...LOOKING FORWARD 2040 HAYWARD·GENERAL·PLAN

POLICY DOCUMENT: PART 3

HAZARDS ELEMENT

The city of Hayward is located in a region that is prone to a variety of natural disasters. The city's geologic setting was formed by regional and local earthquake faults, many of which are still active and can generate devastating damage to buildings and infrastructure in the event of an earthquake. The city's climate can also create hazardous conditions. Severe winter and spring storms can cause landslides in hillside areas and flooding along stream corridors and low-lying areas near the San Francisco Bay. Dry weather during spring and summer months can create hazardous conditions related to wildland fires, which when combined with strong Diablo winds, pose a significant risk to hillside neighborhoods. Climate change is projected to increase the frequency and severity of climate hazards, including increased flood, landslide, drought, extreme heat, and wildfire risks. In addition to natural hazards, Hayward also has a number of transportation facilities and industrial businesses that create risks for man-made hazards, such as aircraft accidents, hazardous material spills, and exposure to excessive noise.

While it is impossible to completely avoid natural and man-made hazards, the Hazards Element establishes goals and policies to protect life and minimize property damage during future disasters and emergencies. The goals and policies address regional hazards mitigation, seismic and geologic hazards, climate change, flood hazards, rising sea levels, wildland wildfires, hazardous materials, airport hazards, and noise.

Several other Elements of the General Plan provide supporting goals and policies that will help the Hayward community prepare for and respond to hazards, including the Community Safety Element, the Natural Resources Element, Public Facilities Element, Environmental Justice Element, the Climate Action Plan, and the Community Health and Quality of Life Element.

Goal 1 Regional Coordination

The impacts of disasters are rarely confined to the limits of a single jurisdiction, and almost always affect multiple agencies within a region. As a result, the Federal Disaster Mitigation Act of 2000 encourages cooperation between State, regional, and local agencies, prompting them to work together to mitigate hazards. This goal and its supporting policies are designed to promote a disaster-resilient region through regional coordination and mitigation planning. This is accomplished by implementing a Local Hazards Mitigation Plan, a comprehensive plan that addresses local hazards in coordination with state and regional agencies. By participating in regional and local hazards mitigation, the City will minimize disaster risks and improve the safety of the Hayward community.

GOAL HAZ-1

Promote a disaster-resilient region by reducing hazard risks through regional coordination and mitigation planning including climate change adaptation. ***[Source: Existing Goal, City Staff]***

HAZ-1.1 Local Hazards Mitigation Plan

The City shall coordinate with regional and local agencies to implement an updated Resiliency Plan (former Local Hazards Mitigation Plan). *[Source: Existing Policy modified; City Staff] (IGC/MPSP)*

HAZ-1.2 Plan Implementation and Monitoring

The City shall monitor and evaluate the success of the Resiliency Plan (Local Hazards Mitigation Plan). The City shall ensure that strategies are prioritized and implemented through the Capital Improvement Program and by providing adequate budget for on-going programs and Department operations. *[Source: Existing Policy modified; City Staff] (MPSP/CSO/FB)*

HAZ-1.3 Plan Updates

The City shall support the Association of Bay Area Governments (ABAG) in its role as the lead agency that prepares and updates the Multi-Jurisdictional Local Hazards Mitigation Plan. If ABAG cannot fulfill this role in the future, the City shall coordinate with Alameda County and other local agencies to encourage the development and implementation of a new Multi-Jurisdictional Local Hazards Mitigation Plan. Ensure all future plan updates include climate change adaptation measures. *[Source: Existing Policy modified; City Staff] (IGC)*

Photographs showing damage from the 1868 Hayward Earthquake. Courtesy of the Hayward Area Historical Society.

Goal 2 Seismic and Geologic Hazards

Hayward is located in a seismically active region that contains several major active faults, including the San Andreas Fault, Hayward Fault, and Calaveras Fault. The Hayward Fault crosses through the city and generally runs parallel and within a few hundred feet of Mission Boulevard. Other potentially active faults within Hayward include the Chabot Fault, the Carlos Bee Fault, and several adjacent and secondary faults. As a result of its location and geologic setting, the city of Hayward is subject to a variety of seismic and geologic hazards, including fault rupture, strong ground shaking, liquefaction, and landslides. In addition, segments of the city could flood if an earthquake generates a tsunami or causes an up-stream dam to fail. This goal and its supporting policies are designed to minimize risks associated with seismic and geologic hazards.

GOAL HAZ-2

Protect life and minimize property damage from potential seismic and geologic hazards. *[Source: Existing Goal, modified]*

HAZ-2.1 Seismic Safety Codes and Provisions

The City shall enforce the seismic safety provisions of the Building Code and Alquist-Priolo Special Studies Zone Act to minimize earthquake-related hazards in new construction, particularly as they relate to high occupancy structures or buildings taller than 50 feet in height. *[Source: Existing Policy] (RDR)*

HAZ-2.2 Geologic Investigations

The City shall require a geologic investigation for new construction on sites within (or partially within) the following zones:

- Fault Zone (see Figure 9.2-1 in the Hazards Background Report)
- Liquefaction Zone (see Figure 9.2-2 in the Hazards Background Report)
- Landslide Zone (see Figure 9.2-3 in the Hazards Background Report)

A licensed geotechnical engineer shall conduct the investigation and prepare a written report of findings and recommended mitigation measures to minimize potential risks related to seismic and geologic hazards. *[Source: Existing Policy; City Staff, GPUTF] (RDR)*

SEISMIC HAZARD TERMINOLOGY

Fault Zone: Zones in which cities and counties must require special geologic studies to prevent the construction of structures intended for human occupancy over an earthquake fault. The California Geological Survey publishes maps of the zones as part of its work to implement the requirements of the Alquist-Priolo Special Studies Zone Act. These maps show the most comprehensive depiction of fault traces that can rupture during an earthquake.

Liquefaction: Liquefaction happens when loosely packed sandy or silty materials saturated with water are shaken hard enough to lose strength and stiffness. Liquefied soils behave like a liquid and are responsible for tremendous damage in an earthquake, causing pipes to leak, roads and airport runways to buckle, and building foundations to be damaged.

Tsunami: A tsunami (pronounced soo-nah-mee) is a series of waves generated in a body of water by a rapid disturbance that vertically displaces the water. These changes can be caused by an underwater fault rupture (that generates an earthquake) or underwater landslides (typically triggered by earthquakes).

HAZ-2.3 Fault Zones Assumption

The City shall assume that all sites within (or partially within) any fault zone are underlain by an active fault trace until a geotechnical investigation by a licensed geotechnical engineer proves otherwise. *[Source: Existing Policy] (RDR)*

Active Fault Zones in the San Francisco bay Area. Source: Association of Bay Area Governments.

HAZ-2.4 New Buildings in a Fault Zone

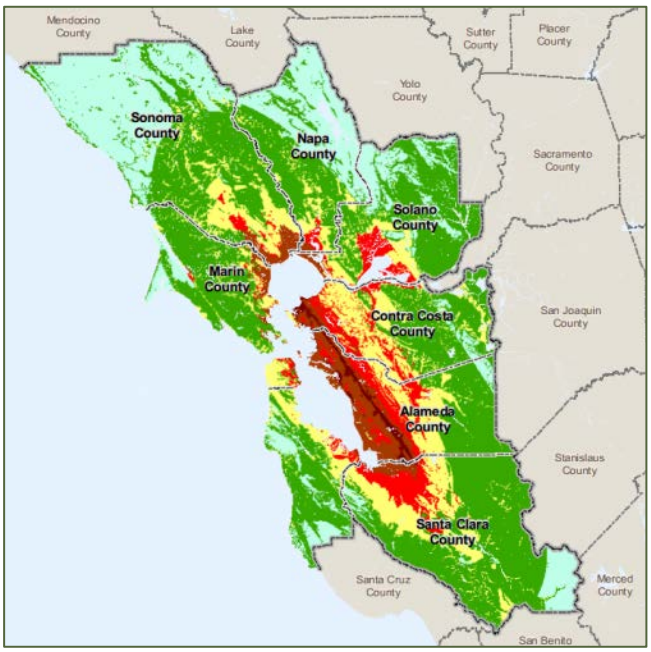
The City shall prohibit the placement of any building designed for human occupancy overactive faults. All buildings shall be set back from active faults by at least 50 feet or as recommended by a licensed geotechnical engineer based on a site and project specific evaluation. *[Source: Existing Policy, modified] (RDR)*

HAZ-2.5 Existing Buildings in a Fault Zone

The City shall prohibit the expansion of existing commercial and multi-family buildings (constructed prior to the adoption of the Alquist-Priolo Special Studies Zone Act) that are located over an active fault. Renovations to existing buildings within a fault zone shall be subject to the limitations and requirements of the Alquist-Priolo Special Studies Zone Act. *[Source: Existing Policy, modified; City Staff] (RDR)*

HAZ-2.6 Infrastructure and Utilities

The City shall require infrastructure and utility lines that cross faults to include design features to mitigate potential fault displacement impacts and restore service in the event of major fault displacement. Mitigation measures may include plans for damage isolation or temporary bypass by using standard isolation valves, flexible hose or conduit, and other techniques and equipment. *[Source: Existing policy] (RDR)*



Potential severity of ground shaking in the Bay Area during a magnitude 6.9 earthquake on the Hayward Fault. Areas in red would experience very strong to very violent ground shaking. Source: Association of Bay Area Governments.

HAZ-2.7 Dam Failure

The City shall coordinate with agencies responsible for the maintenance of the South Reservoir Dam, the Del Valle Dam, and other small dams along Alameda Creek to ensure that dam infrastructure is maintained and enhanced to withstand potential failure during an earthquake. *[Source: Existing Policy, City Staff] (IGC)*

HAZ-2.8 Tsunamis

The City shall coordinate with the Hayward Area Recreation and Park District (HARD), the East Bay Regional Parks District (EBRPD), and the Alameda County Flood Control and Water Conservation District to efficiently evacuate shoreline parks during and prior to potential tsunami events with consideration to sea level rise increasing tsunami impact. *[Source: Existing Policy modified, City Staff] (CSO/MPSP/IGC)*

HAZ-2.9 Seismic Retrofits

The City shall encourage property owners to upgrade buildings for seismic safety purposes, especially masonry and soft-story buildings (i.e., buildings designed with minimal bracing on the first floor). *[Source: Existing Policy, City Staff; GPUTF; Public] (MPSP/PI)*

HAZ-2.10 City Facilities

The City shall strive to seismically upgrade existing City facilities that do not meet current building code standards. Where upgrades are not economically feasible, the City shall consider the relocation and/or reconstruction of facilities. *[Source: Existing Policy; City Staff] (PI/CSO)*

HAZ-2.11 Critical Facilities

The City shall encourage seismic upgrades to hospitals, schools, long-term care facilities, and other important facilities that do not meet current building code standards. Where upgrades are not economically feasible, the City shall encourage the relocation and/or reconstruction of facilities. *[Source: Existing Policy; City Staff] (PI/CSO)*

HAZ-2.12 Public Awareness

The City shall promote greater public awareness of earthquake hazards and promote resources and programs to help property owners make their homes and businesses more seismically safe. *[Source: Existing Policy] (PI)*

Goal 3 Flood Hazards

Various parts of Hayward are subject to flooding during major storm events, including shoreline areas and upland areas located along streams, creeks, and drainage ways. The geographic extent of local flood hazards is anticipated to increase in the next century as a result of rising sea levels caused by climate change. Extreme weather conditions caused by climate change could also increase flooding risks during major storms. Parts of Hayward are also located in dam failure inundation zones. Dam failure refers to the uncontrolled release of impounded water stored behind a dam. It can be caused by heavy rainfall, earthquakes, landslides, improper operation or maintenance, poor construction or maintenance, vandalism, and other natural or human actions. This goal and its supporting policies are designed to minimize damage and risks associated with flood hazards, including flood hazards associated with extreme weather caused by climate change and dam failure. Related policies that address rising sea levels are discussed under Goal 4.

GOAL HAZ-3

Protect life and minimize property damage from potential flood hazards. ***[Source: Existing Goal; GPUTF; Public; CC/PC]***

HAZ-3.1 FEMA Coordination

The City shall coordinate with the Federal Emergency Management Agency (FEMA) to ensure that Federal Insurance Rate Maps correctly depict flood hazards in the city. *[Source: Existing Policy] (IGC)*

HAZ-3.2 Development in Floodplains

The City shall implement Federal, State, and local requirements related to new construction in flood plain areas to ensure that future flood risks to life and property are minimized. *[Source: Existing Policy] (RDR)*

HAZ-3.3 Flood Plain Management Ordinance

The City shall maintain and enforce a Flood Plain Management Ordinance to:

- Promote public health, safety, and general welfare by minimizing public and private losses due to floods,
- Implement the Cobey-Alquist Flood Plain Management Act,
- Comply with the eligibility requirements of the National Flood Insurance Program, and

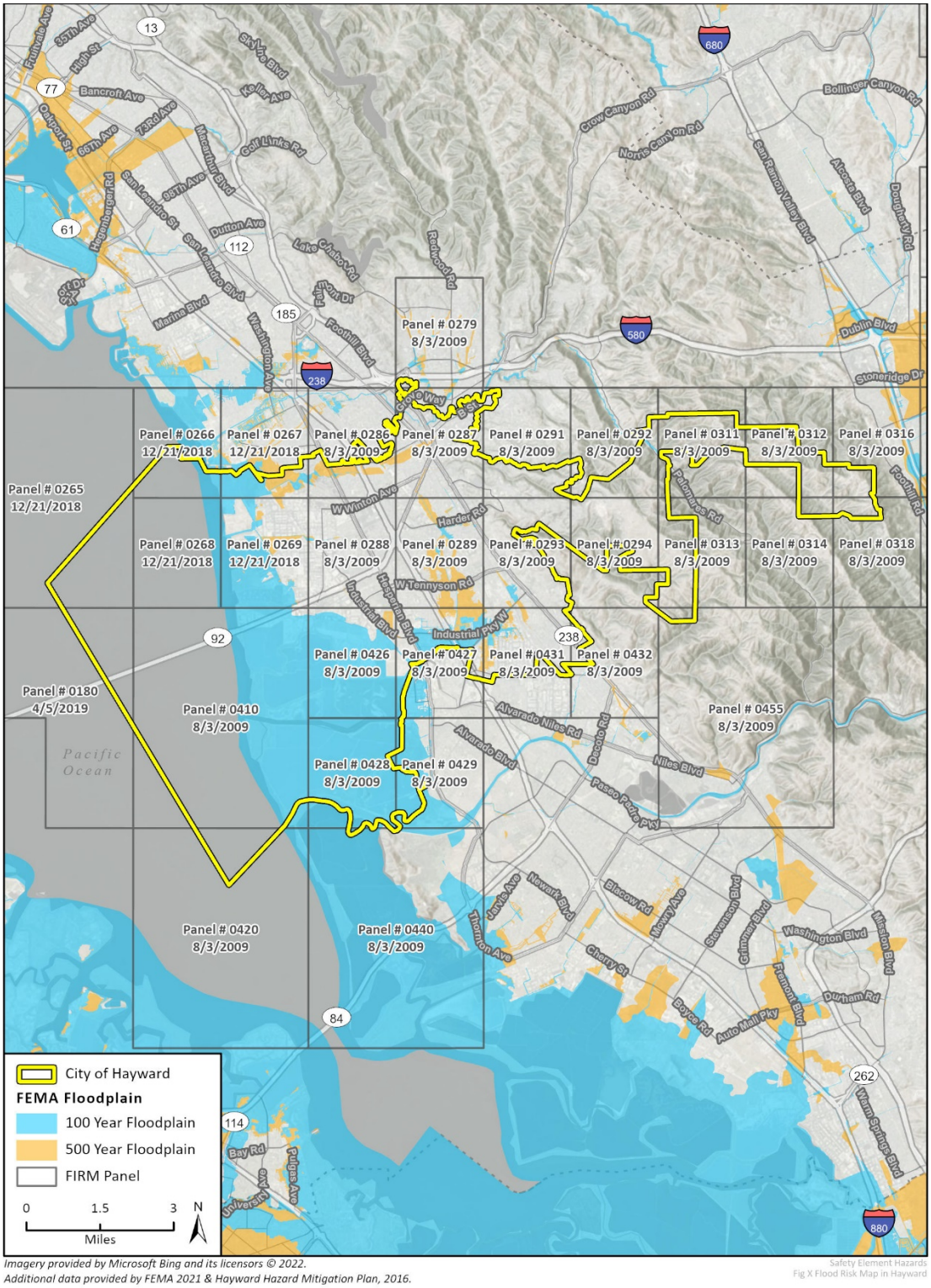
Protect assets within flood zones from increased extreme precipitation events as identified in the Climate Vulnerability Assessment (Appendix A to this Element). *[Source: Existing Policy modified; City Staff] (MPSP/RDR)*

HAZ-3.4 Changing Flood Conditions Associated with Climate Change

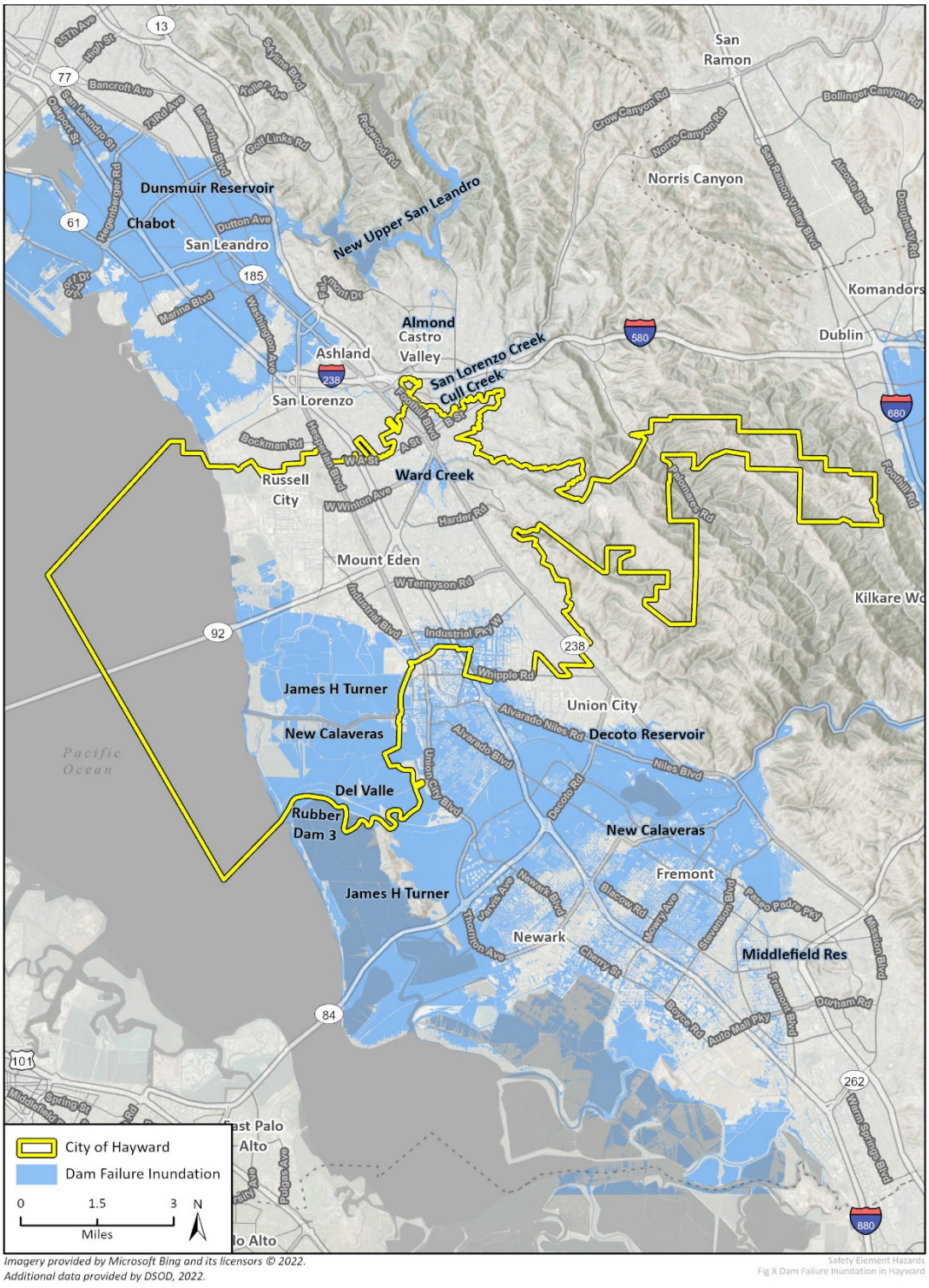
The City shall coordinate with the Alameda County Flood Control and Water Conservation District to evaluate the need to expand the capacity of flood control facilities based on changing flood conditions associated with climate change and extreme weather. *[Source: Existing Policy, modified] (IGC)*

HAZ-3.5 Public Awareness

The City shall promote greater public awareness of flooding hazards and promote resources and programs to help property owners and landlords protect their homes and businesses from flood damage. *[Source: Existing Policy modified; City Staff] (PI)*



Areas of Hayward that are subject to flooding during a 100-year storm (light blue), and a 500-year storm (light orange). Source: FEMA



Areas of Hayward that are located in the dam failure inundation zone are shown in blue. Source: California Department of Water Resources

Goal 4 Rising Sea Levels

Sea levels are projected to rise by up to 1.9 feet by mid-century (See the Climate Vulnerability Assessment in Appendix A). As sea levels rise, the Hayward shoreline, as well as industrial, commercial, and residential areas along creeks and drainage ways, will become more and more vulnerable to water inundation during both normal high tides and flooding during major storm events. If unmitigated, rising sea levels have the potential to inundate the open space and recreational resources along the shoreline, and flood nearby industrial, commercial, and residential areas. This goal and its supporting policies are designed to protect the Hayward shoreline and adjacent urban uses from the impacts of rising sea levels.

The maps below outline mid and end-century sea level rise projections that display areas with marine inundation under the separate scenarios. The first map displays these scenarios outright while the following shows these scenarios under a 100-year or 1 percent chance storm overlaid. The final map following this section displays groundwater hazard risk with water table at surface and up to 3.3 feet by mid-century. Projections in the maps are consistent with best available science but maintain a high degree of uncertainty.

Policies related to climate change and the reduction of greenhouse gas emissions are provided in the Natural Resources Element, Mobility Element, and Climate Action Plan.

GOAL HAZ-4

Safeguard the Hayward shoreline, open space, recreational resources, and urban uses from flooding due to rising sea levels. ***[Source: Existing Goal; Public; GPUTF, CC/PC].***

HAZ-4.1 Monitor Rising Sea Level

The City shall monitor information from regional, State, and Federal agencies on rising sea levels in the San Francisco Bay to determine if additional adaptation strategies should be implemented to address flooding hazards. *[Source: Existing Policy; City Staff] (IGC/CSO)*

HAZ-4.2 Regional Planning for Sea Level Rise

The City shall continue to coordinate with the Bay Conservation and Development Commission, Alameda County, and others to participate in *Bay Adapt: Regional Strategy for a Rising Bay* and similar efforts, to advance regional dialogue on mechanisms for balancing the protection of at-risk communities and enhancing the region's overall resilience to rising sea levels. *[Source: Existing Policy modified; City Staff; Hayward Area Shoreline Adaptation Master Plan] (IGC)*

HAZ-4.3 Shoreline Adaptation Master Plan

The City shall coordinate with Oakland, San Leandro, Alameda County, the Hayward Area Shoreline Planning Agency, the Bay Conservation and Development Commission, and other agencies to expand and restore wetland habitat and increase shoreline resilience through the implementation of the Hayward Regional Shoreline Adaptation Master Plan. *[Source: Existing Policy modified; City Staff; GPUTF] (IGC)*

HAZ-4.4 FIRM Maps

The City shall cooperate with FEMA in the preparation of updated Flood Insurance Rate Maps that reflect rising sea levels and changing flood

conditions. *[Source: Existing Policy modified; City Staff] (RDR)*

HAZ-4.5 Rising Sea Level Notifications

The City shall require that all applicants for new industrial and commercial development, including major remodels, within areas which may flood due to sea level rise by the end of the century during a 100 year flood event, notify residents, tenants and property owners about the risk of future sea level rise and groundwater hazard risk. When maps are updated, the City shall provide notice to all potentially impacted residents, tenants, property and business owners about updated data related to rising sea levels and flooding. *[Source: Existing Policy modified, City Staff; GPUTF] (RDR)*

HAZ-4.6 Adaptation Atlas

The City shall partner with regional jurisdictions to incorporate the findings of the San Francisco Estuary Institute's SF Bay Area Adaptation Atlas. including commitments to nature-based measures, grey infrastructure, policy and regulatory measures, and financial measures *[Source: New Policy)*

HAZ-4.7 Adaptation Programs and Standards

The City shall investigate opportunities to provide programs and funding resources to retrofit and adapt critical facilities, community structures, and infrastructure through:

- Raising buildings and roads by placing fill to rebuild the grades at higher elevations,
- Rebuilding all connecting roads, trails, and utilities to slope up to the new grade determined based on projected sea-level rise,
- Requiring adaptive management plans for restoration/mitigation sites within projected sea-level rise hazard zones to consider increased flooding and erosion potential,
- Installing nature based and grey infrastructure around areas projected to be impacted by sea level rise. *[Source: New Policy)*

HAZ-4.8 Vulnerable Communities

The City shall prepare a sea level rise adaptation plan to identify strategies to increase resilience of Glen Eden, Eden Shore, and Russell City communities with prioritization of vulnerable populations. Include outreach to affected communities that is accessible in multiple formats and in multiple languages.*[Source: New Policy)*

HAZ-4.9 Groundwater Management Plan

The City shall coordinate with Alameda County Flood Control & Water Conservation District to develop a Shallow Groundwater Management Plan to identify feasible strategies for managing rising groundwater tables from sea level rise and storm surges. *[Source: New Policy, Hayward Area Shoreline Adaptation Master Plan]*

HAZ-4.10 Increase Flood Protection Standards for New Construction and Renovations

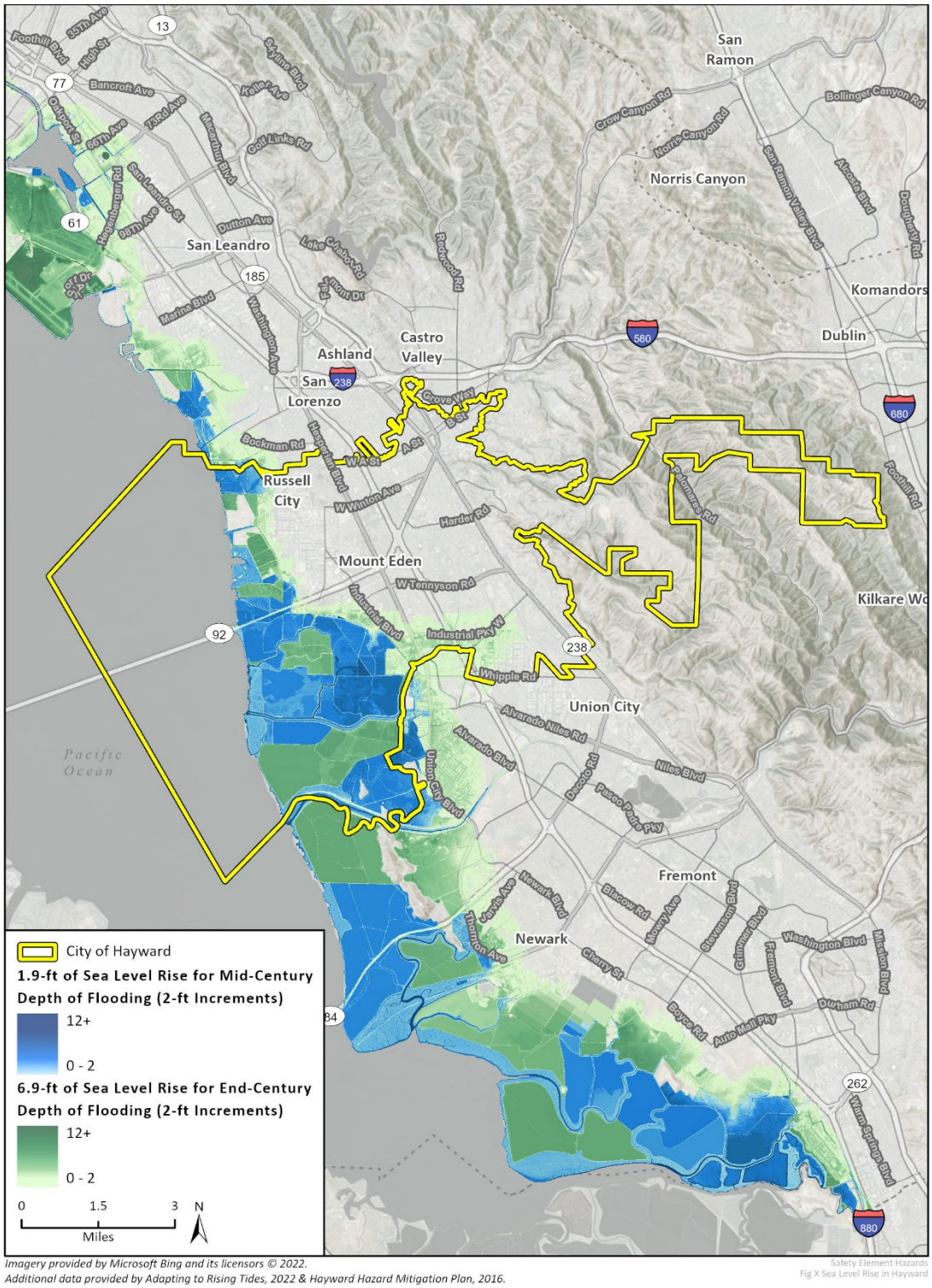
The City shall incorporate sea level rise into the municipal code to require compliance with base floor elevation and flood-proofing requirement to mid-century sea levels. Consider unconventional design elements that may allow structures to accommodate a higher water table and higher liquefaction risks. [*Source: New Policy][Source: Hayward Area Shoreline Adaptation Master Plan]*

HAZ-4.12 Develop Technical Support and Education

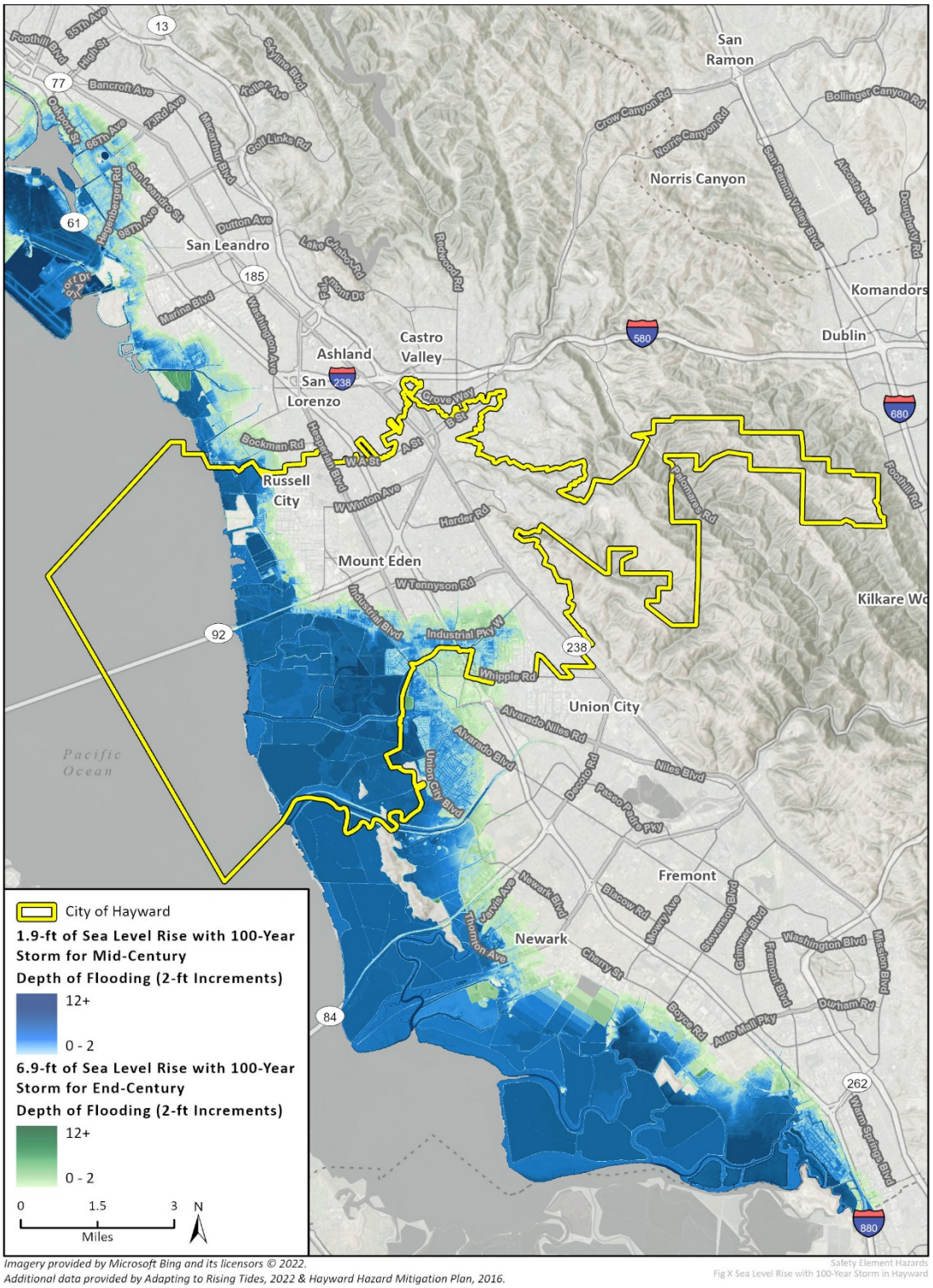
The City shall develop technical support and education to help businesses and residents understand risks from sea level rise and develop mitigation actions *[Source: New Policy, Hayward Area Shoreline Adaptation Master Plan]*

HAZ-4.10 Essential Facilities Siting

Locate, when feasible, new essential public facilities, including hospitals and health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities, outside of flood hazard zones. *[Source: New Policy]*



Areas of Hayward that are subject to sea level rise with a mid-century rise of 1.9 feet (blue gradient) and an end century rise of 6.9 feet (green gradient with a 100 year storm. Source: Adapting to Rising Tides



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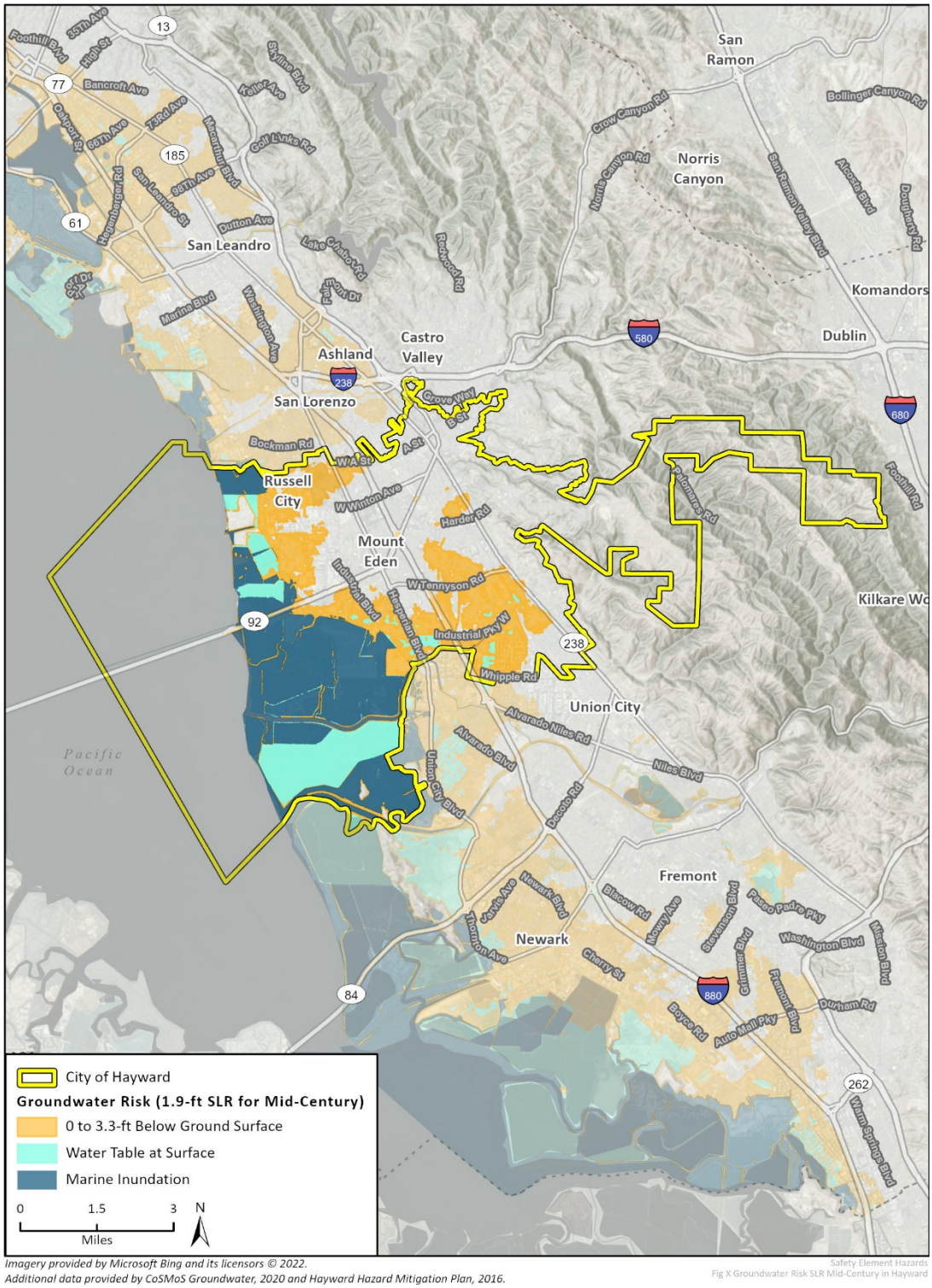


Areas of Hayward that are subject to groundwater risk with a mid-century sea level rise of 1.9 feet showing new depths of groundwater from marine inundation to 0-3.3 feet below ground surface. Source: USGS Groundwater Risk Tool

Goal 5 Urban Wildfire Hazards

The foothill neighborhoods of Hayward are located adjacent to natural hillsides and open space areas that are prone to wildfires. This goal and its supporting policies are designed to minimize urban wildfire risks through the implementation of wildland/urban interface guidelines, fire prevention codes, and open space management practices that reduce the potential for wildfires. Fire hazards zones are mapped in the figure below this section showing both high and very high hazard severity zones (VHFHSZ) located to the northeast and southeast of Hayward with none directly in city limits.

Measures in the California Building Code reduce fire hazards in structures. These include use of specific building construction materials, fire separation walls, building separation, and use of fire sprinklers. Included in development regulations are requirements for minimum road widths that provide adequate access for firefighting equipment and evacuation of residents, as well as clearance around structures (fuel modification areas) to prevent the rapid spread of fire.

Water availability and peak load water supply are essential in combating wildfires. Peak load water supply refers to the supply of water to meet both domestic water and fire-fighting needs during the particular season and time of day when domestic water demand on a water system is at its peak. As development occurs, peak load water supply reserves must be increased. The City of Hayward and East Bay Municipal Utility District, the City's water providers, must ensure peak load water supply requirements are met.

GOAL HAZ-5

Protect life and minimize potential property damage from urban wildfire hazards in hillside areas. *[Source: Existing Goal, modified]*

HAZ-5.1 Wildland/Urban Interface Guidelines

The City shall maintain and implement Wildland/Urban Interface Guidelines for new and existing development within neighborhoods that are proximal to existing fire hazard areas. *[Source: Existing Policy, modified] (MPSP/RDR)*

HAZ-5.2 Fire Prevention Codes

The City shall enforce fire prevention codes that require property owners to reduce wildfire hazards on their property including vegetation management and fire-resistant material retrofits in neighborhoods proximal to fire hazard severity zones. *[Source: Existing Policy, modified] (CSO/RDR)*

HAZ-5.3 Defensible Space and Fuel Reduction

The City shall enforce defensible space criteria and assist property owners in removing overgrown vegetation and to reduce fuel loads on hillside properties in neighborhoods proximal to fire hazard severity zones , especially near structures and homes. *[Source: Existing Policy, modified] (PI/JP/IGC/RDR)*

HAZ-5.4 Grant Funding

The City shall seek grant funding to mitigate potential wildfire threats to the community and to implement special training workshops and projects related to defensible space and fuel reduction practices. *[Source: Existing Policy] (CSO)*

HAZ-5.5 Park District Coordination

The City shall coordinate with the East Bay Regional Park District and the Hayward Area Recreation and Park District to promote forestry and park management practices that reduce the

potential for wildland fires. *[Source: Existing Policy] (CSO)*

HAZ-5.6 Regional Coordination

The City shall coordinate with Alameda County, the cities of Pleasanton, Dublin, and San Ramon, and other fire protection agencies to reduce the potential for wildfire hazards in the East Bay hills and participate in mutual aid agreements. *[Source: Existing Policy, modified] (CSO)*

HAZ-5.7 Fire Flow Adequacy

The City shall maintain adequate water supply systems and flows to meet fire suppression needs throughout the city including new and existing development. Water supply locations to be defined for emergency services. *[Source: New Policy]*

HAZ-5.8 Fire Resistance Retrofits

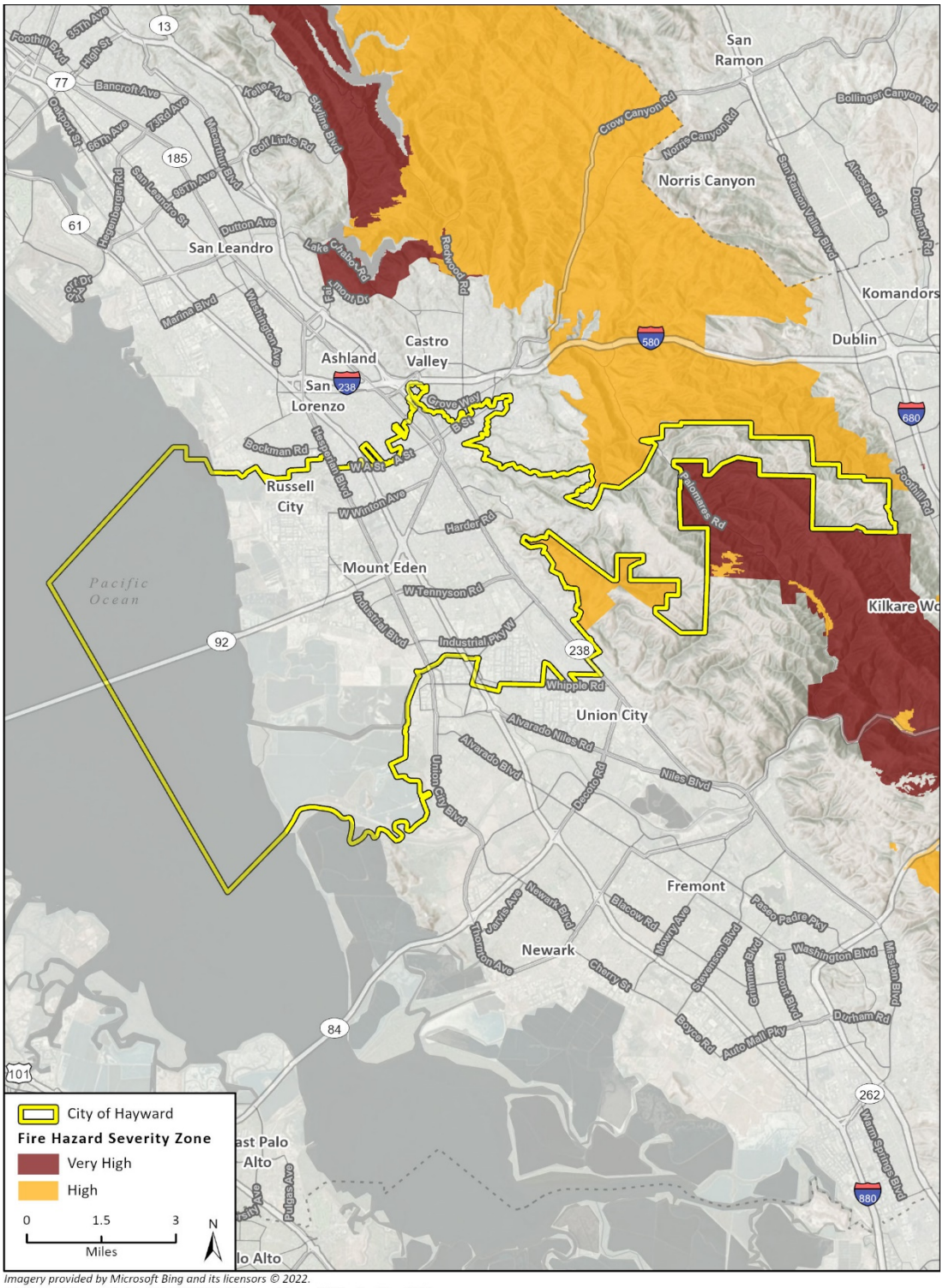
The City shall encourage retrofits of homes within neighborhoods proximal to fire hazard severity zones to increase the prevalence of home hardening techniques. Develop and formalize a plan for providing defensible space assistance, public education, and regulatory enforcement of fire resistance activities and programs, such as the Weed Abatement Program. *[Source: New Policy]*

HAZ-5.9 Evacuation During Wildfires

The City shall increase the resilience of the neighborhoods proximal to fire hazard severity zones during a potential wildfire evacuation through:

- Enforcing visible address numbers painted on sidewalks enforced through the City,
- Developing multiple language accessible materials for how to prepare your family and home for an evacuation and go kit,
- Identifying and preparing vulnerable populations that may need assistance to evacuate,
- Maintaining critical evacuation routes, community fire breaks and,
- Adequate ingress and egress to new developments. *[Source: New Policy]*

Areas of the San Francisco Bay Area that burned during wildfires between 1950 and 2011 (yellow). Source: Association of Bay Area Governments



Areas bordering and near Hayward with Very High Fire Hazard Severity Zones (dark red) and High Fire Hazard Severity Zones (orange). Source: CALFIRE

Goal 6 Climate Change Adaptation/Resiliency

Climate change is caused by the addition of excess greenhouse gases (GHGs) to the atmosphere, which traps heat near the earth's surface raising global average temperatures. The resulting increase in average temperatures across the globe affects sea levels, precipitation patterns, the severity of wildfires, the prevalence of extreme heat events, water supply, and ocean temperatures and chemistry. Hayward is vulnerable to the effects of climate change as understood through the findings of the Climate Vulnerability Assessment (Appendix A). Policies under this goal build on existing policies within the Hazards Element, Natural Resources Element, the Community Health and Quality of Life Element as well as the entire General Plan with the intent of supporting the ability of the community to adapt to climate change.

GOAL HAZ-6

Community resilience to climate change is increased through adapted community capacity, infrastructure, services, parks, and open spaces. ***[Source: New Goal; Climate Vulnerability Assessment]*** **[connected to HQL Goal 9, Community Resiliency**

HAZ-6.1 Vulnerable Populations

The City shall provide vulnerable community members with language-appropriate information on available financial, technical, and educational resources and programming to increase resilience against climate change hazards, including sea level rise, extreme heat, flooding, wildfire, and groundwater rise. The City shall develop and distribute information on adaptation measures including building weatherization, energy and water efficiency, and emergency preparedness. *[Source: New Policy][connected to HQL-9.9 and EJ-1.15]*

HAZ-6.2 Resilience Hubs

The City shall develop and support a network of resilience hubs to facilitate health, food, medical, and emergency services during climate hazards such as extreme heat events, flooding, and poor air quality events. *[Source: New Policy] [connected to HQL-9.9 and EJ-1.15]*

HAZ-6.3 Green Economy

The City's Economic Development Division, Landscape Maintenance Division, and Environmental Services Division shall partner with community-based organizations and the Alameda County Workforce Development Board to support the creation of jobs, training programs, and workforce development in urban forest management, tree planting, and green infrastructure development to provide sustained economic benefit and ensure long-term capacity for maintenance *[Source: New Policy][connected to HQL-9.4 and 9.5] [connected to new CAP action CS-1]*

HAZ-6.4 Adapted Community Structures and Infrastructure

The City shall expand the resilience of critical buildings and infrastructure through assessment of needed retrofits to function properly while subject to increased climate hazard frequency such as flooding, extreme heat, regional wildfires, and landslides. *[Source: New Policy][connected to PFS 1.7][connected to new CAP measure EG]*

HAZ-6.5 Adapted Services

The City shall coordinate with emergency services as well as utility providers to assess needed service improvements in providing increased redundancy and uninterrupted service for water, power, and emergency service response.*[Source: New Policy]*

HAZ-6.6 Transportation Corridors

The City shall improve the resiliency of transportation infrastructure by identifying highly trafficked active transportation and commute patterned streets and prioritizing permeable pavement, shading, lighting, and drinking water improvements. *[Source: New Policy]*

HAZ-6.7 Parks and Open Space Resilience

Protect open spaces, habitats, and parks impacted by sea level rise, floods, drought, extreme heat, and wildfire including:

- Protect existing floodplains, open space, and other natural features that provide flood storage by establishing minimum buffers, limiting new development in wetlands and buffers.
- Protect and expand large, continuous greenspaces such as parks, median strips and street trees wherever possible for greater cooling magnitude and extent. Include a mix of grass and trees for greatest cooling benefits. *[Source: New Policy]*

HAZ-6.8 Resilient Power

The City shall work with utility companies to improve grid resilience and backup power for the community including utility activities that:

- Harden vulnerable overhead lines against winds and wildfires,
- Protect energy infrastructure and increase redundancy of energy storage and distribution systems in surrounding hazard zones for wildfire,
- Invest in sustainable backup power sources to provide redundancy and continued services for critical facilities during periods of high demand during extreme heat events,
- Explore the feasibility of installing microgrids, including for critical health care facilities. *[Source: New Policy] [connected to new CAP action EG-1.4]*

HAZ-6.9 Climate Overlay Zones

The City shall establish hazard overlay zones. Overlay designations shall be developed to address potential future at-risk areas, such as areas prone to wildfire, subsidence, future floodplain or area of temporary inundation, or area at risk for high wind/storm events due to future climate change impact models. Apply overlay zones to areas with the greatest current hazards and/or future climate impacts. Associate corresponding risk reduction, adaptation policies, and standards specific to the hazard or climate impact. Overlay zones should include development standards for appropriate risk mitigation measures. *[Source: New Policy]*

HAZ-6.10 Essential Facilities Siting

Locate, when feasible, new essential public facilities, including hospitals and health care facilities, emergency shelters, fire stations, emergency command centers, and emergency communications facilities, outside of climate change hazard zones. *[Source: New Policy; see also HAZ-4.10]*

HAZ-6.11 Climate Adaptation Planning Coordination

Coordinate with Alameda County and neighboring jurisdictions to prioritize climate adaptation efforts that address regional climate change vulnerabilities of community members, infrastructure and services, natural resources and ecosystems, and critical facilities and buildings. *[Source: New Policy]*

Goal 7 Hazardous Materials

Hazardous materials are toxic, ignitable, corrosive, or reactive substances that can cause harm to people. Hazardous materials are used by households and businesses within urban areas. The

improper use and disposal of hazardous materials can contaminate soil and groundwater resources and compromise the health and quality of life of residents. Accidents involving the transportation of hazardous materials can also cause explosions or spills that endanger the lives and property of nearby residents and businesses. This goal and its supporting policies are designed to establish strategies to minimize exposure to hazardous materials through the documentation, monitoring, clean-up, and re-use of hazardous material sites; and the implementation of best practices for the routine use, storage, transport, and disposal of hazardous materials.

GOAL HAZ-7

Protect people and environmental resources from contaminated hazardous material sites and minimize risks associated with the use, storage, transport, and disposal of hazardous materials. ***[Source: Existing Policy, modified]***

HAZ-7.1 Hazardous Materials Program

The City shall maintain its status as a Certified Unified Program Agency and implement the City's Unified Hazardous Materials and Hazardous Waste Management Program, which includes:

- Hazardous Materials Release Response Plans and Inventories (Hazardous Materials Business Plans - HMBP);
- California Accidental Release Prevention (CalARP) Program;
- Underground Storage Tank (UST) Program;
- Above-ground Petroleum Storage Act (APSA) Program, including Spill Prevention, Control, and Countermeasure (SPCC) Plans;
- Hazardous Waste Generator Program;
- On-site Hazardous Waste Treatment (Tiered Permit) Program; and
- California Fire Code Hazardous Material Management Plans (HMMP) and Hazardous Materials Inventory Statements (HMIS). *[Source: Existing Policy; City Staff] (CSO/MPSP/RDR)*

HAZ-7.2 Site Investigations

The City shall require site investigations to determine the presence of hazardous materials and/or waste contamination before discretionary project approvals are issued by the City. The City shall require appropriate measures to be taken to protect the health and safety of site users and the greater Hayward community. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-7.3 Permit Requirements

The City shall direct the Fire Chief (or their designee) and the Development Services Director (or their designee) to evaluate all project applications that involve hazardous materials, electronic waste, medical waste, and other hazardous waste to determine appropriate permit requirements and procedures. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-7.4 Land Use Buffers

The City shall review applications for commercial and industrial uses that involve the use, storage, and transport of hazardous materials to determine the need for buffer zones or setbacks to minimize risks to homes, schools, community centers, hospitals, and other sensitive uses. *[Source: Existing Policy] (RDR)*

HAZ-7.5 Collection Programs

The City shall maintain and further develop its collection programs for household hazardous waste and e-waste (cell phones, batteries, computers, televisions, computers, monitors, etc.). *[Source: Existing Policy] (CSO/MPSP)*

HAZ-7.6 Education Resources

The City shall provide educational resources to residents and businesses to promote safe practices related to the use, storage, transportation, and disposal of hazardous materials. *[Source: Existing Policy] (PI)*

HAZ-7.7 Agency Coordination

The City shall coordinate with State, Federal, and local agencies to develop and promote best practices related to the use, storage, transportation, and disposal of hazardous materials. *[Source: Existing Policy] (IGC/PI)*

HAZ-7.8 Truck Routes

The City shall maintain designated truck routes for the transportation of hazardous materials through the City of Hayward. The City shall discourage truck routes passing through residential neighborhoods to the maximum extent feasible. *[Source: Existing Policy] (MPSP/PI)*

Goal 8 Evacuation Capacity

Consistent with Government Code Section 65302 as amended by AB 747, AB 1409, and SB 99, the City conducted an emergency evacuation analysis attached as Appendix B. The analysis complies with above requirements in identifying evacuation routes and capacity under several emergency scenarios. The evacuation scenarios included wildfire, tsunami, dam failure, and a gas pipeline failure. Policies address the identified constraints as a result of this analysis.

Pursuant to SB 99, residential developments in hazard areas that do not have at least two emergency evacuation routes are shown in the figure below identifying single access roads. Single access roads are a local street that feeds into a collector with a singular point of entry and exit. These roads present potential evacuation complications necessitating added evacuation management.

GOAL HAZ-8

Community resilience to natural and man-made hazards is attained through increased evacuation capacity and emergency preparedness. ***[Source: New Goal]***

HAZ-8.1 Evacuation Route Maintenance

Maintain roadways that are likely to function as key evacuation routes by property inspections, public education, homeowner association education, roadside vegetation management *[Source: New Policy]*.

HAZ-8.2 Vulnerable Population Assistance

The City shall identify vulnerable populations that may need assistance to evacuate and prepare coordinated language accessible communication and assistance processes for identified populations related to evacuation procedures and preparedness. Include resources for the visually impaired, hearing impaired, mobility impaired, people with medical conditions and the unhoused. *[Source: New Policy; City Staff]*

HAZ-8.3 Transportation Coordination

Encourage implementation of communication systems to coordinate advanced mobilization of transit operators to facilitate evacuations during flood and wildfire events with hazard alert notifications. Implement through a Traffic Control Center to coordinate all evacuation activities. This center would have up to the minute reports on traffic patterns and can communicate directly with the broadcast media to let drivers know about roadway congestion and conditions and direct them to alternate routes. *[Source: New Policy, SCAG]*

HAZ-8.4 Evacuation Management Tools

The City shall coordinate investments with Caltrans in retrofitting freeway and arterial routes through

structural improvements and increased staff capacity including:

- Management controls for signal coordination to allow uninterrupted flow (green wave).
- Traffic control plans to increase intersection capacity including minimized left-turn movements, adjusted signal timings, and toll suspension.
- Ability to manage movements at key intersections to increase throughput.
- Backup power and other preparation for signal operation during power outages.
- Ability to communicate through changeable message signs.
- Lane control equipment procurement
- Shoulder clearance and parking restrictions along primary routes of evacuation *[Source: New Policy]*

HAZ-8.5 Single Access Roads

The City shall provide obstruction removal services where road systems are antiquated and do not provide for proper evacuation or two-way flow. Additionally, the City will improve the accessibility of single access roads by emergency vehicles. *[Source: New Policy]*

HAZ-8.6 Evacuation Facilities

The City shall implement communication methods to coordinate advanced and timely evacuations with schools, hospitals, and vulnerable populations to evacuation shelters when relevant. *[Source: New Policy]*

HAZ-8.7 Evacuation Planning

The City shall develop pre-response plans and accompanying evacuation plans for all neighborhoods proximal to each type of hazard zone including city-wide earthquake risk. *[Source: New Policy]*

HAZ-8.8 Annual Trainings

The City shall conduct community and emergency response evacuation trainings annually through the Traffic Control Center. *[Source: New Policy]*

HAZ-8.9 High Fire Limitations

The City shall facilitate restriction of parking, construction permits or right-of-way encroachment on high fire days. *[Source: New Policy; SCAG]*

HAZ-8.10 Public Education

The City shall communicate to the public on essential resources and procedures through a variety of communication tools and in multiple languages on topics including:

Education on the California Standard Statewide Evacuation Terminology.

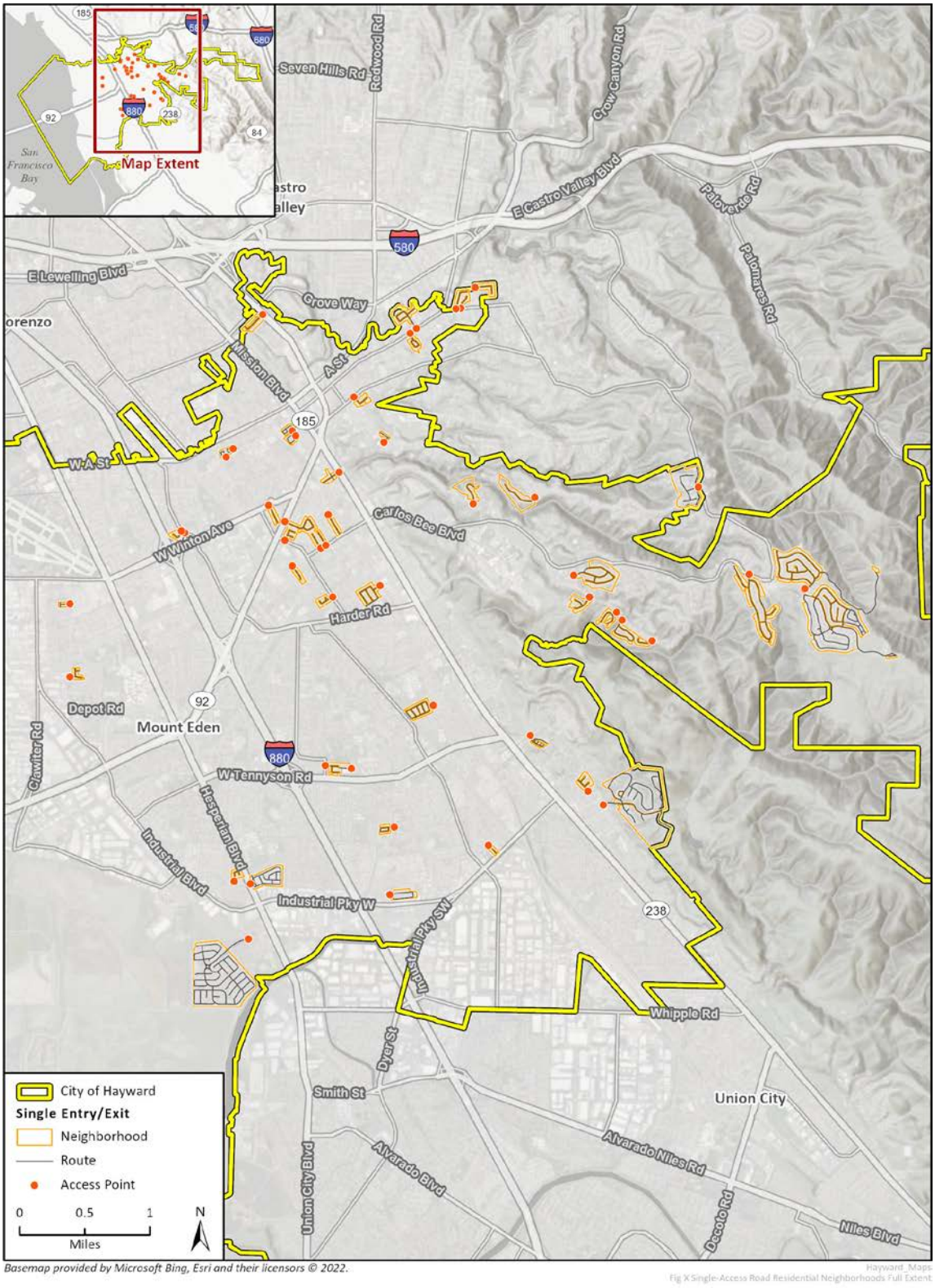
- Emergency evacuation checklists for residents.
- Creation and education of the public on evacuation maps.
- Available transportation services.
- Evacuation shelter and support service options. *[Source: New Policy]*

HAZ-8.11 Resource Management

The City shall create clear and transparent evacuation plans and systems across critical facilities and residential areas including strategies of

- Redundant staffing and clarity on staff roles and expertise.
- Prepared critical facilities with backup communication systems and critical supplies/services.

- Transportation plans for all critical facilities and communities in need of additional assistance
- Routine management exercises to practice evacuation drills as well as inform resource needs. *[Source: New Policy]*



Neighborhood areas of Hayward with Single Access Roads identified with access points (orange) and neighborhood perimeters (yellow).

Goal 9 Airport Hazards

The Hayward Executive Airport is designated as a General Aviation Reliever Airport located in northwest Hayward. The airport is owned and operated by the City of Hayward. A variety of aircraft, including single and twin-engine airplanes, corporate jets, and helicopters, use the airport on a daily basis. Commercial, industrial, residential, and recreational properties near the airport could be exposed to aviation-related accidents and related hazards. This goal and its supporting policies are designed to minimize this exposure. The Federal Aviation Administration (FAA) has the sole authority to regulate aviation activities in the United States, including the certification of aircraft and pilots. The City of Hayward's role is to maintain and operate the airport and regulate land uses in the vicinity of the airport. Related policies that address airport noise are provided under Goal HAZ-8.

GOAL HAZ-9

Minimize exposure to safety hazards associated with aircraft using the Hayward Executive Airport. ***[Source: Existing Goal; City Staff].***

HAZ-9.1 Land Use Safety Compatibility and Airspace Protection Criteria

The City shall consider all applicable federal statutes (including 49 U.S.C. 47107), federal regulations (including 14 Code of Federal Regulations 77 et seq.), the FAA's Airport Compliance Manual, FAA Advisory Circulars and other forms of written guidance, and State law, with respect to criteria related to land use safety and airspace protection when evaluating development applications within the Airport Influence Area of the Hayward Executive Airport. *[Source: Existing Policy, City Staff] (RDR)*

Hayward Executive Airport.

HAZ-9.2 Airport Land Use Compatibility Plan

The City shall require all development projects within the Airport Influence Area designated in the Airport Land Use Compatibility Plan of the Hayward Executive Airport to comply with all applicable federal statutes (including 49 U.S.C. 47107), federal regulations (including 14 Code of Federal Regulations 77 et seq.), the FAA's Airport Compliance Manual, FAA Advisory Circulars and other forms of written guidance, and State law, with respect to criteria related to land use safety and airspace protection. *[Source: Existing Policy, City Staff] (IGC/RDR)*

HAZ-9.3 Commission Review

The City shall ensure that all applicable plans, ordinances, and development applications are reviewed by the Alameda County Airport Land Use Commission if required by State law. *[Source: Existing Policy, City Staff] (IGC/MPSP/RDR)*

Goal 10 Noise Hazards

Exposure to excessive noise can impact the health and quality of life of residents and employees. Excessive noise can cause hearing loss, stress, hypertension, sleep disturbance, and fatigue. The Hayward community contains a variety of noise sources, including aircraft, trains, vehicle traffic on freeways and roadways, and industrial and

commercial operations. This goal and its supporting policies are designed to minimize human exposure to excessive noise by evaluating noise exposure risks and incorporating appropriate mitigation measures.

GOAL HAZ-10

Minimize human exposure to excessive noise and ground vibration. ***[Source: Existing Policy]***

HAZ-10.1 Locating Noise Sensitive Uses

The City shall strive to locate noise sensitive uses, (e.g., residences, schools, hospitals, libraries, religious institutions, and convalescent homes) away from major sources of noise. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-10.2 Noise Study and Mitigation

The City shall require development projects in areas where they may be exposed to major noise sources (e.g. roadways, rail lines, and aircraft or other non-transportation noise sources) to conduct a project level environmental noise analysis. The noise analysis shall determine noise exposure and noise standard compatibility with respect to the noise standards identified in Table HAZ-1 and shall incorporate noise mitigation when located in noise environments that are not compatible with the proposed uses of the project. The City shall use Table HAZ-1 (Exterior Noise Standards for Various Land Uses) and Figure HAZ-1 (Future Noise Contour Maps) to determine potential noise exposure impacts, noise compatibility thresholds, and the need for mitigation. The City shall determine mitigation measures based on project-specific noise studies, and may include sound barriers, building setbacks, the use of closed windows and the installation of heating and air conditioning ventilation systems, and the installation of noise attenuating windows and wall/ceiling insulation. *[Source: Existing Policy] (RDR)*

NOISE TERMINOLOGY

dBA: Measurement unit for "a-weighted decibels," which are commonly used for measuring environmental and industrial noise and the potential hearing damage associated noise health effects.

Equivalent Noise Level (Leq): Constant noise level that would deliver the same acoustic energy to the ear of a listener as the actual time-varying noise would deliver over the same exposure time. No "penalties" are added to any noise levels during the exposure time; Leq would be the same regardless of the time of day during which the noise occurs.

Day-Night Average Noise Level: (Ldn): A 24-hour average Leq with a 10 dBA "penalty" added to noise levels during the hours of 10:00 P.M. to 7:00 A.M. to account for increased sensitivity that people tend to have to nighttime noise. Because of this penalty, the Ldn would always be higher than its corresponding 24-hour Leq (e.g., a constant 60 dBA noise over 24 hours would have a 60 dBA Leq, but a 66.4 dBA Ldn).

Community Noise Equivalent Level (CNEL): An Ldn with an additional 5 dBA "penalty" for the evening hours between 7:00 P.M. and 10:00 P.M. This is essentially a measure of ambient noise.

Sound Exposure Level or Single Event Level (SEL): A descriptor used to characterize the severity of short-duration sound events. SEL is the time-averaged, constant intensity, A-weighted sound level over a one-second reference time that would produce the same sound exposure as the actual time-varying sound over the actual exposure time. In practice, SEL is usually applied in situations where there are multiple sound events, each one having its own characteristic SEL.

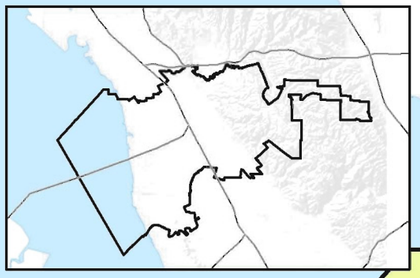
TABLE HAZ-1 Exterior Noise Compatibility Standards for Various Land Uses	
Land Use Type	**Highest Level of Exterior Noise Exposure that is Regarded as "Normally Acceptable"[a] (Ldn[b] or CNEL[c])**
Residential: Single-Family Homes, Duplex, Mobile Home	60
Residential: Townhomes and Multi-Family Apartments and Condominiums	65
Urban Residential Infill[d] and Mixed-Use Projects[e]	70
Lodging: Motels and Hotels	65
Schools, Libraries, Churches, Hospitals, Nursing Homes	70
Auditoriums, Concert Hall, Amphitheaters	Mitigation based on site-specific study
Sports Arena, Outdoor Spectator Sports	Mitigation based on site-specific study
Playgrounds, Neighborhood Parks	70
Golf Courses, Riding Stables, Water Recreation, Cemeteries	75
Office Buildings: Business, Commercial, and Professional	70
Industrial Manufacturing, Utilities, Agriculture	75

Source: Governor's Office of Planning and Research, *State of California General Plan Guidelines 2003,* October 2003.

a. As defined in the *State of California General Plan Guidelines 200,* "Normally Acceptable" means that the specified land uses is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise mitigation. For projects located along major transportation corridors (major freeways, arterials, and rail lines) this "normally acceptable" exterior noise level may be exceeded for certain areas of the project site (e.g. the frontage adjacent to the corridor or parking areas) with the exception of primary open space areas (see policies HAZ-8.5 and HAZ-8.6).
b. Ldn or Day Night Average is an average 24-hour noise measurement that factors day and night noise levels.
c. CNEL or Community Noise Equivalent Level measurements are a weighted average of sound levels gathered throughout a 24-hour period.
d. Urban residential infill would include all types of residential development within existing or planned urban areas (such as Downtown, The Cannery Neighborhood, and the South Hayward BART Urban Neighborhood) and along major corridors (such as Mission Boulevard).
e. Mixed-Use Projects would include all mixed-use developments throughout the City of Hayward.

...LOOKING FORWARD 2040 HAYWARD GENERAL PLAN

Figure HAZ-1
Future Noise Contour Map



Foothill Boulevard
Mission Boulevard
Center Street
D Street
Second Street
A Street
B Street
Watkins Street
Mission Boulevard
Carlos Bee Boulevard
Winton Avenue
Jackson Street
Santa Clara Street
Winton Avenue
Hesperian Boulevard
I-880
SR 92
Clawiter Road
Harder Road
Huntwood Avenue
Tennyson Road
Industrial Boulevard
Eden Landing Road
Industrial Parkway West
Industrial Parkway West
Mission Boulevard
Huntwood Avenue

238
580
880
92
880

Hayward Planning Area
Noise Level dBA
75
70
65
60

0 0.375 0.75 1.5 Miles

Data source: Ascent Environmental 2013

G12010071 01 004

September, 2013

HAZ-10.3 Incremental Noise Impacts of Commercial and Industrial Development

The City shall consider the potential noise impacts of commercial and industrial developments that are located near residences and shall require noise mitigation measures as a condition of project approval. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-10.4 Noise Mitigation and Urban Design

The City shall consider the visual impact of noise mitigation measures and shall require solutions that do not conflict with urban design goals and standards. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-10.5 Residential Noise Standards

The City shall require the design of new residential development to comply with the following noise standards:

- The maximum acceptable interior noise level for all new residential units (single-family, duplex, mobile home, multi-family, and mixed use units) shall be an Ldn of 45 dB with windows closed.
- For project locations that are primarily exposed to aircraft, train, and BART noise, the maximum instantaneous noise level in bedrooms shall not exceed 50dB(A) at night (10:00 pm to 7:00 am), and the maximum instantaneous noise level in all interior rooms shall not exceed 55dB(A) during the day (7:00 am to 10:00 pm) with windows closed.
- The maximum acceptable exterior noise level for the primary open space area of a detached single-family home, duplex or mobile home, which is typically the backyard or a fenced side yard, shall be an Ldn of 60 dB. This standard shall be measured at the approximate center of the primary open space area. This standard does not apply to secondary open space areas, such as front yards, balconies, stoops, and porches.
- The maximum acceptable exterior noise level for the primary open space area of townhomes and multi-family apartments or condominiums (private rear yards for townhomes; and common courtyards, roof gardens, or gathering spaces for multi-family projects) shall be an Ldn of 65 dB. This standard shall be measured at the approximate center of the primary open space area. This standard does not apply to secondary open space areas, such as front yards, balconies, stoops, and porches.
- The maximum acceptable exterior noise level for the primary open space area of urban residential infill and mixed-use projects (private rear yards for townhomes; and common courtyards, roof gardens, or gathering spaces for multi-family or mixed-use projects) shall be an Ldn of 70 dB. Urban residential infill would include all types of residential development within existing or planned urban areas (such as Downtown, The Cannery Neighborhood, and the South Hayward BART Urban Neighborhood) and along major corridors (such as Mission Boulevard). This standard shall be measured at the approximate center of the primary open space area. This standard does not apply to secondary open space areas, such as front yards, balconies, stoops, and porches. *[Source: Existing Policy] (RDR)*

HAZ-10.6 Noise Standards for Lodging, Nursing Homes, and Hospitals

The City shall require the design of new lodging facilities, nursing homes, hospitals, and other

similar uses to comply with the following noise standards:

- The maximum acceptable interior noise level for sleeping areas shall be an Ldn of 45 dB with windows closed.
- For project locations that are primarily exposed to aircraft, train, and BART noise, the maximum instantaneous noise level in sleeping areas shall not exceed 50dB(A) at night (10:00 pm to 7:00 am) and 55dB(A) during the day (7:00 am to 10:00 pm) with windows closed. *[Source: Existing Policy; City Staff] (RDR)*

HAZ-10.7 Noise Standards for Office and Similar Uses

The City shall require the design of new office developments and similar uses to achieve a maximum interior noise standard of 45dBA Leq (peak hour). *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.8 Park Noise

The City shall coordinate with the Hayward Area Recreation and Park District (HARD) and the East Bay Regional Park District (EBRPD) to establish and enforce hours of operation for park and recreational facilities near residential homes. *[Source: Existing Policy; City Staff] (IGC)*

HAZ-10.9 OSHA Standards

The City shall encourage businesses to comply with Occupational Safety and Health Administration (OSHA) standards related to noise safety and ear protection when employees work in noisy environments (interior and exterior). *[Source: Existing Policy; City Staff] (CSO)*

HAZ-10.10 BART Trains and Bus Transit

The City shall encourage BART and AC Transit to upgrade their trains and transit fleets with vehicles that generate less noise when driving and idling. *[Source: Existing Policy] (IGC)*

HAZ-10.11 Freeway Sound Walls

The City shall encourage Caltrans, in conjunction with any new freeway project, to construct attractive sound walls and landscaping strips along freeways to protect adjacent areas from excessive freeway noise. *[Source: Existing Policy] (IGC)*

HAZ-10.12 Transportation Noise

The City shall consider potential noise impacts when evaluating proposals for transportation projects, including road, freeway, and transit projects, and will strive to minimize noise impacts through the implementation of mitigation measures. *[Source: Existing Policy] (RDR/IGC)*

Sources of noise in the city of Hayward.

HAZ-10.13 Utilities

The City shall require the evaluation of public facilities (e.g., utility substations, water storage facilities, and pumping stations) to determine

potential noise impacts on surrounding uses and identify appropriate mitigation measures. *[Source: Existing Policy] (IGC/CSO/RDR)*

HAZ-10.14 Airport Noise

The City shall monitor noise impacts from aircraft operations at the Hayward Executive Airport and maintain and implement the noise abatement policies and procedures outlined in the Airport Noise Ordinance and Airport Land Use Compatibility Plan. *[Source: Existing Policy] (CSO, MPSP, RDR)*

Aircraft at the Hayward Executive Airport

HAZ-10.15 Airport Noise Evaluation and Mitigation

The City shall require project applicants to evaluate potential airport noise impacts if the project is located within the 60 dB CNEL contour line of the Hayward Executive Airport or Oakland International Airport (as mapped in the Airport Land Use Compatibility Plan). All projects shall be required to mitigate impacts to comply with the interior and exterior noise standards established by the Airport Land Use Compatibility Plan. *[Source: Existing Policy, City Staff] (IGC/RDR)*

HAZ-10.16 Airport Disclosure Notices

The City shall require that all new development within an airport-defined over-flight zone provide deed notices disclosing airport over-flights and noise upon transfer of title to future residents and property owners. *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.17 Community Noise Control Ordinance

The City shall maintain, implement, and enforce a community noise control ordinance to regulate noise levels from public and private properties, vehicles, construction sites, and landscaping activities. *[Source: Existing Policy] (CSO/MPSP)*

HAZ-10.18 Mixed-Use Developments

The City shall require the full disclosure of the potential noise impacts of living in a mixed-use development by requiring residential disclosure notices within deeds and lease agreements as a condition of project approval. *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.19 Downtown Housing Development

The City shall require the full disclosure of the potential noise impacts of living in an urban downtown environment by requiring residential disclosure notices within deeds and lease agreements as a condition of project approval. *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.20 Construction Noise Study

The City may require development projects subject to discretionary approval to assess potential construction noise impacts on nearby sensitive uses and to minimize impacts on those uses, to the extent feasible. *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.21 Construction and Maintenance Noise Limits

The City shall limit the hours of construction and maintenance activities to the less sensitive hours of the day (7:00am to 7:00pm Monday through

Saturday and 10:00am to 6:00 pm on Sundays and holidays) *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.22 Vibration Impact Assessment

The City shall require a vibration impact assessment for proposed projects in which heavy-duty construction equipment would be used (e.g. pile driving, bulldozing) within 200 feet of an existing structure or sensitive receptor. If applicable, the City shall require all feasible mitigation measures to be implemented to ensure that no damage or disturbance to structures or sensitive receptors would occur. *[Source: Existing Policy, City Staff] (RDR)*

HAZ-10.23 Transportation Vibration

The City shall require new residential and commercial projects located within 200 feet of existing major freeways and railroad lines (e.g. freight, Amtrak, and Bay Area Rapid Transit) to conduct a ground vibration and vibration noise evaluation consistent with City approved methodologies (e.g. Caltrans, Federal Transportation Authority). *[Source: Existing Policy, City Staff] (RDR)*

Hazards Element Update

Climate Change Vulnerability Assessment

prepared by

City of Hayward
Planning Division
777 B Street
Hayward, California 94541
Contact: Leigha Schmidt, Principal Planner

prepared with the assistance of

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June 2022

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
rinconconsultants.com

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Figures

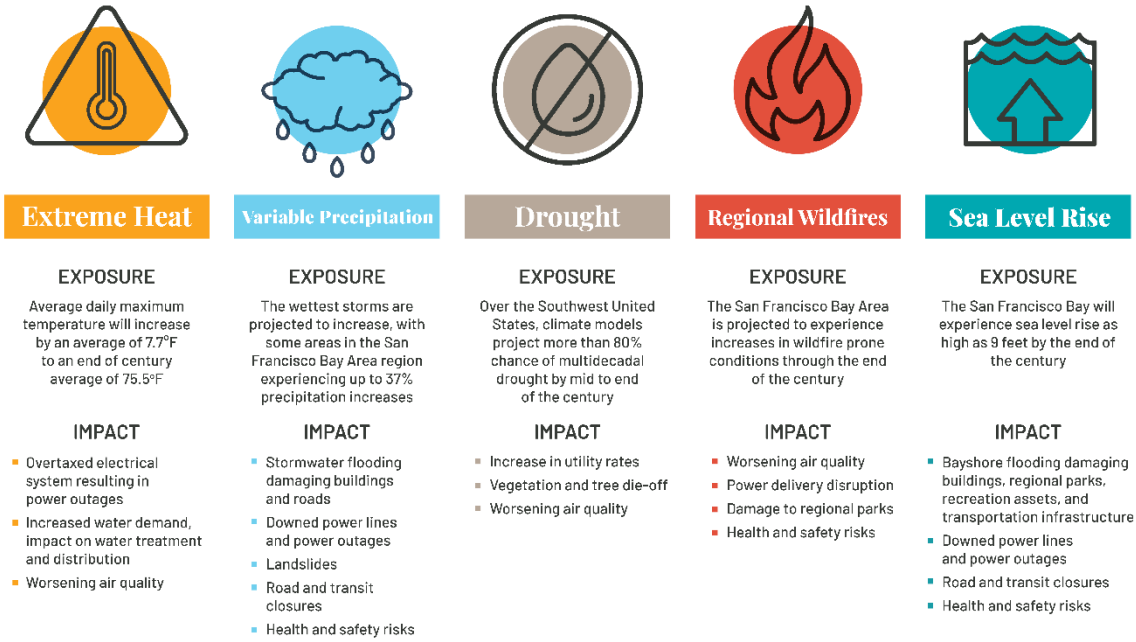
1 Introduction

Climate change is caused by the addition of excess greenhouse gases (GHGs) to the atmosphere, which traps heat near the earth's surface raising global average temperatures. This is what is referred to as the greenhouse effect. The resulting increase in average temperatures across the globe affects sea levels, precipitation patterns, the severity of wildfires, the prevalence of extreme heat events, water supply, and ocean temperatures and chemistry.[1] According to the Intergovernmental Panel on Climate Change (IPCC), global GHG concentrations are now higher than they have been in the past 400,000 years; an increase from 280 parts per million to 410 parts per million in the last 150 years.[2] This dramatic increase is attributed to human activities beginning with the industrial revolution in the 1800s, which represented a shift from an agrarian and handicraft-based economy to one dominated by industry and machine manufacturing.[1]

The City of Hayward (the City) has initiated an update to the Hazards Element chapter of their General Plan. Consistent with government code 65302 (as amended by Senate Bill 379), this report provides a climate change vulnerability assessment for the City to assist in the development of climate change adaptation and resilience policies and programs for the Hazards Element. The assessment evaluates the potential impacts of climate change on community assets and populations. Understanding the community's vulnerabilities to climate change provides a foundation to develop adaptation strategies for the Hazards Element Update and other planning efforts in the City.

The IPCC Sixth Assessment Report defines vulnerability as "the propensity or predisposition to be adversely affected."[2] The Assessment Report adds that vulnerability "encompasses various concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."[2] This climate change vulnerability assessment examines the susceptibility of the City's social, economic, and environmental assets to harm from climate related hazards, and the community's ability to adapt to the changing risks pertaining to those hazards. Figure 1 identifies projected climate changes and anticipated impacts that the Hayward community are anticipated to experience.

Figure 1 Climate Change Hazards and Anticipated Impacts in Hayward



1.1 Settings

History

Hayward was incorporated on March 11, 1876.[3] The City encompasses 64 square miles and borders the cities of San Leandro, Union City, Freemont, and Pleasanton.[3] Several census designated places also border Hayward including Castro Valley, San Lorenzo, Cherryland, Sunol, and Fairview. The City is part of the larger East Bay Area, located 25 miles southeast of San Francisco. The San Francisco Bay is located immediately to the west and East Bay Regional Parks are located to the east. The Hayward Faultline runs north to south at the base of the Hayward hillside.

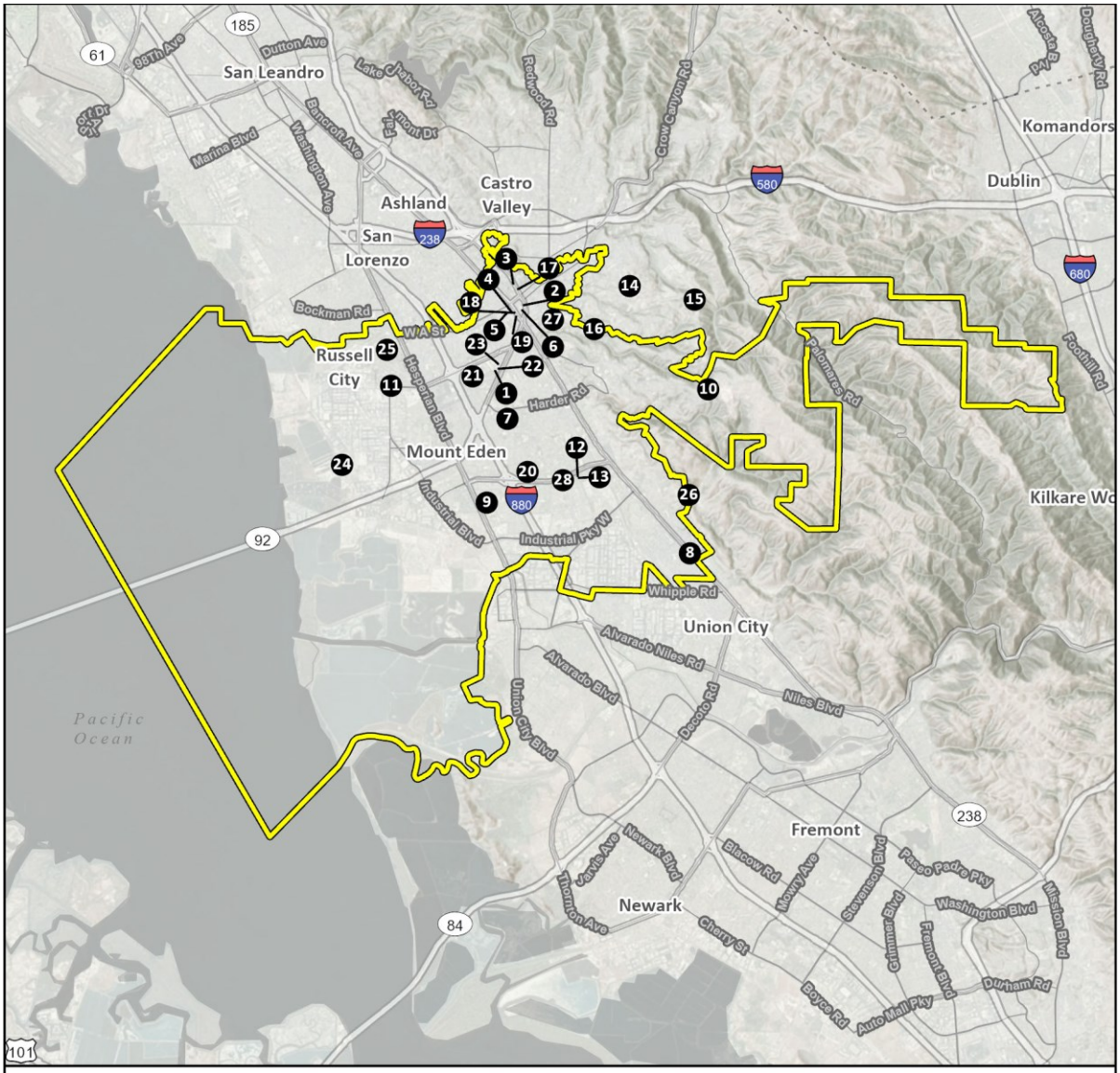
Land Use

Over half of the City of Hayward is comprised of San Francisco Bay waters, the Baylands, and open space. The Baylands are part of the Hayward Regional Shoreline and functions as a tidal wetland. The remainder of the city is composed of residential (18 percent), parks and recreation (7 percent), industrial (6 percent), and an assortment of mixed use and quasi-public land uses.[4] Residential development is present throughout the city with minimal residential use in areas west of Industrial Boulevard and south of Industrial Parkway, where industrial land uses are more prevalent. The vast majority of residential development is single-family with only 3% of land area dedicated to multi-family.[4] The industrial areas are situated to the western and southern most areas of the City. Commercial areas are located around Mission Street which runs north to south along the entire length of Hayward as well as downtown and along Jackson Street. The City is home to approximately 147,163 residents.[5]

Public Facilities and Amenities

The City operates a variety of public buildings and facilities, including City Hall, two libraries, an animal shelter, a water pollution control facility, nine fire stations, an airport and parking facilities.[5] Public facilities managed by the City amount to approximately 2,500 acres. The City also owns and operates approximately 2,400 acres of open space, 3,000 acres of parks and recreation, and 400 acres of public utilities including storm drainage, streetlights, and wastewater treatment.[4] Hayward maintains two different sanitary sewer systems, water distribution pipelines, and the local road network.

Figure 2 Map of Key City Facilities in Hayward



1. Hayward Animal Shelter
   16 Barnes Ct.
2. Cinema Place Garage
   22631 Foothill Blvd.
3. City Center Garage
   22332 Foothill Blvd.
4. City Hall Garage
   22600 Watkins St.
5. City Hall
   777 B St.
6. Fire Station #1
   22700 Main St.
7. Fire Station #2
   360 West Harder Rd.
8. Fire Station #3
   31982 Medinah St.
9. Fire Station #4
   27836 Loyola Ave.
10. Fire Station #5
    28595 Hayward Blvd.
11. Fire Station #6 &
    Training Center
    1401 West Winton Ave.
12. Fire Station #7
    28270 Huntwood Ave.
13. Fire Station Clinic
    28300 Huntwood Ave.
14. Fire Station #8 (Old)
    24200 Fairview Ave.
15. Fire Station #8 (New)
    25862 Five Canyons Pkwy
16. Fire Station #9
    24912 2nd St.
17. Former Hayward Area Historical
    Society Building
    22380 Foothill Blvd.
18. Main Library
    22675 Mission Blvd.
19. 21st Century Library & Heritage Plaza
    835 C St.
20. Weekes Branch Library
    27300 Patrick Ave.
21. Police Department HQ
    300 West Winton Ave.
22. Corp Yard
    24505 Soto Rd.
23. Utilities Center
    24499 Soto Rd.
24. Water Pollution Control Facility
    3700 Enterprise Way
25. Executive Airport
    20301 Skywest Dr.
26. Garin Radio Building/Garin Regional Park
    1320 Garin Ave.
27. Walpert Radio Building
    Walpert St.
28. Stack Community Center
    680 W Tennyson Rd.

City of Hayward # City Facility

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Miles

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Additional data provided by Hayward Hazard Mitigation Plan, 2016.

Hayward_Maps
Fig X Map of City Facilities in Hayward

Services

The City provides public and community services to residents and businesses in Hayward, including the procurement and distribution of potable water, maintaining the network of sewer collection pipelines and wastewater lift stations, wastewater treatment, and maintenance of smaller storm drain pipes. The City also operates its own police and fire departments providing public safety and emergency services. The Hayward Fire Department provides wildfire mitigation, flood response and regulation of hazardous materials.[5] The City-based fire department may also request and/or respond to mutual aid agreements between surrounding areas as well as the Alameda County Fire Department (ACFD) for mitigation services.[5] The Hayward Police Departments provides community safety related services.

The Alameda County Flood Control and Water Conservation District own and maintain major storm drainage facilities in Hayward. It also owns and maintains major flood protection facilities within Hayward and much of western Alameda County. East Bay Municipal Utilities District (EBMUD) and Alameda County provide services and maintenance associated with water provision to some parts of the City.[5] Water for the City is sourced through San Francisco Public Utilities Commission (SFPUC) which provides drinking water from Hetch Hetchy aqueducts and the Sierra Nevada.

Interstate 880 runs through the City from the north to south providing access to the Bay Area and eventually linking up with interstate 80 traversing across the entire country. The Hayward-San Mateo Bridge is accessed through the western point of the City and provides access to the west side of the Bay. Union Pacific owns and operates heavy rail lines in Hayward providing regional access to the Bay Area's major ports. Two Bay Area Rapid Transit (BART) lines traverse through the City providing residents and businesses access to the Bay Area's major employment centers. The City is also served by AMTRAK's Capital Corridor (passenger rail), AC Transit bus service, and the Hayward Executive Airport.

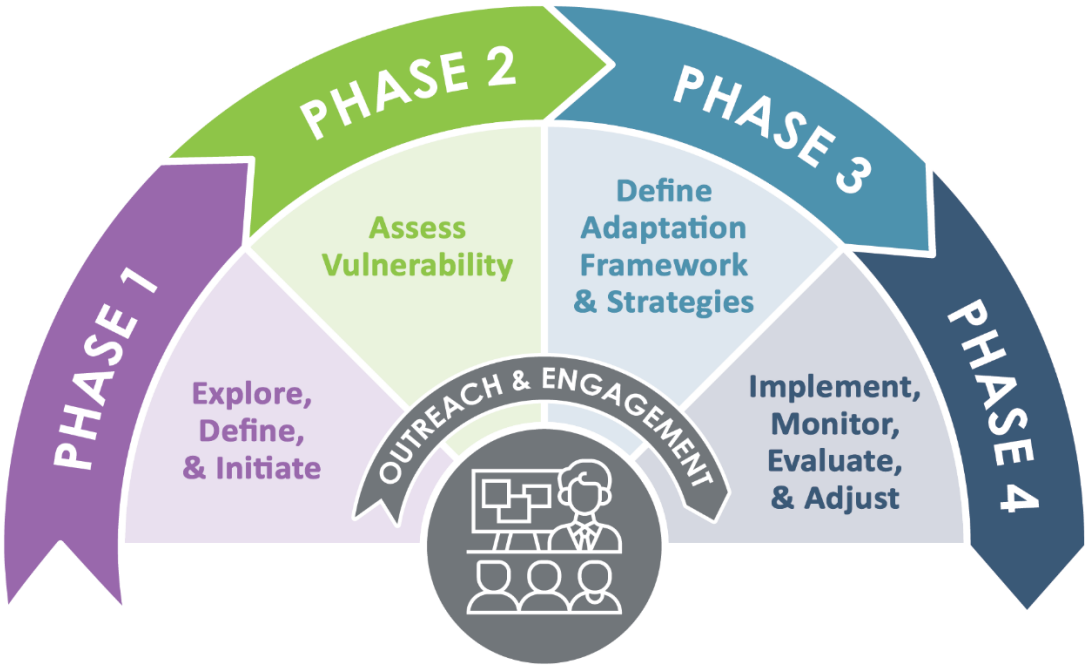
Pacific Gas and Electric Company (PG&E) provide electricity and natural gas services.[5] Hayward is a member of East Bay Community Energy (EBCE) which provide customers with the option to purchase energy through renewable sources. The City works with telecommunication providers to provide infrastructure, fiber optic network, wireless networks, and broadly accessible service.

Environment

Hayward is a part of the greater San Francisco Bay Area and occupies a relatively flat stretch of land within the East Bay Area region with bay waters bordering the western edge and regional hills to the east.[6] The City is split by the Hayward fault line running north to south through the downtown area. The City is at an intersect of multiple freeways, erosion-prone landscape and subsequently experiences both natural and human-induced hazards as expanded on in the City's Local Hazard Mitigation Plan (LHMP).

1.2 Vulnerability Assessment Methodology

The City's Climate Change Vulnerability Assessment follows the vulnerability assessment process recommended by the California Governor's Office of Emergency Services (Cal OES), as documented in the 2020 California Adaptation Planning Guide (Cal APG).[7] The adaptation planning process outlined by the Cal APG consists of four phases, illustrated in the graphic below, with Phase 2 detailing the vulnerability assessment process.[7]



The assessment is comprised of the following five elements that parallel the Phase 2 Cal APG steps to assess vulnerability:

1. **Exposure.** The nature and degree to which a climate stress or hazard occurs within the City's geography.
2. **Sensitivity.** The aspects of the community (i.e., populations, community structures and infrastructure, parks and open space, and services) most affected by the identified climate hazards.
3. **Potential Impacts.** The nature and degree to which different aspects of the community can be affected by a given stressor, change, or disturbance.
4. **Adaptive Capacity.** The ability to cope with extreme events, to make changes, or to transform to a greater extent, including the ability to moderate potential damages and to take advantage of opportunities.
5. **Vulnerability Analysis.** The overall risk to different aspects of the community of potential impacts given their adaptive capacity.

Data Sources

The vulnerabilities to community assets as well as the outlining of relevant climate hazards to the County were sourced using the following data sources and tools, many of which are recommended within the California Adaptation Planning guide.

Climate Model Projections

Future changes in climate presented in this assessment are based on global models. The IPCC provides several greenhouse gas (GHG) emissions scenarios to describe possible future GHG emissions and associated climate outcomes. These scenarios are termed "Representative Concentration Pathways" (RCPs) and are commonly used to explore a range of possible future climate conditions. RCP 4.5 represents a "mitigation" scenario in which collective action at the

global scale results in the successful implementation of GHG reduction strategies. In this scenario, global emissions peak around 2040 and decline by the end of the century. RCP 8.5 represents a "high emissions" scenario in which emissions continue to rise throughout the 21st century. RCP 4.5 and RCP 8.5 are used in this assessment, as recommended in the Cal OES 2020 Adaptation Planning Guide.

Cal-Adapt is a tool developed by the State and is designed to assist local jurisdictions with climate change adaptation and resilience planning. It is intended to provide a consistent set of model outputs for climate assessments across the State for local and regional planning. Cal-Adapt is a web-based platform that includes climate change projections and climate impact research downscaled to the local level for different RCP scenarios. The projections are based on the extensive body of peer-reviewed climate research described in California's Fourth Climate Change Assessment which summarizes and makes state climate science actionable for resilience efforts. The University of California Berkeley's Geospatial Innovation Facility developed and maintains the Cal-Adapt tool with oversight and funding from the California Energy Commission and California Strategic Growth Council. Climate change projections taken from Cal-Adapt for the RCP 4.5 and RCP 8.5 projections are assessed for temperature, precipitation and wildfire within the Local Climate Change Snapshot tool.[10] These projections are used in conjunction with population and built environment data to determine the degree to which the community of Hayward is vulnerable under different climate change scenarios.

The Adapting to Rising Tides (ART) Bay Flood Shoreline Explorer was used to assess vulnerabilities related to sea level rise. The tool was developed by the San Francisco Bay Conservation and Development Commission (BCDC) and NOAA's Office for Coastal Management (NOAA OCM) to map impacts of sea level rise along the Alameda County shoreline. The ART Bay Flood Shoreline Explorer maps sea level rise under a range of 1 foot through 9 feet of bay shore rise in combination with 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, and King Tide storm surges. This tool was developed by the San Francisco Bay Conservation and Development Commission to be used with Ocean Protection. Sea level rise was assessed using 1.9-foot and 6.9-foot scenarios from the ART Bay Flood Shoreline Explorer, which approximately corresponds to recommended projections under the State of California Sea-Level Rise Guidance for the San Francisco Bay Area.[14]

California's Fourth Climate Change Assessment, San Francisco Bay Are Regional Summary Report was used to further understand regional changes that may affect the City both directly and indirectly. This report presents an overview of climate science, specific strategies to adapt to climate impacts, and key research gaps needed to spur additional progress on safeguarding San Francisco Bay Area Region from climate change.

The data in Cal-Adapt is combined with information from the California Fourth Climate Change Assessment and the ART Bay Flood Shoreline Explorer to model future changes in specific types of hazards. Data from these sources was drawn on to round out projections and information on several individual hazards not fully expanded on within the Cal-Adapt tool.

Identifying Sensitive Communities

The California Healthy Places Index (HPI) is an online mapping tool that reports on community conditions that are known to predict health outcomes and life expectancy. The tool was prepared by the Public Health Alliance of Southern California, a collaborative of local health departments in California. HPI displays 25 community characteristics at various legislative boundaries, including census tracts, and city and county boundaries. The community characteristics relate to the following Policy Action Areas: economic, education, housing, health care access, neighborhood, clean

environment, transportation, and social factors. HPI applies a relative percentile score across all census tracts in California using statistical modeling techniques based on the relationship of the Policy Action Areas to life expectancy at birth. Low percentile scores reflect unhealthy conditions. This report uses a percentile score of 50 or lower city-wide to determine vulnerable communities.

Hayward Local Hazard Mitigation Plan is used to for general information on existing processes and plans that are already in place regarding climate change. The Hazard Mitigation Plan also was used in determining Hayward's adaptive capacity by pulling existing hazard planning and identified vulnerabilities into the analysis.

2 Exposure

Climate change is a global phenomenon that can impact local health, natural resources, infrastructure, emergency response, and many other aspects of society. Projected changes to the climate are dependent on location. The Cal-Adapt tool provides climate data from global scale models that have been localized (downscaled). For the purposes of this report, the term "climate driver" is defined as a trend in average conditions over time such as temperature, precipitation, and sea level rise. The Climate Hazards section provides information on projected changes to extreme heat, drought, wildfire, landslides and Bayshore flooding as influenced by climate drivers. The interplay between climate drivers and hazards is understood through compounding risks and cascading impacts defined below.

Compounding Risks

Risks associated with specific aspects of climate change (i.e., extreme temperatures, sea level rise, etc.) are often assessed and planned for separately. However, the timing and sequencing of more than one type of risk can increase the potential for new or more amplified hazard events and conditions. For example, an extreme precipitation event occurring after a wildfire event increasing the severity of a landslide hazard. Compounding risks, as presented in the IPCC report on Changes in Climate Extremes, can include: "(a) extremes that occur simultaneously or successively; (b) extremes combined with background conditions that amplify their overall impact; or (c) extremes that result from combinations of 'average' events."[8]

Cascading Impacts

Cascading impacts are viewed as compromised infrastructure or critical service disruptions (e.g., power outages), caused by a climate-related event. The IPCC describes cascading impacts within Chapter 6 of the 2019 Special Report, "Extremes, Abrupt Changes and Managing Risks."[9] These cascading impacts can increase the severity of a climate event by affecting multiple sectors of the community. For Hayward these cascading impacts can be viewed and sourced based on linkages between services or in the way a hazard sets off a chain of related impacts. An example would be increased precipitation or intense precipitation leading to a cascading risk of downed communication networks. Hazards that cascade into infrastructure such as above ground power lines damage and subsequently impact public health, safety, and communications.

2.1 Climate Drivers

In Hayward the climate drivers of concern include Temperature, Precipitation, and Sea Level Rise. The following section summarizes projected changes to the identified climate drivers.

Temperature

Under the RCP 4.5 and 8.5 scenarios, the average maximum temperature projected for Hayward is expected to rise between 4.4° Fahrenheit (F) and 7.3°F by the end of the 21st century when compared to a 30-year average baseline of 1961 to 1990.[10] The average minimum temperature is expected to rise between 4.1°F (RCP 4.5) and 7.2°F (RCP 8.5) by the end of the 21st century.[10] These

projections indicate a shift in temperature maximums and minimums for an overall warmer climate range in Hayward.

Figure 3 and Figure 4 below show the observed trends and projections for the annual average maximum and minimum temperatures in Hayward. The purple line on the graphs shows the high emissions scenario (RCP 8.5), the blue line shows the medium emissions scenario (RCP 4.5), and the grey line illustrates the current trend (observed). The shaded areas indicate the range for the emissions scenario. For example, the blue shaded area represents the range of data for the medium emissions scenario (RCP 4.5). Temperature as a climate driver influences many hazards discussed in the Climate Hazards section below, including extreme heat, drought, and wildfire.

Figure 3 Historical and Projected Average Maximum Temperature in Hayward (Graph)[10]

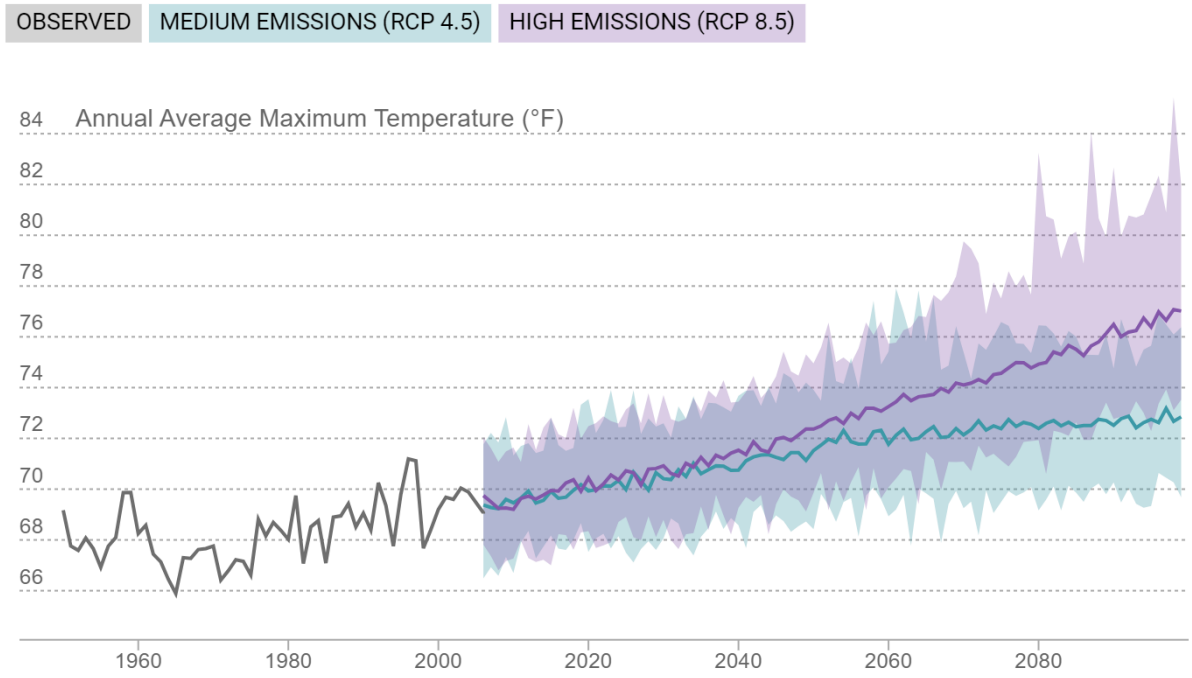
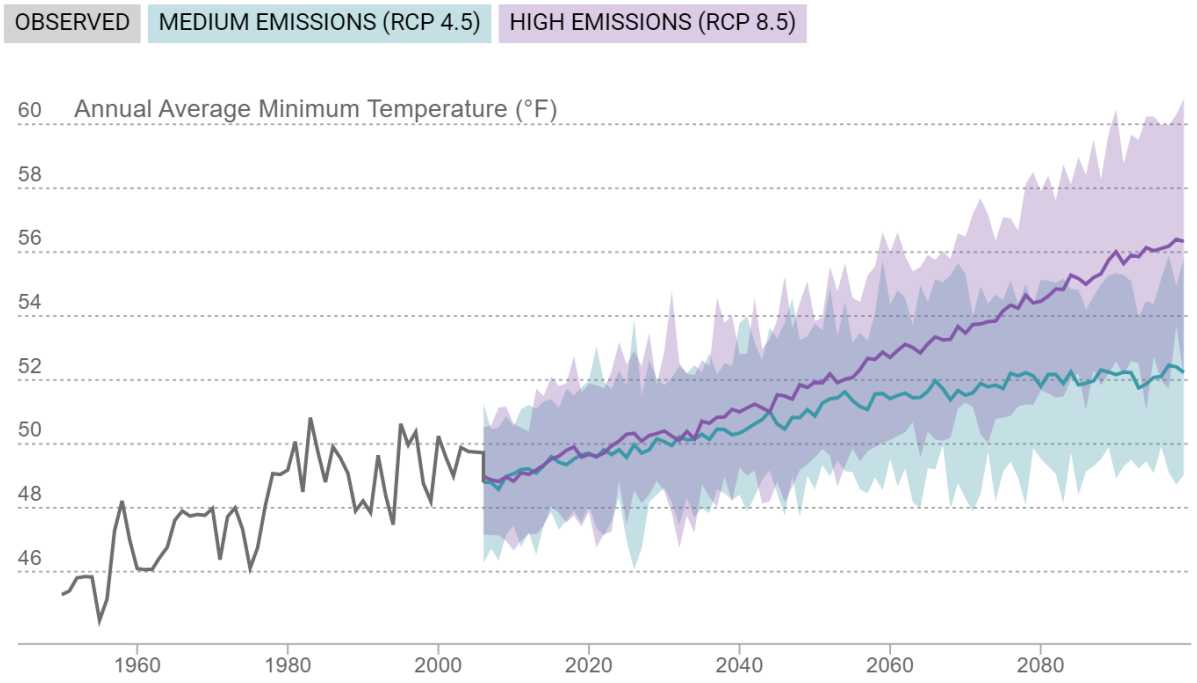


Figure 4 Historical and Projected Average Minimum Temperature in Hayward[10]



Precipitation

Increased intensity of precipitation events are expected for the greater San Francisco Bay Area, including Hayward through the end of the century.[12] Precipitation in the Bay Area region is variable from year to year, which obscures trends in projected annual precipitation totals.[12] Average precipitation values for Hayward range between a decrease in total precipitation of 1.5 percent to an increase in total precipitation by 4 percent.[10] Climate change may create a small tendency towards a wetter Hayward, but the projected trends for precipitation totals remain small compared to the year-to-year variability that characterizes California's climate. As a result, projected changes to precipitation extremes are of greater significance than changes in precipitation averages. The projections show that there will be more dry periods punctuated by increased precipitation intensities of the largest storms or wet periods, producing little net change in precipitation totals but more extreme conditions. The amount of precipitation from the largest storms is projected to increase by 6-37 percent compared to the historical averages by end of century.[10]

In Hayward, the modeled historical annual precipitation baseline is a 30-year average of approximately 18.9 inches between 1961 and 1990. Mid-century projections show changes in annual total precipitation ranging from a decrease of 0.3 inches (RCP 4.5) to an increase of 0.2 inches (RCP 8.5). By the end of the century, annual precipitation is expected to increase between 0.2 inches (RCP 4.5) to 0.8 inches (RCP 8.5).

Maximum 1-day precipitation models for Hayward have a current 30-year average of approximately 1.4 inches. By the middle of the century maximum precipitation event averages will range between approximately 1.47 inches (RCP 4.5) and 1.5 inches (RCP 8.5). These numbers increase even more by the end of the century with projections ranging between 1.52 inches (RCP 4.5) and 1.65 inches (RCP 8.5).

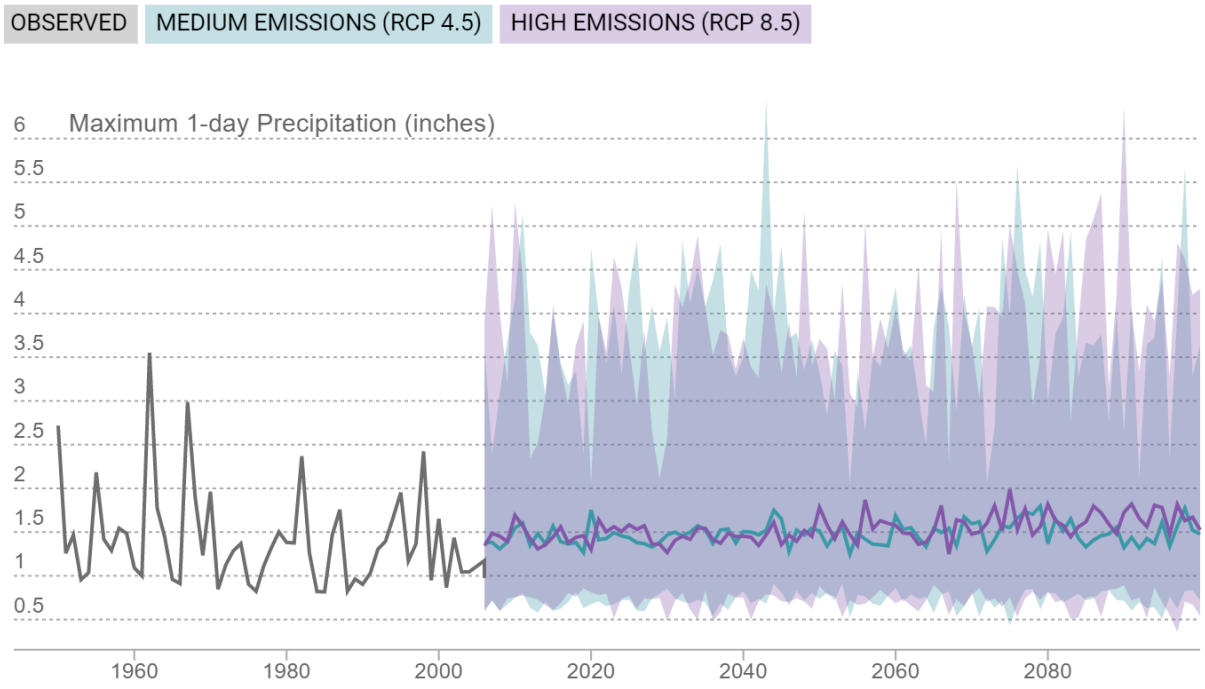
Figure 5 and Figure 6 show the historical and projected changes in annual precipitation and maximum 1-day precipitation, respectively. Though these averages are expected to increase, observed changes within the region have shown multi-year periods of small amounts of precipitation offset by atmospheric river events of increasing intensity.[12]

Figure 5 Historical and Projected Average Annual Precipitation in Hayward[10]

Observed (1961-1990) 30yr Average: 18.9 inches

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	19.9 inches	18.2 - 21.7 inches
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	-0.3 inches	19.6 inches	17.1 - 26.3 inches
HIGH EMISSIONS (RCP 8.5)	+0.2 inches	20.1 inches	16.4 - 25.3 inches
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+0.2 inches	20.1 inches	16.6 - 25.2 inches
HIGH EMISSIONS (RCP 8.5)	+0.8 inches	20.7 inches	14.2 - 27.4 inches

Figure 6 Historical and Projected Average Maximum 1-Day Precipitation in Hayward[10]



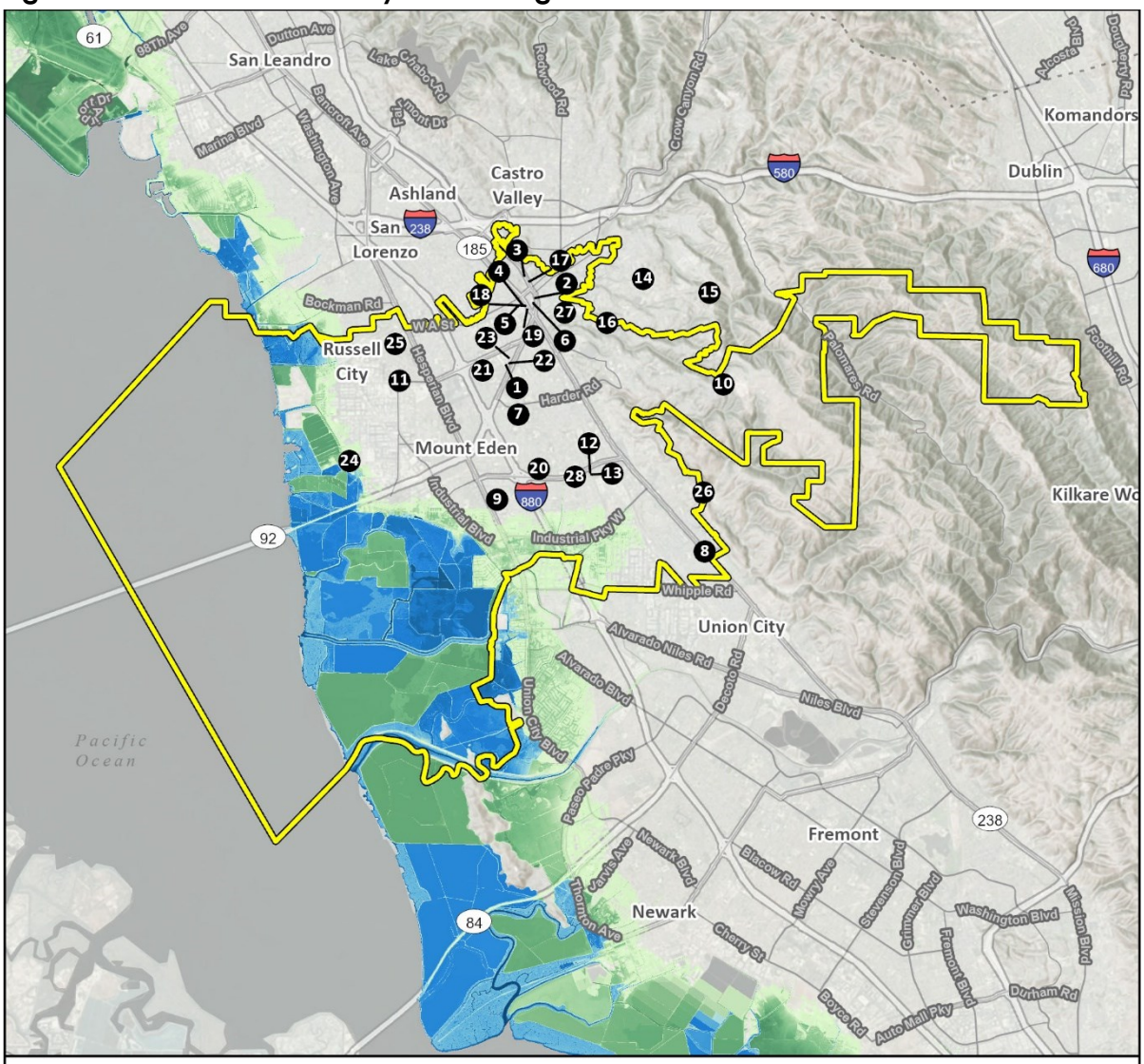
Sea Level Rise (SLR)

By the end of the century, the median projected SLR is 4.5 feet in the San Francisco Bay Area.[12] The region could experience up to a maximum SLR of approximately 9.5 feet by the end of the century.[12] SLR studies depict large ranges in part due to unpredictability of ice sheet melting capacity and

water expansion rates as the oceans warm through the end of the century.[11] Observed changes in SLR show a 8-inch rise in the San Francisco Bay Area over the previous century.[12]

The rate of SLR is expected to increase from observed changes. Modeling SLR under different projections helps in visualizing anticipated changes affecting the City. Data available within the Adapting to Rising Tides Bay Shoreline Flood Explorer depicts various scenarios of SLR for both Hayward and the greater Bay Area.[13] Per the State of California Sea Level Rise Guidance document published by the Ocean Protection Council, this assessment uses SLR estimates of 1.9-feet by 2050 and 6.9-feet by 2100.[14] Figure 7 shows 1.9 feet of SLR by 2050 in blue and 6.9 feet of SLR by 2100 in green. The lighter the shade of blue or green the shallower the area is. According to these projections, by 2050 the Water Pollution Control Facility will be located within the SLR hazard zone and by 2100 Fire Station #4 will be located in the SLR hazard zone.

Figure 7 Sea Level Rise in Hayward through 2050 and 2100[13]



1. Hayward Animal Shelter
   16 Barnes Ct.
2. Cinema Place Garage
   22631 Foothill Blvd.
3. City Center Garage
   22332 Foothill Blvd.
4. City Hall Garage
   22600 Watkins St.
5. City Hall
   777 B St.
6. Fire Station #1
   22700 Main St.
7. Fire Station #2
   360 West Harder Rd.
8. Fire Station #3
   31982 Medinah St.
9. Fire Station #4
   27836 Loyola Ave.
10. Fire Station #5
    28595 Hayward Blvd.
11. Fire Station #6 & Training Center
    1401 West Winton Ave.
12. Fire Station #7
    28270 Huntwood Ave.
13. Fire Station Clinic
    28300 Huntwood Ave.
14. Fire Station #8 (Old)
    24200 Fairview Ave.
15. Fire Station #8 (New)
    25862 Five Canyons Pkwy
16. Fire Station #9
    24912 2nd St.
17. Former Hayward Area Historical Society Building
    22380 Foothill Blvd.
18. Main Library
    22675 Mission Blvd.
19. 21st Century Library & Heritage Plaza
    835 C St.
20. Weekes Branch Library
    27300 Patrick Ave.
21. Police Department HQ
    300 West Winton Ave.
22. Corp Yard
    24505 Soto Rd.
23. Utilities Center
    24499 Soto Rd.
24. Water Pollution Control Facility
    3700 Enterprise Way
25. Executive Airport
    20301 Skywest Dr.
26. Garin Radio Building/Garin Regional Park
    1320 Garin Ave.
27. Walpert Radio Building
    Walpert St.
28. Stack Community Center
    680 W Tennyson Rd.

City of Hayward | # City Facility

1.9-ft of SLR for Mid-Century Depth of Flooding (2-ft Increments): 12+ … 0 - 2

6.9-ft of SLR for End-Century Depth of Flooding (2-ft Increments): 12+ … 0 - 2

0 1.5 3 Miles

N

Imagery provided by Microsoft Bing and its licensors © 2022.
Additional data provided by Adapting to Rising Tides, 2022 & Hayward Hazard Mitigation Plan, 2016.

Hayward_Maps
Fig X Sea Level Rise in Hayward

2.2 Climate Hazards

Most climate hazards of concern for Hayward and the surrounding region have only minimally impacted the community in the past. Climate drivers (temperature, precipitation, and sea level rise) are expected to influence the frequency, duration, and magnitude of the following climate hazards:

- Extreme Heat
- Drought
- Wildfire
- Landslides
- Bayshore Flooding

Extreme Heat

Extreme heat events are defined as days in which the daily maximum temperature exceeds the 98thpercentile value of the historical average. For Hayward, extreme heat days occur when the maximum temperature is above 90.5°F. There has been an observed average of 4 extreme heat days annually from 1961 to 1990.[10] The intensity and frequency of extreme heat days is projected to increase in Hayward. There is a dramatic increase from the observed average of 4 extreme heat days annually since 1950, to 2050 mid-century projections of 15 days annually (RCP 8.5) and end of century projections of 28 days annually (RCP 8.5). While there have been no Federal Emergency Management Agency (FEMA) or Cal OES declared heat disasters in the city to date, extreme heat poses an especially hazardous risk to the City as there is a lack of cooling infrastructure and extreme heat conditions can result in increased health risks for the City's vulnerable populations.[18] Extreme heat without adequate cooling infrastructure exacerbates health impacts across all populations. This comes into effect especially with higher occurrences of warm nights, shown in Figure 9, when the population is given little break for the body to cool. By the end of the century warm nights are expected to increase from a 30-year historical average of 4 nights annually to anywhere between 49 nights (RCP 4.5) and 96 nights (RCP 8.5).[10]

Figure 8 Historical and Projected Annual Average of Extreme Heat Days in Hayward[10]

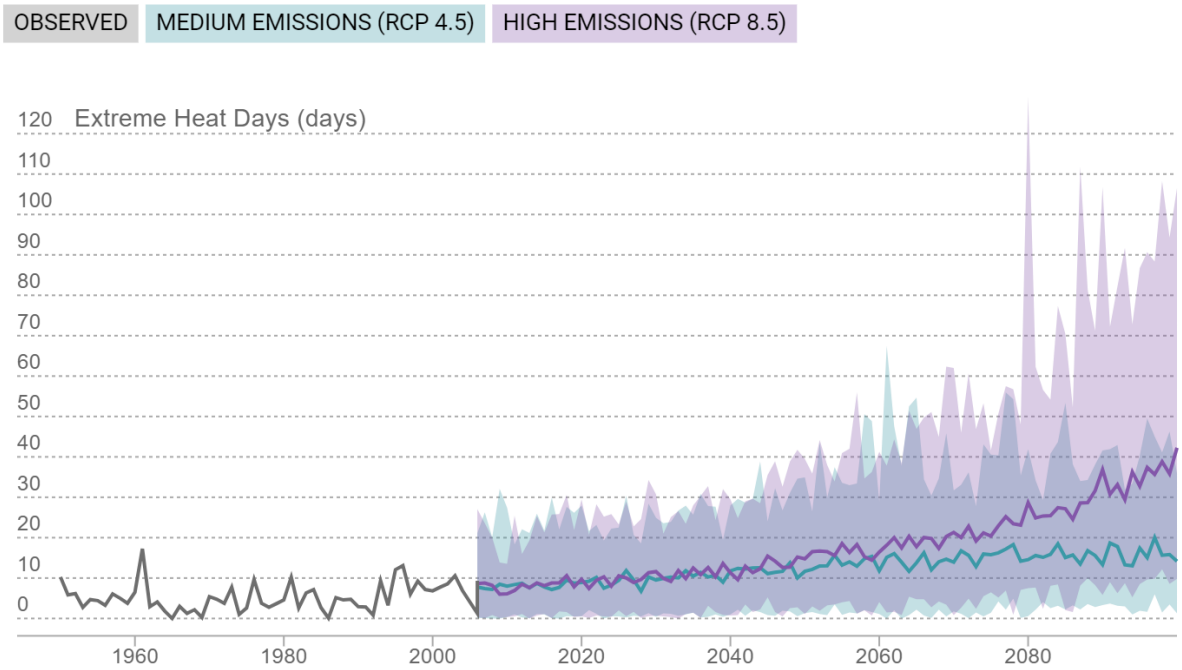
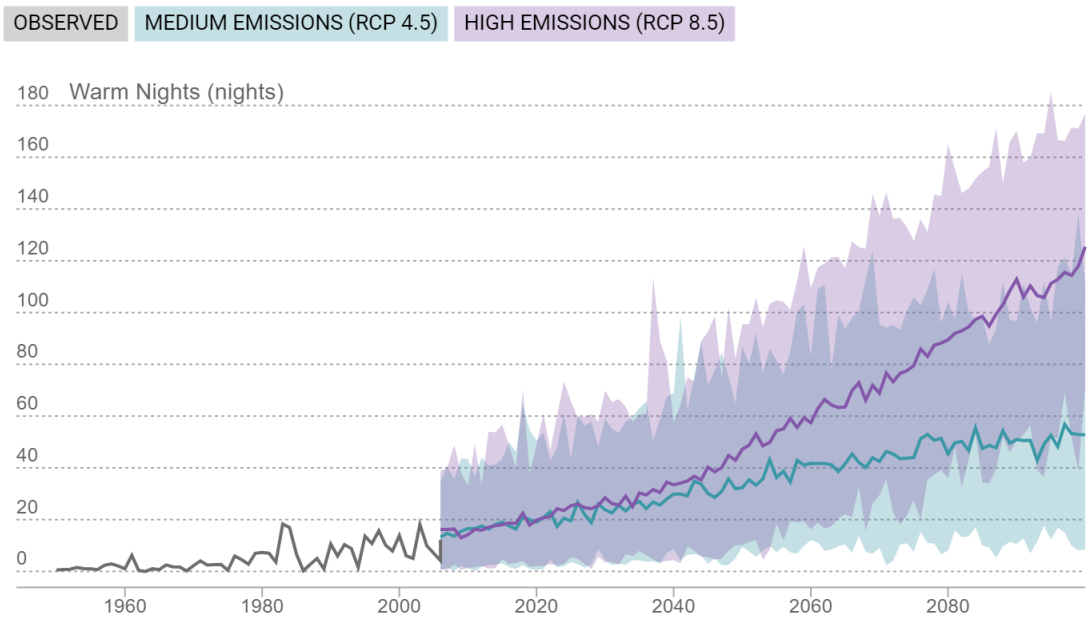


Figure 9 Historical and Projected Annual Average of Warm Nights in Hayward[10]



Drought

Climate change will increase the likelihood that low-precipitation years will coincide with above-average temperature years.[12] Warming temperatures increase seasonal dryness and the likelihood of drought due. This is due to a decreased supply of moisture and increased atmospheric demand for moisture as evaporation from bare soils and evapotranspiration from plants increases.[12] The increased moisture loss from soils and vegetation amplifies dryness during periods without

precipitation. In California's highly variable climate setting, climate models project the number of dry years to increase.

Drought is defined within this report using the Standardized Precipitation Index (SPI) as well as the National Drought Mitigation Center five drought categories ranging from least to most severe drought conditions of D0 to D4.[10] Both metrics were used in producing analysis of drought as it relates to Hayward. The duration of dry spells is projected to vary based on emissions scenario. Like patterns in precipitation some of the annual variability is obscured within 30-year averages. Despite this, the clear trend is for maximum lengths of dry spells to increase through the end of century. By mid-century dry spells are expected to increase between 7 days (RCP 4.5) and 10 days (RCP 8.5). By the end of the 21st century dry spells are expected to increase between 8 days (RCP 4.5) and 13 days (RCP 8.5). Both ranges can be found within Figure 8.

Recent Drought Hazards

Historically there have been ten recorded multi-year droughts affecting Alameda County. The most recent occurrences were 2007-2009, 2012-2016 and 2021-present; all have been statewide in scope with the most recent being the driest 4-year period on record for California.[1]

Additionally, the Keetch- Byram Drought Index (KBDI) levels are expected to increase as well. This KBDI is a proxy measure of wildfire plausibility through projections of how dry the soil is in an area. By using the KBDI climate indicator it is possible to project wildfire risk, but it is more direct in indicating drought conditions. In Figure 11 the KBDI projections show an increase from low drought conditions in the 0-200 range to a 200-400 level increase.[10]

Figure 10 Historical and Projected Changes to Maximum Dry Spell in Hayward[10]

Maximum Length of Dry Spell

The maximum length of dry spell for each year. In other words, the maximum number of consecutive days with precipitation < 1mm for each year.

Observed (1961-1990) 30yr Average: 111 days

		30yr Average	30yr Range
Baseline (1961-1990)			
MODELED HISTORICAL	-	115 days	105 - 132 days
Mid-Century (2035-2064)			
MEDIUM EMISSIONS (RCP 4.5)	+7 days	122 days	103 - 142 days
HIGH EMISSIONS (RCP 8.5)	+10 days	125 days	108 - 140 days
End-Century (2070-2099)			
MEDIUM EMISSIONS (RCP 4.5)	+8 days	123 days	102 - 144 days
HIGH EMISSIONS (RCP 8.5)	+13 days	128 days	96 - 164 days

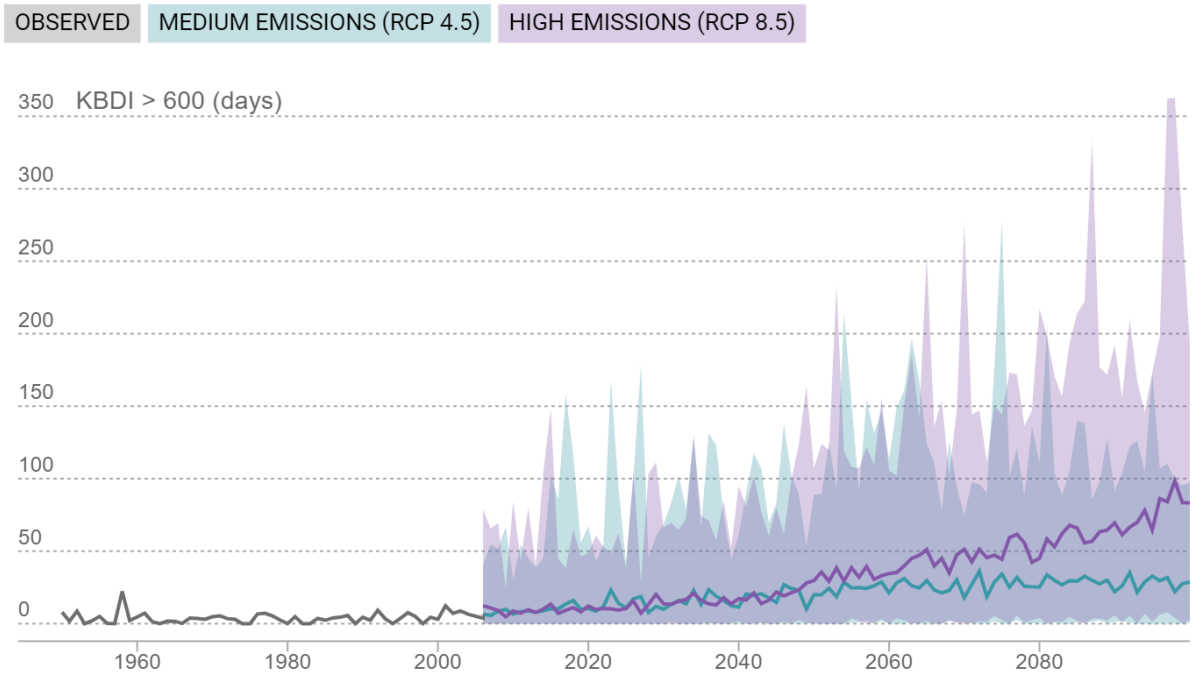
Figure 11 KBDI Historical and Projected Changes in Hayward[10]

KBDI > 600

Number of days in a year where Keetch-Byram Drought Index (KBDI) > 600. KBDI provides an estimate for how dry the soil and vegetative detritus is.

KBDI is cumulative. The KBDI values increase on dry and warm days and decrease during rainy periods. In California we would expect KBDI to increase from the end of the wet season (spring) into the dry season (summer & fall). The list below explains what values of KBDI represent:

0–200	Soil moisture and fuel moistures are high, low wildfire risk.
200–400	Soil and fuels start to dry, average wildfire risk.
400–600	Onset of drought with moderate to serious wildfire risk.
600–800	Severe drought, extreme wildfire risk and increased wildfire occurrence.

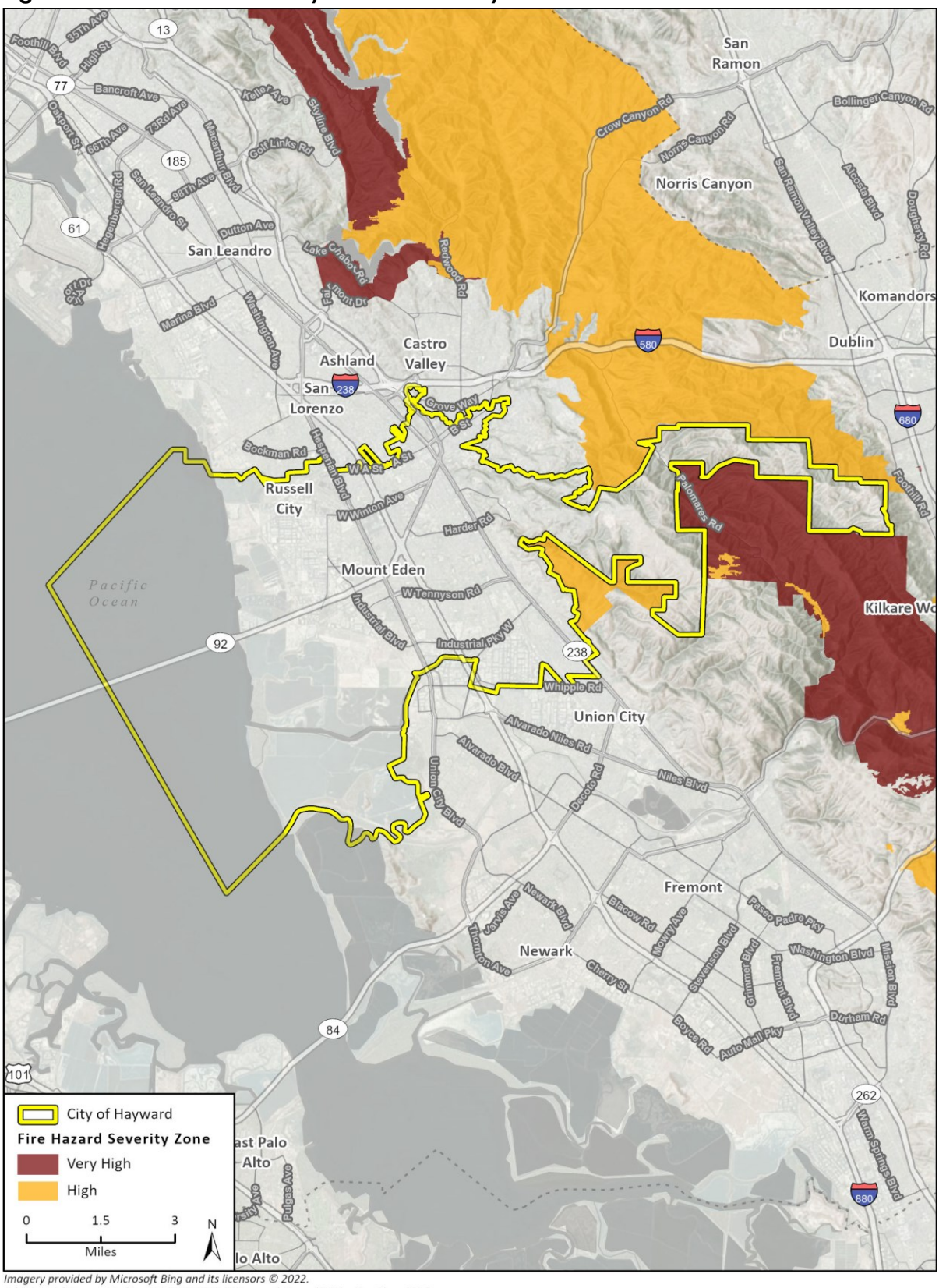


Wildfire

The size and severity of wildfires are expected to increase substantially in the coming decades.[12] The National Oceanic and Atmospheric Administration's Fourth National Climate Assessment, released in 2018, reported that the area burned by wildfire in the southwestern United States from 1984 to 2015 was twice what would have burned had climate change not occurred.[15] The areas surrounding Hayward have some very high fire hazard severity zones (VHFHSZ) mainly within the East Bay parks and hills that characterizes the eastern edge of East Bay Area Cities and Areas. Hayward has a VHFHSZ bordering the boundaries of the City shown in Figure 12. This zone is not within City limits but general proximity to this as well as other regional VHFHSZ's place Hayward at risk for health

hazards related to wildfire smoke. There have been no historical wildfires within the Hayward city limits. The area burned by wildfires throughout the state has increased. If higher temperatures continue to be accompanied by an increase in the incidence and extent of large wildfires, regional air quality could worsen affecting Hayward, the region, and the State.

Figure 12 Fire Hazard Severity Zones in the Hayward Area



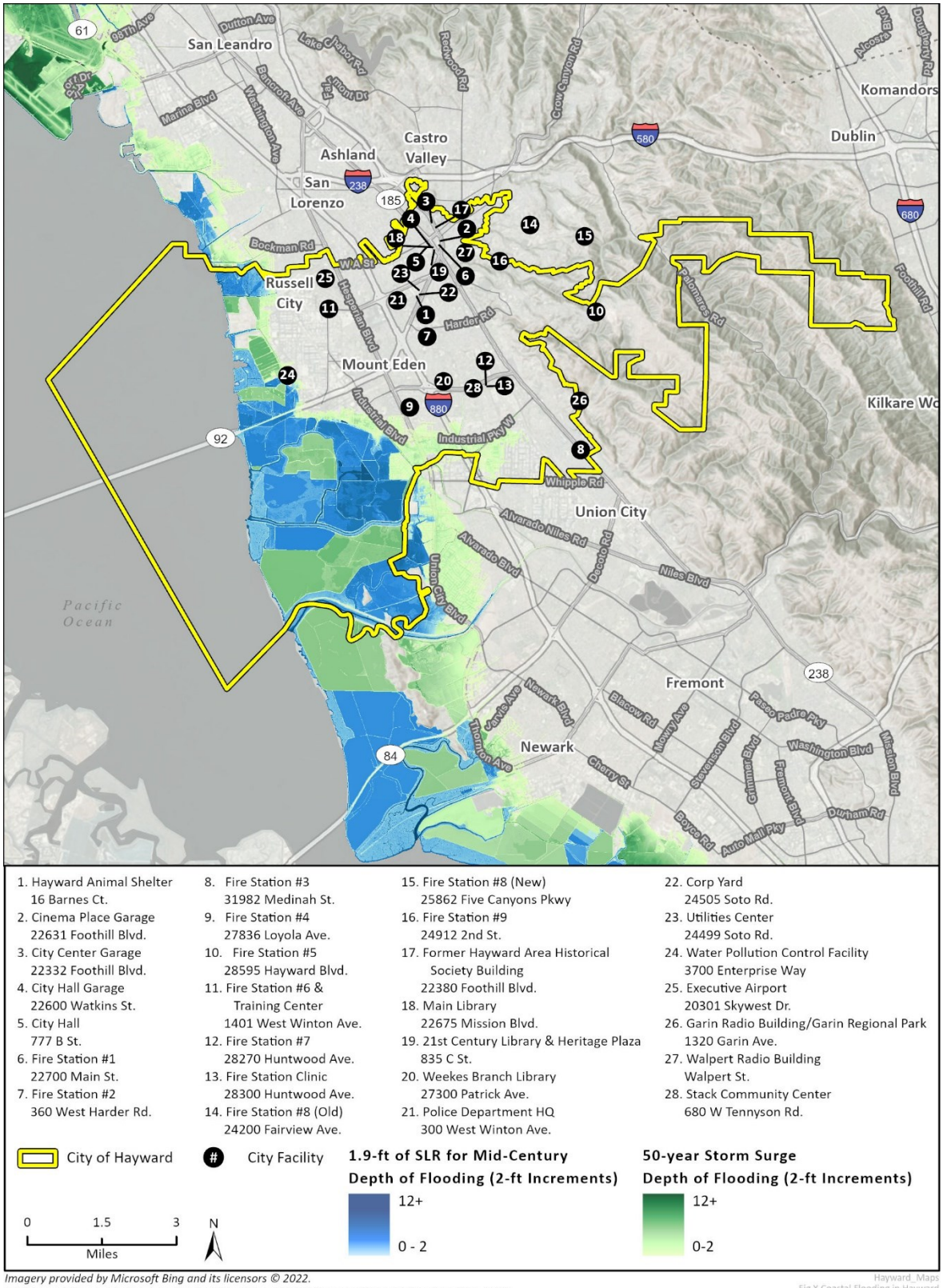
Landslides

Triggered by extreme bouts of precipitation, the susceptibility of Hayward to landslides is projected to increase as precipitation variability increases.[12] Landslides for the area are plausible given that eastern Hayward is a known landslide-prone area.[5] The projections of rain-induced landslides are inconsistent. However, it is reasonable to assume a likely increase in landslides because of increases in maximum daily precipitation through the end of the century under both RCP 4.5 and 8.5.[12]

Bayshore Flooding

As shown in the SLR scenarios, the Hayward Shoreline is exposed to immediate effects and displacement associated with climate change. Though the projections have a clearly defined area of impact, a secondary hazard associated with SLR is Bayshore flooding brought about by intense storm surges. With increased sea levels in the greater Bay Area and particularly along the western edge of the City, the range of impact can stretch much further inland given 25-year, 50-year and 100-year storm surges as well as King Tide occurrences. Under each of these instances the scope of adversely impacted areas in Hayward increases with inundation zones due to Bayshore flooding. Figure 13 shows hazard zone of 2050 SLR along with a 50-year storm surge to better understand Bayshore flooding as it impacts the community. According to the Healthy Places Index (HPI) 4.78 percent of people in Hayward occupy sea level rise inundation areas placing the City in the 32.7 percentile for California.[16] This statistic was developed under the conditions of a 100-year flood event and expected sea level rise through the end of the 21st century. By 2050 the Water Pollution Control Facility as well as the entire southwest portion of the City will be inundated as a result of Bayshore flooding under a 50 year storm surge scenario. The southwest inundation area is predominately state-owned land consisting of the Eden Landing Ecological Reserve.

Figure 13 2050 Projected Bayshore SLR in Hayward with a 50-Year Storm Surge[13]



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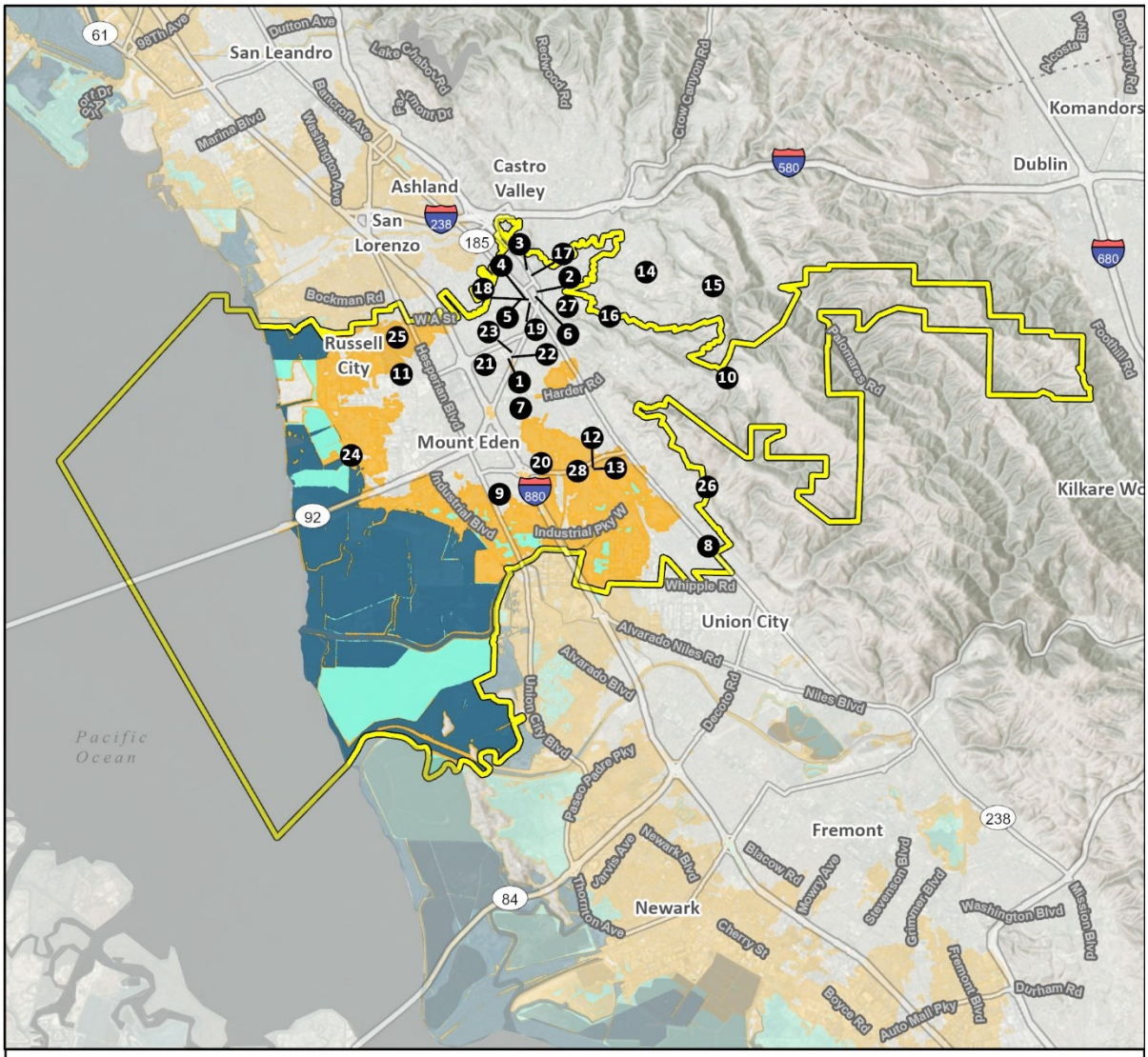
Additional data provided by Adapting to Rising Tides, 2022 & Hayward Hazard Mitigation Plan, 2016.

Groundwater Hazards

Hayward's Shoreline is susceptible to groundwater inundation as sea levels rise. Due to the City's susceptibility to coastal flooding and general inundation from sea level rise there is a cascading risk of rising groundwater.[17] As the sea rises, groundwater is pushed to the surface or closer to the surface, referred to as water table at surface. Groundwater that is up to 3.3 feet below ground surface can mobilize pollutants, stress pipes, and affect roadbeds as the sea rises. Between 3.3 feet and 6.6 feet below ground surface the groundwater shifts can weaken structural foundations, affect basements, begin to affect pipes, and amplify the potential for liquefaction (for example, during an earthquake). Deeper than 6.6 feet below ground surface the groundwater changes resulting from sea level rise can negatively affect deep basements in buildings, structural foundations, septic systems, and contaminants in the ground.[17] Projections for 2050 groundwater levels can be found in Figure 14 while projections for 2100 can be found in Figure 15. The Marine Inundation zone parallels the same projections used in the other hazard figures for sea level rise. The main changes to be observed are changing levels of surface table water as well as greater areas of groundwater that has been brought up to the 0 to 3.3 feet below ground surface level. By 2050 Fire Station #4, Fire Station #7, Fire Station Clinic, Weekes Branch Library, Water Pollution Control Facility, and the Executive Airport are all at risk to shallow groundwater inundation.

Figure 14 Mid-Century Groundwater Risk in Hayward[17]



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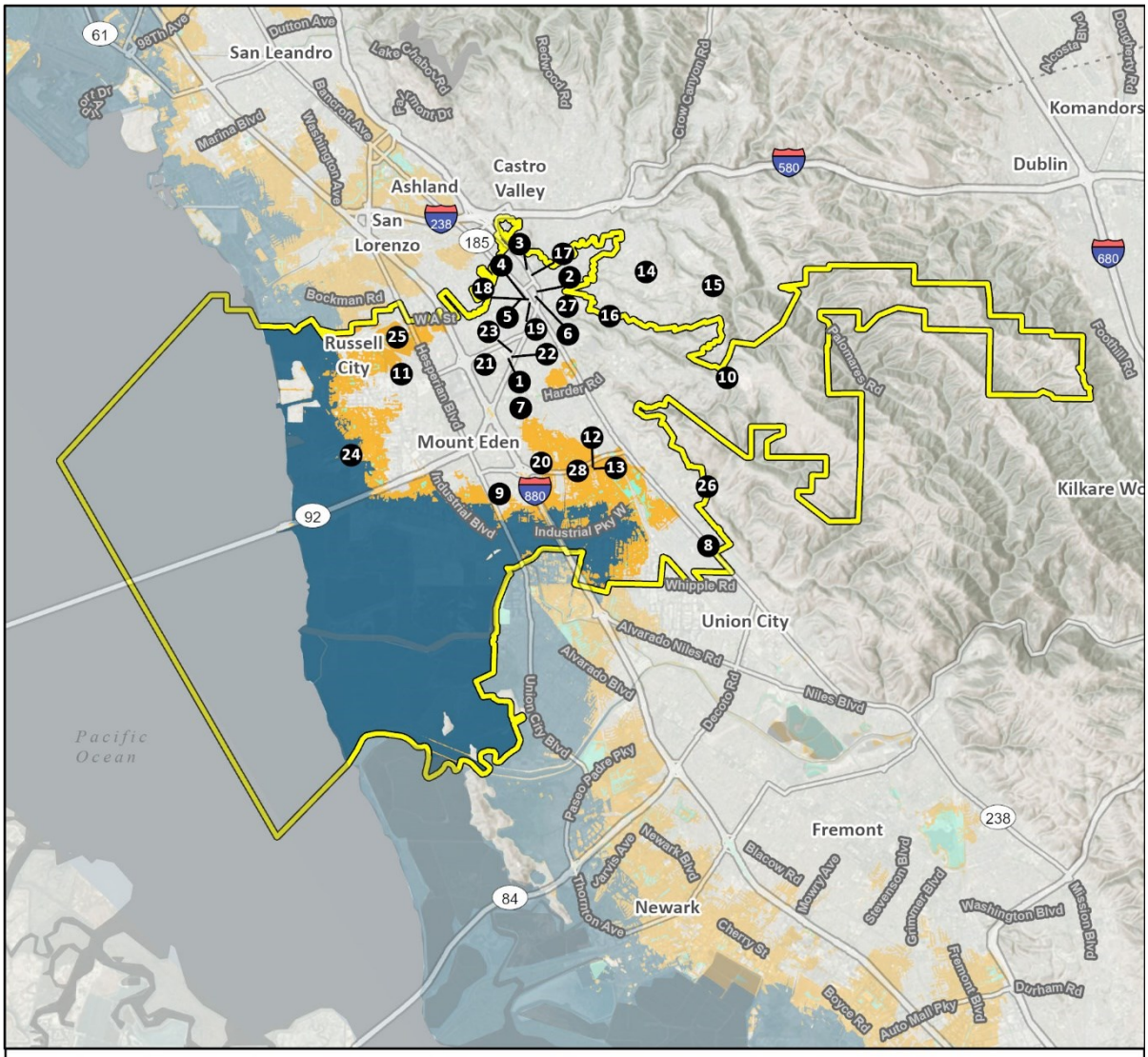
Adapting to Rising Tides, 2022 and Hayward Hazard Mitigation Plan, 2016.

Hayward_Maps
Fig X Groundwater Risk SLR Mid-Century in Hayward

Figure 15 End-Century Groundwater Risk in Hayward[17]



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Adapting to Rising Tides, 2022 and Hayward Hazard Mitigation Plan, 2016.

Hayward_Maps
Fig X Groundwater Risk SLR End-Century in Hayward

3 Sensitivity

While all people, facilities, and services in a community will experience climate change, some may be more affected than others. For example, individuals living with disabilities may be more at-risk to heat illness during an extreme heat event. Sensitivity to climate hazards can be influenced by several factors, including differences in individual health, age, and ability; institutional bias or exclusion from political and decision-making power; inequities in infrastructure and access to health care, economic opportunity, education, and other services; and inequities in environmental and living conditions. The following section identifies specific groups and types of built and natural assets that are sensitive to climate hazards and the specific underlying factors that are associated with their sensitivity. The points of sensitivity, or potentially affected community resources, are grouped under the following asset categories:


People


Community Structures & Infrastructure


Parks & Open Space


Services

3.1 People 

The following population groups may be disproportionally harmed by the impacts of climate change in Hayward. Population demographics are determined using the California Healthy Places Index (HPI) and United States Census Bureau unless otherwise noted.

- **Seniors.** Seniors can be more vulnerable to climate change if they have limited mobility, challenges, live independently, live on fixed-incomes, and/or experience chronic health conditions. As a result, they may be less equipped to deal with adverse environmental conditions and respond effectively to adverse events.[18] About 11 percent of the Hayward population is 65 and older.[19] Older residents can have mobility challenges, challenges living independently, are more likely to live on a fixed-income, and experience health conditions which make them more vulnerable to climate hazards and less equipped to respond effectively when an extreme weather event occurs.
- **Young Children.** Young children in Hayward can be more vulnerable to the impacts of heat waves, air pollution, and trauma resulting from climate change, due to physiological and developmental factors. Children under 5 are rapidly growing, their lungs are developing, they breathe at a higher rate than adults, and they spend more time outdoors. According to the California Healthy Places Index, Hayward's young children account for 7 percent of the overall population.

- **Low-Income Individuals/households.** Populations that are below median income levels for Hayward as well as renters and/or housing burdened households can experience difficulty with climate change impacts due to their limited resources. Approximately 46 percent of occupied housing units in the City are rented. Renters have less control over home improvements than homeowners and may not be able to adequately protect themselves from climate hazards by retrofitting their homes. In Hayward 23 percent of low-income renters pay over 50 percent of their income on housing costs, which is above the average for California.[16] This cost burden places financial stress on households, which makes it more difficult to effectively manage risk. For example, low-income individuals and renters may not have adequate resources to use air conditioning during extreme heat events. Additionally, low-income populations are shown to have lower access to health care and healthy foods, which puts them at greater health risks associated with extreme climate events.[18] Populations within Hayward living below poverty account for 8percent of the general population.[6]
- **Individuals with Chronic Health Conditions.** Chronic health conditions are broadly defined as conditions that last one year or more and require ongoing medical attention, or limit activities of daily living. Individuals with chronic health conditions can be at higher risk to the effects of climate change as well as general exposure to unhealthy environmental conditions. HPI scores indicate less than healthy conditions regarding the percentage of asthma ER admissions, with the city ranking higher in admissions than 94 percent of all California cities.[16] The City has a higher rate of heart attack ER admissions than 87 percent of the state. Additionally, HPI scores indicate less than healthy conditions regarding life expectancy higher than 60 percent of other California cities.
- **Pollution Burdened Individuals**. The average daily amount of particulate pollution (very small particles) from diesel sources (for July) in Hayward is 30.98 kg/day. Hayward has a higher average daily amount of diesel particulate pollution than 98 percent of other California cities, making it one of the most exposed areas for individuals with pre-existing respiratory health issues in the state. Since diesel particulate matter is small, it can reach deep into people's lungs, increasing the risk of cardiovascular and respiratory diseases, poor birth outcomes, and premature death.
- **Individuals Experiencing Homelessness.** Alameda County accounts for a substantial portion of California's homeless population. Based on information provided by EveryOne Counts within the 2022 Point in Time Count of unsheltered and sheltered individuals, Hayward has 114 sheltered and 267 unsheltered homeless individuals.[20]
- **Non-white Individuals.** Race and ethnicity can be important determinants of health impacts related to climate change as racial and ethnic minorities are more likely to live in high-risk areas, including areas with higher flooding risk and areas with fewer public transit routes.[21] In addition, non-white communities experience disproportionally high levels of vulnerability to climate change, including co-morbidities, lower income, poorer physical health, language barriers, less access to vehicle ownership, less access to air conditioning, among others.[18] The U.S. Census, reports that approximately 84 percent of residents in Hayward are of non-white populations.[22]
- **Non-English Speakers.** The U.S. Census considers linguistically isolated households as households where no person over the age of 14 speaks English proficiently.[23] People with limited English proficiency may not have access to emergency public health warnings in their native language, exacerbating climate impacts on this population.[18] Less than healthy conditions regarding linguistic isolation in Hayward, approximately 24 percent of residents are considered linguistically isolated in Hayward. [24]

3.2 Community Structures and Infrastructure

A population's vulnerability increases exponentially when critical infrastructure is not designed, operated, and/or maintained to function effectively or can be damaged by extreme weather conditions. Climate change is expected to amplify extreme weather as described in Climate Hazards. The following community structures within Hayward would be particularly sensitive to climate change:

- **Municipal Buildings.** City Hall, Hayward Animal Shelter, Fire Station #1-9, Two Libraries, Former Hayward Area Historical Society Building, Utilities Center, and the Water Pollution Control Facility.[5]
- **Educational Facilities**. The Hayward School District serves a population of around 21,000 students across 30 schools with 950 teachers.[4]
- **Hospitals:** Hayward's three hospitals are the Hayward Hospital, Kindred Hospital-SF Bay Area, and St. Rose.
- **Residential and Commercial Development.** Residential development accounts for 45% of the City's land area and commercial development accounts for 8%. There is a significant amount of industrial development within the city as well at around 19%. High densities of up to 100 units per acre can be found within the downtown area of Hayward. Commercial areas are largely retail, restaurants and services and some office space. The main sensitivity for land use is density complications in the event of an evacuation.
- **Roadways and Transportation Facilities.** Roadways and transportation facilities such as bridges and railways may be threatened by the impacts of climate change. The transportation system is sensitive to increased risk of storm flooding and coastal flooding brought on by variable precipitation, increased storm intensity, and sea level rise projected to occur in the decades ahead. These climate hazards could adversely impact the public transportation system, which is an important part of the movement of people throughout Hayward, especially for vulnerable populations that may not have access to a single passenger vehicle. Climate changes may result in increased maintenance and repair expenditures, disruptions of economic activity, interruptions of critical lifelines, and ultimately reductions in the overall quality of life for residents and businesses.

3.3 Parks and Open Spaces

Parks and open spaces serve a critical role in the health and well-being of the community. They are also vulnerable to climate changes in several ways. The following open spaces may be vulnerable to climate change impacts:

- **Parks.** Cannery Park, J.A. Lewis Park, Garin Regional Park, Mount Eden Park, East Avenue Park, Centennial Park, San Felipe Community Park, Tennyson Park, Sorensdale Park, Cherryland Park, Hayward Regional Shoreline, Weekes Community Center Park, Southgate Park, Gordon E. Oliver Eden Shores Park, Lakeridge Park, Greenwood Park, Carlos Bee Park, Birchfield Park, Kennedy Park, Don Castro Regional Recreation Area. Parks and recreation account for 2,959 acres of the Hayward planning area.[4]

- **Open Space.** The EBRPD and the Hayward Area Recreation & Park District owns and maintains approximately 2,400 acres of open space and 8,300 acres of Baylands supporting local habitat and biodiversity.[4]

3.4 Services

Descriptions of municipal services were drawn from the Hayward Local Hazard Mitigation Plan adopted in 2017, unless otherwise noted. The following services may be sensitive to the impacts of climate change:

- **Water Services:** Water is provided to the City by SFPUC. The water is originally sourced from the Hetch Hetchy reservoir and the Sierra Nevada Mountain range. SFPUC has undergone multiple system improvements to reduce vulnerability and increase system redundancy for drought projections.
- **Wastewater:** The City wastewater is provided by the Utilities and Environmental Services Department. Hayward owns and operates the Water Pollution Control Facility, a 300-acre structure with multiple wastewater treatment facilities. The building has been retrofitted since being originally constructed in 1952.
- **Power:** Power services in Hayward include electricity and natural gas delivered through above and below ground utility lines from PG&E. Public Safety Power Shutoffs (PSPSs) due to high-risk conditions for fire are likely to increase in the future as climate change increases temperatures, droughts, and vegetative drying. Though Hayward is not located in a VHFHSZ, the PSPSs are facilitated for regional safety as power lines travel across all of California. Additionally, power lines are at risk to storm damage should trees fall over.
- **Fire and Emergency Services:** Fire protection and emergency services in Hayward are available through the City's nine operational fire stations. The City of Hayward contracts with surrounding fire departments, including ACFD and Cal-Fire for fire services and fire prevention if mutual aid is required past the Hayward Fire Department (HFD) capacity. The wildland fire mitigation program is an ongoing effort due to yearly regrowth of vegetation and the nature of fire season. The increasing frequency, severity, and extent of wildfires could strain fire and emergency services beyond the extent of their capacity.

4 Impacts

The relationship between climate hazards and sensitivities is illustrated through potential impacts. As part of the Cal APG guidance within phase 2 the overlay of exposure and sensitivities clarifies impacted assets to a community. The impact of a climate hazard may extend beyond the initial direct impact. Infrastructure sectors rely on and support each other, including the workers that service the system. Rather than directly related to the climate hazard, these cascading risk factors may be directly compromised by the hazard and, in turn, lead to impacts on sensitive groups, facilities, and assets. For example, a senior may have air-conditioning to prevent heat stroke during an extreme heat event. But, if there is a power outage associate with that same extreme heat event, the senior's air conditioning may fail, and they may experience a heat related illness. Potential impacts and cascading risk factors associated with identified climate hazards for populations, community structures and infrastructure, parks and open space, and services are described below.

4.1 Temperature

Temperature-related climate hazards identified previously in Climate Hazards include:

- Extreme Heat and Warm Nights
- Drought
- Increased Wildfire Risk and Reduced Air Quality

The potential impacts and cascading risk factors across sensitivity types are summarized in Table 1 below.

Table 1 Potential Impacts and Cascading Risk Factors related to Temperature

Sensitivity Type	Sensitivity	Impact Description	Cascading Risk Factors
	**Seniors** Vulnerability associated with mobility limitations, challenges living independently, those on fixed-incomes, and those with chronic health conditions	**Heat:** Vulnerable populations can experience heat-related illnesses, such as heat stress and dehydration, both of which can be fatal. Non-white minority groups in the United States have reportedly higher morbidity and mortality rates associated with hot weather, which can be associated with more exposed occupations and housing.[25] **Wildfire**: There is risk of injury, death, or financial hardship if personal property is damaged.[26] Smoke conditions for vulnerable populations with chronic health conditions can impact health and safety. **Drought**: There is a risk of reduced access to water for low-income households unable to accommodate increased utility costs.	**Power outages** could expose seniors reliant on power to operate medical devices and maintain cool indoor conditions during a heat wave. Power outages could disrupt public transit, limiting access to health care facilities for seniors.
	Young Children Vulnerability associated with physical and mental development and time spent outdoors		**Power outages** could expose young children who attend school, afterschool, and daycare with one or more risk factors to health impacts from extreme heat. if the facilities are ill-equipped to maintain safe temperatures.
	Low Income Individual & Households Vulnerability associated with limited financial resources and access to services		**Power outages** could expose renters with one or more risk factors to health impacts from extreme heat if the units are ill-equipped to maintain safe temperatures.

Sensitivity Type	Sensitivity	Impact Description	Cascading Risk Factors
			Compromised public transit options could introduce additional health risks or reduced mobility options.
	Individuals with Chronic Health Conditions Vulnerability associated with mobility limitations, challenges living independently		**Power outages** could expose individuals with chronic health conditions with one or more risk factors to health impacts from extreme heat if facilities are ill-equipped to maintain safe temperatures. **Reduced air quality** associated with wildfires presents a significant risk to vulnerable populations.
	Individuals experiencing Homelessness Vulnerability associated with mobility limitations, limited financial resources and access to services, physical exposure to hazards.		**Power Outages** may cause shelters to be compromised or overpopulated. **Reduced air quality** associated with wildfires presents a significant risk to vulnerable populations.
	Non-white Individuals and Households Vulnerability associated with mobility limitations, limited financial resources and access to services		**Power outages** could expose non-white individuals and households with one or more risk factors to health impacts from extreme heat if the units are ill-equipped to maintain safe temperatures. **Compromised public transit** options could introduce additional health risks or reduced mobility options.
	Non-English Speakers Vulnerability associated with linguistic isolation, mobility limitations, limited financial resources and access to services		**Power outages** could expose non-English speakers with one or more risk factors to health impacts from extreme heat if the units are ill-equipped to maintain safe temperatures. **Linguistic Isolation** for members of ethnic minority language groups can be excluded from access to English-based media and health messages.[21] This can affect individuals' ability to follow weather reports and instructions from government organizations and service providers, including information aimed at increasing awareness and reducing the impact of extreme heat.[21]
	Municipal Buildings		

Sensitivity Type	Sensitivity	Impact Description	Cascading Risk Factors
	Vulnerability associated with structural preparedness and ability to provide services	**Wildfire:** There is a risk of structural damage in the event of a fire for any development within the WUI bordering the VHFHSZ to the east of city limits. **Heat**: There is a risk of structural damage from buckled rail ties. Impacts on the road network would include an increase in rutting and potholes and can place stress on bridge joints, increasing maintenance costs. Extreme heat can also limit construction activities.	**Power outages** could limit service provisions from community structures and infrastructure with one or more risk factors that are ill-equipped without backup systems.
	Educational Facilities Vulnerability associated with structural preparedness and ability to provide services		
	Hospitals Vulnerability associated with structural preparedness and ability to provide services		
	Residential, and Commercial Development Vulnerability associated with structural preparedness		
	Roadways and Transportation Facilities Vulnerability associated with structural preparedness and ability to provide services		
	**Parks** Vulnerability associated with direct exposure to hazards	**Heat:** The primary impacts are heat-related stressed or dead flora and fauna. Extreme heat can lead to ecosystem-scale shifts. Vegetation is more likely to experience heat stress and drying, species' habitat ranges may shift, some pests can proliferate more easily with warmer temperatures, and some plants and animals ill-suited to the new warmer conditions may suffer increased mortality rates.[12] illnesses, such as heat stress and dehydration, both of which can be fatal. **Wildfire**: There is risk of wildlife to move to more habitable areas across the WUI.[12] **Drought**: There is a risk of stressed vegetation in relation to increased drought conditions.	**Irrigation** supply can be affected by drought conditions, irrigated park facilities may receive less water, which may further contribute to stressed or dead vegetation. **Urban heat island** effects will increase with lack of and/or damaged parks and open spaces.
	Open Space Vulnerability associated with direct exposure to hazards		

Sensitivity Type	Sensitivity	Impact Description	Cascading Risk Factors
	**Water and Wastewater Services** Vulnerability associated with structural preparedness and ability to provide services	**Wildfire.** The primary impacts include damage to distribution infrastructure from wildfire in identified high-risk locations.[27]	**Service Reliability** may decline from increased demand from higher temperatures which place additional burden on water suppliers. **Power Outages** can also affect water distribution. **Wildfire** can be a cascading risk factor for water services as it requires adequate water reliability in a larger number of areas at higher frequencies.
	Power Vulnerability associated with structural preparedness, direct exposure to hazards, and ability to provide services	**Heat.** The primary impact is overload failures to the grid if it is overwhelmed by demand from increased temperature. **Wildfire.** Distribution infrastructure can also be damaged from wildfire in identified high-risk locations.[28]	**Services Reliability** can be a cascading risk factor from heat stress and wildfire damages affecting all reliant populations, infrastructure, and service lines. **Cooling** of buildings and subsequently people can be impacted because of power outages.
	Fire and Emergency Services Vulnerability associated with ability to provide services	The primary impacts include heat-related illnesses, such as heat stress and dehydration to emergency responders, both of which can be fatal. There is also risk of death from wildfire in identified high-risk locations.	**Service Strain** from increased frequency of wildfire and heat hazards can strain Fire and emergency services ability to provide community protection. **Power outages** can isolate populations making it more difficult for fire and emergency services to communicate with impacted populations and areas. **Structural Damage** to the water distribution system can compromise fire and emergency services.

4.2 Precipitation

Changes in precipitation can lead to the following climate hazards:

- Extreme precipitation
- Storm flooding
- Landslides

The potential impacts and cascading risk factors across sensitivities are summarized in Table 2.

Table 2 Potential Impacts and Cascading Risk Factors related to Precipitation

Sensitivity Type	Sensitivity	Impact Description	Cascading Impacts
	**Seniors** Vulnerability associated with mobility limitations, challenges living independently, those on fixed-incomes, and those with chronic health conditions	**Storm Flooding.** The primary impacts include injury, death, or financial hardship if personal property is damaged from inundation. **Extreme Precipitation.** There is a risk of injury or death from falling debris/storm damage. May face financial hardship in repairing property damage, reduced mobility following a storm, or impaired living conditions if property is damaged.[18] **Landslides.** There is risk of injury, death, or financial hardship if personal property is damaged.	**Power outages** could expose seniors with one or more risk factors to health impacts from flooding if facilities are ill-equipped to deal with inundation and structural damage. **Compromised public transit** options could introduce additional health risks or reduced mobility.
	Young Children Vulnerability associated with physical and mental development and time spent outdoors.		**Power outages** could expose young children with one or more risk factors to health impacts from flooding and landslides if facilities or schools are ill-equipped to deal with inundation and structural damage.
	Low Income Individual & Households Vulnerability associated with limited financial resources and access to services and ability to affect building maintenance.		**Power outages** could expose populations with one or more risk factors to impacts from flooding and landslides if property is ill-equipped to deal with inundation and structural damage. **Compromised public transit** options could introduce additional risks or reduced mobility.
	Individuals with Chronic Health Conditions Vulnerability associated with mobility limitations, challenges living independently		**Power outages** could expose individuals with chronic health conditions to impacts from flooding and landslides if property is ill-equipped to deal with inundation and structural damage. **Compromised public transit** options could introduce additional risks or reduced mobility.

	Individuals experiencing Homelessness Vulnerability associated with mobility limitations, limited financial resources and access to services, physical exposure to hazards.		**Shelters** may be compromised or overpopulated because of power outages or storm damage when homeless are seeking shelter during a heavy rain event. **Compromised public transit** options could introduce additional risks or reduced mobility.
	Non-white Individuals and Households Vulnerability associated with mobility limitations, limited financial resources and access to services		**Power outages** could expose populations with one or more risk factors to impacts from flooding and landslides if facilities or schools are ill-equipped to deal with inundation and structural damage. **Compromised public transit** options could introduce additional risks or reduced mobility.
	Non-English Speakers Vulnerability associated with linguistic isolation, mobility limitations, limited financial resources and access to services		**Power outages** could expose populations with one or more risk factors to impacts from flooding and landslides if facilities or schools are ill-equipped to deal with inundation and structural damage. **Compromised public transit** options could introduce additional risks or reduced mobility.
	**Municipal Buildings** Vulnerability associated with structural preparedness and ability to provide services **Educational Facilities** Vulnerability associated with structural preparedness and ability to provide services **Hospitals** Vulnerability associated with structural preparedness and ability to provide services **Residential, and Commercial Development**	**Flooding.** The primary impacts include structural damage from inundation for buildings ill equipped and within the bounds of storm flooded areas. **Extreme Precipitation.** There is risk of structural damage from increased extreme precipitation events including falling debris. There is also a risk of mold within structures that have been inundated. **Landslides.** There is risk of structural damage in areas of debris flow.	**Power outages** could limit service provisions from community structures and infrastructure with one or more risk factors that are ill-equipped without backup power systems. **Evacuation Preparedness.** Buildings not well equipped to deal with precipitation that are expected as evacuation locations may have reduced ability to provide critical and essential services to residents.

	Vulnerability associated with structural preparedness		
	Roadways and Transportation Facilities Vulnerability associated with structural preparedness and ability to provide services	**Flooding.** The primary impacts include structural damage from inundation for roadways and facilities ill equipped and within the bounds of storm flooded areas. **Extreme Precipitation.** There is risk of structural damage from increased extreme precipitation events including erosion, washouts, and sinkholes. **Landslides.** There is risk of structural damage in areas of debris flow.	**Service Dependencies** for emergency services, schools, hospitals, general transportation are all reliant on roadway reliability and may experience delays in service from roadway and transportation closures. **Economic Loss**. Locally there is the potential for local economic losses associated with loss of mobility.
	**Parks** Vulnerability associated with direct exposure to hazards **Open Space** Vulnerability associated with direct exposure to hazards	**Flooding.** The primary impacts include damage from inundation within the bounds of storm flooded areas. **Extreme Precipitation.** There is risk of damage from increased extreme precipitation events including erosion, washouts, and sinkholes. **Landslides.** There is risk of damage in areas of debris flow from.	**Accessibility** to parks and open spaces may be affected by erosion, landslides and storm damages which has been linked to declines in community health. **Habitat displacement** for flora and fauna may occur due to inhabitability of damaged parks and open spaces.
	**Water and Wastewater Services** Vulnerability associated with structural preparedness and ability to provide services	**Flooding.** The primary impacts include structural damage from inundation for delivery equipment ill equipped and within the bounds of storm flood prone areas. **Extreme Precipitation.** May disrupt or damage water supply infrastructure in addition to flooding and damage, transmission lines, wastewater treatment facilities, culverts, and canals are likely to be challenged, with associated service and business interruptions, releases of untreated wastewater, and structural damages **Landslides.** There is risk of structural damage in areas of debris flow from landslides/ mudflows that assist in water or wastewater delivery.	**Services Reliability** can be a cascading risk factor from flooding, precipitation, and landslides affecting all reliant populations, infrastructure, and service lines. Stormwater drainage systems may become overburdened by increases in runoff, particularly during highly productive storms, causing flooding and potentially damaging this infrastructure.[29]

Power Vulnerability associated with structural preparedness, direct exposure to hazards, and ability to provide services	**Flooding.** Impacts include electrical substations or natural gas transmission pipelines being damaged from flooding. **Extreme Precipitation.** There is a risk of above ground power line infrastructure damage from intense storms and extreme precipitation **Landslides.** Damages can occur in the form of above ground utility lines.	**Services Reliability** can be a cascading risk factor from flooding, precipitation, and landslides affecting all reliant populations, infrastructure, and service lines.
Fire and Emergency Services Vulnerability associated with ability to provide services	**Flooding.** The primary impacts include injury, death, or financial hardship if personal property is damaged from inundation. **Extreme Precipitation.** There is a risk of injury or death from falling debris/storm damage. May face financial hardship in repairing property damage, reduced mobility following a storm, or impaired living conditions if property is damaged.[18] **Landslides.** There is risk of injury, death, or financial hardship if personal property is damaged.	**Service Strain** from increased frequency of increased precipitation hazards can strain emergency services ability to provide community protection. **Power outages** can isolate populations making it more difficult for fire and emergency services to communicate with impacted populations and areas. **Structural Damage** to the water distribution system can compromise fire and emergency service abilities.

4.3 Sea Level Rise

Bayshore Flooding is the climate hazard associated with sea level rise identified in Climate Hazards. The potential impacts and cascading risk factors across sensitivities are summarized in Table 3.

Table 3 Potential Impacts and Cascading Risk Factors related to Bayshore Flooding

Sensitivity Type	Sensitivity	Impact Description	Cascading Impacts
	**Seniors** Vulnerability associated with mobility limitations, challenges living independently, those on fixed-incomes, and those with chronic health conditions	**Flooding.** The primary impacts include injury, death, or financial hardship if personal property is damaged.	**Power outages** could expose seniors with one or more risk factors to health impacts from extreme heat if facilities are ill-equipped to maintain safe temperatures. **Compromised public transit** options could introduce additional health risks or reduced mobility.

Sensitivity Type	Sensitivity	Impact Description	Cascading Impacts
	Young Children Vulnerability associated with physical and mental development and time spent outdoors		**Power outages** could expose young children who attend school, afterschool, and daycare with one or more risk factors to impacts from flooding if the facilities are ill-equipped to handle storm surges and increased inundation of more areas.
	Low Income Individual & Households Vulnerability associated with limited financial resources and access to services		**Power outages** could expose low-income individuals and household that are ill-equipped to maintain safety during a storm surge inundation event. **Compromised public transit** options could introduce additional health risks or reduced mobility.
	Individuals with Chronic Health Conditions Vulnerability associated with mobility limitations, challenges living independently		**Power outages** could expose individuals with one or more risk factors to health impacts from flooding that are not prepared for inundation. **Compromised public transit** options could introduce additional health risks or reduced mobility.
	Individuals experiencing Homelessness Vulnerability associated with mobility limitations, limited financial resources and access to services, physical exposure to hazards		**Compromised public transit** options could introduce additional health risks or reduced mobility. **Shelters** may be compromised or overpopulated because of power outages.
	Non-white Individuals and Households Vulnerability associated with mobility limitations, limited financial resources and access to services	**Flooding.** Primary impacts include damages to personal property, loss of home/living space, and financial hardship. Non-White Households and Individuals are more likely to live in high-risk geographies such as those who would experience Bayshore flooding.[18]	**Power outages** could expose individuals with one or more risk factors to health impacts from flooding that are not prepared for inundation. **Compromised public transit** options could introduce additional

Sensitivity Type	Sensitivity	Impact Description	Cascading Impacts
			health risks or reduced mobility.
	Non-English Speakers Vulnerability associated with linguistic isolation, mobility limitations, limited financial resources and access to services	**Flooding.** Primary impacts include damages to personal property, loss of home/living space, and financial hardship. Linguistically Isolated communities may lack access to information to prepare, mitigate, and respond to coastal floods.	**Power outages** could expose individuals with one or more risk factors to health impacts from flooding that are not prepared for inundation. **Compromised public transit** options could introduce additional health risks or reduced mobility.
	**Municipal Buildings** Vulnerability associated with structural preparedness and ability to provide services	**Flooding.** The Southwest portion of Hayward is expected to be flooded by 2050 between the 92 and 880 Freeways including all service areas and potential satellite facilities.	**Power outages** could limit service provisions from community structures and infrastructure with one or more risk factors that are ill-equipped without backup power systems.
	Educational Facilities Vulnerability associated with structural preparedness and ability to provide services		
	Hospitals Vulnerability associated with structural preparedness and ability to provide services		
	Residential, and Commercial Development Vulnerability associated with structural preparedness		
	Roadways and Transportation Facilities Vulnerability associated with structural preparedness and ability to provide services	**Flooding.** General inundation of roadways to the western edge of the City such as Enterprise Ave and Huntwood Ave within the SLR and Bayshore flooding hazard zones is projected to occur by the year 2050.[13] Additional impacted infrastructure includes the Hayward San-Mateo Bridge.	**Service Reliability.** Decreased access to transportation services like BART could isolate whole populations and reduce the flow of critical good and services during the event of Bayshore flooding.

	**Parks** Vulnerability associated with direct exposure to hazards	**Flooding.** The entirety of the western open spaces and Baylands are expected to be inundated by the year 2050.[13]	**Accessibility** to parks and open spaces may be affected by inundation and damages which has been linked to declines in community health. **Habitat displacement** for flora and fauna may occur due to inhabitability of damaged parks and open spaces. **Community Health.** Inundation of most parks and open spaces decreases recreation and access to greenspace for the community which has associated with decrease general health.[33]
	Open Space Vulnerability associated with direct exposure to hazards		
	**Water and Wastewater Services** Vulnerability associated with structural preparedness and ability to provide services	**Flooding.** Hayward's Water Pollution Control Facility is expected to be inundated through SLR.[13]	**Services Reliability** can be a cascading risk factor from flooding affecting all reliant populations, infrastructure, and service lines.
	Power Vulnerability associated with structural preparedness, direct exposure to hazards, and ability to provide services	**Flooding.** Utility lines, substations, and other power infrastructure could be damaged by Bayshore flooding.	**Services Reliability** can be a cascading risk factor from flooding affecting all reliant populations, infrastructure, and service lines.
	Fire and Emergency Services Vulnerability associated with ability to provide services	**Flooding.** The primary impacts include structural damage from inundation for delivery equipment ill equipped and within the bounds of flood prone areas including Fire Station #4 which will be inundated by SLR and Bayshore Flooding by the year 2050.[13]	**Service Strain** from increased frequency of increased precipitation hazards can strain emergency services ability to provide community protection. **Power outages** can isolate populations making it more difficult for fire and emergency services to communicate with impacted populations and areas. **Structural Damage** to the water distribution system can compromise fire and emergency service abilities.

5 Adaptive Capacity

Adaptive capacity is the ability to adjust to the consequences of climate change. This section summarizes the ways in which the City currently manages for the negative impacts of climate change. Types of adaptive capacity include adjustments in behavior, resources, and technologies.[7]**Error! Bookmark not defined.** The City has already taken several steps to increase the community's adaptive capacity, which include encouraging water preservation and conservation, promoting renewable energy and energy conservation, and coordinating with regional emergency services across the county. The following section provides an overview of the City's existing capacity to adapt to climate change organized by county coordination and assistance, and city-specific capacity. The organization of this section is meant to inform the Hazards Element update by identifying policy gaps around adaptive capacity.

5.1 Regional and Local Coordination and Assistance

Coordination and assistance between governing bodies is foundational to a city's adaptive capacity. Though operating on a municipal scale, Hayward is part of a larger region adversely impacted by climate change.

Coordinating Entities

- **Alameda County Office of Emergency Services (OES)** is responsible for coordinating with County departments, municipalities, key stakeholders, and special districts to mitigate against, prepare for, respond to, and recover from all disasters. OES designs and conducts simulated disaster response exercises, evaluates emergency staff training, creates evacuation strategies, and maintains the County Emergency Operations Center (EOC) in a state of readiness. OES also educates the community on preparedness, facilitates stakeholder collaboration, and seeks additional funding through grants and strategic partnerships. OES manages the Alameda County Government's response to and recovery from a disaster and provides support to any city, town, or special district responding to and recovering from a disaster. These services are relevant for all climate related hazards.
- **The Alameda County Public Health Department** is responsible for an array of programs and services designed to protect the health and safety of County residents. Its programs and services include assessments of the health status of residents, disease prevention and control, community mobilization and outreach, policy development, education, and assurance of access to quality medical and health care services. Seated within its Division of Communicable Disease Control and Prevention, it has responsibilities for Public Health Emergency Preparedness, which includes responsibility for coordinating public health emergencies, including "extreme heat waves that can increase the risk of heat-related illnesses.
- **Alameda County Flood Control District** provides flood protection for Western Alameda County residents and businesses. The district plans, designs, constructs, and maintains flood control systems such as natural creeks, channels, levees, pump stations, dams, and reservoirs. The district also cares for the natural environment through public outreach and enforcement of pollution control regulations governing its waterways.
- **Hayward Department of Public Works** is the staff lead for many of the City's mitigation strategies including the green infrastructure plan development, climate action and adaptation

plan, and energy assurance plan. Hayward Department of Public Works also owns and maintains 175 miles of the City's drainage system.

- **Hayward Area Shoreline Planning Agency (HASPA)** is a joint powers authority responsible for coordinating agency planning activities, implementing policies for the improvement of the Hayward Shoreline, and addressing impacts related to Sea Level Rise. The organization prepared the Hayward Regional Shoreline Adaptation Master Plan, which includes multi-benefit strategies to address sea level rise.
- **San Francisco Public Utilities Commission (SFPUC)** is the water provider for Hayward and operates within the greater San Francisco Bay Area Region providing water delivery and infrastructure services. SFPUC is accounted for within the San Francisco Local Hazard Mitigation Plan regarding hazard planning around service provision.
- **Hayward Fire Department (HFD)** is responsible for Hayward's fire mitigation both in fuel reduction and firefighting during the event of a fire. With none of the city as a VHFHSZ, there have been few instances of need for mutual aid in Hayward specific disasters.
- The **Diablo Firesafe Council** operates in Alameda and Contra Costa Counties and serves as a catalyst for bringing together people, agencies, and the means to substantially reduce the impact of wildland fire on communities. The organization prepared the Alameda County Community Wildfire Protection Plan, which includes wildfire mitigation strategies that can support the City.
- **Bay Climate Adaptation Network (BayCAN)**: BayCAN is a collaborative network of local government staff and partnering organizations working to help the Bay Area respond effectively and equitably to the impacts of climate change on human health, infrastructure, and natural systems. Hayward is involved within this network through the Hayward Area Shoreline Planning Agency.
- **Additional Coordination:** Hayward is also part of the Association of Bay Area Governments (ABAG) which operates as a planning agency and service provider for local governments in the San Francisco Bay Area region. Part of the ABAG coordination involves participations in the regional lifelines council

The coordinating entities contribute towards the following planning documents and agreements found in Table 4 below:

Table 4 Coordinated Planning Documents & Agreements

Document	Most Recent Revision	Climate Change Impact	Update Cycle	Responsible Entity
Alameda County Safety Element Update	2013	Multi-hazard	5-8 years	Alameda County Planning Department
City of Hayward Local Hazard Mitigation Plan	2016 (update underway)	Multi-hazard	5 Years	Hayward Planning Department
Alameda County Local Hazard Mitigation Plan (2016-2021)	2016 (update underway)	Multi-hazard	5 Years	Alameda County Alameda County Fire Department Alameda County Flood Control and Water Conservation District
Alameda County Community Wildfire Protection Plan	2015	Wildfire	N/A	Diablo Firesafe Council
City of Hayward Emergency Operations Plan (EOP) aka "Disaster Plan"	2021	Multi-hazard	Reviewed Annually	Hayward Emergency Management Director

Alameda County Emergency Operations Plan (EOP)	2012	Multi-hazard	N/A	Alameda County Sheriff's Office of Homeland Security and Emergency Services
Annex to 2010 ABAG Local Hazard Mitigation Plan	2010	Multi-hazard	5 Years	BCDC
Preliminary Study of the Effect of Sea Level Rise on the Resources of the Hayward Shoreline	2010	SLR	N/A	HASPA
Hayward Shoreline Resilience Study	2015	SLR	N/A	BCDC
Hayward Shoreline Adaptation Master Plan	2021	SLR	N/A	HASPA
Alameda County Capital Improvement Program	2021	Multi-hazard	5 years	County Administrator
SFPUC Urban Water Management Plan	2021	Drought	5 years	SFPUC
Hayward Adopted Capital Improvement Plan (CIP)	2021	Multi-hazard	Reviewed Annually	Hayward Public Works
Hillside Design and Urban/Wildlife Interface Guidelines	1993	Wildfire	N/A	Hayward Planning Department
City of Hayward Climate Action Plan	2014 (update underway)	Multi-hazard	N/A	Hayward Public Works Department – Environmental Services Division
California State Hazard Mitigation Plan (SHMP)	2018	Multi-hazard	N/A	Cal OES
Alameda County Water Shortage Contingency Plan	2021	Drought	N/A	Alameda County Water District
Hayward General Plan	2014	Multi-hazard	N/A	Hayward Planning Department

Temperature Specific Coordination/Planning

The Alameda County Public Health Department is responsible preparing and responding to extreme heat events. The Division of Communicable Disease Control and Prevention provides County residents guidance on how to prepare for and deal with heat emergencies.

Wildfire Specific Coordination/Planning

The Alameda County Community Wildfire Protection Plan includes Hayward in its planning efforts and details the regional risks and how the collaborative efforts of fire departments will mitigate wildfire risk. Hayward lists participation in the ABAG regional Lifelines Council as another way to coordinate wildfire mitigation support.

Variable Precipitation and Drought Specific Coordination/Planning

The City coordinates with SFPUC for drought contingency planning through the San Francisco LHMP which details the water redundancies currently in place for anticipated increases in droughts. Hayward coordinates with the county as well as through the Alameda County Water Shortage Contingency Plan.

The Alameda County Flood Control District is the lead coordinating entity for the City for planning and managing regional stormwater infrastructure and systems. The District prepares Master Plans, implements environmental restoration projects. It also inspects and maintains more than 500 miles of conduit, channels, and natural creeks in western Alameda County. It clears excess vegetation, sediment, and debris from watercourses. It also maintains 22 pump stations and 3,700 County tide gates. Notably, the Bockman and Estudillo Canals along with 12 separate creeks run through various parts of the City. The 2014 Hayward Climate Action Plan calls for water conservation and recycling as a part of a larger regional effort along with green stormwater infrastructure and rainwater harvesting.[30]

Sea Level Rise Specific Coordination/Planning

The City is a member of the Hayward Area Shoreline Planning Agency (HASPA),Bay Adapt Working Group and Bay Area Climate Adaptation Network.. Through these efforts, it is engaged in regional SLR adaptation planning and coordination. The HASPA Shoreline Adaptation Master Plan developed various multi-benefit strategies for the shoreline, its existing infrastructure and surrounding natural habitat related to SLR planning. HASPA is currently working towards implementation of projects identified within the Master Plan.

5.2 City-Specific Capacity

Increased Temperature Preparedness and Response

Cities in Alameda County generally rely on the County Public Health Department to direct responses to public health emergencies, including excessive heat emergencies. As such, it does not currently have City-specific plans, protocols, or trainings to address or respond to increased temperature and increased risk of extreme heat beyond those coordinated by the County. The Alameda County OES issues Heat Alerts through AC Alert, the County's emergency alerts system with accessibility measures taken to address linguistically isolated individuals. Hayward's Climate Action Plan includes multiple strategies to reduce urban heat island effect and improve the urban forest through establishing a healthy and resilient tree canopy throughout the City.

Wildfire Preparedness and Response

Increasing wildfire risk for the region has yielded several city-specific preparedness efforts. The Hillside design plan guides most changes in wildfire management but has not been updated since 1993. The Hayward LHMP lists several actions for wildfire preparedness including emergency response trainings, community education, power redundancies, creation of a disaster recovery plan, equipment acquisition, and assurance of defensible space.

Extreme Precipitation and Drought Preparedness and Response

The City's LHMP details a drought related recycled water project as a high priority measure for Hayward. Alameda County also has water shortage preparedness measures, but these are not necessarily Hayward-specific. Most drought preparedness is organized from a broader regional level. The City primarily relies upon SFPUC for drought contingency planning in compliance with State requirements.

There are several mitigation strategies in the City's LHMP that relate to extreme precipitation mostly concerning general community education` and community emergency response trainings.

There are few inland flooding or extreme precipitation-specific actions for the City. There is a recycled water measure through the LHMP concerning Drought adaptation.

Sea Level Rise Preparedness and Response

The City, as a member of HAPSA, has conducted two studies about sea level rise impacts and shoreline resiliency to determine the best direction and actions for SLR adaptation planning. Building upon these studies, HASPA developed the Hayward Regional Shoreline Adaptation Master Plan which includes various multi-benefit strategies for the shoreline, its existing infrastructure and surrounding natural habitat to adapt to SLR. The Master Plan has specific projects to protect the Hayward Water Pollution Control Facility, industrial areas and shoreline infrastructure for rising sea levels. This project was identified in the Hayward LHMP alongside the expansion of HASPA . The City is currently coordinating with other agencies to expand HASPA's membership as a way to support the implementation of the Master Plan and increase the region's ability to adapt to SLR.

6 Vulnerability Analysis

Vulnerability is based on the potential for impacts combine with the capacity to adapt. This section provides a qualitative analysis of vulnerability for identified assets in Hayward. The discussion will be used to inform policy and program selection to prioritize policies and programs that provide the greatest resiliency benefits.

6.1 People

Hayward's population is vulnerable to potential health and safety risks mainly from the direct impacts of extreme heat. Risks derived from wildfire, extreme precipitation and Bayshore flooding are possible, but less likely in the near term.

The growing intensity and occurrence of **extreme heat events** is the main climate impact of concern for the Hayward population through the end of the century with impacts already being felt. The City has limited cooling centers to address the need extreme heat poses. Seniors, young children, individuals with chronic health conditions are particularly vulnerable to heat-related illnesses. **Increasing average temperatures** may place an increasing financial strain on people in Hayward. Weatherization and air conditioning investments can be expected to become more desirable as temperatures increase in the coming decades. This may also lead to increased energy costs, which may strain the budgets of seniors on a fixed income, those who are housing burdened, and those who are generally financially disadvantaged. An additional contributing factor to vulnerability is the slightly lower-than-average tree canopy cover within the City which can provide natural cooling for the community along active transportation corridors and throughout the urbanized parts of the city outside of PG&E managed fuel reduction efforts in the Hayward hills.[16]

Presently, **wildfire** risk (per CAL FIRE hazard maps) to the City is generally limited to areas associated with the East Bay Regional Parks (adjacent to the eastern City limits. Climate change is anticipated to increase the risk of wildfire in eastern Hayward. If wildfires continue to become more intense, the potential area at-risk could shift westward into the City limits. The Hayward Fire Department has primary responsibility for wildfire mitigation within the City limits. There is a county-level community wildfire protection plan last updated in 2015 but no city-level community protection plan.

Opportunities exist to include more robust community-specific planning in future community wildfire protection updates including actions for adapting the community to increased wildfire smoke. The City could develop its own community wildfire protection plan (or be an active participant in an updated County effort. Despite not having a VHFHSZ within the City, the WUI with fire zones across the eastern border of the city is very prevalent and includes residential neighborhoods. Wildfire-caused smoke is also likely to become an increasingly prevalent hazard. With recent significant increase in acres of land exposed to wildfire per the Hayward LHMP, plans like the Hillside Design and Urban/Wildlife Interface Guidelines last updated in 1993 could use an update. It may also be beneficial to accelerate additional types of wildfire prevention programming for residential neighborhoods to the East, building on existing pilot programs.

Smoke-related air quality emergencies are secondary impacts of increases in regional wildfire. This type of impact would be handled by the County Department of Public Health and Emergency Alerts issued by County OES. At-risk groups with chronic health conditions, young children, and seniors

may be especially vulnerable to these events. Those who are financially disadvantaged may not be able to protect their living spaces to smoke. There is minimal existing infrastructure for mitigating smoke impacts for vulnerable populations and adapting response efforts to minimize negative health outcomes.

Sea Level Rise and Bayshore Flooding are likely to affect the most western areas of Hayward by the year 2050. Planning efforts surrounding theses hazards need to account for financial burdens and the displacement of people. Homeowners in the Glen Eden, Eden Shores and communities neighboring the Hayward Regional Shoreline are at increased risk for financial burdens associated with the damage or loss of property. Budgets will be even more strained for seniors on fixed incomes, homeowners who are housing burdened and homeowners who are financially disadvantaged. These risks and impacts also apply to business owners in this hazard zone

Cascading impacts from climate hazards for the populations of Hayward occur mainly in the form of power outages, compromised public transit, and reduced air quality. All of these impacts can further the isolation of vulnerable populations and/or exacerbate existing vulnerabilities. The loss of critical services in association with a climate hazard presents a cascading risk factor that may amplify the vulnerability of people to identified climate hazards. The power grid is of particular importance during heat emergencies as people will depend on electric powered air-conditioning or fans to cool themselves. The power grid will be strained from increasing demand during extreme heat events, which would increase the likelihood of outages. It may also increase the risk that a failure triggers a wildfire. Water supply reliability and communications are also critical, particularly for wildfire response.

6.2 Community Structures & Infrastructure

Damaged infrastructure can lead to a loss of electricity, sanitation services, food, clean water, health care, communication services and transportation which poses health risks for the Hayward community. To help reduce adverse effects on vulnerable populations and increase Hayward's ability to adapt, adaptation strategies and policies must be identified to ensure a high standard of condition and performance for all infrastructure systems. Adaptation strategies and policies should focus on overall disaster mitigation and preparedness. Hayward community structures and infrastructure are exposed to damages associated with **extreme precipitation, sea level rise** and **increased temperatures**. **Wildfires** are less likely to directly impact structures and infrastructure.

The greatest potential risk to community structures and infrastructure in Hayward is from **increased precipitation**. The numerous creeks that run through Hayward present inland flooding vulnerabilities during extreme precipitation events potentially flooding structures and roadways limiting access for the community. Damages from storms via falling debris such as downed trees or erosion, washouts, sinkholes, and landslides can all adversely impact community structures and infrastructures. The Flood Control District plays a key role in the city's adaptive measures. Community structures and infrastructure are set up well to handle increased precipitation.

Inundation through **Bayshore flooding poses few direct threats to community structures and infrastructure.** Like precipitation hazards, SLR limits mobility and accessibility of the community. Most impacts from SLR and Bayshore flooding occur when community structures become strained as a secondary impact due to displacement of people associated with this hazard. Community plans and Resilience hubs were not identified to respond to this anticipated need in increased capacity. An added secondary impact related to infrastructure would be storm drain damage from SLR. As the

sea levels rise, storm drain's capacity is reduced as the drains become access points for Bay water to inundate roads and the community.

Community structures and infrastructure are exposed to **increased temperatures** more generally with **extreme heat** impacting the community in secondary ways. Power outages may inhibit the ability for community structures and infrastructure to remain operational. The ACDPH has an extreme heat plan to incorporate extreme heat planning for community structures. The Hayward CAP includes measures to improve the cooling infrastructure for the City through tree canopy development.

Compromised transportation and service provision as a cascading risk factor of these hazards can have adverse impacts afflicting vulnerable populations of low income, seniors, individuals experiencing homelessness, non-English speakers, and young children. All these populations have a higher likelihood for infrastructure and community structure dependencies that can be limited by the hazards associated with climate change. Over time there will be service enhancement opportunities through community structures and infrastructure retrofits and weatherization of buildings which may place financial strain on the City. The reliability of community structures for any hazard plan involving evacuation as well as adequate resilience considerations of public infrastructure for mobility and functionality reliability are the most susceptible aspects of community structures and infrastructure to climate change.

6.3 Parks & Open Space

Variations in precipitation can stress vegetation, increased temperatures and drought may lead to vegetation drying out due to increased evapotranspiration, and soil moisture reductions, and prolonged drought may increase vegetation mortality. Increased intensity of storms can result in increased risk of temporary flooding, soil saturation, and slope instability. Parks and open space also serve a critical role in the City's adaptive capacity to climate change.

Primary impacts of **increased temperature** leading to **drought** and **extreme** heat can cause dead/heat stressed vegetation within Hayward's parks and open spaces. These hazards may create a secondary impact of greater needs around maintenance and irrigation to ensure the useability of the parks. This process would create an increased investment for irrigation demands, and maintenance.

Bayshore flooding will inundate Gordon E. Oliver, Palma Ceia, Southgate, Mount Eden and Greenwood Park by 2050. Hayward coordinates with the Hayward Area Shoreline Planning Agency (HASPA), Bay Adapt Working Group and Bay Area Climate Adaptation Network to coordinate SLR planning efforts. Implementation of the Hayward Shoreline Adaptation Master Plan will lead to the adaptation and protection of parks, open space and recreational resources from rising sea levels.

Increased precipitation can also lead to damages of community parks .,with higher likelihood of erosion, inland flooding, and general vegetative stress as well as downed trees. This hazard further compounds secondary impacts of access reductions for the Hayward community.

The EBRPD and HARD-managed parks and open spaces are not located within **wildfire** VHFHSZs. As discussed earlier, the KBDI shows how wildfire conducive conditions increase through the end of the century by compounding with **drought** and **increased temperatures** potentially changing the classification of the City's parks and open spaces to VHFHSZs which would require more specific planning for the City. Currently the Alameda County Community Wildfire Protection Plan is what Hayward follows for wildfire mitigation guidance along with City-specific coordination through the Hayward Fire Department. Existing activities managed by the EBRPD include the fuel reduction

efforts conducted seasonally to mitigate wildfires.[31] Efforts through HARD include acknowledgement of the role parks and open space play in mitigating the effects of extreme heat.[32]

The projected hazards to affect Hayward parks and open spaces create cascading risk factors around general community health declines especially for already vulnerable populations who may depend on the parks as a buffering mechanism.[33] Secondary impacts of greater needed investments caused by inundation from **Bayshore flooding,** dead vegetation from **increased temperatures**, or general damages from **intense precipitation** creates a clear need for specific adaptive planning measures around the Hayward parks and open spaces which exist only in the broad sense with the City's LHMP.

6.4 Services

The services within Hayward including wastewater, waste, power, water and emergency services are all limited by the impacts of climate change with respect to their operational capacity in the face of hazards. Most service complications arise due to water and power unreliability from **intense precipitation, wildfire, and flooding.** Emergency service personnel can also suffer from **extreme heat**-related illnesses, such as heat stress and dehydration, both of which can be fatal.

Wildfire conditions of the greater region can also impact service reliability for Hayward. While wildfires will have minimal direct impacts for the City, generally unhealthy air quality associated with regional wildfires can create secondary impacts of increased need for both emergency services as well as power and water to cope with this hazard. Additionally, regional wildfires can complicate emergency service distribution through power safety shutoffs limiting communications and creating further vulnerabilities for isolated populations. The City relies on HFD, the Alameda Community Wildfire Protection Plan and the LHMP for service measures relating to wildfire. The gap in service is smoke and air quality related.

Increased precipitation leading to greater inland flooding, storm debris and damage of power lines or stormwater drainage capacity are the main impacts of concern. Secondary impacts include further concerns of water and power reliability during intense storms as well as isolation of populations within hazard affected areas who may not be able to access emergency services due to the broad implications of increased precipitation. has many of the same reliability vulnerabilities as increased temperature except associated with storm debris, flooding and more closely aligned with power reliability and emergency service accessibility.

Stormwater management along with **SLR** and **Bayshore flooding** may be a point of vulnerability for the city without continued measures put in place to increase resilience and capacity of this service. **SLR** and **Bayshore flooding** are tied to primary impacts around reduced power and water service because of damages to power and water lines from flooding. **SLR** secondary impacts are like other hazards with population isolation because of communication power dependencies are general accessibility reductions from flooding. Additionally, Fire Station #4 and the Water Pollution Control Facility are both located within the **Bayshore flooding** hazard zone. Planning for the protection of the Water Pollution Control Facility is explicitly identified in the Hayward Regional Shoreline Adaptation Master Plan while planning efforts for other facility have been more general.

Cascading risk factors for Hayward services encompasses mainly the intersectionality between hazards and service provision. All hazards outlined within the City present an obstacle in reliability of emergency services as we well as power and water. These risks cascade into the sensitivities of vulnerable populations by either isolating them or having such a large service strain that the community is inadequately prepared for the needed capacity in the face of climate change.

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Technical Memorandum

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Project# 26593

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RE: City of Hayward Evacuation Analysis – Methodology, Results, and Considerations

INTRODUCTION

This memorandum presents the evacuation analysis methodology, results, and considerations for the City of Hayward (City) as part of their ongoing General Plan Safety Element update. Kittelson & Associates, Inc. (Kittelson) modeled five (5) evacuation scenarios for the City to estimate roadway capacity constraints during evacuations. Specifically, the analysis helps identify locations with a greater potential for evacuation-related traffic congestion. This evaluation is consistent with requirements outlined in Assembly Bill (AB) 747[1] and Senate Bill (SB) 99[2]. These laws require agencies to evaluate the resiliency of their transportation system, the capacity of evacuation routes, and identify key routes for community areas with only one access point. The legislative requirements are briefly summarized in the following subsection.

The document is organized into four sections:

1. Roadway network baseline conditions;
2. Evacuation scenarios methodology and evaluation;
3. Evacuation scenario findings, including potential evacuation congestion; and,
4. Evacuation planning considerations and recommendations.

Legislative Requirements

Recent California legislation, including AB 747 and SB 99, has been passed requiring all local agencies to review accessibility and evacuation routes when specific elements within the General Plan or other emergency planning documents are completed or updated by a local agency.

- **Senate Bill 99** requires review and update of Safety Element to include information to identify residential developments in hazard areas that do not have at least two emergency evacuation routes. This is intended to assist the city in identifying opportunities to improve the connectivity and resiliency of the transportation system.
- **Assembly Bill 747** requires that the Safety Element be reviewed and updated to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. This is a requirement for all Safety Elements or updates to Hazard Mitigation Plans completed after January 2022.

[1] https://openstates.org/ca/bills/20192020/AB747/
[2] https://openstates.org/ca/bills/20192020/SB99/

ROADWAY NETWORK & BASELINE CONDITIONS

The City of Hayward is in the San Francisco East Bay Area, bounded by San Lorenzo to the north and Union City to the south. Communities and businesses are oriented along interstates and several state highway facilities. Evacuation trips from Hayward are most likely to use the least congested route to Interstate-880 (I-880), or one of the other state routes (SR) – SR 238 and SR 92. There are also several secondary routes that run parallel to the interstate and state highways that are also likely to be used for evacuation purposes, depending on the evacuation area, including: Hesperian Boulevard, Jackson Street, Industrial Parkway, Harder Road, Winton Avenue, A Street, and Santa Clara Street.

The evacuation analysis utilizes the Alameda County Transportation Commission (CTC) Countywide Travel Demand Model (model). The current model was completed in 2019 and includes Plan Bay Area 2040 land use assumptions. The model represents all land uses in the County grouped into traffic analysis zones (TAZs) and includes a representative roadway network (generally all streets except for very local residential streets). Each road segment is coded with functional classification, number of lanes, uncongested speed, and an estimate of the typical hourly capacity. The model estimates vehicle trips generated by each land use, distributes the trips to a variety of likely destinations, and assigns each origin-destination pair to the best route. The model also assesses congestion and iteratively diverts traffic to alternative routes until congestion is balanced between all available routes. For this analysis, Kittelson considered the land use associated with the future 2040 year plus the Housing Element scenario (this scenario includes land use assumptions from Plan Bay Area 2040, the Hayward General Plan, and the addition of new housing and employment as part of the City's current (2022) Housing Element update.

Each evacuation scenario analysis compares results to the baseline 2040 year plus Housing Element weekday PM peak hour conditions to identify locations where evacuation traffic might be expected to result in substantial congestion. The baseline conditions model estimates indicate that congestion in 2040 will be present. Specifically, roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound I-238 (towards San Leandro)
- Southbound I-238 (towards Fremont)
- Eastbound SR - 92
- Eastbound W Jackson St (between I-880 and I-238)
- Northbound Hesparian Blvd (between W Winton Avenue and W A St)
- Northbound Whitman St (between Tennyson Rd and Alves St)

This congestion reflects regular commute congestion in the Bay Area. The secondary roadways noted above serve as parallel routes to freeways as well as east-west connections in the City. These congested roadways represent the usual commute traffic patterns and congestion, specifically in the City of Hayward and generally in the Bay Area. Figure 1 shows the conditions for the City of Hayward where the highest baseline 2040 PM peak hour volume to capacity conditions are estimated.

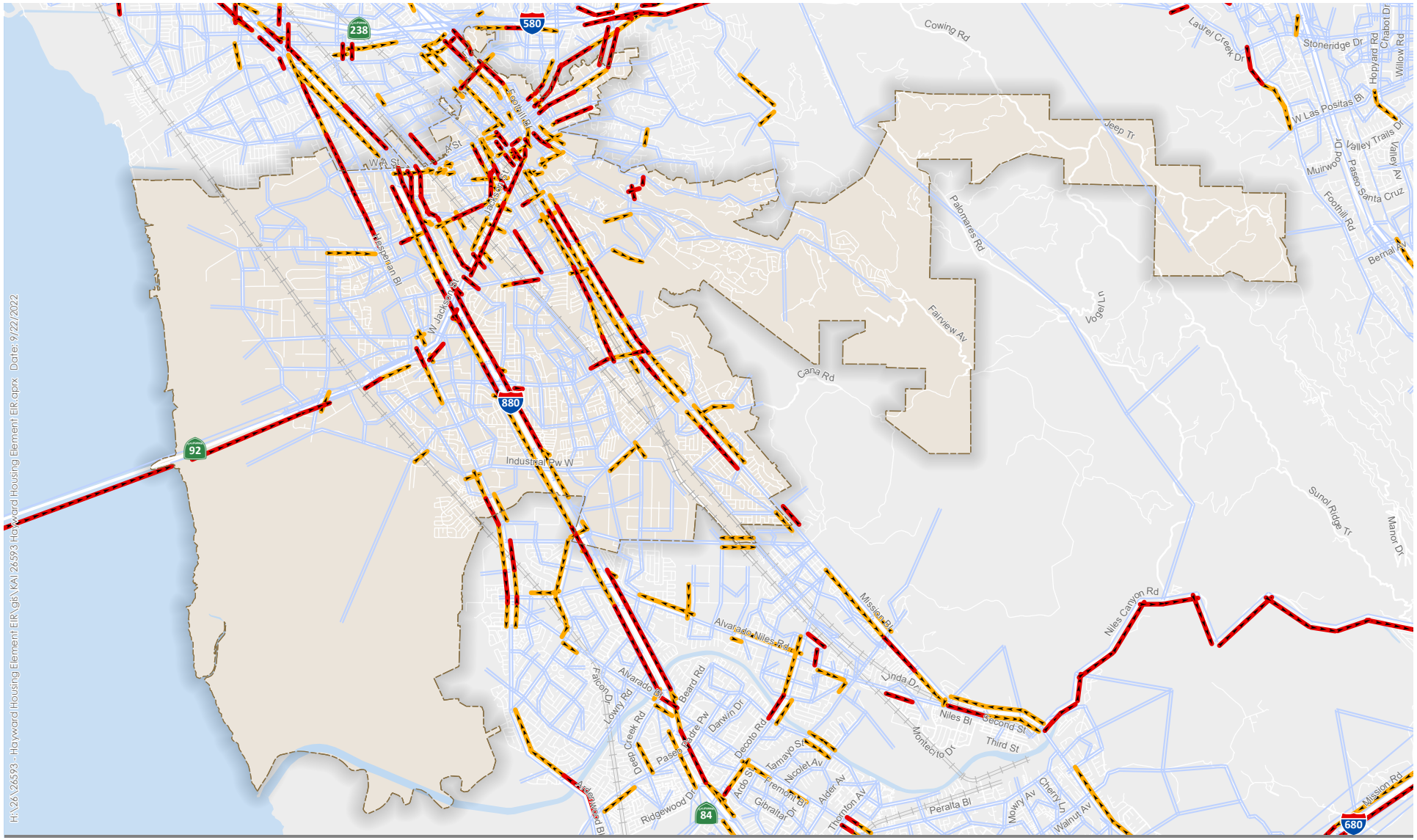

Figure 1

KITTELSON & ASSOCIATES

Baseline Conditions
Hayward, California

EVACUATION EVALUATION

Kittelson modeled evacuations for five emergency scenarios selected based on City staff and stakeholder input. These stakeholders included the City's emergency services specialist, Alameda County Fire Department, and Alameda County Sheriff's Office. Through these discussions and the most likely emergency scenarios expected to impact the City, the scenarios identified for evacuation analysis include:

- Wildfire
- Tsunami
- New Calaveras Dam Failure
- Downtown Pipeline Failure
- Eden/Southgate Pipeline Failure

Each of these scenarios and their analysis assumptions are described in the *Scenario Selection Technical Memorandum* (July 2022). The evaluation steps for the evacuation analysis are described below.

Step 1: Identifying Travel Patterns

Time Period: Kittelson modeled transportation activity for one time period – PM peak hour for all evacuation scenarios. All evacuation traffic was assumed to occur during this period involving the specified area within the city. For the PM peak hour, Kittelson reviewed the model's TAZs and assigned each TAZ a combination of Baseline travel and Evacuation travel (25% and 75%, respectively), based on its presence in the evacuation area.

Travel Type: Baseline travel represents normal travel patterns during the PM peak hour as included in the travel model. Evacuation travel represents estimated evacuation trips from each evacuating TAZ. Evacuation travel replaces the normal travel patterns (discussed in Step 2 below). Kittelson modeled travel for each evacuating TAZ shifting to a mix of baseline and evacuation travel (i.e., 25% and 75%, respectively).

Roadway Capacity: Kittelson modeled trip patterns using the default capacities for each roadway within and outside the city. The scenarios represent conditions without implementation of any evacuation strategies, such as contraflow lanes, which could increase roadway capacity in one direction versus the other.

Step 2: Estimating Evacuation Trips and Routing

Number of Evacuation Trips: In general, modeled trips are a function of several patterns, including the land uses in an area, the socio-economic characteristics of the population in the area (e.g., auto ownership, income, and household size), and the type and extent of transportation facilities in an area. Kittelson obtained citywide 2040 land use information by TAZ (including households, population, and employment information) from the Alameda CTC travel demand model as well as citywide auto ownership information by Census Tract from the American Community Survey (ACS) data website. Kittelson estimated total evacuation trips by calculating the trips generated at the household level and trips generated at the non-residential level. Kittelson assumed 75% of the residents and 75% of the employees evacuated for each modeled scenario. The number of occupied households and employees by TAZ for each of the evacuation scenarios are summarized in the following evacuation results section for each scenario.

Evacuation Destination and Route Choice: For each evacuation TAZ, Kittelson assigned likely evacuation destinations based on Red Cross emergency evacuation destinations in the area. These include schools, community colleges, public libraries, and community centers. Evacuation destinations were assigned based on the location and direction of the evacuation. Destinations are selected for each evacuation scenario with the goal of identifying evacuation travel patterns and congestion throughout the City based on expected destinations. The distribution of the destinations is not intended to reflect a precise distribution of the routes that would be taken during an evacuation. The trips were distributed from each evacuating TAZ to each destination TAZ, as appropriate. The evacuating TAZ locations and destination TAZs for each evacuation scenario is provided in the Evacuation Results section.

EVACUATION RESULTS

Evacuation capacity analysis was conducted for the PM peak hour for the five (5) different evacuation scenarios. The results represent the peak hour conditions for a potential evacuation when non-evacuation traffic would be at its highest levels. Each evacuation scenario's results are discussed below.

Wildfire Scenario

Under this scenario, the areas east of SR 238 were identified for evacuation evaluation. This scenario includes the Hayward Highland area including the Stonebrae Elementary School, California State University - East Bay, and neighborhoods east of SR 238 from Ward Creek in the north to Garin Park in the south, including the Mission-Garin neighborhood. The Hayward Highland area was identified for analysis because of its proximity to Garin Regional Park and Dry Creek Pioneer Regional Park which are Moderate CAL FIRE Fire Hazard Severity Zones. Table 1 shows the number of occupied households and employees as well as the total estimated evacuation trips for this scenario.

Table 1: Modeled Wildfire Evacuation Trips for PM Peak Hour

Evacuating TAZs	Households	Population	Employment	Evacuation Trips
697	766	2,171	278	1,037
698	609	1,703	60	734
699	768	1,950	62	920
701	504	1,348	154	751
703	538	1,439	376	1,130
704	852	2,329	170	1,608
705	1,776	6,326	92	3,193
706	0	0	950	529
710	587	1,714	28	711
711	1,797	4,901	38	2,150
712	1,587	4,810	120	1,945
713	294	983	36	422
768	695	2,174	490	1,402
769	400	1,252	217	771

SOURCE: ALAMEDA COUNTY TRAVEL DEMAND MODEL; KITTELSON & ASSOCIATES, INC., 2022

The model indicates substantial over-capacity conditions on several roadways in the city as shown in Figure 2. Specifically, the roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound SR-238 (towards San Leandro)
- Southbound SR-238 (towards Fremont)
- Eastbound SR - 92
- Eastbound W Jackson St (between Santa Clara St and SR-238)
- Westbound W Jackson St (between SR-238 and Amador St)
- Northbound Whitman St (between Harder Rd and Orchard Ave)
- Northbound Hesparian Blvd (between W Winton Avenue and W A St)
- Westbound Industrial Pkwy (between SR-238 and Hesparian Blvd)
- Eastbound W Harder Rd (between SR-238 and Jackson St)

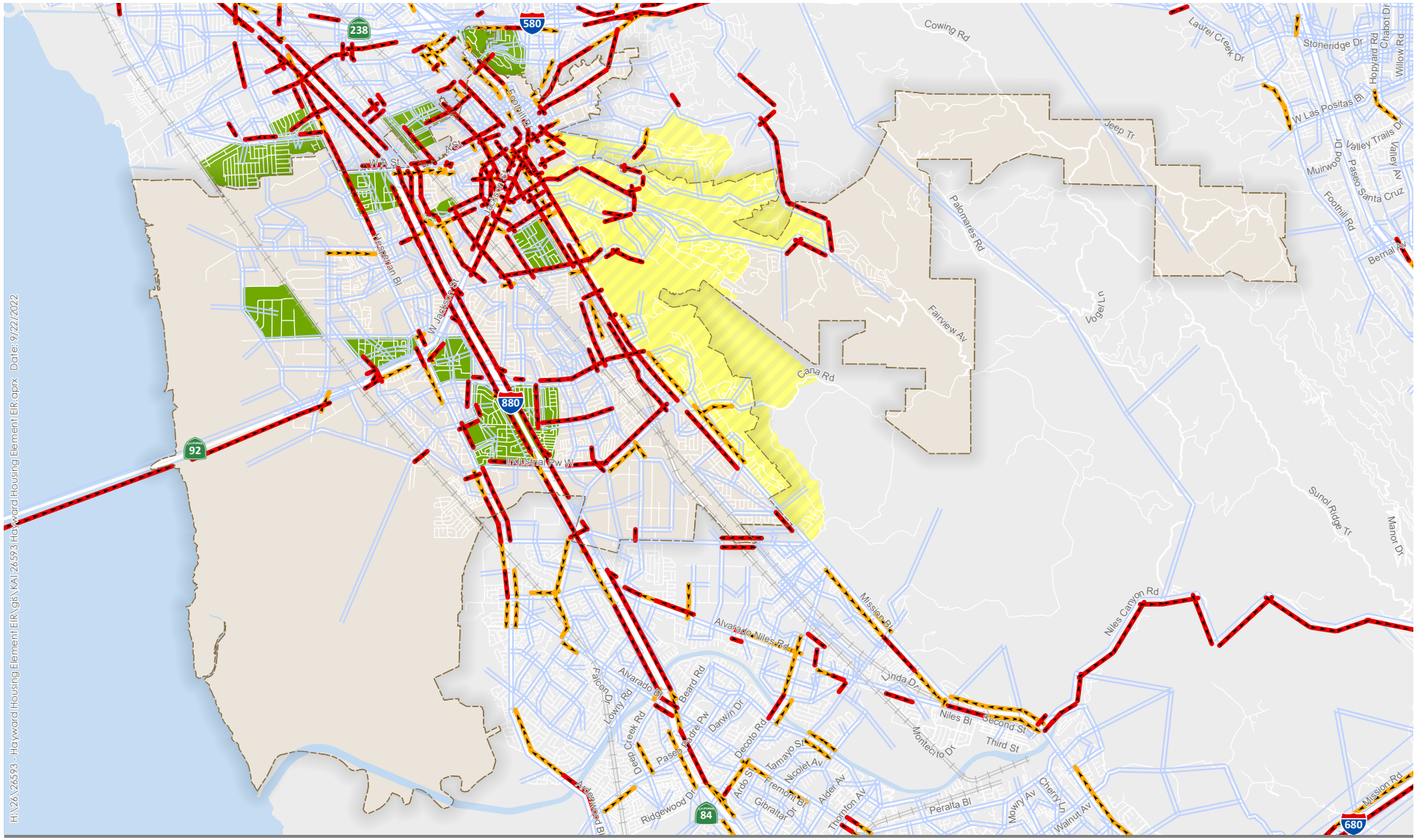

Figure 2

KITTELSON & ASSOCIATES

Wildfire Scenario
Hayward, California

Tsunami Scenario

Under this scenario, potential tsunami-related flooding is assumed to affect portions of the shoreline area (see Figure 3 for the potential affected area for this scenario). The Russell City neighborhood and Eden Landing Ecological Reserve & Eden Shores neighborhood west of the Union Pacific Rail Line were identified for a tsunami-based evacuation scenario evaluation based on the California Department of Conservation's tsunami inundation map[3] (affected area shown in Figure 3). Table 2 shows the number of occupied households and employees as well as the total estimated evacuation trips for the tsunami scenario.

Table 2: Modeled Tsunami Evacuation Trips for PM Peak Hour

Evacuating TAZs	Households	Population	Employment	Evacuation Trips
735	0	0	819	460
736	0	0	1,770	994
738	0	0	828	465
745	5	17	1,916	1,084
746	2	7	801	452
747	0	0	606	340
748	0	0	1,509	847
749	8	27	4,176	2,359
750	14	47	3,650	2,072
752	287	992	1,035	1,045

SOURCE: ALAMEDA COUNTY TRAVEL DEMAND MODEL; KITTELSON & ASSOCIATES, INC., 2022

The model indicates substantial over-capacity conditions on several roadways in the city as shown in Figure 3. Specifically, the roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound SR-238 (towards San Leandro)
- Southbound SR-238 (towards Fremont)
- Eastbound SR-92
- Eastbound W Jackson St (between I-880 and SR-238)
- Northbound Hesparian Blvd (between W Winton Avenue and W A St)
- Southbound Hesparian Blvd (between SR-92 and south city limits)
- Westbound Industrial Pkwy W (between Baumberg Ave and SR-238)
- Eastbound W Winton Ave (between Cobalt Blvd and Hesparian Blvd)
- Eastbound W Winton Ave (between Southland Dr and D St)
- Eastbound W Harder Rd (between W Jackson St and SR-238)
- Northbound Santa Clara St (between W Jackson St and north city limits)
- Southbound Whitman St (between Orchard Ave and Tennyson Rd)

[3] https://www.conservation.ca.gov/cgs/tsunami/maps/san-francisco, accessed August 2022.

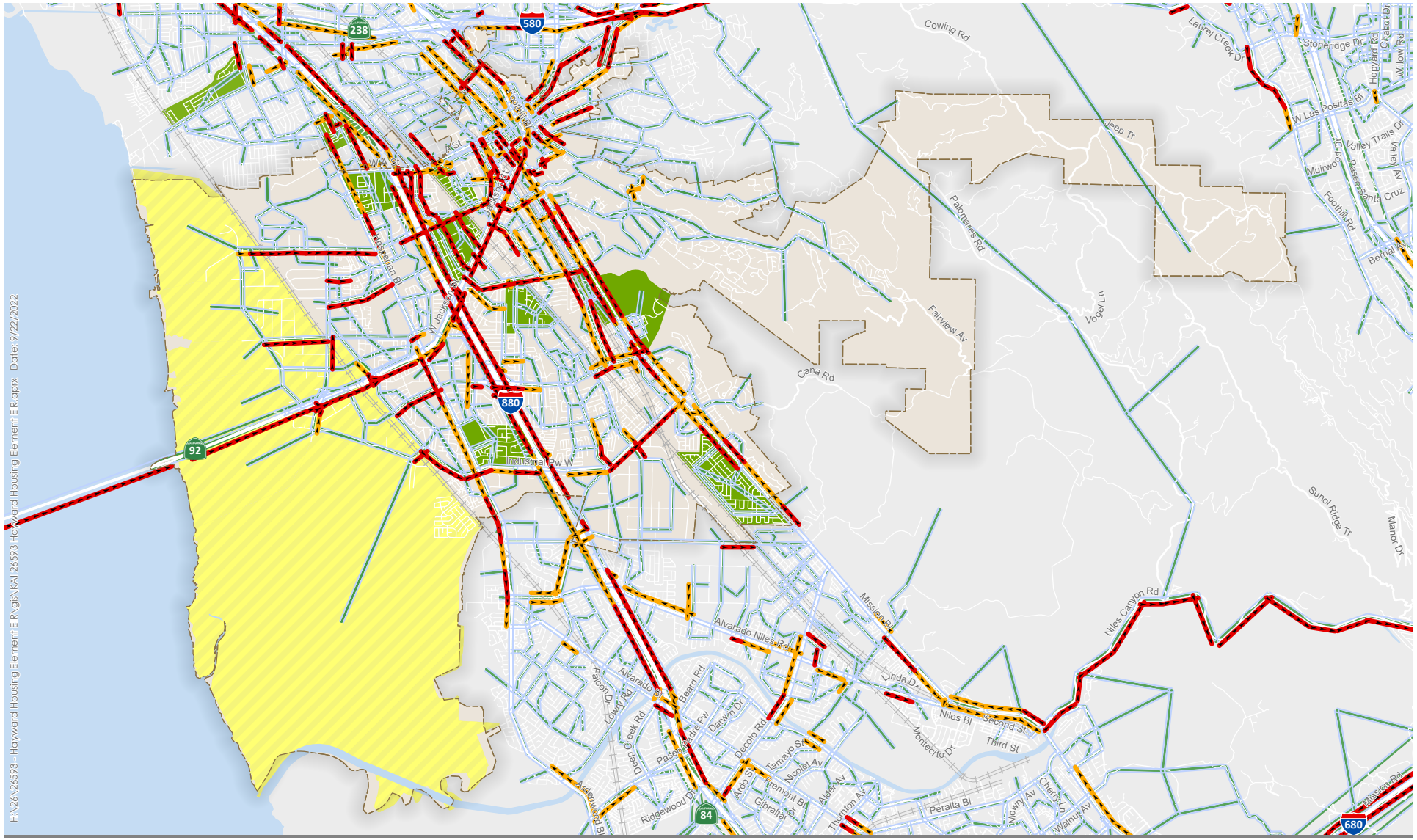

Figure 3

KITTELSON & ASSOCIATES

Tsunami
Hayward, California

Dam Failure Scenario

Under this scenario, the potential flooding from a failure of the New Calaveras Dam is assumed to affect portions of South Hayward (see Figure 4 for the potential evacuation area for this scenario). Evacuation is expected to be primarily directed north of the City. The industrial areas south of Industrial Parkway West including the Carpenter neighborhood, the Southeast corner of Glen Eden and the Stratford Village Park neighborhood south of Tennyson Alquire are the main inundation zones, which have been identified from State of California and Department of Water Resources' Division Safety of Dams (DSOD) dam breach inundation map[4]. Table 3 shows the number of occupied households and employees and total estimated evacuation trips.

Table 3: Modeled Dam Failure Evacuation Trips for PM Peak Hour

Evacuating TAZs	Households	Population	Employment	Trips
753	2	7	827	2,356
754	744	2,467	1,326	756
757	1,239	4,879	228	133
758	0	0	937	1,640
762	763	2,425	2,600	1,482
764	0	0	4,152	2,367
765	0	0	4,101	4,714
766	1,911	7,157	1,024	3,711
767	545	1,951	77	862
1504	1,644	5,229	392	1,388

SOURCE: ALAMEDA COUNTY TRAVEL DEMAND MODEL; KITTELSON & ASSOCIATES, INC., 2022

The model indicates substantial over-capacity conditions on several roadways in the city as shown in Figure 4. Specifically, the roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound SR-238 (towards San Leandro)
- Southbound SR-238 (towards Fremont)
- Eastbound SR-92
- Eastbound W Jackson St (between I-880 and SR-238)
- Northbound Hesparian Blvd (between La Playa Dr and W A St)
- Northbound Hesparian Blvd (between Eden Shores Blvd and California 92)
- Westbound Industrial Pkwy W (between I-880 and SR-92)
- Northbound Huntwood Rd (between Whipple Rd and W Harder Rd)
- Northbound Santa Clara St (between W Jackson St and north city limits)
- Eastbound Winton Ave/D St (between Southland Dr and SR-238)
- Eastbound W Harder Rd (between W Jackson St and SR-238)
- Eastbound Teenyson Rd (between Portsmouth Ave and SR-238)

[4] https://fmds.water.ca.gov/webgis/?appid=dam_prototype_v2, accessed August 2022.

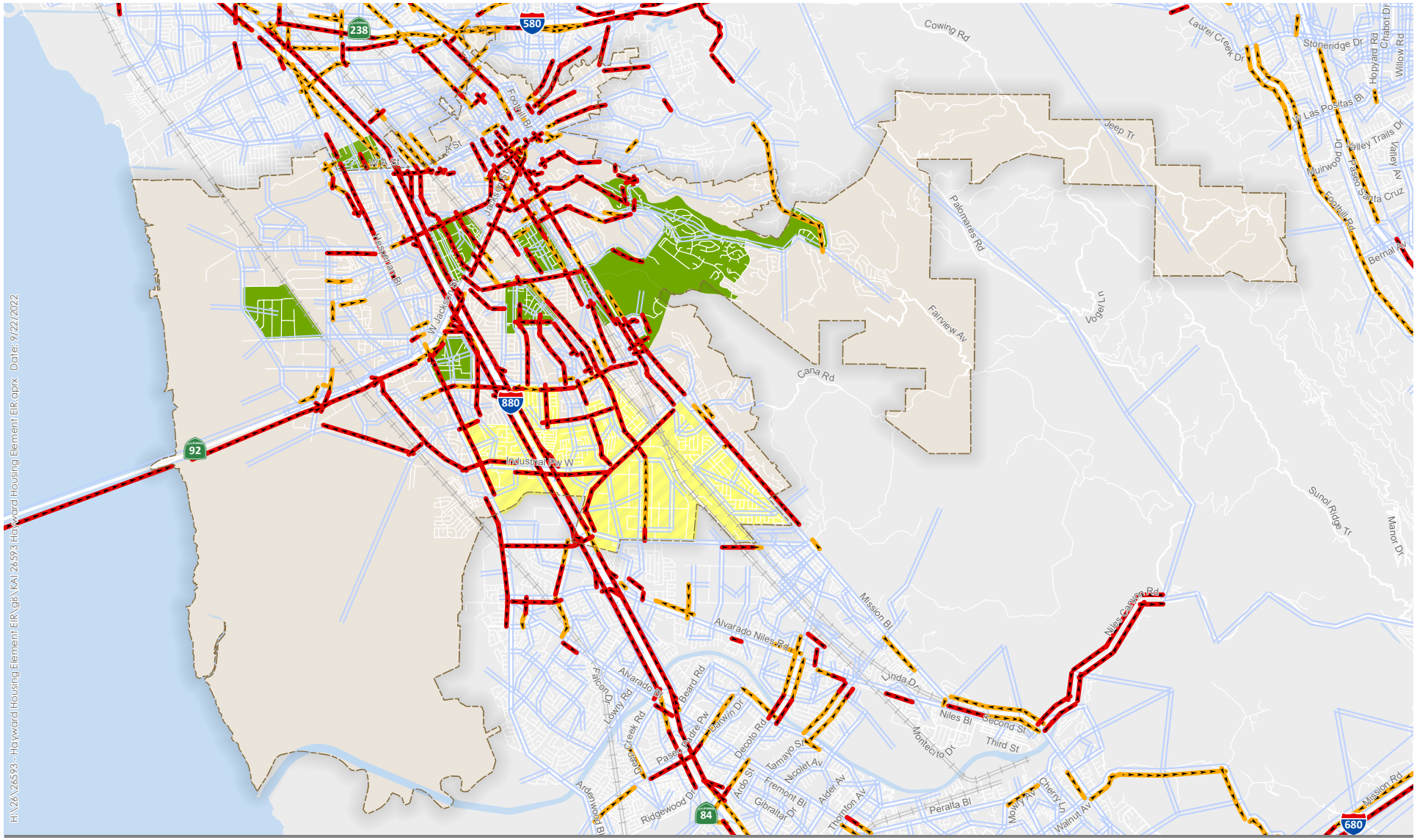

Figure 4

KITTELSON & ASSOCIATES

New Calaveras Dam Failure
Hayward, California

Downtown Pipeline Failure Scenario

This scenario considers the neighborhoods around A Street in downtown as the Pacific Gas and Electric (PG&E) natural gas pipeline roughly follows the street orientation. The scenario evacuates the Burbank neighborhood, the northern sections of Santa Clara, Longwood–Winton Grove neighborhoods, and the southern sections of the Cherryland, Hayward Acres and North Hayward neighborhoods (see Figure 5 for the potential evacuation area for this scenario). Table 4 shows the number of occupied households and employees and total estimated evacuation trips.

Table 4: Modeled Downtown Pipeline Failure Evacuation Trips for PM Peak Hour

Evacuating TAZs	Households	Population	Employment	Evacuation Trips
636	908	2,998	456	1,184
657	84	201	54	124
659	138	331	248	297
660	249	596	371	491
662	212	523	146	320
663	160	383	136	257
664	113	271	238	263
667	1,032	2,496	335	1,353
672	93	222	144	185
673	157	392	130	250
677	9	30	71	56
678	1,394	5,336	573	2,047
680	813	2,757	1,172	1,785
682	334	1,014	75	471
683	134	455	32	190
685	242	834	93	362
686	1,051	3,614	110	1,400
688	589	1,592	52	786
1484	371	1,224	187	486
1489	11	37	84	65
1490	126	435	32	179
1491	126	435	32	179
1493	126	435	32	179
1494	279	667	181	417
1495	68	232	38	108
1496	362	1,244	149	550
1499	13	32	130	88

SOURCE: ALAMEDA COUNTY TRAVEL DEMAND MODEL; KITTELSON & ASSOCIATES, INC., 2022

The model indicates substantial over-capacity conditions on several roadways in the city as shown in Figure 5. Specifically, roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound SR-238 (towards San Leandro)
- Southbound SR-238 (towards Fremont)
- Eastbound SR-92
- Eastbound W Jackson St (between I-880 and SR-238)
- Southbound Hesparian Blvd (between W A St and S Pepsi Dr)

- Eastbound Industrial Pkwy W (between Baumberg Ave and SR-238)
- Eastbound W Winton Ave (between Hesparian Blvd and D St)
- Eastbound W A St (between Hesparian Blvd and SR-238)
- Eastbound W Harder Rd (between W Jackson St and Jane Ave)

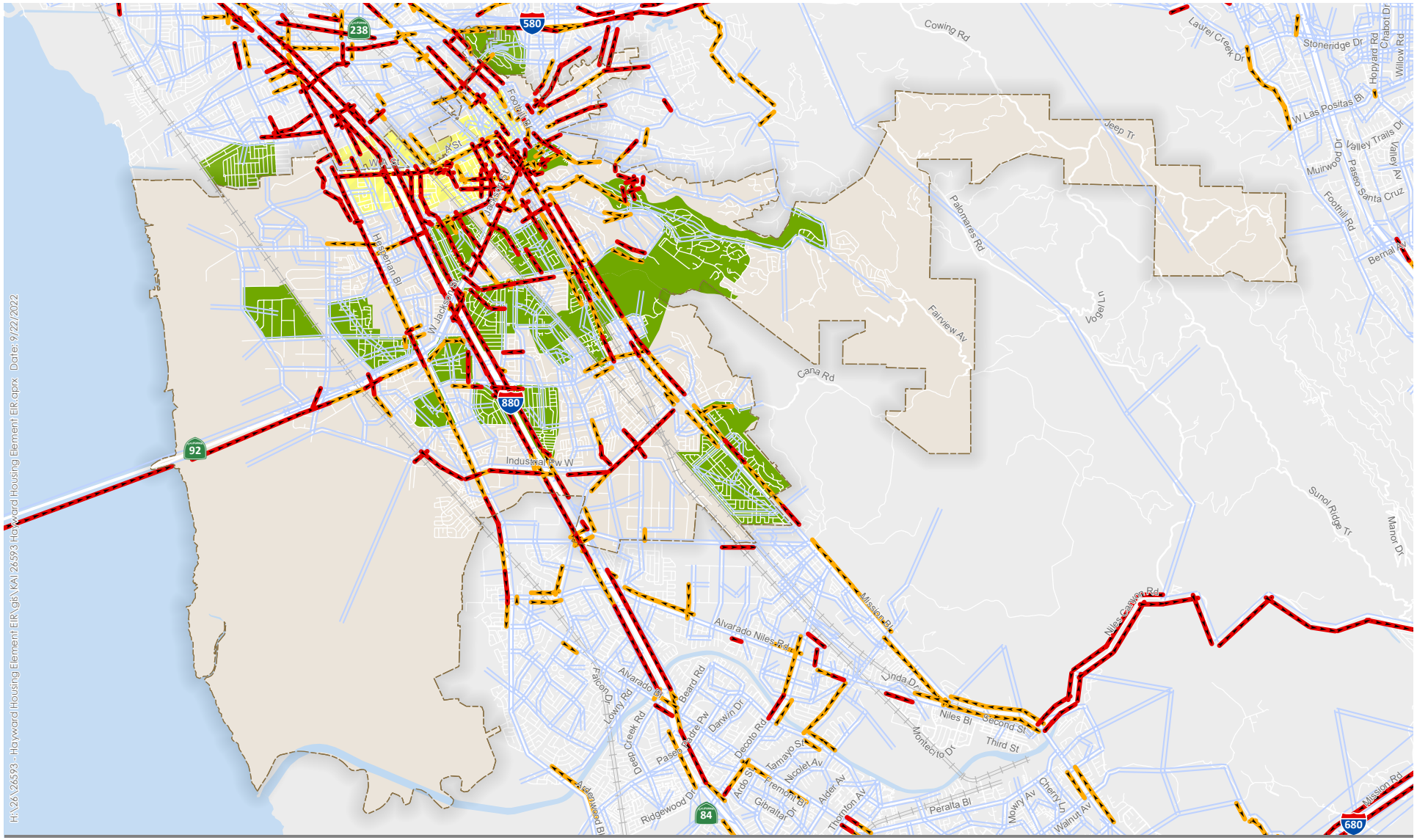

Figure 5

KITTELSON & ASSOCIATES

Downtown Pipeline Failure
Hayward, California

Eden/Southgate Pipeline Failure Scenario

This scenario considers the evacuation of the geographical area corresponding to Southland Mall to the north and Chabot College to the south, simulating a PG&E natural gas pipeline failure in the vicinity. This area is bounded by Industrial Boulevard/Clawtier Road on the west, I-880 on the east, Winton Avenue on the north, and US 92 on the south side (see Figure 6 for the evacuation area for this scenario). Table 5 shows the number of occupied households and employees and total estimated evacuation trips.

Table 5: Modeled Pipeline Failure Evacuation Trips for PM Peak Hour

Evacuating TAZs	Households	Population	Employment	Evacuation Trips
725	138	416	3,748	2,333
727	633	1,933	228	1,038
728	1,009	3,056	296	1,818
729	69	209	938	646
730	514	1,567	508	1,129
731	327	991	239	671

SOURCE: ALAMEDA COUNTY TRAVEL DEMAND MODEL; KITTELSON & ASSOCIATES, INC., 2022

The model indicates substantial over-capacity conditions on several roadways in the city as shown in Figure 6. Specifically, roadways where volumes are at/exceed capacity include:

- Northbound I-880 (towards Oakland)
- Southbound I-880 (towards San Jose)
- Northbound SR-238 (towards San Leandro)
- Southbound SR-238 (towards Fremont)
- Eastbound SR-92
- Eastbound W Jackson St (between I-880 and SR-238)
- Southbound Hesparian Blvd (between Depot Rd and Catalpa Rd)
- Eastbound W Winton Ave (between Southland Dr and D St)
- Northbound Santa Clara St (between W Jackson St and W A St)
- Eastbound Industrial Pkwy W (between Industrial Pkwy SW and SR-238)
- Whitman St (between W Harder Rd and Tennyson Rd)

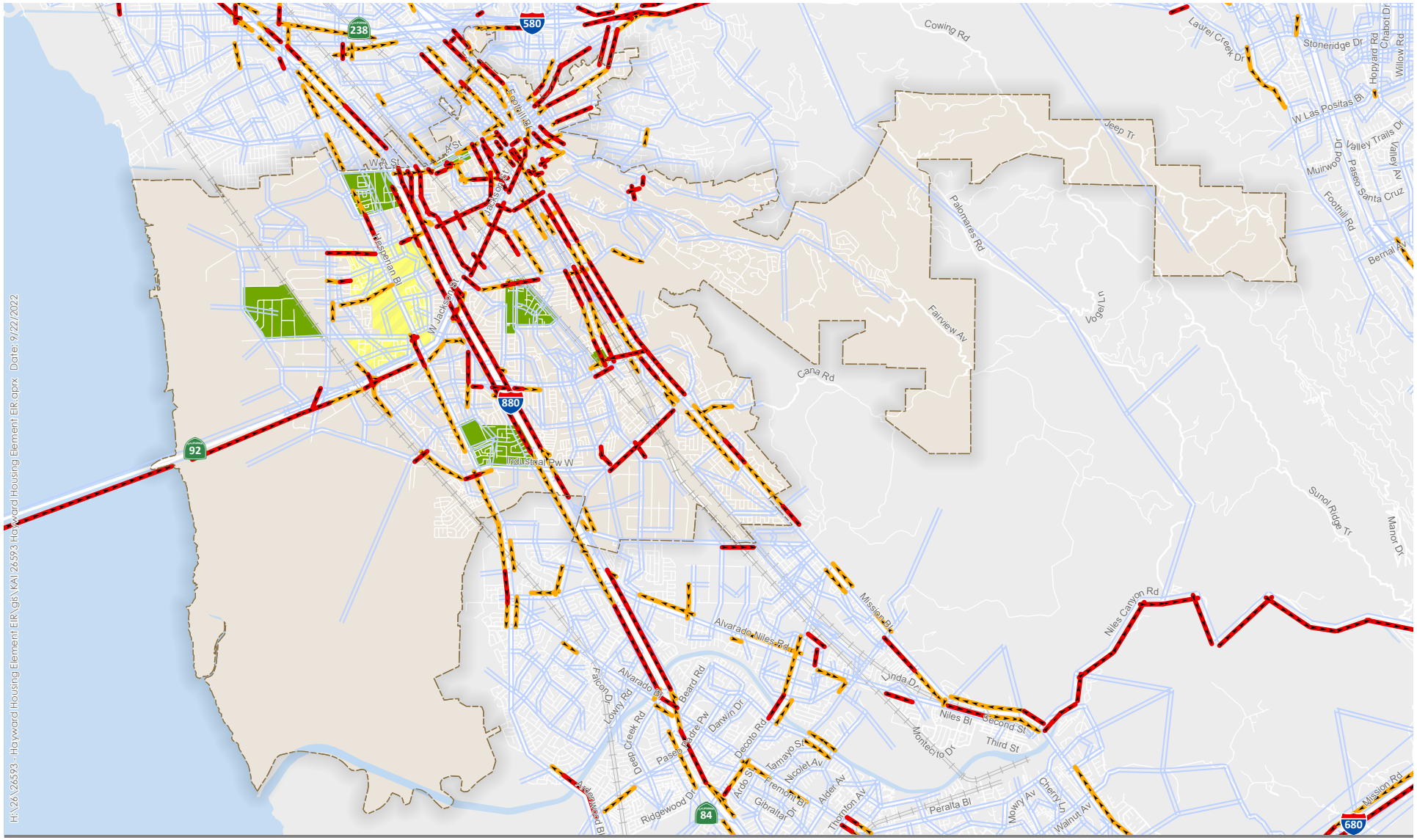

Figure 6

KITTELSON & ASSOCIATES

Eden/Southgate Pipeline Failure
Hayward, California

Limitations

The results of this memo are intended to identify potential congested locations during modeled evacuation scenarios. These scenarios were developed based on conservative assumptions and modeling techniques that reflect current understanding of evacuation analysis. These scenarios are intended to model a potential range of different evacuation scenarios but not all possible scenarios.

The scenarios represent potential emergency occurring in a portion of the City of Hayward. Actual emergencies may occur at other locations in the City and the specific conditions of an emergency evacuation could result in evacuation behavior that diverges from the definitions and assumptions used for this analysis. As a result, the identified scenarios and evacuation constraints represent informed estimates of the most likely potential evacuation scenario footprints and capacity constraints based on available data.

EVACUATION PLANNING CONSIDERATIONS

This section describes evacuation planning considerations and strategies for improving the capacity and resilience of the City's roadway network to support future evacuation events. The strategies and considerations were identified based on previous congestion and evacuation studies, review of recent evacuation efforts, effective evacuation planning practices identified by US Department of Transportation (USDOT)[5], Federal Highway Administration (FHWA)[6], California Governor's Office of Emergency Services[7], American Red Cross and staff feedback. The strategies are organized into five (5) categories:

1. Traffic Management
2. Communications
3. Vulnerable Populations
4. Public Education
5. Resource Management

[5] *Using Highways During Evacuation Operations for Events with Advance Notice*, Routes to Effective Evacuation Planning Primer Series, USDOT, FHWA, Accessed August 2022.
[6] *Using Highways for No-Notice Evacuations: Five Planning Considerations*, FHWA, Accessed August 2022.
[7]

Traffic Management

This section includes infrastructure-related strategies that will aid in efficient and expeditious evacuation traffic flows, which is the most critical and challenging element in a successful evacuation. For each infrastructure-related treatments, it is necessary to consider downstream capacity limitations and identify if those limits limit or nullify the potential benefits of the treatment. Table 6 outlines each of these strategies and provides a brief description of the strategy and desired outcomes.

Table 6: Roadway and Intersection Capacity and Resilience Related Strategies

Strategy	Action Items
Limited contra flow on highways	Reverse one or more lanes of highway to accommodate an increased flow of traffic in one direction.
Unlimited contra flow on highways	Redirect of all lanes of a designated evacuation route to accommodate rapid evacuation from a city or region.
Limited/unlimited contra flow on unlimited access arterials	Temporarily close inbound travel lanes on selected unlimited access arterials (such as parkways and boulevards) to allow outbound traffic to utilize these lanes during evacuation.
Phased releases at major parking centers	Implement a coordinated release of evacuation traffic from parking facilities that would reduce congestion on evacuation routes, especially in the downtown area. A phased release protocol could be developed for each parking facility, depending on size, location, and other relevant factors.
Closure of inbound lanes on selected roads and highways	Close inbound lanes on highways utilized for evacuation routes to prevent drivers on these routes from entering the city while evacuation is underway.
Restrict left-turn movements	Minimize left-turn movements along evacuation routes and on roads leading to evacuation routes.
Suspension of tolls	Consider coordinating suspension of tolls to encourage people to use toll roads to reduce bottlenecks at toll collection booths.
Signage	Use variable message board equipment and targeted installation of permanent dynamic message signs on evacuation routes to improve communication and reduce public confusion.
Stage tow trucks	Consider how to stage tow trucks at bottleneck locations along evacuation routes to help detect and clear minor crashes and maintain traffic flows.
Adjust signal timing	Increase the green time and/or progression band for through movements leading out of an evacuation zone.
Signal operation during power outage	Identify, prioritize, and install signal battery backups in case signal operations need to be maintained during a power outage. Consider using channeling

Strategy	Action Items
	devices, static signs, and coning strategies to manage intersection flow during power outage if the signals lack power.
Additional access routes	Identify and communicate with communities that have at least two access points. Prioritize adding additional access to communities which are currently served by only one or two access points.
Bus system	Develop transportation solutions such as the use of a bus system for evacuating individuals with special needs (such as those with mobility limitations).
Traffic control points	Establish traffic control points (i.e., locations along designated evacuation routes with emergency management personnel) to maintain a greater degree of evacuation management. These locations could enhance the efficiency of an evacuation, reduce public confusion, and allow increased operational flexibility during an evacuation.
Stay-at-home requests	Identify unaffected communities and request individuals to stay at home during evacuations to help reduce roadway capacity constraints and minimize traffic during evacuation operations.
Early evacuation of vulnerable communities	Consider incorporating early evacuations under high-risk conditions for vulnerable communities with limited egress routes.
Identify evacuation capacity-increasing projects	Consider locations identified as capacity-constrained (see the Evacuation Results section) for improvements to allow for increased evacuation capacity to reduce evacuation congestion. Identify and earmark, or apply for grant funds, for infrastructure improvements to support evacuation capacity enhancing projects.
Evacuation operations staff capacity	Improve staff capacity to conduct signal coordination during evacuation events for changed or uninterrupted flow. Improve staff capacity to communicate evacuation routing, closures, or other messages through changeable message signs.

Communications

This section describes communication strategies that address how information may be shared among agencies, organizations, and to the general public for evacuations. During an emergency evacuation event, two types of communication take place: (1) communication among entities involved in the management of response, and (2) communication between the city and the general public. Table 7 outlines each of these strategies and provides a brief description of the strategy and desired outcomes.

Table 7: Communications Related Strategies

Strategy	Action Items
Establish and maintain communications	Strengthen and maintain communication among coordinating emergency event agencies. This could be achieved through systems such as the Public Information Emergency System and Emergency Satellite Communications.
Vulnerable population communication plans	Identify vulnerable populations (see Vulnerable Populations subsection) that may require special assistance and develop population-specific communication plans to appropriate notify and support evacuations of these populations.
Traffic Control Center	Implement a Traffic Control Center to coordinate all evacuation activities. This center would have up to the minute reports on traffic patterns and can communicate directly with the broadcast media to let drivers know about roadway congestion and conditions and direct them to alternate routes.
Traffic counters/CCTV cameras	Install counters and/or CCTV cameras to assess traffic flow, volume of vehicles evacuating, and monitor incidents.
Highway Advisory Radio	Develop communication plan to provide timely traffic and travel condition information to the public

Vulnerable Populations

This section identifies strategies specifically for evacuation of vulnerable populations[8]. The City can use demographic data and U.S. Census data to identify vulnerable population locations and communities. City staff and emergency response teams may work with specialized organizations such as hospitals, medical associations, public service organizations, public health staff, and other providers or community groups to identify and locate relevant population segments and the types of assistance needed. Table 8 outlines considerations by need.

Table 8: Additional Steps for Evacuation of Vulnerable Populations

Special Need	Action Items/Considerations
Visually impaired	May be reluctant to leave familiar surroundings when the request for evacuation comes from a stranger. People who are blind or partially sighted may have to depend on their guide dogs and/or others to lead them to safety.
Hearing impaired	May need to make special arrangements to receive evacuation warnings. Include visual aids such as pictures or maps to reinforce key messages
Mobility impaired	May need special assistance such as paratransit. Partner with neighboring cities/private/non-profit agencies to provide adequate paratransit services
People without vehicles	Emphasize the importance of carpooling with neighbors or other community members. Provide information on transit routes and transit stops
Non-English-speaking persons	Provide bilingual or multilingual materials to support communication with non-English speaking populations during evacuation.
People with medical conditions	Communicate in advance the location and availability of hospitals or facilities with emergency/life-sustaining medical equipment such as a dialysis machine
Unhoused (Homeless) population	Arrange for food, shelter, and transportation for unhoused (homeless) population. Offer age-appropriate emergency and evacuation information to homeless children.

[8] *Using Highways for No-Notice Evacuations: Five Planning Considerations*, FHWA, Accessed August 2022.

Public Education

This section discusses the information that will be most beneficial in helping the general public preparing in advance of an evacuation. The public education process by the City should consider covering the following topics:

Table 9 Strategies for Public Education

Strategy	Action Items
Meaning of different types of evacuation orders	Educate people of the California Standard Statewide Evacuation Terminology such as an Evacuation Order, Evacuation warning, Shelter in Place, Evacuation Order(s) Lifted, Hard Closure, Soft Closure, Resident Only Closure
Method of communicating evacuation orders to the public	Tools to communicate evacuation orders include in-person events (briefings and public meetings), print media(newspapers), broadcast media (television and radio), mobiles, internet, and social media. The most appropriate and effective communication tool is one that reaches the target audience including people with special needs, gets timely information to the audience, delivers message reliably, and can be accessed within resource limitations
Provide information on preparations to conduct in advance	Encourage the creation of emergency evacuation checklists for residents which should include • Emergency 'go' kit with water, non-perishable food items, first aid kit and prescription medicines • Cellphone, battery powered radio and flashlights • Special items for infants, elderly, or persons with disabilities • Pet supplies • Family and emergency contact information • Credit cards and cash
Creating and educating on Evacuation Maps	• Create static and interactive maps for the audience to know their evacuation zone, nearby emergency shelters and plan evacuation routes • Conduct public affairs campaign/events to provide information on understanding and using the evacuation maps • Highlight ADA accessible emergency public shelters and shelters closer to hospitals on the evacuation maps • Make sure the public knows outdoor assembly areas or public meeting points or temporary refuge areas in the neighborhood
Provide information on available transportation options, including for vulnerable populations	• Create maps showing emergency evacuation bus routes and bus stops • Establish a buddy system by assigning 2 or more neighbors to assist a person with disability during evacuation
Provide information on evacuation shelters and support services offered during evacuation	• Educate the public on the facilities available/to be expected from an emergency public shelter • Educate the individuals/families who choose not to evacuate on the support services that might/might not be available during the disaster

Resource Management

Evacuations are extremely resource-intensive events that require significant personnel, facilities, and equipment to implement successfully. Table 10 shows the strategies and action items for resource management.

Table 10 Strategies for Resource Management

Strategy	Action Items
Clarity on staff personnel's roles and expertise available	• Identify the public authority, e.g., city's emergency personnel, authorized to issue evacuation orders • Train staff personnel on their roles and responsibilities during an evacuation • Cross-train key individuals and develop strategies to backfill their roles

Facilities available	• Conduct evacuation drills with Traffic Control Center on the implementation of operating procedures, monitoring traffic congestion, coordination with other local agencies and infrastructure surveillance like maintaining emergency access or evacuation routes
	• Work with hospitals in the city to conduct a Hazard Vulnerability Analysis (HVA) which includes studying issues related but not limited to:
	  o Types and volumes of supplies on hand/will they meet the need?
	  o Staff availability
	  o Availability of alternate sources for critical supplies/ services
	• Ensure gas stations keep more fuel in reserve for evacuations

Communication systems	• Several communication tools such as landlines, cell phones, two-way radio, and internet/email/social media can be used during an evacuation • Emergency plans by wireless providers do not always include backup power for cell towers • Landlines and two-way radio can thus be reliable and operate without external power supplies or communications infrastructure that cell phones rely on
Vehicles/transports	• Make separate transportation plans for evacuating schools, colleges, nursing homes, hospitals, and assisted-living communities • Determine mass transit resources or other modes of transportation (air, rail, water/boat) as appropriate to the incident • Review the transportation options and corridors for public transit in the areas at risk and identify possible alternative options • Estimate available personnel and equipment such as drivers, transit vehicles, tow-trucks, heavy equipment, traffic cones, channeling devices, static signs, etc., and fill the resource gaps where necessary
Evacuation management exercises	• Conduct evacuation management exercises to prepare for evacuation events and inform resource needs.

The City should review these potential strategies and conduct a needs assessment to identify what resources they have available as well as what resources they will need to perform their allotted roles, the quantity of resource required, when will the resource be required, the capability and limitations of a resource, and the cost of procuring or having the resource available. If critical resource gaps are identified, the City is recommended to work with other evacuation entities to determine additional resources and

needs. The City may also work with private sector to expand the resource base. Private service companies such as ambulance operators, and towing companies can provide additional assets during evacuation. These companies can clarify what is expected of them during a potential evacuation event to ensure their services are available, when needed.

NEXT STEPS

This memorandum describes the results of the evacuation analysis as well as evacuation planning considerations and strategies to help improve the capacity and resilience of the City's roadway network to support future evacuation events. This information will be used to frame supportive policies for the Safety Element update. These strategies and policies can be used to identify potential evacuation resiliency improvements throughout the City.