe or the dike, including the structural makeup of the dike itself, which is partially built on sunken ships and dredged material. ■ Flooding on Bay Farm Island is connected to several sources of overtopping, making it challenging to identify a primary source. More detailed assessment could help determine the source of flooding, but a coordinated approach to adaptation across Bay Farm Island is warranted. <p>Functional</p> <ul style="list-style-type: none"> ■ Some equipment at the outlet gate and pump is deficient, including the tide gate itself, which is currently inoperable—a pump drains the lagoon. The pump is undersized to drain the lagoons rapidly, which may be necessary if there is a large storm event on top of sea level rise. Compounding this, pressure transducers used to measure water levels in the lagoons are inaccurate and unreliable. <p>Physical</p> <ul style="list-style-type: none"> ■ The structural condition of the dike is unknown, and the seawall built on it may be at risk of failure during a large event like an earthquake. Deficiencies along the interior lagoon retaining walls could also contribute to flooding next to the lagoons.
Adaptive Capacity	<ul style="list-style-type: none"> ■ Operational and physical changes at this site could increase its resilience to sea level rise and storm surge. Relatively minor modifications to the seawall could provide short-term protection from storm events and remove substantial areas from the FEMA 1 percent annual chance floodplain.
Consequences	<ul style="list-style-type: none"> ■ Social: If the seawall breaches or the lagoon system fails to drain during a storm, many homes and businesses could be flooded. ■ Economic: Flooding next to the lagoon system would impact important roads and cut off access to some neighborhoods on the island.

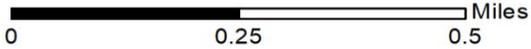
BFI Lagoon System Outlet Gate



Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Inundation in this area is derived from overtopping of the Veteran's Court Seawall, Harbor Bay Lagoon System outlet gate and seawall, and flooding originating from the golf course and Oakland Airport. It is not possible to identify the specific origin of flooding.

 24" Water Level Scenario Flood Extent (8.4ft NAVD88)	 Storm Drain Pump Stations
 36" Water Level Scenario Flood Extent (9.4ft NAVD88)	 Sewer Pump Stations
 48" Water Level Scenario Flood Extent (10.4ft NAVD88)	 AC Transit Bus Routes (Winter 2019)
Asset Inventory (from 2016 LHMP)	
 Critical Recovery Priority (from LHMP)	
 Other Recovery Priority (from LHMP)	



NOTE: Inundation maps in this area do not consider the impact of active pumping from the lagoon system. The inundation shown here reflects overtopping throughout the lagoon system.



Table G-8. Veteran's Court Seawall Vulnerability Summary

<p>Veteran's Court is a small road near the Bay Farm Island Bridge touchdown on Bay Farm Island. It connects to Island Drive and serves primarily as an access road to the shore for maintenance or recreation. Veteran's Memorial Park is also considered part of this priority shoreline area due to its importance to flood mitigation strategies. Veteran's Court itself serves as a conduit for floodwaters if the seawall in this area is breached, potentially contributing to substantial inundation along Island Drive and adjacent neighborhoods.</p>	
Key Issue(s)	<ul style="list-style-type: none"> ■ The Veteran's Court area is located within the FEMA 1 percent annual chance floodplain. Overtopping of this shoreline results in flooding at a major intersection on Bay Farm Island (Doolittle and Island Drives). While there are options for adapting this specific section of low-elevation shoreline, other shoreline areas across Bay Farm Island also overtop at similar water levels. Beyond 36" total water level, a coordinated response to shoreline overtopping on Bay Farm Island is needed to prevent flooding.
Exposure	<ul style="list-style-type: none"> ■ The Veteran's Court seawall overtops at 36" total water level, below the FEMA base flood elevation (10' NAVD88). At 48" total water level, inundation from Veteran's Court merges with inundation from other overtopped shorelines on Bay Farm Island, making it difficult to determine the exact source of floodwaters. The Veteran's Court area is likely responsible for some component of flooding at the intersection of Island Drive and Doolittle Drive.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> ■ The seawall itself is owned by the City but is not accredited by FEMA. Addressing vulnerabilities in this immediate area, especially over the longer term as water levels continue to rise, would likely require coordination with adjacent private landowners, including the Harbor Bay Club and adjacent neighborhoods. ■ Flooding on Bay Farm Island, derived from Veteran's Court and other locations, impacts State Route (SR) 61 (Doolittle Drive), which Caltrans owns. Coordination with Caltrans is important to maintain traffic flow along this critical road, one of the primary evacuation routes from Alameda. <p>Informational</p> <ul style="list-style-type: none"> ■ It is very difficult to determine the exact source of flooding on Bay Farm Island beyond 36" total water level due to overtopping at multiple locations. <p>Functional</p> <ul style="list-style-type: none"> ■ The presence of other vulnerable spots along the shoreline in this immediate area and more broadly across Bay Farm Island means that fixing the Veteran's Court seawall alone will not reduce all local flood vulnerability. <p>Physical</p> <ul style="list-style-type: none"> ■ Alameda's 2008 Storm Drain Master Plan indicates that seepage is observed along the seawall at high tide.
Adaptive Capacity	<ul style="list-style-type: none"> ■ There are multiple options for enhancing flood protection along Veteran's Court, but construction and engineering of some sort is required; however, no immediate or simple modifications to this location could address sea level rise and storm surge.
Consequences	<ul style="list-style-type: none"> ■ Social: Community impacts are likely if major transportation routes on Bay Farm Island are blocked. Flooding is also likely to directly impact residences and businesses. ■ Economic: Substantial disruption to commuter and commercial transit is likely if Island Drive and/or Doolittle Drive flood. ■ Environmental: SAV is present immediately adjacent to Veteran's Court and should be protected.

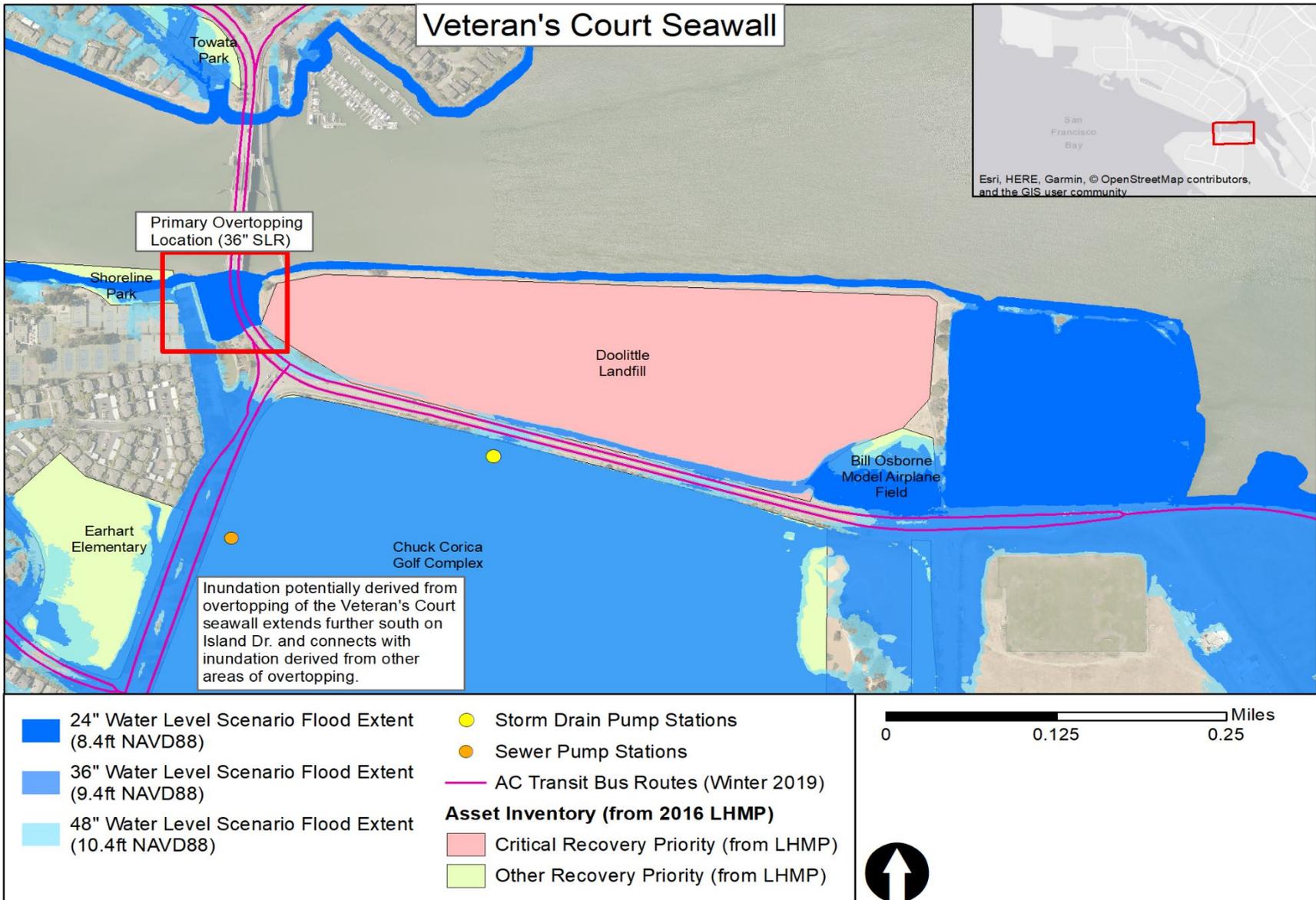


Table G-9. Bay Farm Island Bridge Touchdown and Towata Park Vulnerability Summary

<p>The stretch of shoreline near the Bay Farm Island Bridge touchdown on Alameda Island provides flood protection to the adjacent residential area, Bridgeview Isle, and Krusi Park. Overtopping at this location begins at 24” total water level but does not impact residential areas until a total water level of 36”. The current shoreline is composed of seawalls and riprap with a mix of City and Raven’s Cove HOA ownership. Towata Park at this location is owned and maintained by the City and is impacted by flooding by 36” total water level.</p>	
Key Issue(s)	<ul style="list-style-type: none"> Shoreline protection structures in this area currently provide flood protection for surrounding roads, residential neighborhoods, and Krusi and Towata Parks. Floodwater originating in this area may merge with water derived from overtopping in other areas at higher water levels, leading to substantial inundation that is only addressed with shoreline modifications in several locations.
Exposure	<ul style="list-style-type: none"> Minor overtopping of the shoreline directly west of the bridge touchdown on Alameda Island begins at 24” total water level. At 36” total water level, Bridgeview Isle and some nearby houses are impacted. At 48” total water level and higher, the flood area expands significantly with several important streets and other assets impacted. Flooding at higher water levels could connect with the lagoons, leading to more widespread inundation.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> Several jurisdictions have oversight of assets near the Bay Farm Island Bridge. The bridge itself is within the Caltrans Right of Way. The shoreline west of Towata Park is owned by the California Department of Parks and Recreation, while Towata Park is owned by the City. There is also information suggesting the Raven’s Cove HOA may own parts of the shoreline in this area. Coordination among multiple agencies is necessary to address shoreline deficiencies in this area. <p>Informational</p> <ul style="list-style-type: none"> Beyond 48” total water level, multiple areas of shoreline overtopping could lead to flooding of large segments in southeastern Alameda Island, including around the South Shore Lagoons. Because the shoreline overtops at several locations in the same general area, it is not clear where the majority of floodwaters originate, making it challenging to prioritize actions. The lack of clear information on floodwater source suggests an integrated approach is necessary for this entire area. <p>Functional</p> <ul style="list-style-type: none"> Shoreline overtopping in this area leads to flooding along Otis Drive, Fernside Drive, and High Street, which all connect to the Bay Farm Island Bridge and are important connections between Alameda and Bay Farm Island. The bridge is also part of official evacuation routes in Alameda. <p>Physical</p> <ul style="list-style-type: none"> There are eelgrass beds present in the San Leandro Bay Inlet immediately near the Bay Farm Island Bridge. Any adaptation actions in this area need to avoid or mitigate impacts to eelgrass and should seek to enhance eelgrass habitat where possible.
Adaptive Capacity	<ul style="list-style-type: none"> Adaptation in this area will likely require strategies to be integrated and coordinated across multiple landowners and agencies because flooding over the longer term originates from multiple areas of shoreline overtopping.
Consequences	<ul style="list-style-type: none"> Social: Bay Farm Island Bridge is an important corridor for commuters, businesses, and emergency response. It is the only direct connection between the islands and blocked access would greatly disrupt daily life. Economic: Approximately 40,000 vehicles cross the bridge daily and disruptions would greatly impact the movement of goods and services. Environmental: Degradation of the adjacent tidal flat and marsh panne could negatively impact nearby SAV.

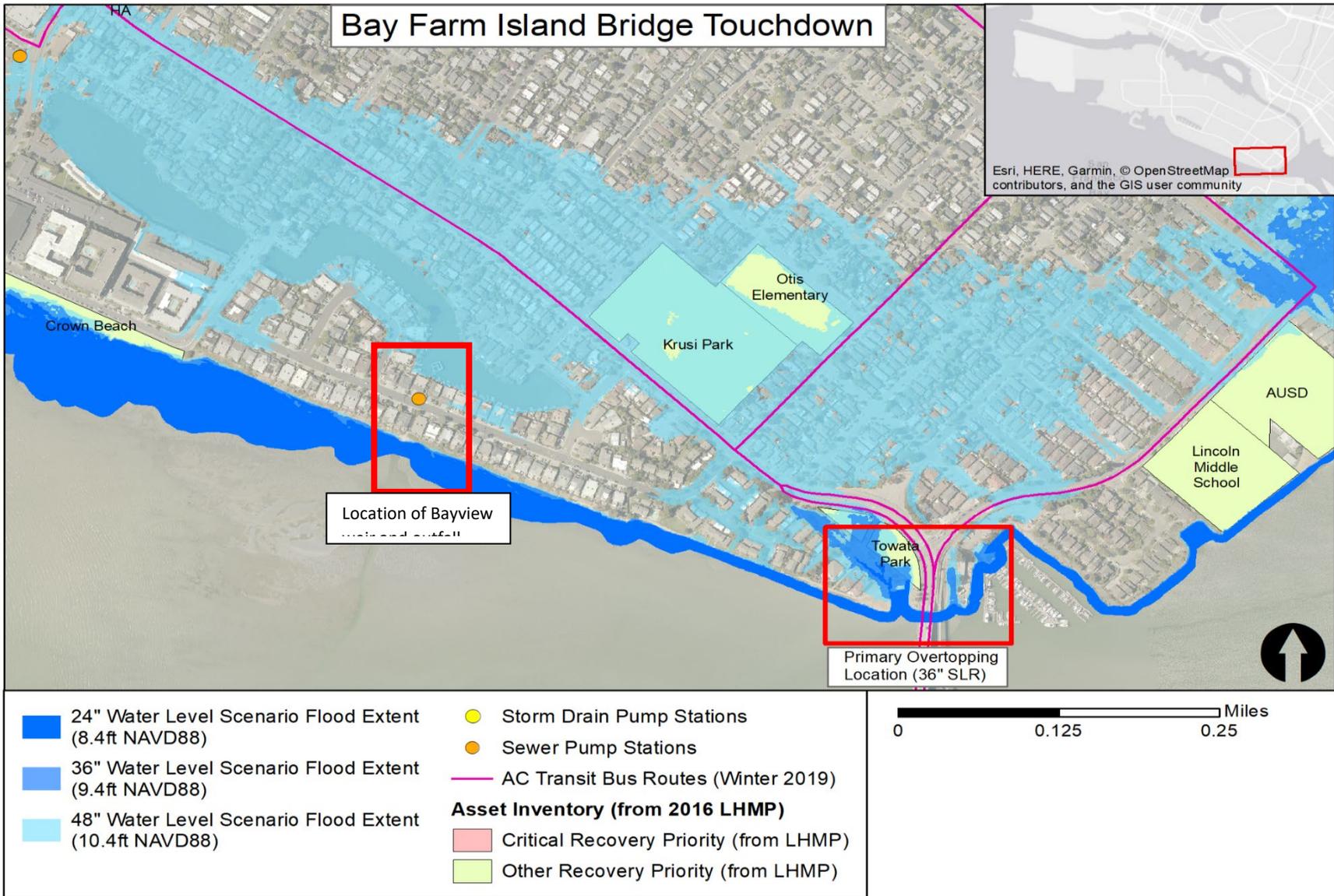


Table G-10. SR260, Including Webster and Posey Tubes, Vulnerability Summary

<p>SR260 is a critical transportation corridor connecting Alameda and Oakland—the tubes are one of four ways on or off Alameda Island. The historic average annual daily traffic at the tubes is approximately 31,500, including numerous commercial vehicles, which account for approximately 2.5 percent of daily traffic. The Posey Tube is the second oldest underwater tunnel in the United States (built in 1928) and was added to the National Register of Historic Places in 2000. Although seismic retrofits were completed in 2004, the age of the tube may increase its vulnerability to climate impacts. Webster Tube, built in 1963 to ease traffic volume in Posey Tube, is at lower risk of age-related deterioration.</p>	
Key Issue(s)	<ul style="list-style-type: none"> SR260 is essential to the movement of people, goods, and emergency services. However, the tubes are vulnerable to flooding derived from both shoreline overtopping and precipitation events. Mixed jurisdictional oversight of the asset(s) could also pose a barrier to the implementation of adaptation measures, primarily because Caltrans is not specifically authorized to implement resilience/adaptation projects (but can incorporate adaptation/resilience into larger transportation projects).
Exposure	<ul style="list-style-type: none"> SR260 and the tubes are exposed to sea level rise and storm surge flooding at 36" total water level. Inundation likely originates along the northern shoreline adjacent to the tubes (as described in the summary for that shoreline area). Overtopping near the Main Street Ferry Terminal may also contribute to flooding at the tubes. There is also substantial exposure to storm drain flooding driven by precipitation events near the entrance to the tubes, with storm drain modeling indicating multiple locations of potential flooding greater than 1 foot above street level.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> Caltrans owns and maintains SR260 and the tubes. The City of Alameda also has some maintenance responsibility and oversight, particularly along streets that lead to the tubes. <p>Informational</p> <ul style="list-style-type: none"> The extent of age-related deterioration of the Posey Tube and elements within it (electrical/ventilation systems) is not clear. <p>Functional</p> <ul style="list-style-type: none"> SR260 is a very high-use transportation corridor that is highly sensitive to disruptions. Traffic rerouting would be incredibly difficult if the tubes are blocked due to floodwaters, as vehicles would need to be redirected to one of the bridges leading to Alameda. <p>Physical</p> <ul style="list-style-type: none"> Many physical vulnerabilities are associated with the tubes. Notable issues include stormwater pumps that are not corrosion-resistant, and therefore could become inoperable if saltwater enters the tubes. The tubes themselves are also “immersed” and rely on careful waterproofing to maintain their function.
Adaptive Capacity	<ul style="list-style-type: none"> Short-term modifications at the ramps to the tubes could reduce the potential for flooding in the tubes; however, new structures would be required (elevated roadway, floodwalls, etc.). The tubes themselves have very limited adaptive capacity because modifications would be very complicated and require closure during construction.
Consequences	<ul style="list-style-type: none"> Social: SR260 and the tubes are critically important to traffic flow on and off Alameda Island. Multiple AC Transit bus routes use the tubes, and disruptions could disproportionately impact transit-dependent communities that don’t have alternative transportation options. Economic: Major economic impacts are likely if access to the tubes is blocked. Environmental: There are known underground and submerged hazardous waste sites along SR260 and adjacent to the tubes.

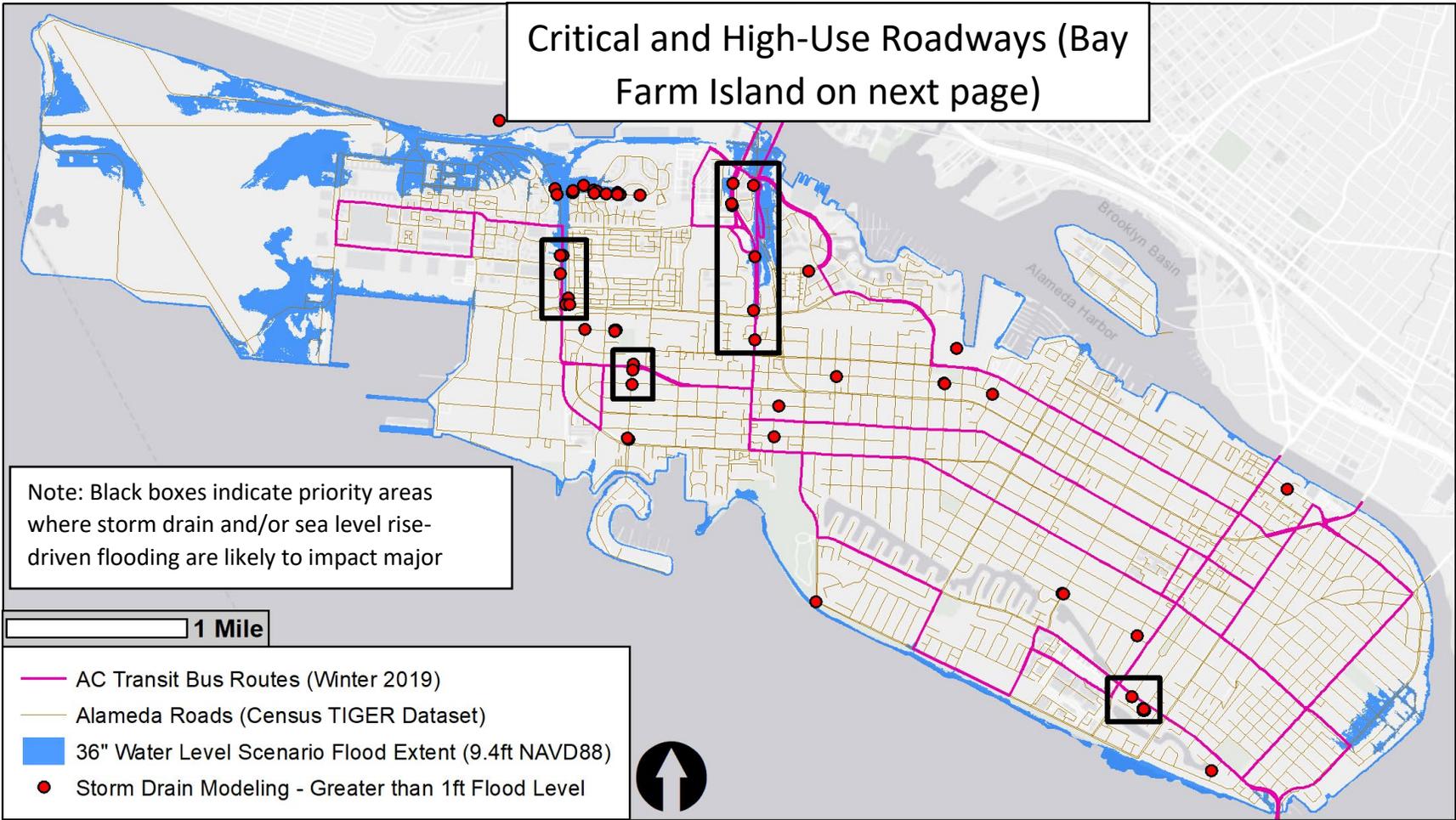
Table G-11. SR61 (Doolittle Drive and Other Segments) Vulnerability Summary

<p>SR61 is a state highway owned and maintained by Caltrans. The route runs from the intersection with SR112 near Oakland Airport and terminates on Alameda Island at the intersection of Webster Street and Central Avenue. The road connects Bay Farm Island and Alameda Island across the Bay Farm Island Bridge. Multiple AC Transit bus routes use SR61, including several that serve transit-dependent or disadvantaged communities. The City of Alameda has designated SR61 south of Otis Drive as a primary evacuation route and the segment on Alameda Island as critical access for the evacuation route.</p>	
Key Issue(s)	<ul style="list-style-type: none"> Disruptions to SR61 could have substantial impacts on the flow of commuters and goods within Alameda and to Oakland, including several important bus routes. Existing traffic issues in Alameda would be exacerbated if the City closes SR61 or restricts traffic flow. Overtopping of Doolittle Drive on Bay Farm Island also contributes to broad flooding across the island, with the road serving as a conduit for floodwaters.
Exposure	<ul style="list-style-type: none"> SR61 is exposed to flooding from multiple sources of overtopping, including Veteran’s Court seawall, along Doolittle Drive, and at the Bay Farm Island Bridge touchdown on Alameda Island. Shoreline overtopping begins at around 36” total water level. Precipitation-driven storm drain flooding also impacts SR61—the modeled 25-year storm event results in several areas with water levels greater than 0.5 feet above street level.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> Caltrans owns and maintains SR61, both in Alameda and Oakland. Flooding along SR61 is also a concern for the City of Oakland and Port of Oakland, and a coordinated approach to address vulnerabilities is warranted. <p>Informational</p> <ul style="list-style-type: none"> It is very difficult to determine the exact source of flooding on Bay Farm Island beyond 36” total water level due to overtopping at multiple locations. <p>Functional</p> <ul style="list-style-type: none"> SR61 has very high average daily traffic, and it is very important for travel between the islands and for emergency services. Several emergency operations staging areas are along SR61. Major congestion issues exist along SR61 during peak hours, primarily at the junction of Webster Street and Central Avenue, and at Doolittle Drive and Island Drive. Traffic flow on SR61 is affected by local Alameda surface streets, traffic from SR112, and traffic diverted from I-880 in Oakland due to construction or accidents. GPS systems like Google Maps and Waze often redirect people onto SR61 if major congestion is on I-880. <p>Physical</p> <ul style="list-style-type: none"> Overtopping in this area could impact Doolittle Landfill, which is protected by a perimeter levee that has known seepage concerns. Groundwater impacts to the landfill are also likely.
Adaptive Capacity	<ul style="list-style-type: none"> There are multiple options for enhancing flood protection along SR61, but construction and engineering of some sort is required. No immediate or simple modifications to this location could address sea level rise and storm surge.
Consequences	<ul style="list-style-type: none"> Social: SR61 is used by several AC Transit bus routes that serve transit-dependent communities, and disruptions could result in major delays to most bus routes in Alameda. SR61 is also a priority evacuation route from Alameda. Economic: Substantial disruption to commuter and commercial transit is likely if SR61 floods. Environmental: Several species of concern are found along SR61. There are also known underground hazardous waste sites along the southern end of SR61 and just north of the route on Alameda Island. Contamination could impact Arrowhead Marsh and other sensitive areas.

Table G-12. Critical and High-Use Roadways (Excluding Caltrans Roads) Vulnerability Summary

<p>Many major and minor roads in Alameda are expected to be impacted by flooding and inundation associated with both sea level rise and storm events. To analyze and present vulnerabilities, key roadways were bundled into a single priority asset group. The common theme for roadways in this asset group is that they are heavily used by multiple AC Transit bus routes, specifically those that serve transit-dependent or socially vulnerable communities and provide critical connections between Alameda and the mainland. Although roadways other than those described here are at risk of damage due to flooding, this assessment prioritized roads that serve as key transit corridors because of their importance to transit-dependent communities.</p>	
Key Issue(s)	<ul style="list-style-type: none"> Entire roads and specific road segments or intersections in Alameda are exposed to flooding from sea level rise, storm surge, and major rainfall events. Given the limited number of connections between Alameda and the mainland, disruptions to key roads like Webster Street can have large impacts on transit-dependent residents and commerce. One key vulnerability is the inability of connecting streets in Alameda to handle additional traffic volume if key roads are closed or restricted and major traffic rerouting is necessary.
Exposure	<ul style="list-style-type: none"> Most of the exposure to key roadway segments is due to precipitation-driven, storm drain flooding—some segments are exposed to sea level rise and storm surge flooding in isolated locations. There is substantial exposure to storm drain flooding as modeled for a 25-year storm event. Flooding greater than 1 foot above street level could occur at multiple locations along key roadways. Heavily impacted roads include Main Street, Webster Street, Stargell Avenue, Atlantic Avenue, Pacific Avenue, and Otis Drive.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> The City of Alameda is responsible for maintenance and upgrades of almost all roadways except Caltrans-owned SR260 and SR61. However, the City has very limited control over operational conditions like route alignments for AC Transit. Any route adjustments would be made by AC Transit in collaboration with the City. Alameda is a relatively minor component of the AC Transit system, which also serves Oakland, Berkeley, and other cities in Alameda and Contra Costa counties. AC Transit has four planning districts—Alameda is part of the Northern Alameda County planning area, with a total population of 616,000, potentially resulting in less attention being paid to the transit system within Alameda except where it is part of a major transit route like AC Transit Route 51A. <p>Functional</p> <ul style="list-style-type: none"> AC Transit routes have multiple connections with regional transit services (primarily BART) and are heavily used by commuters. The bus system serves highly transit-dependent and socially vulnerable communities in Alameda Point and adjacent neighborhoods. The entirety of Route 96 runs through census tracts with high social vulnerability, as defined by a composite of several economic and demographic indicators. <p>Physical</p> <ul style="list-style-type: none"> Location-specific issues on roads contribute to overall vulnerability. For example, stormwater catch basin inlets along Mariner Square Drive (used by AC Transit Route 96) are lower in elevation than surrounding road sections, leading to flooding during precipitation events.
Adaptive Capacity	<ul style="list-style-type: none"> Modifications to roadways are often very expensive and require long environmental review and permitting processes. It may be difficult to identify short-term strategies that allow rapid response to threats.
Consequences	<ul style="list-style-type: none"> Social: Multiple AC Transit bus routes serve transit-dependent and disadvantaged communities. Closures or disruptions to roads along these routes would limit the ability of these residents to commute to work and go about daily activities. Economic: Substantial impacts to the transport of goods around Alameda and on/off the islands could occur if key roads are closed/disrupted.

Critical and High-Use Roadways (Bay Farm Island on next page)



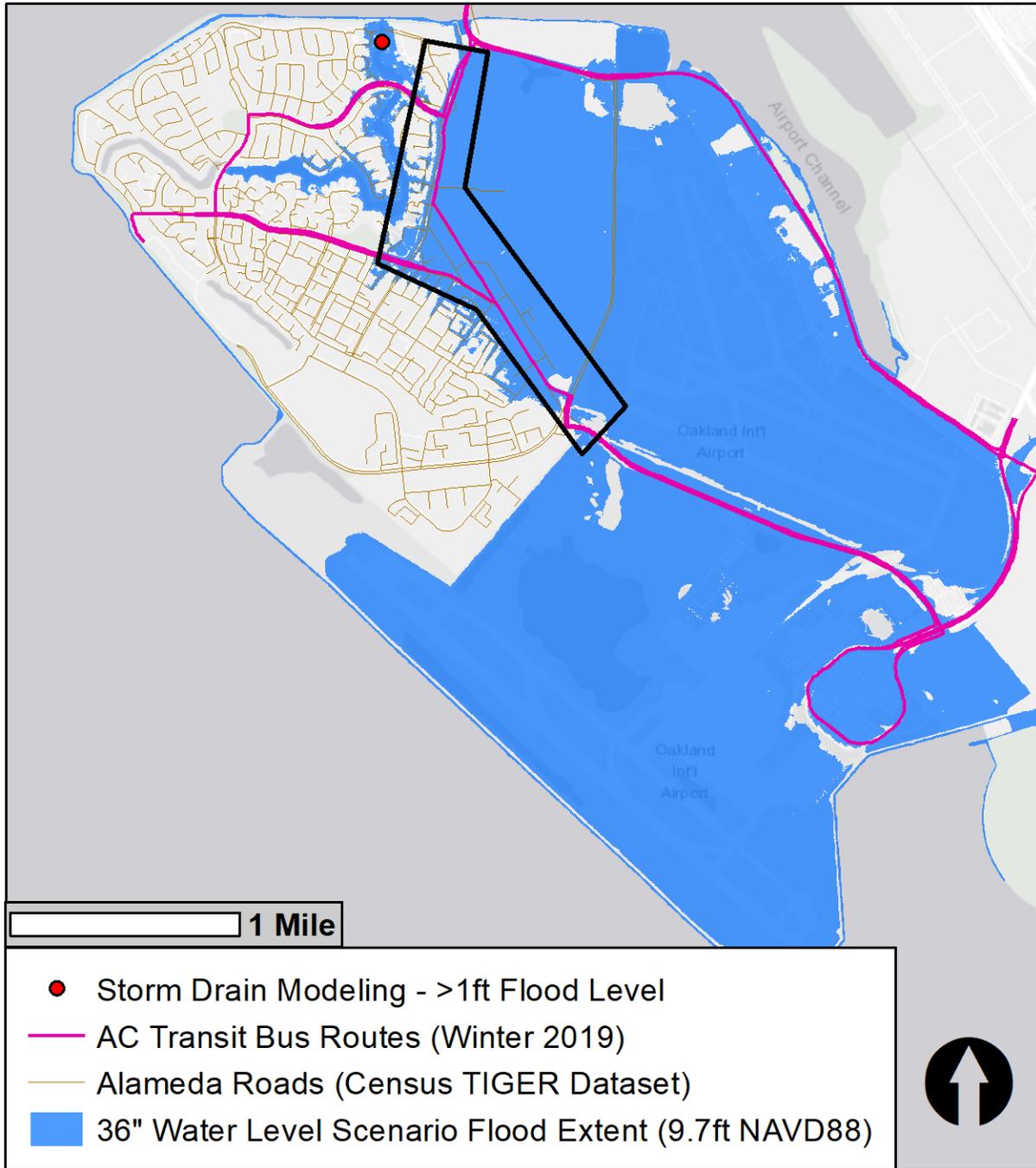


Table G-13. Storm Drain Pipes and Pump Stations Vulnerability Summary

<p>Storm drain pump stations across Alameda are a critical component of the stormwater system and are expected to become even more important as water levels rise. The pump stations operate in areas that cannot drain through a gravity system, although it is likely that most of the gravity-fed components of Alameda’s stormwater system will become obsolete as outfalls are submerged and rising groundwater impacts hydraulic conditions.</p>	
Key Issue(s)	<ul style="list-style-type: none"> Alameda’s storm drain pump stations are already subject to capacity and operational issues, including flap gate failures, sedimentation, and lack of backup power. While capacity upgrades have already been identified, the City must consider other modifications at the pump stations to increase the resilience of the station infrastructure to floodwater.
Exposure	<ul style="list-style-type: none"> Shoreline overtopping due to sea level rise and storm surge at multiple locations could lead to temporary flooding or permanent inundation at storm drain pump stations. Precipitation-driven storm drain flooding could also impact the pump stations. The degree of flooding varies from station to station. Initial exposure at the storm drain pump stations is primarily related to access; direct impacts to infrastructure are not likely until higher water levels.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> The City of Alameda owns and maintains most of the storm drain pump stations. For those that are not owned by the City (Harbor Bay Lagoon System stations and Southshore Lagoon inlet pump), there is a clear division of responsibility for station maintenance. <p>Informational</p> <ul style="list-style-type: none"> None—regular inspections and maintenance result in substantial information related to station condition. <p>Functional</p> <ul style="list-style-type: none"> Operating storm drain pump stations are a vital component of Alameda’s stormwater system and their failure would have wide-ranging ripple effects throughout the system. There are known capacity issues with the overall stormwater system (upgrades planned) that result in overland flooding across Alameda during heavy precipitation events. Sea level rise is likely to block some stormwater outfalls, increasing the strain on storm drain pumps or resulting in pump failure. <p>Physical</p> <ul style="list-style-type: none"> Pump stations contain both electrical and mechanical equipment that floodwaters could damage (electric motors drive all pumps). The primary risks are for shorted electrical systems or corroded mechanical equipment. There are known issues with sedimentation at several pump stations and outfalls, further reducing their capacity and functionality. Pump stations were not designed with built-in excess capacity (backup pumps), and several lack backup power systems.
Adaptive Capacity	<ul style="list-style-type: none"> City ownership of most storm drain pump stations increases their adaptive capacity by removing barriers to action. The City can take (and is currently taking) some immediate steps to increase the resilience of the stations, including elevating electrical panels.
Consequences	<ul style="list-style-type: none"> Social: Malfunctioning storm drain pump stations could lead to flooding across Alameda with broad impacts even far from the station itself. Economic: City resources are used to prepare for, handle, and recover from flood events. Flood damage is also a major economic impact. Environmental: The stormwater system conveys water directly to the Bay. Failure of individual pump stations could lead to greater overland flow and mobilization of contaminants from the land surface.

Table G-14. Bayview Weir and Outfall Vulnerability Summary

<p>Water levels in the South Shore Lagoons are maintained by the Bayview weir and outfall, located near the Elsie Roemer Bird Sanctuary. Water is pumped into the lagoon system at the west end at high tide and released from the Bayview outfall at low tide to move water through the lagoon system at a rate that prevents stagnation and water quality issues. The Bayview weir functions as a barrier between lagoon waters and the Bay. The location of the weir and outfall is shown on the map for Crown Beach and the bird sanctuary earlier in this appendix.</p>	
Key Issue(s)	<ul style="list-style-type: none"> ■ The Bayview weir and outfall system is an important component of the South Shore Lagoons. An operational lagoon system is important to maintain water quality and to prevent flooding in communities adjacent to the lagoons. The current weir and outfall are at high risk of sea level rise and storm surge, and they need major repairs and/or replacement. The greatest vulnerability to the weir and outfall system is from sea level rise, which will eventually prevent the gravity-fed system from operating, necessitating an active pump.
Exposure	<ul style="list-style-type: none"> ■ The Bayview weir and outfall are directly exposed to flooding from sea level rise, storm surge, and major rainfall events. Sea level rise compromises the operation of the weir and outfall system due to its current reliance on gravity flow during low tide. Based on engineering drawings, the outfall is roughly equivalent in elevation to mean sea level, or approximately 2 feet above mean low tide. As a result, 24" of sea level rise (not including storm surge) would likely result in the outfall structure being regularly submerged except for a short window around low tide. By 36" total water level, the outfall structure is likely permanently below low tide levels.
Sensitivity	<p>Governance</p> <ul style="list-style-type: none"> ■ The local HOA owns the lagoon system, but the City of Alameda is responsible for maintaining water levels. Residents with homes along the lagoon shoreline have a vested interest in a functioning water level management system. <p>Informational</p> <ul style="list-style-type: none"> ■ Engineering drawings for the outfall structure are old (1959 and 1989) and may not accurately reflect current water levels and mean tide levels. <p>Functional</p> <ul style="list-style-type: none"> ■ The gravity-fed system relies on low tide to drain water from the lagoons. Sea level rise poses a direct and imminent risk to this system as currently designed. Even if the outfall was exposed at low tide in the coming years, rising water levels will reduce the amount of time the City can discharge water from the lagoons, greatly restricting the flood management capacity of this system. ■ The current system design could expose homes surrounding the lagoon system to precipitation-driven overland flooding if water levels at the outfall are too high to allow for discharge. Increased storm intensity in the future could exacerbate the risk of overland flooding. <p>Physical</p> <ul style="list-style-type: none"> ■ BCDC inundation maps indicate the South Shore Lagoon system could eventually be directly connected to the Bay at higher water levels if steps are not taken to protect critical shoreline segments and improve the weir and outfall system. ■ Multiple components of the weir are damaged, including an inoperable flap gate and platform columns.
Adaptive Capacity	<ul style="list-style-type: none"> ■ The existing outfall structure has very limited adaptive capacity because it relies on a gravity flow system. Raising the outfall to accommodate higher water levels would not be feasible. Installation of a pump station at the weir would greatly decrease the vulnerability of the lagoons.
Consequences	<ul style="list-style-type: none"> ■ Social: There is a small chance that the failure of the weir and outfall system could result in flooding adjacent to the lagoons, threatening residential neighborhoods and critical assets, including Alameda Hospital. ■ Environmental: There is known contaminated sediment in the east lagoon (where the weir is located).

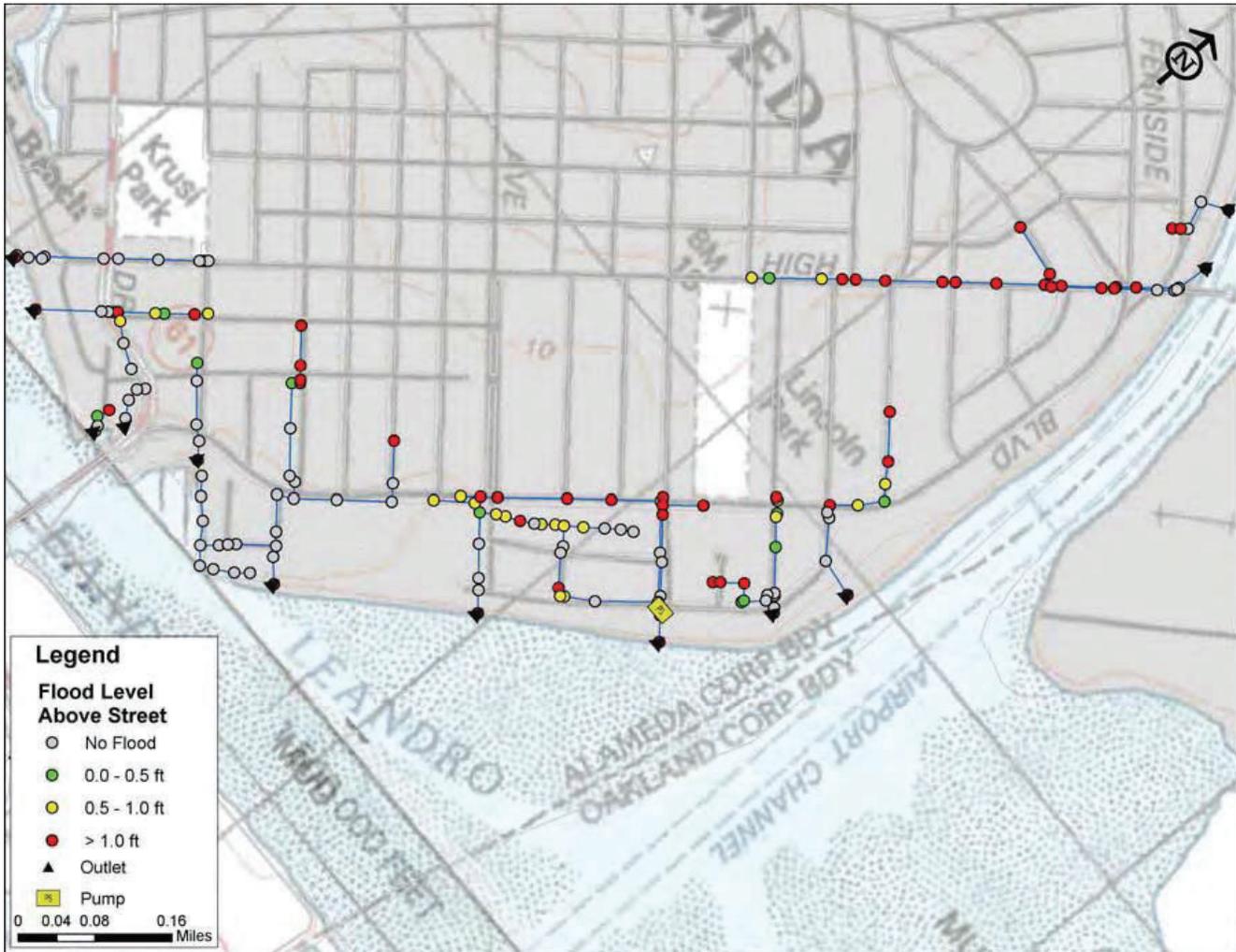


Appendix H Additional Maps

June 2022

Modeled Flooding of Stormwater Assets at 25-Year Storm Event

Alameda Eastside Area Existing 25-Year Flooding Depths



Source: Storm Drain Master Plan, Alameda, California, 2008, Schaaf & Wheeler, Appendix A

Figure A-3: Alameda North Central Area Existing 25-Year Flooding Depth

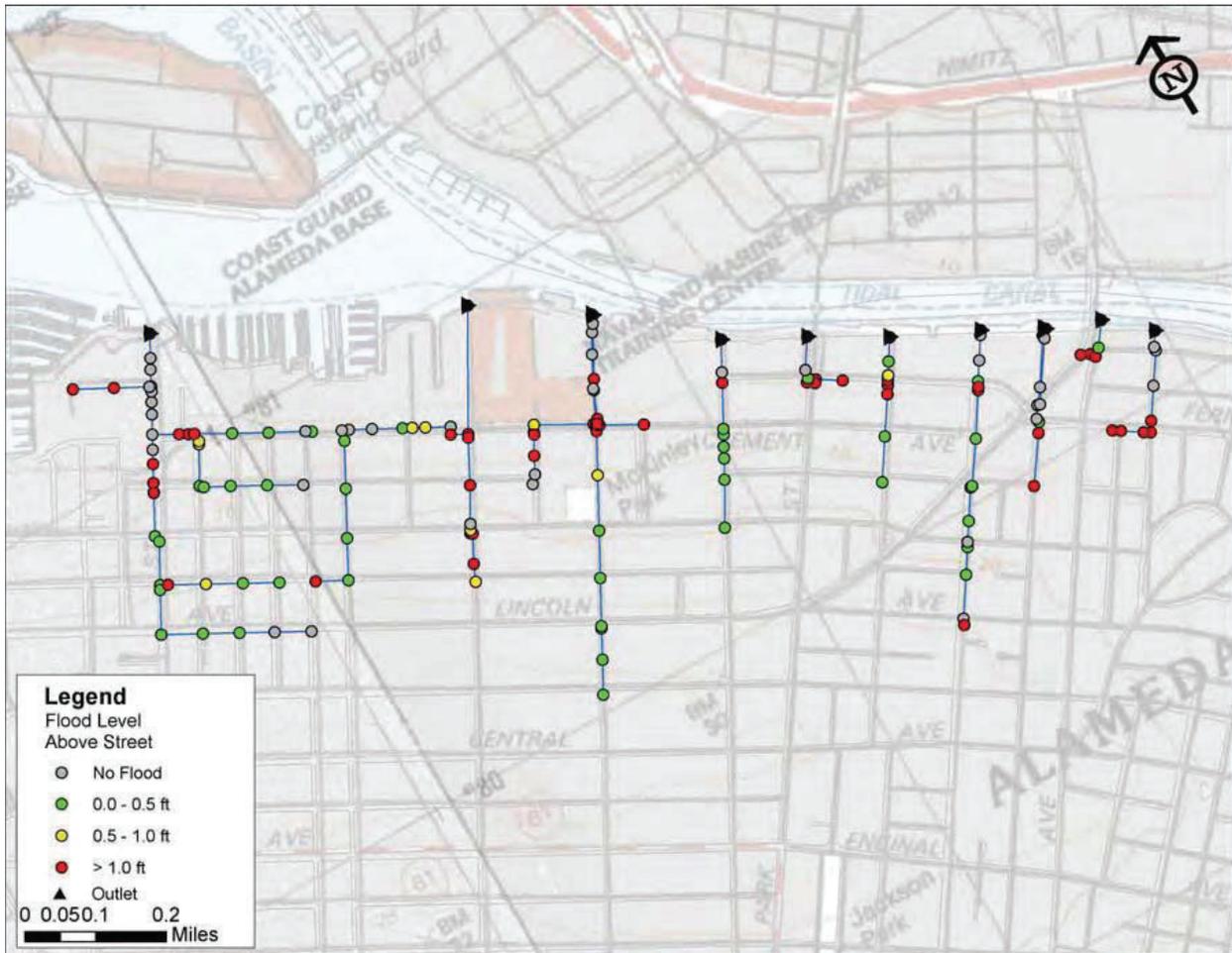


Figure A-5: Alameda Northside Area Existing 25-Year Flooding Depths

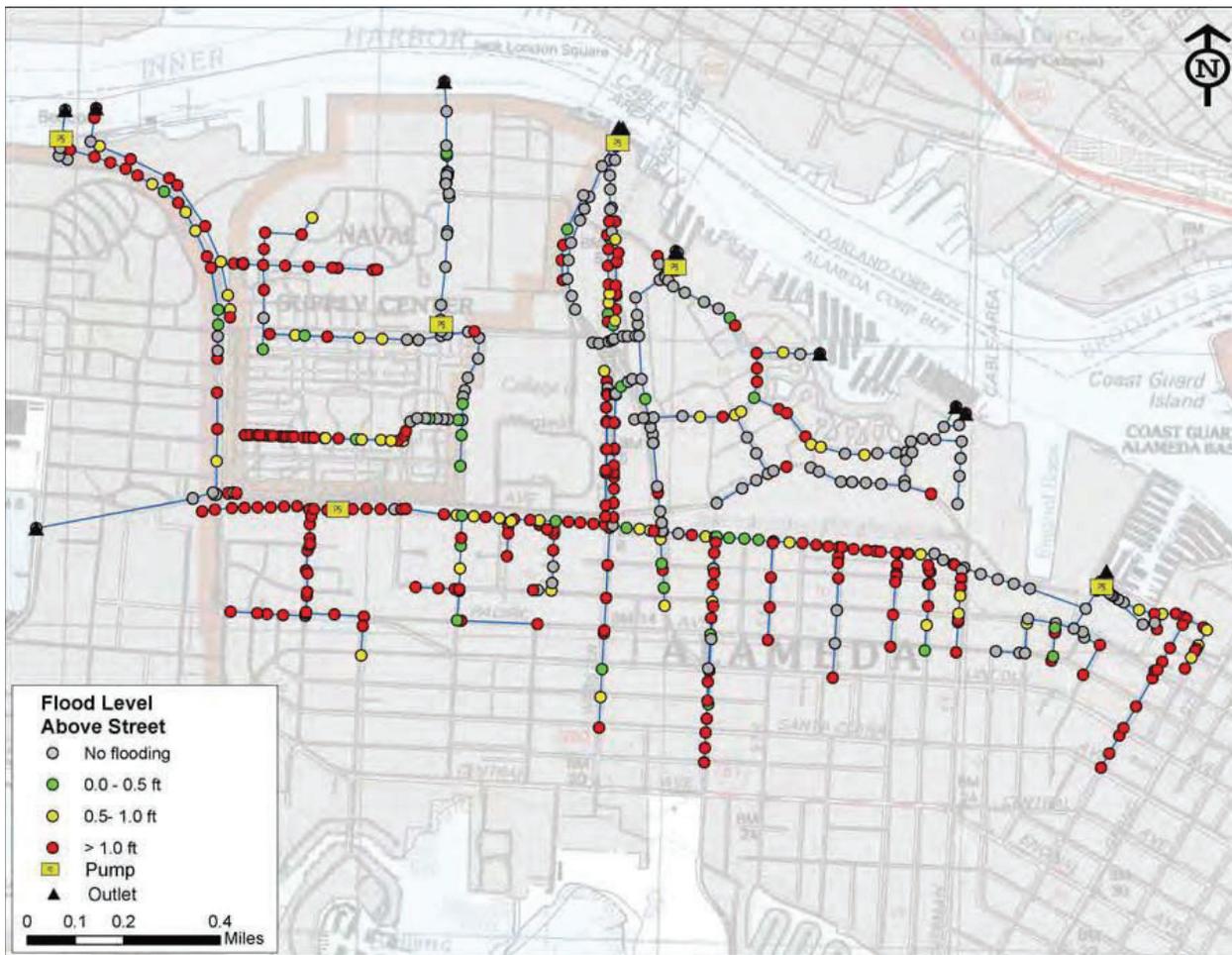


Figure A-7: Alameda South Area Existing 25-Year Flooding Depths

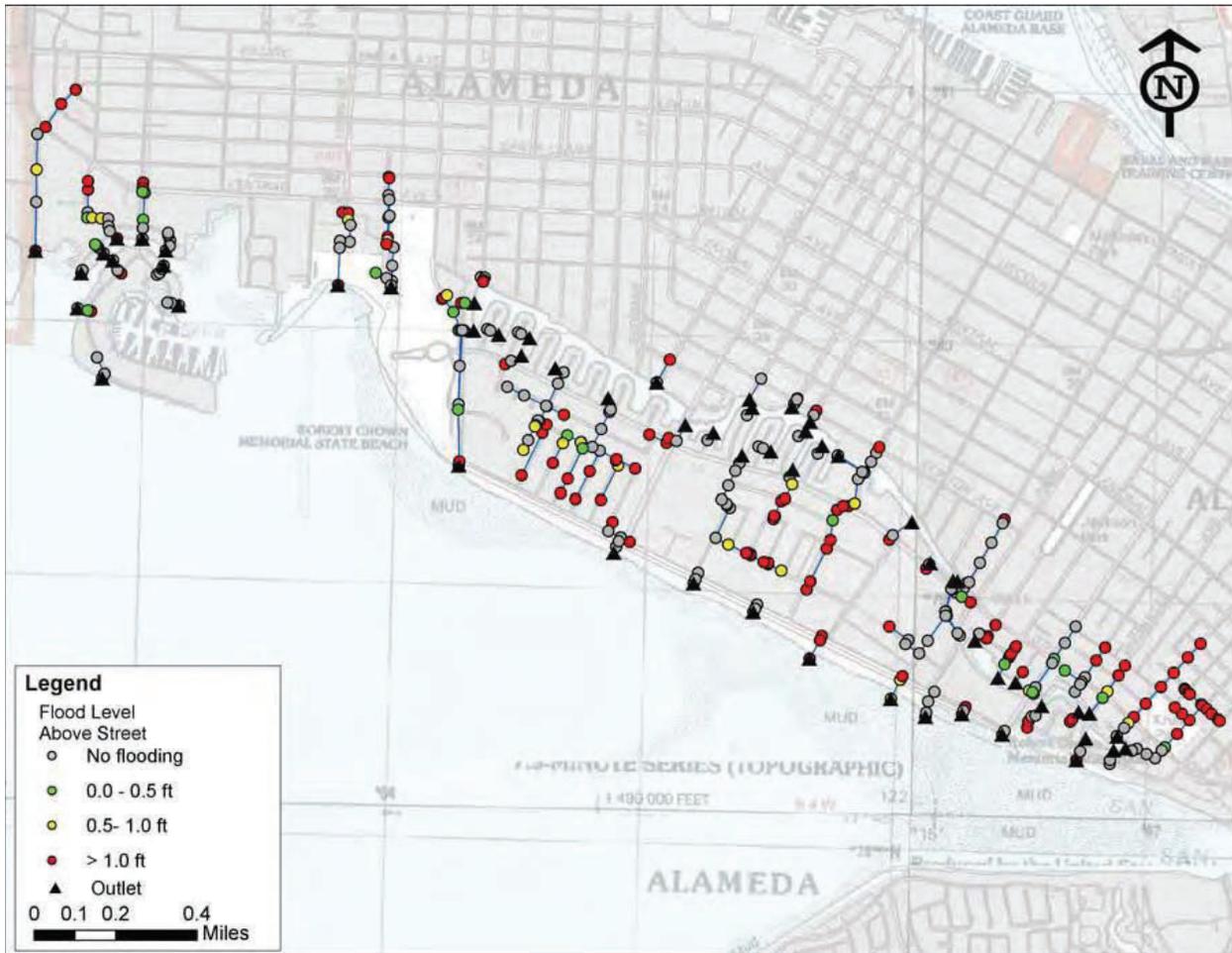


Figure A-9: Bay Farm East Area Existing 25-Year Flooding Depths

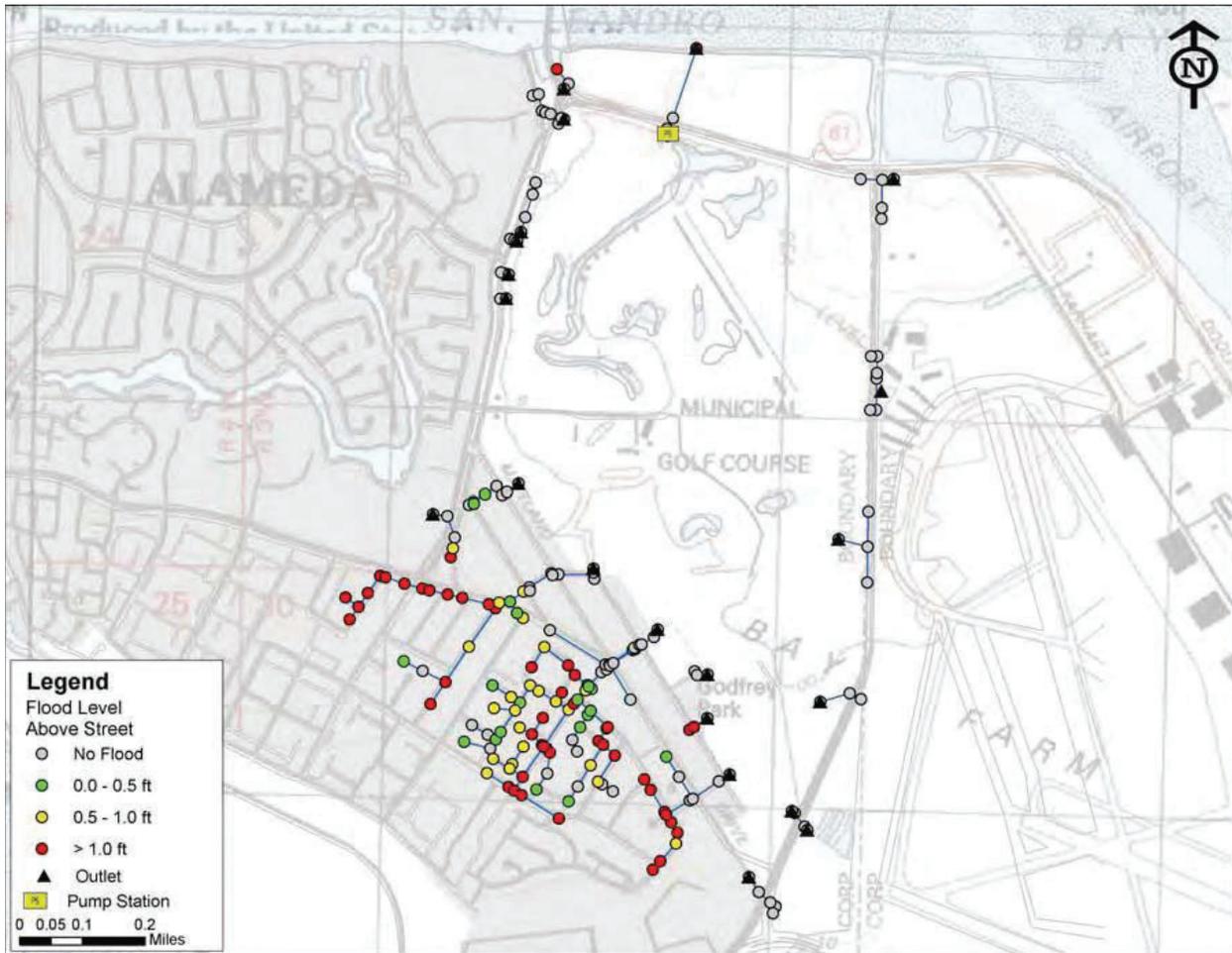


Figure A-11: Bay Farm North Area Existing 25-Year Flooding Depths

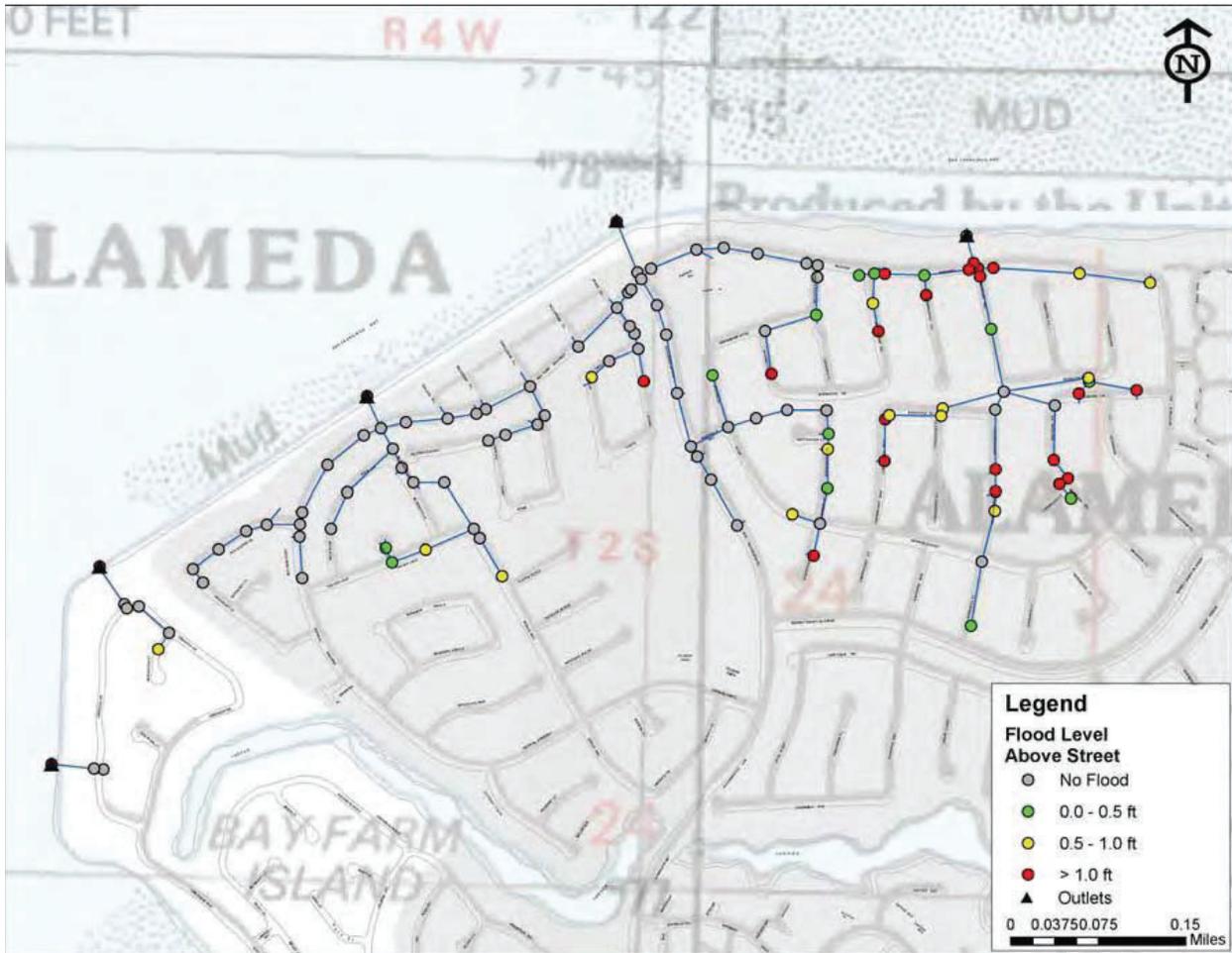
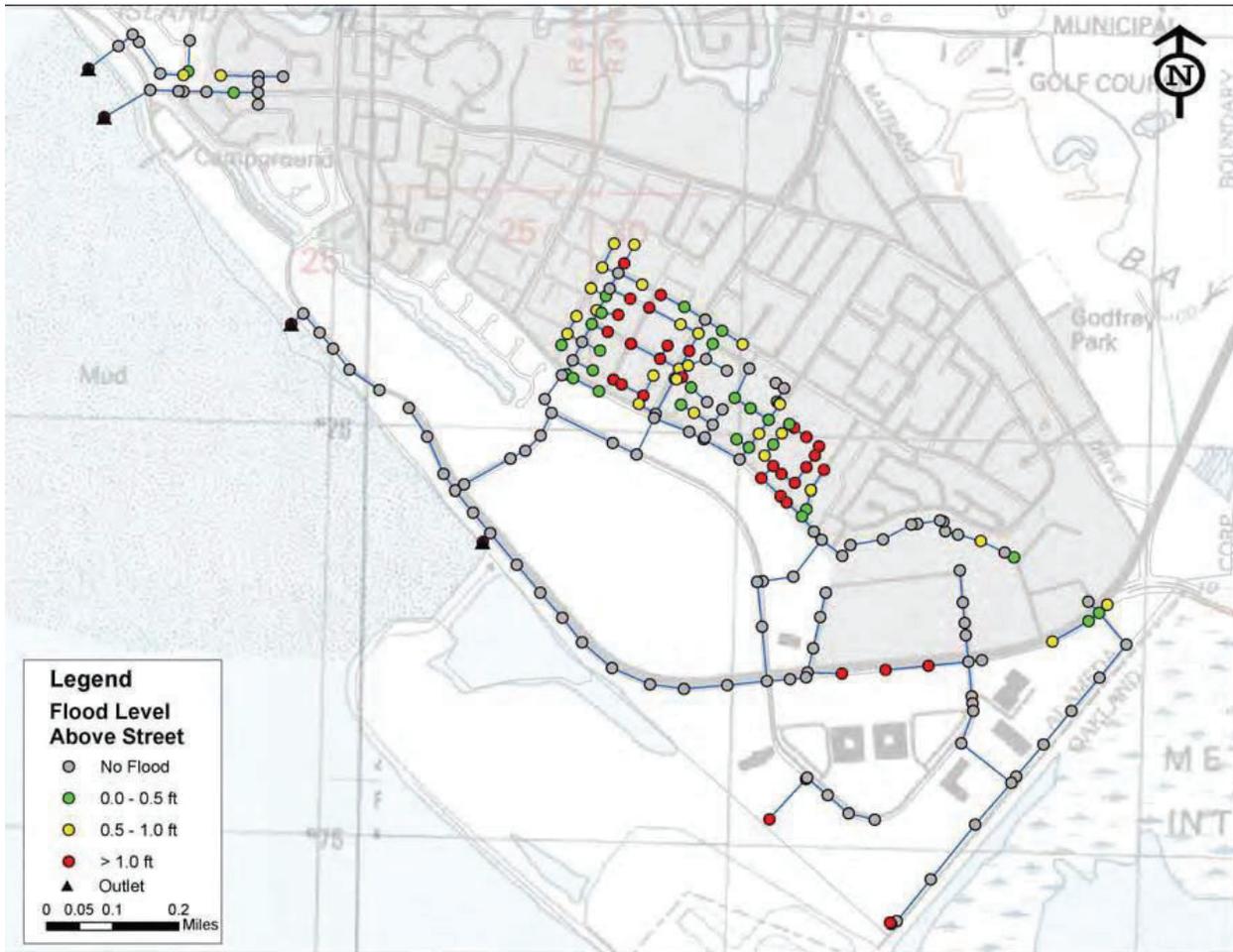
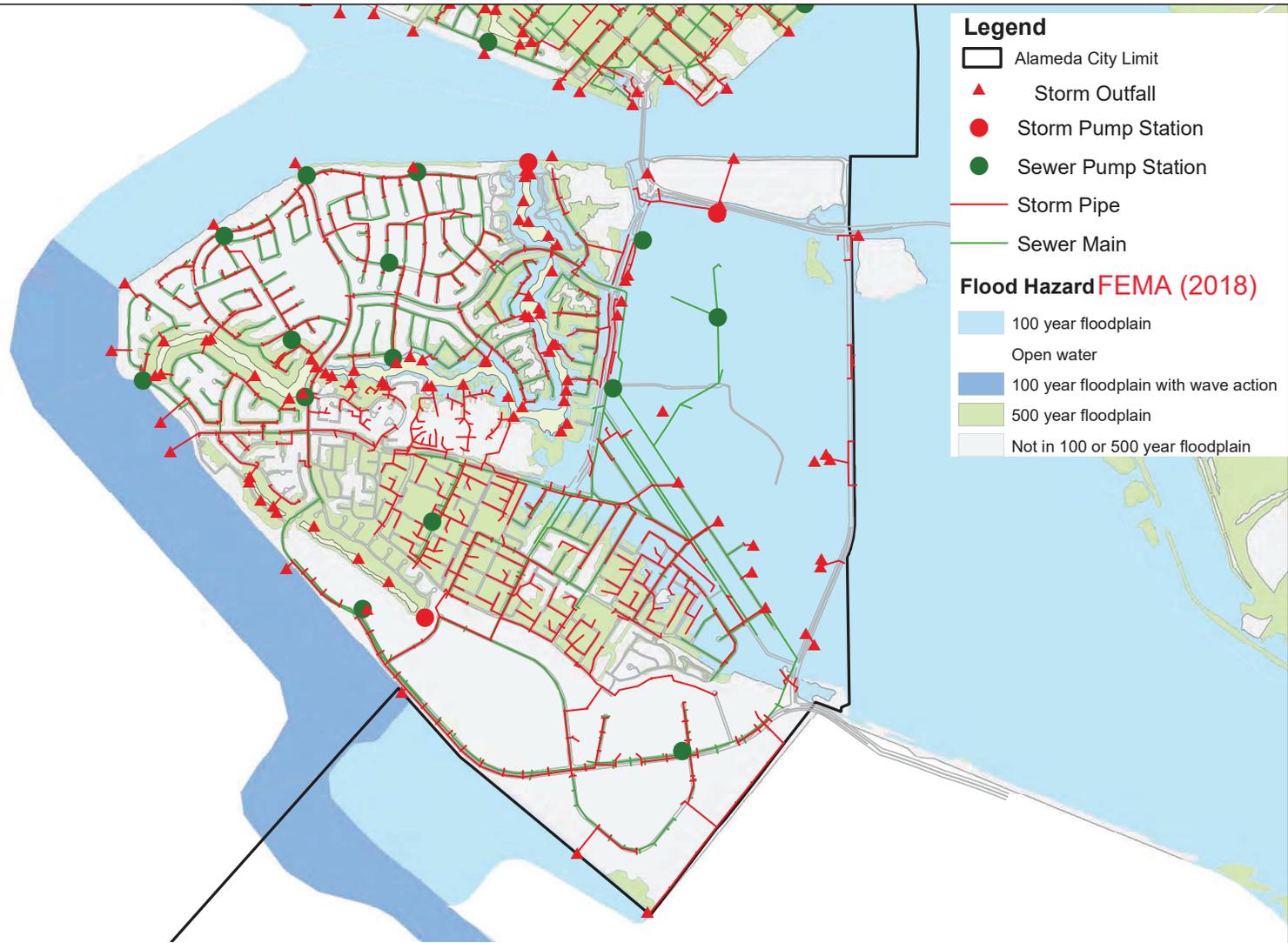


Figure A-15: Bay Farm South Area Existing 25-Year Flooding Depths



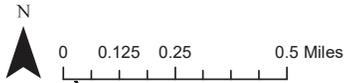
**Location of City Stormwater and Wastewater Assets
in Relation to Current FEMA 100 Year-Flood Zone
(and Sea Level Rise: a Future 42" Total Water Level Above MHHW)**



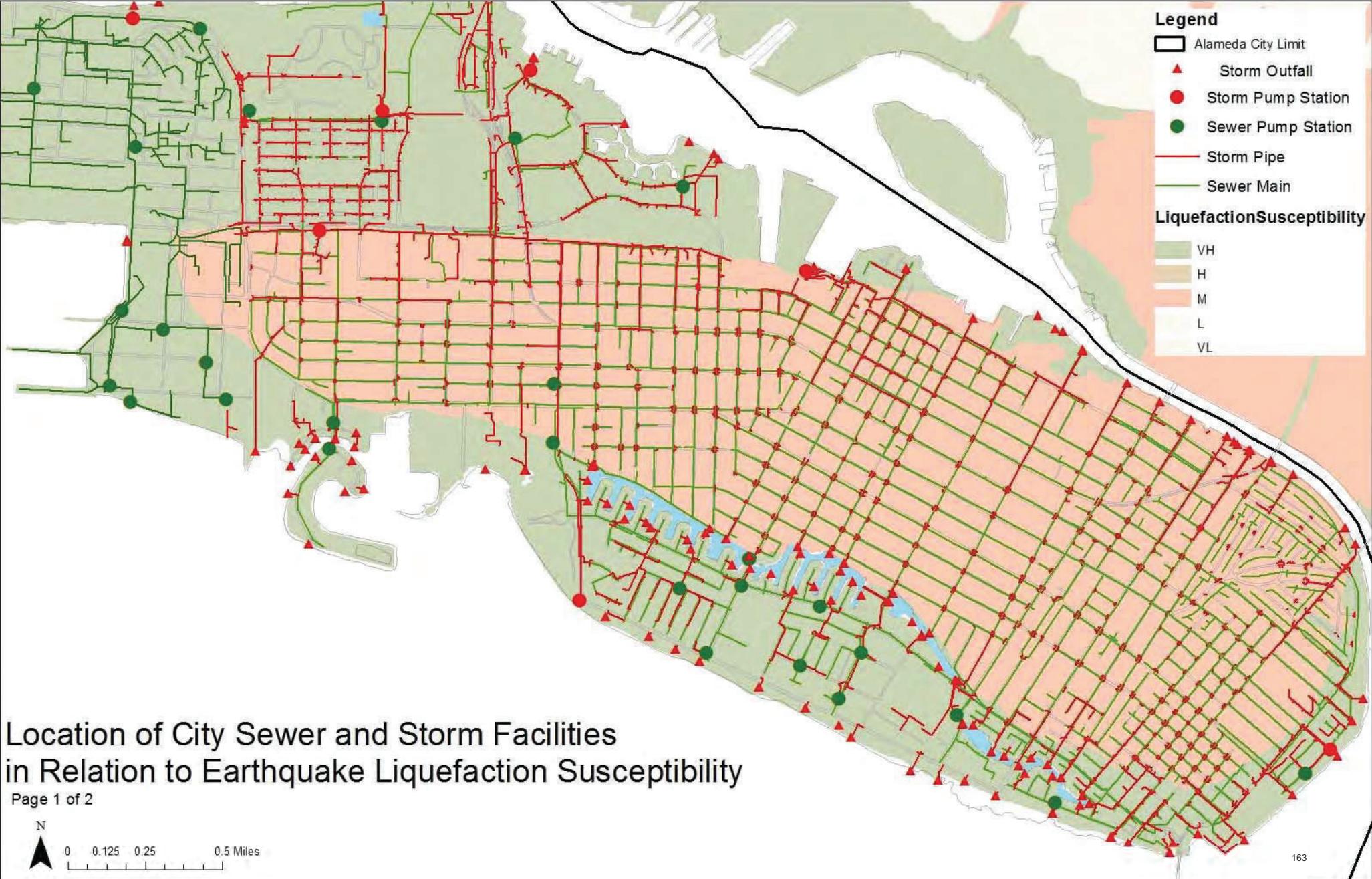


Location of City Sewer and Storm Facilities
 in Relation to FEMA Current 100 and 500 Year Flood Zones

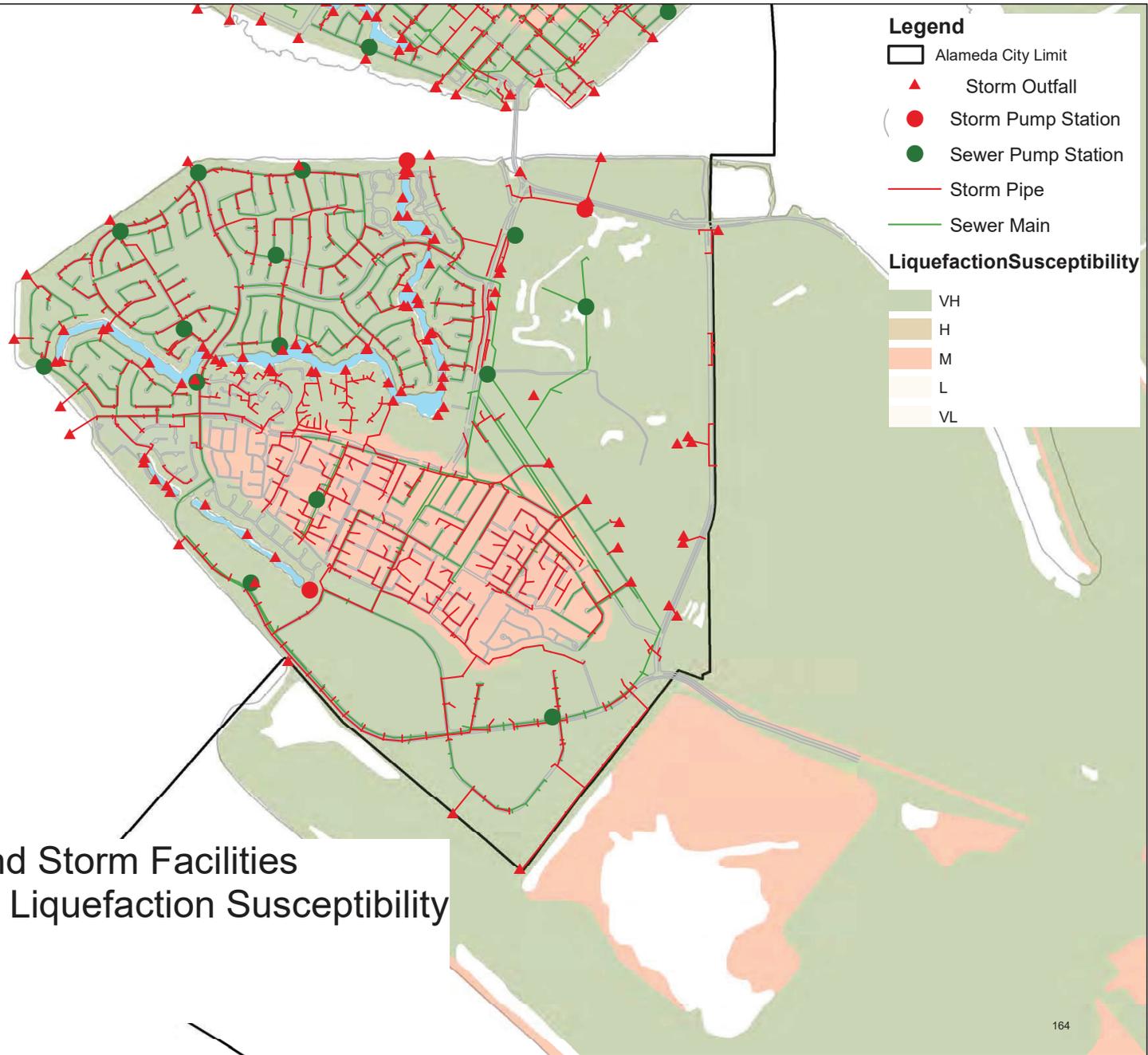
This also reflects a 42" Total Water Level above
 MHHW under future sea level rise conditions.



**Location of City Stormwater and Wastewater Assets
in Relation to Earthquake Liquefaction Susceptibility**

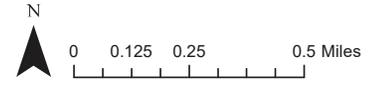


Location of City Sewer and Storm Facilities in Relation to Earthquake Liquefaction Susceptibility

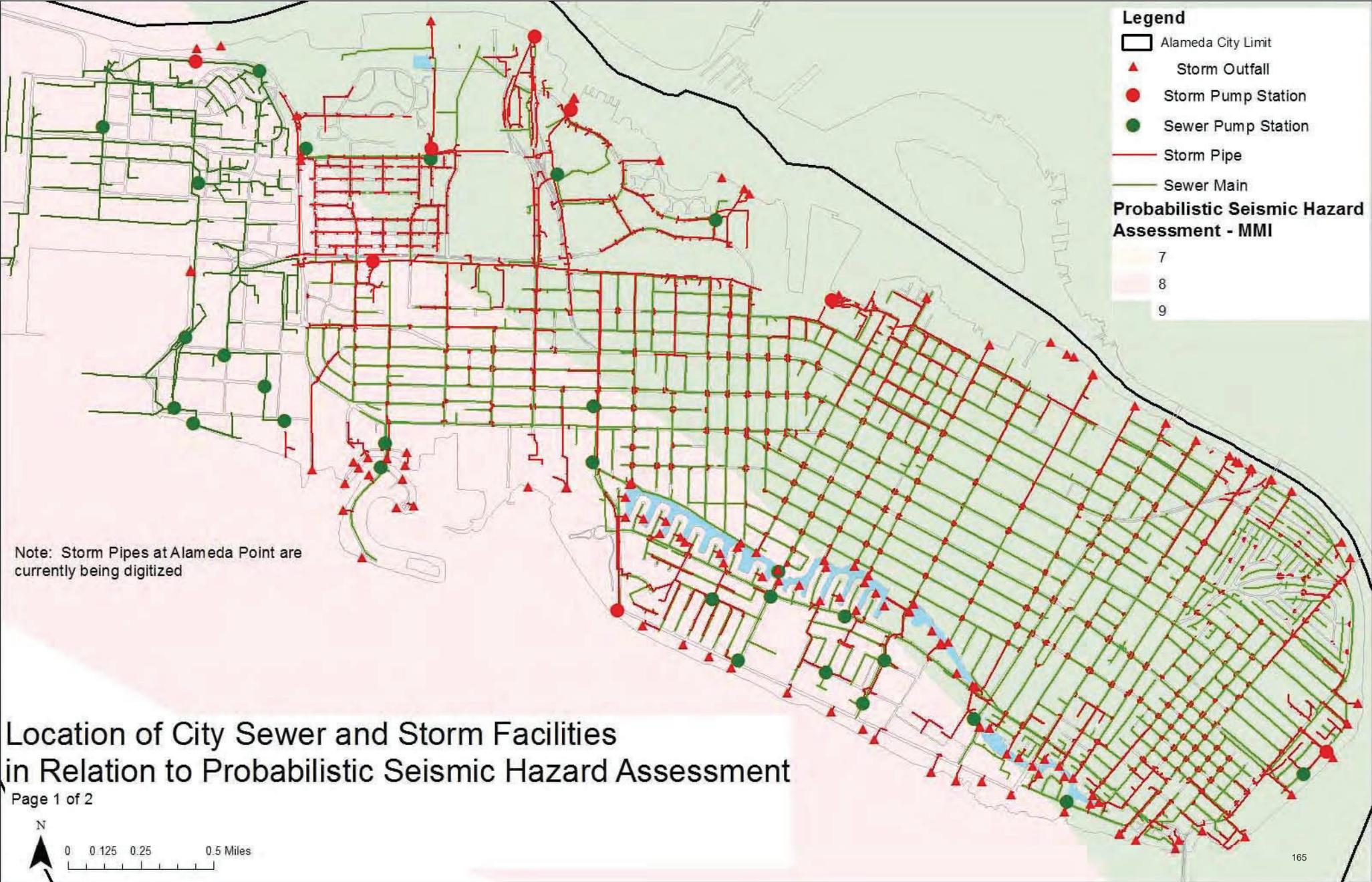


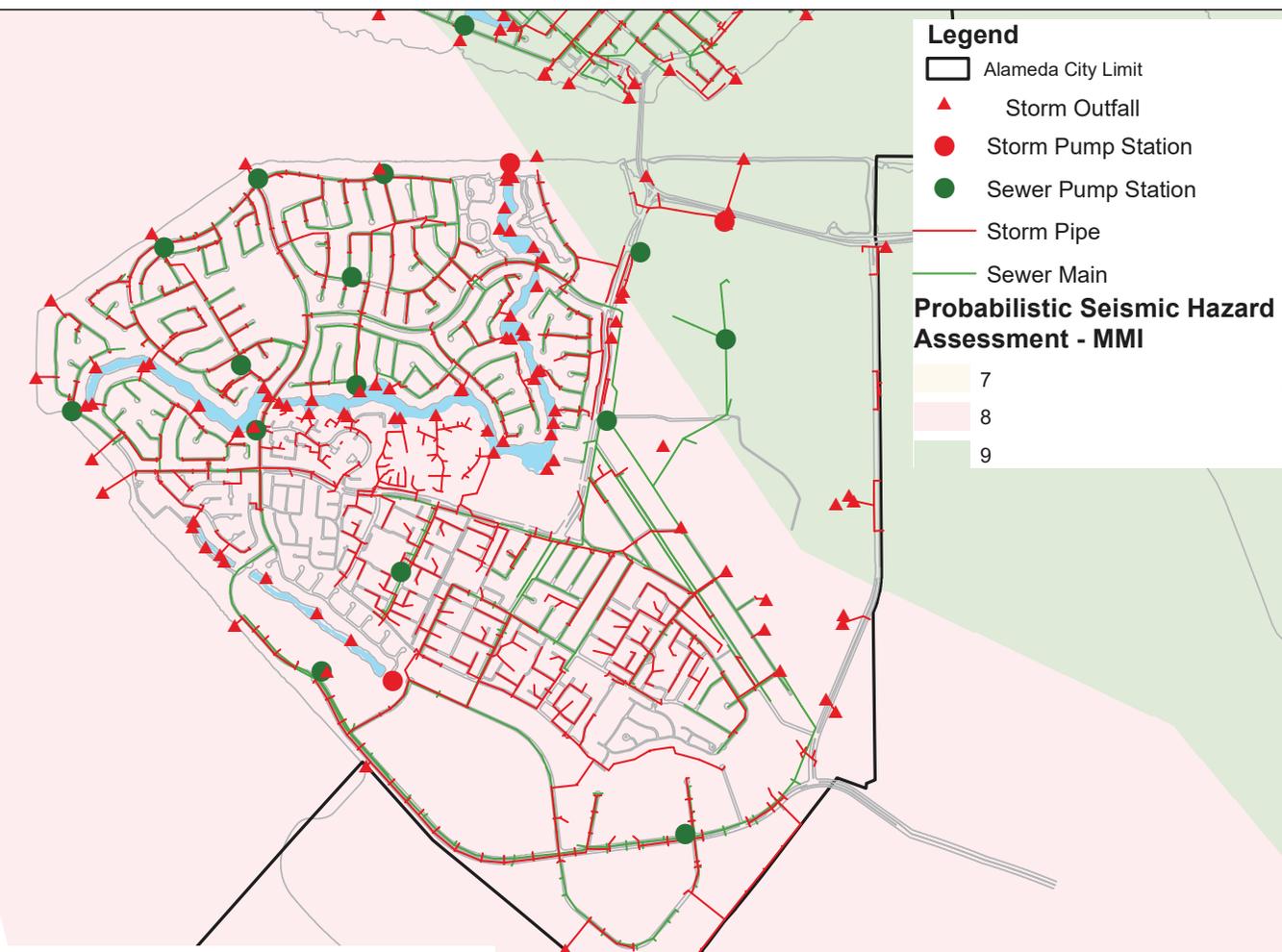
Location of City Sewer and Storm Facilities in Relation to Earthquake Liquefaction Susceptibility

Page 2 of 2



**Location of City Stormwater and Wastewater Assets
in Relation to Probabilistic Seismic Hazard Assessment**





Legend

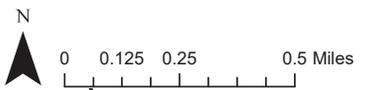
- Alameda City Limit
- ▲ Storm Outfall
- Storm Pump Station
- Sewer Pump Station
- Storm Pipe
- Sewer Main

Probabilistic Seismic Hazard Assessment - MMI

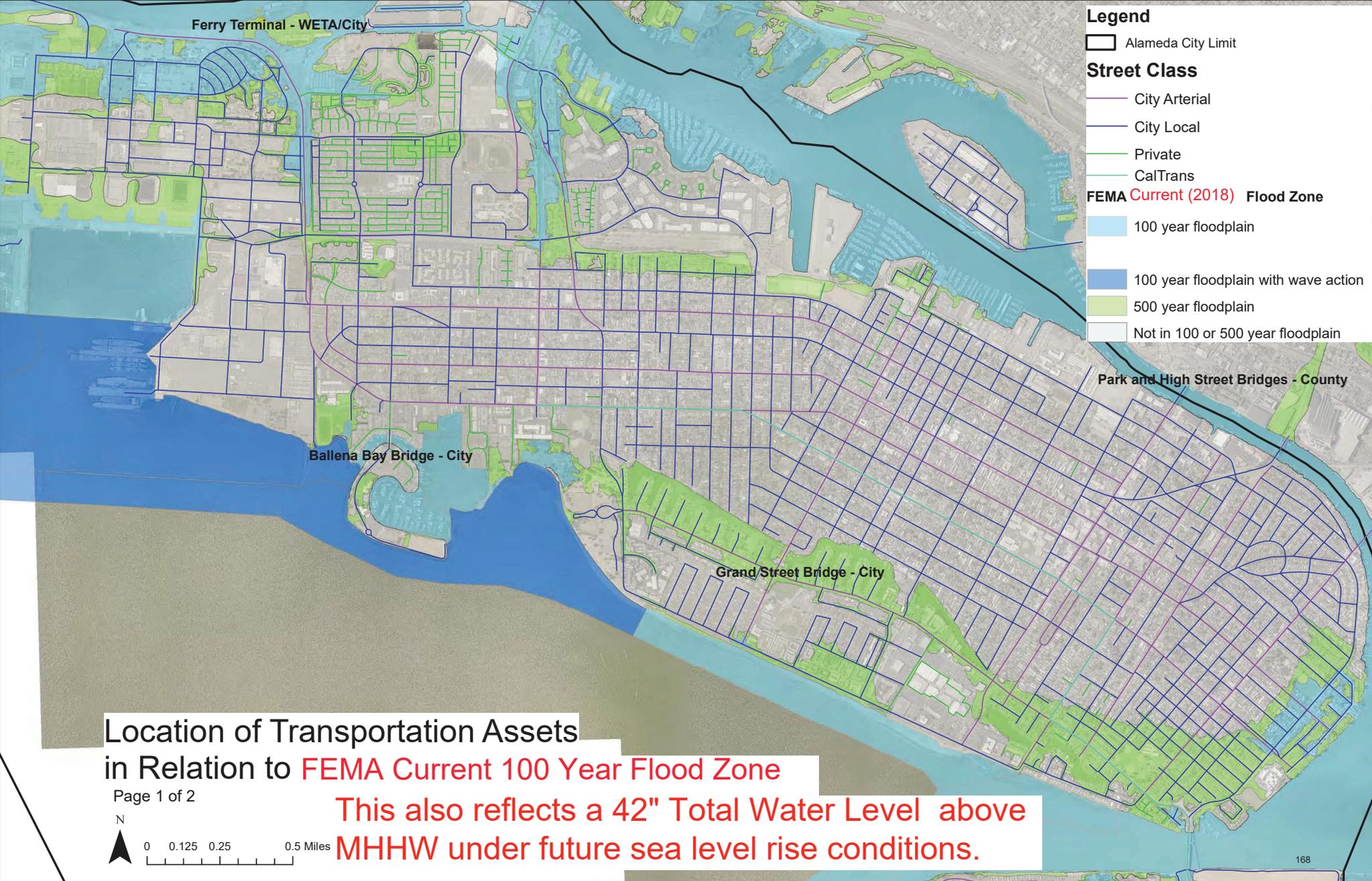
- 7
- 8
- 9

Location of City Sewer and Storm Facilities
in Relation to Probabilistic Seismic Hazard Assessment

Page 2 of 2



**Location of City Transportation Assets
in Relation to Current FEMA 100 Year-Flood Zone
(and Sea Level Rise: a Future 42" Total Water Level Above MHHW)**



Legend

- Alameda City Limit

Street Class

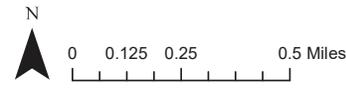
- City Arterial
- City Local
- Private
- CalTrans

FEMA Current (2018) Flood Zone

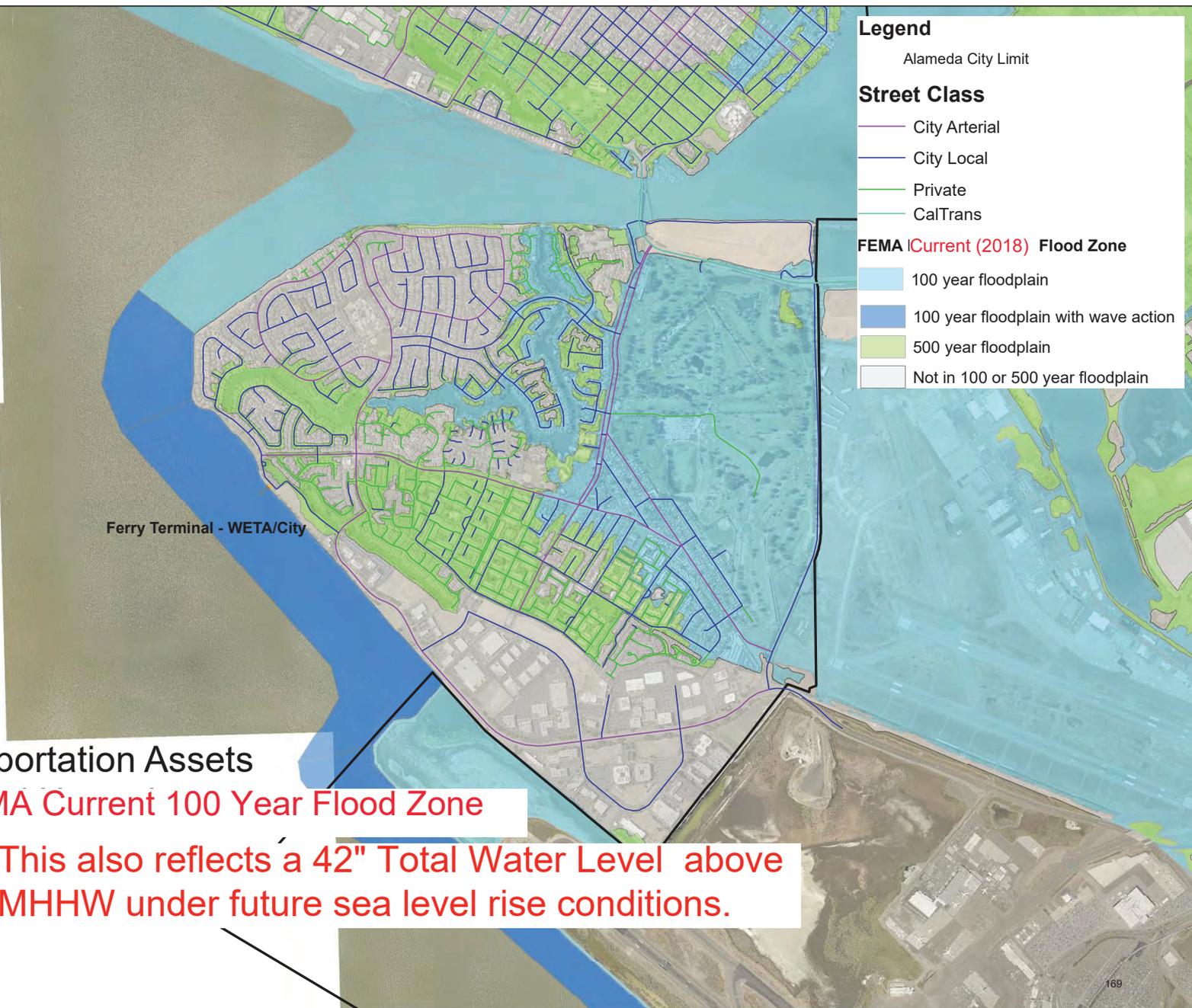
- 100 year floodplain
- 100 year floodplain with wave action
- 500 year floodplain
- Not in 100 or 500 year floodplain

**Location of Transportation Assets
in Relation to FEMA Current 100 Year Flood Zone**

Page 1 of 2



**This also reflects a 42" Total Water Level above
MHHW under future sea level rise conditions.**



Legend

- Alameda City Limit

Street Class

- City Arterial
- City Local
- Private
- CalTrans

FEMA Current (2018) Flood Zone

- 100 year floodplain
- 100 year floodplain with wave action
- 500 year floodplain
- Not in 100 or 500 year floodplain

Location of Transportation Assets
in Relation to FEMA Current 100 Year Flood Zone

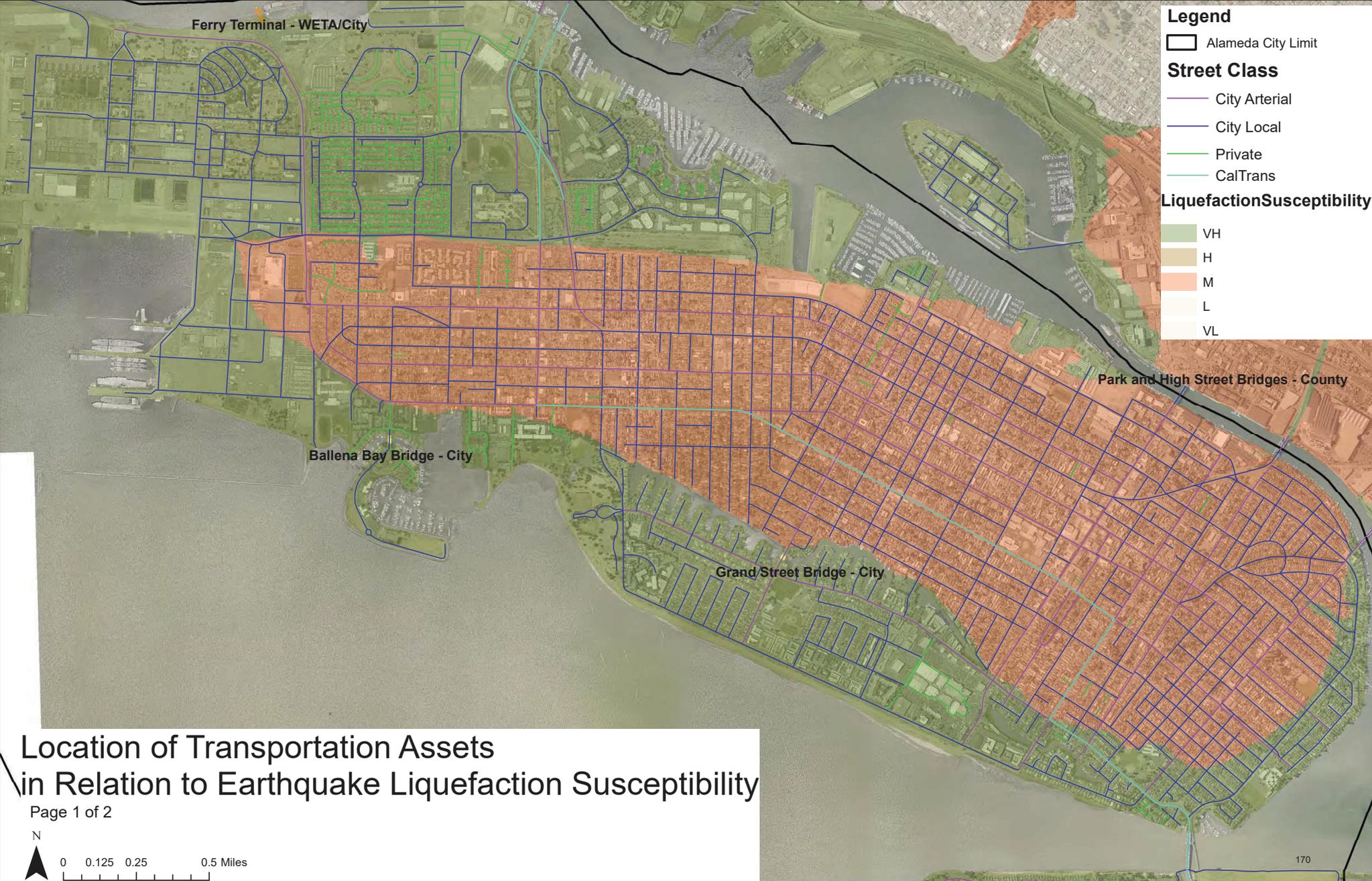
Page 2 of 2

N

0 0.125 0.25 0.5 Miles

This also reflects a 42" Total Water Level above MHHW under future sea level rise conditions.

**Location of City Transportation Assets
in Relation to Earthquake Liquefaction Susceptibility**



Legend

- Alameda City Limit

Street Class

- City Arterial
- City Local
- Private
- CalTrans

Liquefaction Susceptibility

- VH
- H
- M
- L
- VL

**Location of Transportation Assets
in Relation to Earthquake Liquefaction Susceptibility**

Page 1 of 2

N

0 0.125 0.25 0.5 Miles

Legend

-  Alameda City Limit

Street Class

-  City Arterial
-  City Local
-  Private
-  CalTrans

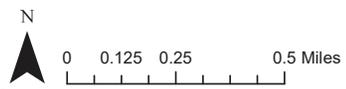
Liquefaction Susceptibility

-  VH
-  H
-  M
-  L
-  VL

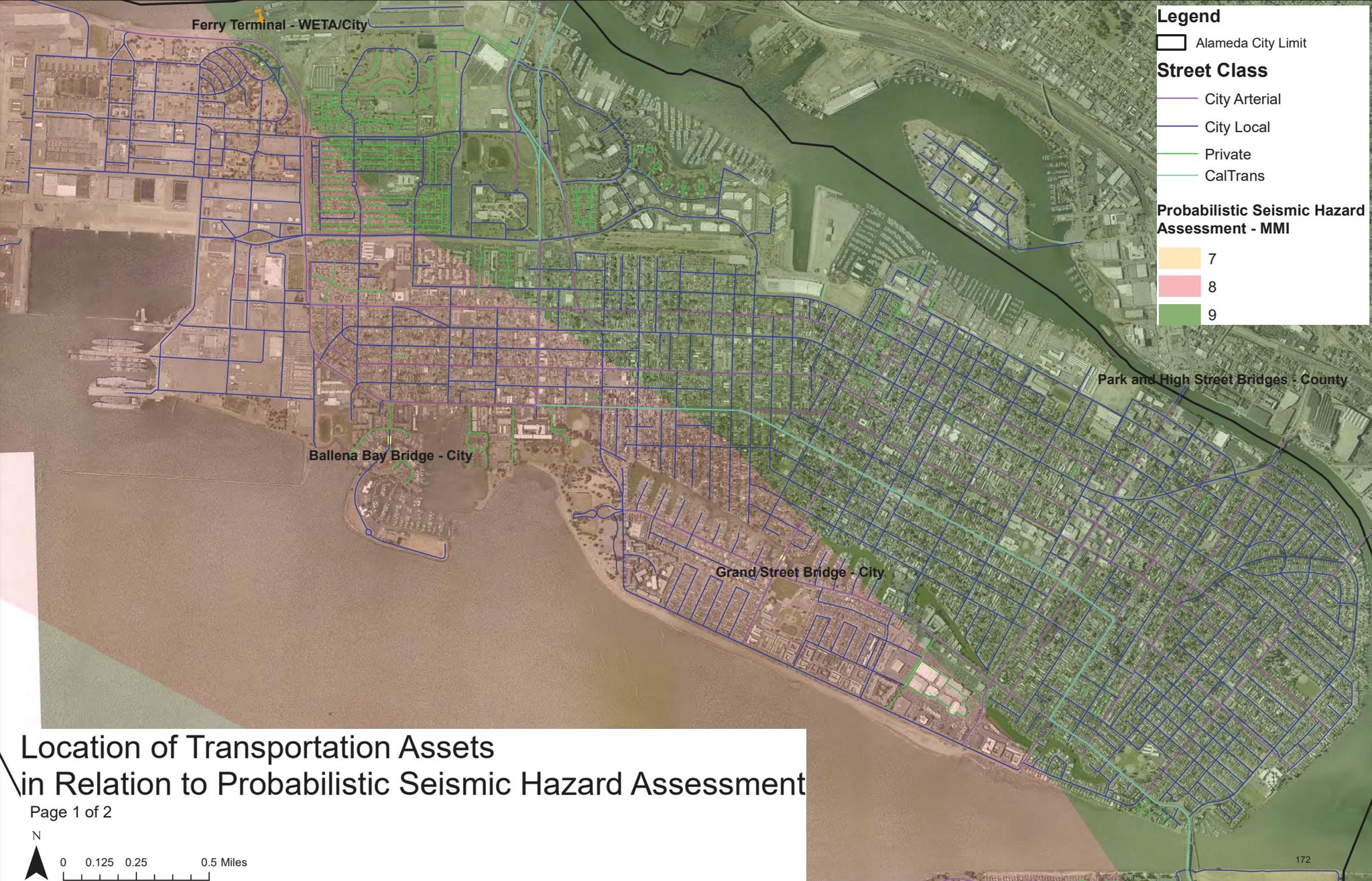
Ferry Terminal - WETA/City

Location of Transportation Assets in Relation to Liquefaction Susceptibility

Page 2 of 2



**Location of City Transportation Assets
in Relation to Probabilistic Seismic Hazard Assessment**



Legend

- Alameda City Limit

Street Class

- City Arterial
- City Local
- Private
- CalTrans

Probabilistic Seismic Hazard Assessment - MMI

- 7
- 8
- 9

Location of Transportation Assets in Relation to Probabilistic Seismic Hazard Assessment

Page 1 of 2

N

0 0.125 0.25 0.5 Miles



Appendix I Approval Documentation

June 2022

CITY OF ALAMEDA RESOLUTION NO. 15910

APPROVING THE CITY OF ALAMEDA CLIMATE ADAPTATION AND HAZARD MITIGATION PLAN AS THE CITY'S LOCAL HAZARD MITIGATION PLAN INCLUDING INCORPORATION INTO THE CITY OF ALAMEDA GENERAL PLAN SAFETY ELEMENT BY REFERENCES, AND ADOPTING A GENERAL PLAN AMENDMENT AMENDING THE HEALTH AND SAFETY ELEMENT AND CONSERVATION AND CLIMATE ACTION ELEMENT OF THE ALAMEDA GENERAL PLAN 2040 TO ALIGN WITH THE CLIMATE ADAPTATION AND HAZARD MITIGATION PLAN, 2022

WHEREAS, due to Alameda's proximity to major earthquake faults, our geography as a low-lying island community with older building stock, Alameda faces risks from a number of climate and natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property; and

WHEREAS, earthquakes, floods and sea level rise pose the greatest risk to people and property in Alameda; and

WHEREAS, Alameda also faces risks from tsunamis, heat, drought, wildfire related hazards of smoky air and power outages, and dam breach inundation; and

WHEREAS, climate change is exacerbating the frequency, duration, extent, and consequences of many of the hazards Alameda faces; and

WHEREAS, some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to lack of stable housing, financial resources, and by zoning laws that have historically disproportionately placed people of color into areas of the city more vulnerable to natural hazards.

WHEREAS, the success of the Climate Adaptation and Hazard Mitigation rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City's Climate Action and Resiliency Plan (CARP) and reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030 and become carbon neutral soon as possible. By taking strong actions to reduce our GHG emissions, Alameda will do our part to achieve a climate safe path and avoid some of the most extreme climate effects we could face; and

WHEREAS, the City of Alameda seeks to be prepared for future hazards and climate impacts by reducing the potential loss of life, property damage, and environmental degradation from natural disasters, while accelerating equitable economic recovery from those disasters; and

WHEREAS, the City of Alameda is committed to increasing the resilience of the infrastructure, health, housing, economy, government services education, environment, and land use systems in the City of Alameda; and

WHEREAS, given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively with key stakeholders across the region to help ensure uniform protections for all communities, especially for under resourced communities, and speak with a unified voice to expedite collective hazard mitigation and climate adaptation goals; and

WHEREAS, the federal Disaster Mitigation Act of 2000 (DMA 2000) requires all cities counties, and special districts to have adopted a Local Hazard Mitigation Plan (LHMP) to receive disaster mitigation funding from FEMA; and

WHEREAS, the LHMP for the City of Alameda planning area was developed in accordance with DMA 2000 and followed FEMA's 2011 Local Hazard Mitigation Plan guidance; and

WHEREAS, the LHMP incorporates a process where hazards are identified and profiled, the people and facilities at risk are analyzed, and mitigation actions are developed to reduce or eliminate hazard risk; and

WHEREAS, the implementation of these mitigation actions, which include both short and long-term strategies, involve planning, policy changes, programs, projects, and other activities; and

WHEREAS, the Federal Emergency Management Agency approved the City's Local Hazard Mitigation Plan, 2022, pending City Council adoption of the plan on May 1, 2022.

WHEREAS, Government Code section 65300.5 requires the City of Alameda (City) to maintain a General Plan that is an "integrated, internally consistent and compatible statement of policies for the adopting agency"; and

WHEREAS, the General Plan establishes the local development and conservation policies necessary to guide the long-term plan for the physical development of the City and protect the general health, safety and welfare of the community and the environment; and

WHEREAS, Alameda's General Plan 2040 was adopted November 30, 2021 by the City Council; and

WHEREAS, staff recommends revisions to policies in both the Health and Safety Element and Conservation and Climate Action Element of the General Plan so that the strategies and policies are aligned and consistent with the Mitigation Plan strategies; and

WHEREAS, incorporation of the recommended revisions outlined in the Addendum List (Exhibit 1) will align the strategies in the Mitigation Plan with the proposed General Plan policies. Staff is recommending that the General Plan be amended to reflect this alignment; and

WHEREAS, the draft General Plan amendments and the adequacy of the General Plan EIR were considered by the City Planning Board at a duly noticed public hearing on May 9, 2022, during which the Planning Board received and considered public testimony and written comments before making its recommendation to the City Council.

NOW, THEREFORE, BE IT RESOLVED that the City of Alameda adopts the Climate Adaptation and Hazard Mitigation Plan, 2022 as Alameda's Local Hazard Mitigation Plan.

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Climate Adaptation and Hazard Mitigation Plan is incorporated into the City of Alameda General Plan Safety Element by reference.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the City Council finds that on November 30, 2021, by Resolution No. 15841, the City Council certified a Final Environmental Impact Report (State Clearinghouse No. 2021030563) in compliance with the California Environmental Quality Act, and adopted written findings, a Statement of Overriding Considerations, and a Mitigation Monitoring and Reporting Program for the General Plan Amendment to update the Alameda General Plan. Pursuant to CEQA Guidelines sections 15162 and 15163, none of the circumstances necessitating further CEQA review are present. The proposed General Plan amendments would not require major revisions to General Plan Amendment EIR due to new significant impacts or due to a substantial increase in the severity of the significant environmental effects. There have been no substantial changes with respect to the circumstances under which the policies would be implemented that would require major revisions of the General Plan Amendment EIR due to new or substantially increased significant environmental effects. Further, there has been no discovery of new information of substantial importance that would trigger or require major revisions to the General Plan Amendment EIR due to new or substantially increased significant environmental effects. For these reasons, no further environmental review with respect to the General Plan Amendment EIR is required.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the Health and Safety Element and Conservation and Climate Action Element of the Alameda General Plan 2040 be amended to reflect the amendments shown in Exhibit 1; and

Exhibit 1:

The Conservation and Climate Action Element policies shall be amended as follows:

CC-16

Water Efficiency and Conservation. Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.

Actions:

- a. **Water Efficient Landscape Requirements.** *Maintain up-to-date water-efficient landscaping regulations and ordinances to reduce water use in both private and public landscapes that include healthy, drought tolerant soils, diverse native plant species, non-invasive drought tolerant/low water use plants, and high-efficiency irrigation systems.*
- b. **Water-Efficient Buildings.** *Require low-flow fixtures, such as low-flow toilets and faucets in new construction.*
- c. **Recycled and Reclaimed Water.** *Promote the production and usage of recycled and reclaimed water (sometimes called "grey water") for potable and non-potable uses.*
- d. **Pesticides, Herbicides, and Fertilizers.** *Limit the use of pesticides, herbicides, and fertilizers throughout the city by fostering healthy soil practices, which include organic carbon amendments (e.g. compost and mulch) on all non-turf planting areas.*
- e. **Soil Health.** *Encourage soil health by promoting and educating the public about the benefits of organic carbon soil amendments that improve water retention in local landscapes.*
- f. **EBMUD.** *Work with EBMUD to improve effectiveness of water conservation programs and increase drought awareness.*
- g. **City Buildings.** *Implement water-saving technologies at all City-owned buildings and post visible signage to educate visitors.*

CC-21

~~Sea Level Rise Plans.~~ Develop neighborhood shoreline sea level rise protection and funding plans to 50 years of the Ocean Protection Council's Medium-High Risk Aversion, high emissions scenario of sea level rise in addition to a 100-year storm in the initial design and funding mechanisms to pay for later adaptation improvements to address future sea level and groundwater increases above that level. (See also Policies HS-18 and HS-22). Adaptation Pathway Master Plan. Develop an adaptation pathway master plan that includes updated vulnerability studies, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda and the entire San Leandro Bay and Oakland-Alameda Estuary area adapt to rising sea and groundwater levels. The plan should include economic analysis and cost estimates to facilitate the development of funding strategies and regional cooperation. (See also Policies LU-14, CC-24, and HS-24).

CC-22

Critical Public Assets. Ensure resilience and long-term functionality of the transportation network. Implement improvements to move or protect critical public assets threatened by earthquakes, sea level rise or rising groundwater. (See also Policy HS-127).

Actions:

- a. **Stormwater System.** Identify funding sources to improve the public stormwater infrastructure and ensure it meets current needs and is prepared for the effects of sea level rise and climate change.
- b. **Sewer System.** Protect vulnerable wastewater systems and facilities to minimize disruption to the systems following ground shaking and extreme weather events.
- c. **Electric System.** Ensure electrical infrastructure is flood-proofed or elevated. Where possible, move assets out of the hazard zone.
- d. **Transportation.** Work with Caltrans and the Alameda County Transportation Commission to identify funding to adapt the regional and local roadways in Alameda.

CC-23

Rising Groundwater. Prepare for the impacts of rising groundwater levels on private and public property. (See also Policy HS-24).

Actions:

- a. **Infrastructure and Access.** Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property.
- b. **Building Codes.** Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater.
- c. **Annual Review.** Annually monitor groundwater levels and progress on specific strategies to mitigate impacts.
- d. **Data.** Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model.

SPOTLIGHT: BUILDING ELECTRIFICATION BENEFITS

Fiscal Responsibility and Inevitability: Key regional and state decision-makers, including PG&E, have indicated the desire and intention to go all-electric and eventually discontinue gas service.

Equity: As natural gas costs rise over time, customers will switch to all-electric appliances and homes at faster and faster rates. Coordinating and subsidizing a timely and fair transition for lower-income and more vulnerable residents is critical.

Healthy Air: Gas appliances emit pollutants and increase risk of respiratory illness, cardiovascular disease, and other long-term illnesses. Children living in homes with gas stoves are 40% more likely to develop asthma. According to the Rocky Mountain Institute, children who grow up in buildings with natural gas stoves were 42% more likely to develop asthma.

Resilience and Safety: Buildings that depend on natural gas may have to wait up to 6 months following severe earthquake events for service to return (compared to up to 1 week with electric appliances). Removing gas infrastructure reduces the risk of fires in the event of an earthquake.

Climate: Replacing gas appliances with electric appliances will reduce methane emissions from natural gas use, which is 86 times stronger than carbon dioxide, having significant impacts on climate change. Electrification transitions building energy use to clean energy from a renewable grid and supports green jobs.

The Health and Safety Element policies and Spotlights shall be amended as follows:

NEW SPOTLIGHT

Local Hazard Mitigation Plan. The Local Hazard Mitigation Plan (LHMP) for the City of Alameda was developed in accordance with the Disaster Mitigation Act of 2000 (DMA 2000) and followed FEMA's 2011 Local Hazard Mitigation Plan guidance. The LHMP incorporates a process where hazards are identified and profiled, the people and facilities at risk are analyzed, and mitigation actions are developed to reduce or eliminate hazard risk. The implementation of these mitigation actions, which include both short and long-term strategies, involve planning, policy changes, programs, projects, and other activities. The LHMP is available for review at <https://www.alamedaca.gov/HazardMitigationPlan>

HS-3

Emergency Coordination Mutual Aid Agreements. Coordinate local emergency preparedness efforts with the Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies. (See also Policy CC-3).

HS-4

Public Communication. Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food

banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood. (See also Policy CC-1).

Actions:

- a. **Volunteers.** Maintain community based emergency preparedness training programs targeted to neighborhoods and business groups, such as Community Emergency Response Teams and including outreach and coordination with Voluntary Organizations Active in Disasters (VOAD) and other community based programs.*
- b. **Education.** Prepare and/or make available public education and awareness materials in multiple languages on all aspects of emergency preparedness, including the type and extent of hazards in the community, measures to reduce the likelihood of damage and injury, provisions for emergency supplies, steps to take immediately after a disaster, and the location of shelters and medical facilities.*
- c. **Targeted Communication.** Engage Alamedans using a wide range of tools, languages and strategies to communicate about all types of threats and planning, with a special emphasis on the most vulnerable people who are least likely to know about or be able to adapt to various threats.*
- d. **Resilience Hubs.** Promote resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life.*

7.2 SEISMIC + GEOLOGIC HAZARDS

Figure 7.2 illustrates Alameda's susceptibility to severe liquefaction in the event of ground shaking. Climate change may increase the risk of liquefaction. Rising sea levels will cause rising groundwater levels in Alameda. Liquefiable soils that become saturated with groundwater are at increased risk of liquefaction. As the risks grow, so does the need for Alameda to strengthen its requirements to make buildings safer and more resilient to severe ground shaking and liquefaction.

HS-9

Building and Infrastructure Standards. Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure.

HS-12

City Buildings and Infrastructure Continue to strengthen and rehabilitate city buildings and infrastructure, including but not limited to waste water systems and pump stations, storm water systems and pump stations, and electric systems and facilities to ensure that the City can respond effectively to a seismic event and to provide resilience and long-term functionality. (See also Policies CC-4, CC-5, CC-13, CC-14, and CC-16, and CC-22).

- a. **Stormwater System.** Rehabilitate the existing storm system conveyances and pump stations to increase capacity and resilience during storms, high tides, sea level rise, seismic events, and power outages, thereby decreasing the chance of flooding of nearby streets, utilities, and buildings.*

- b. **Sewer System.** Protect vulnerable wastewater system and facilities to minimize disruption to the systems following ground shaking and extreme weather events and consider the impact of rising groundwater levels and increasing salinity on buried utility infrastructure.
- c. **Electric System.** Protect vulnerable electric systems and facilities. Ensure electrical infrastructure is flood-proofed or elevated and strengthened for earthquakes. Where possible, move assets out of the hazard zone, including elevating utility junction boxes and other electrical infrastructure on scaffolding.
- d. **Transportation.** Work with Caltrans and the Alameda County Transportation Commission to identify funding to adapt and strengthen the regional and local roadways in Alameda.

HS-13

Private Buildings. Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled.

Actions:

- a. **Soft Story Program.** *Continue to implement and expand the City's Soft Story Program, including mandatory requirements for substantially improving the seismic performance of multi-family wood frame residential buildings with open ground floor parking or commercial spaces known as soft stories.*
- b. **Wood Framed Building Program.** *Continue to implement and expand the City's Wood Framed Building Program, including ~~voluntary~~ requirements for substantially improving the seismic performance of one- and two-story wood frame residential buildings with vulnerable "cripple walls".*
- c. **Non-ductile Concrete Buildings.** *Identify, evaluate and retrofit non-ductile concrete residential and nonresidential buildings that are vulnerable to collapse in earthquakes.*
- d. **Chimneys.** *Encourage owners to remove or rebuild masonry or stone chimneys vulnerable to collapse in earthquakes.*
- e. **Incentives.** *Develop incentives and assistance to help property owners make their homes and businesses more earthquake-safe. Pursue a variety of funding sources, such as grants, low-interest loans, tax credits and zoning waivers and density bonuses, to assist residents and businesses with seismic upgrades. Provide exemptions from City zoning requirements, such as off-street parking and/or common open space to facilitate the retrofitting of vulnerable privately-owned buildings.*
- f. **Shoreline Property Management.** *Require owners of shoreline properties, to the extent feasible, to inspect, maintain, and repair the perimeter slopes to withstand earthquake ground shaking, consolidation of underlying bay mud, and wave erosion.*
- g. **Cool/Green Buildings.** Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.

HS-14

Flood Insurance. Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Identify ways to increase Alameda's Community Rating to reduce flood insurance costs.

HS-18

Preferred Adaptation Strategies. In the Adaptation Pathways Master Plan (see Policy CC-21), develop sea level and groundwater rise adaptive strategies for different areas of the City for public discussion and evaluation, including but not limited to: avoidance/planned retreat, enhanced levees, setback levees to accommodate habitat transition zones, buffer zones, beaches, expanded tidal prisms for enhanced natural scouring of channel sediments, raising and flood-proofing structures, and/or provisions for additional flood water pumping stations, and inland detention basins to reduce peak discharges. (See also Policies LU-14 and CC-24).

- a. Funding for Priority Flooding Mitigations. Design and approve "shovel-ready" adaptation projects at areas of location-based priority flooding identified in the Local Hazard Mitigation Plan.

HS-20

Tsunami Preparedness Strategy. Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations. ~~including Assess vertical evacuation options and develop an evacuation strategy, including wayfinding signs, with a focus on access and functional needs.~~

Actions:

- a. **Awareness.** Develop a public information campaign to educate the public about tsunami risks and evacuation procedures, with special emphasis on access and functional needs populations and maritime communities.
- b. **Evacuation Emergency Annex.** Include and maintain an Evacuation Emergency Annex in the Emergency Operations Plan that includes a strategy for tsunami evacuation.
- c. **Signs.** Place tsunami inundation zone and evacuation route signs.
- d. **Vertical Evacuation.** Assess vertical evacuation options.
- e. **Drills.** Conduct tsunami evacuation training and drills with schools.
- f. **Partner.** Partner with Caltrans, Alameda County, AC Transit, the City of Oakland and Port of Oakland to plan for tsunami evacuation.
- g. **Tsunami Ready.** Become recognized as a Tsunami Ready community by the National Weather Service.

HS-22

New Development. Design For Flooding Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas, and require all new development to design for sea level and associated groundwater rise based on the most current regional projections. (See also Policies LU-30 and CC-20).

Actions:

- a. **Waterfront Setbacks.** *Require new development to provide adequate setbacks along waterfront areas for the future expansion of seawalls and levees to adapt to sea level rise.*
- b. **Data.** *Update maps and publish open data that display these risks clearly as soon as new data or guidelines are created, such as a digital elevation model, sea level and groundwater risks, or the latest risk tolerance guidance provided by the State of California.*
- c. **Building Codes.** *Amend local codes to require flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels.*
- d. **Risk Prioritization.** *Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades.*
- e. **Assistance.** *Adopt fee waiver or small grant programs to help low-income households and other vulnerable residents pay for flood retrofits.*

HS-35

Contaminated Sites Cleanup. Work with county, regional, state, and federal agencies and private property owners to ensure that the necessary steps are taken to clean up residual hazardous wastes on any contaminated sites.

Actions:

- a. **New Construction.** *Require that all new construction, including construction on former industrial sites, has been cleared for residential, commercial or industrial uses from the appropriate federal, state and local agencies and acts, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Program, the Resource Conservation and Recovery Act (RCRA), the California Department of Toxic Substances Control (DTSC), the Regional Water Quality Control Board (RWQCB) and the Alameda County Department of Environmental Health (ACDEH), which is the Certified Unified Program Agency (CUPA) responsible for implementing state environmental regulations related to hazardous waste and hazardous materials.*
- b. **Groundwater Rise.** *Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable.*

I, the undersigned, hereby certify that the foregoing Resolution was duly and regularly adopted and passed by the Council of the City of Alameda in a regular meeting assembled on the 7th day of June, 2022, by the following vote to wit:

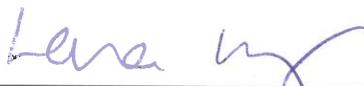
AYES: Councilmembers Daysog, Herrera Spencer, Knox White, Vella and Mayor Ezzy Ashcraft – 5.

NOES: None.

ABSENT: None.

ABSTENTIONS: None.

IN WITNESS, WHEREOF, I have hereunto set my hand and affixed the official seal of said City this 8th day of June, 2022.



Lara Weisiger, City Clerk
City of Alameda



Yibin Shen
City Attorney