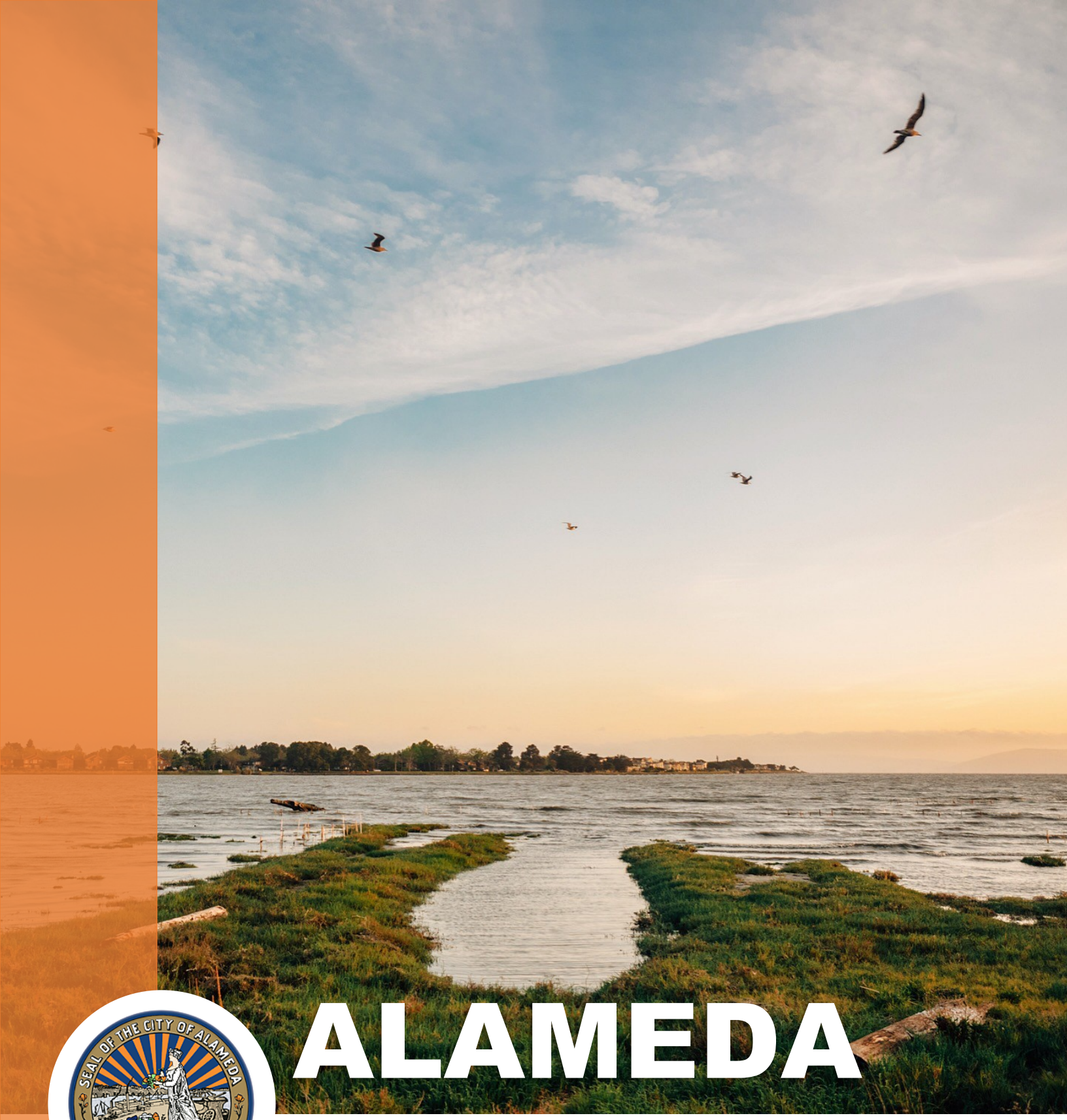

ALAMEDA

Climate Adaptation and Hazard Mitigation Plan

June 2022

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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 CO_2 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.