PENINSULA RESILIENCE PLANNING PROJECT

EAST PALO ALTO VULNERABILITY ASSESSMENT SUMMARY

Public Draft

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Introduction

There are nine jurisdictions in San Mateo County working collaboratively on the Peninsula Resilience Planning (PREP) project: San Mateo County; the Town of Atherton; and the cities of Belmont, Brisbane, Burlingame, East Palo Alto, Half Moon Bay, Pacifica, and San Bruno. The PREP project is a coordinated effort to identify the hazards facing communities across San Mateo County, evaluate how these hazards may change with the changing climate, recognize the communities and features that are most vulnerable, and develop strategies for improving community safety and resilience.

What is a General Plan?

A general plan is each local government's blueprint for meeting the community's long-term vision for the future, with goals, policies, and actions for achieving the vision. All cities and counties in California are required to have General Plans with, at minimum, eight chapters, or elements: Land Use, Circulation, Housing, Conservation, Open Space, Noise, Safety, and Environmental Justice (if applicable). The City's General Plan is available online: https://www.cityofepa.org/planning/page/vista-2035-general-plan.

Source: Governor's Office of Planning and Research. 2017. *State of California General Plan Guidelines*.

As a participant in PREP, East Palo Alto is conducting a comprehensive update of its Safety Element. As part of the technical background work for the update to the San Mateo County Safety Element, the PREP team prepared an updated Climate Change Vulnerability Assessment to analyze how climate-related hazards may harm the community. California law requires that, as part of the need to assess and protect against hazards, that safety elements analyze climate vulnerability, which is the degree to which people, nature, the built environment, and other systems are susceptible to harm from climate change and associated hazards. This includes physical and mental injuries, property damage or destruction, environmental harm, economic damage, and other factors.

The Vulnerability Assessment helps community members, City staff, and decision makers understand how climate change hazards may alter community conditions and what parts of the community (people and places) should be prioritized for adaptation and resilience. Its analysis also informs updates to the Safety Element, which, in combination with the San Mateo County Multijurisdictional Local Hazard Mitigation Plan (MJLHMP), the 2030 Climate Action Plan and Adaptation Strategies, and the Acterra Community-Based Vulnerability Planning Pilot Project, will help safeguard East Palo Alto against both current and future hazard conditions. The findings from the Vulnerability Assessment will be used to inform the goals, policies, and implementation programs that will be included in East Palo Alto's updated Safety Element. This assessment does not include hazards that are present in the community but are not affected by climate change, such as earthquakes.

Community Profile

East Palo Alto is in the southern end of San Mateo County's shoreline along the San Francisco Bay, The city encompasses approximately 2.2 square miles and is surrounded by San Francisquito Creek, Ravenswood Point, and the cities of Menlo Park and Palo Alto. Its residential neighborhoods are a mix of single-family homes, townhomes, and apartments. East Palo Alto also contains regional shopping centers, local businesses, and industrial and manufacturing centers near Cooley Landing, schools, and public facilities. Ravenswood Open Space Preserve and Don Edwards Wildlife Preserve are the main open space areas, with neighborhood parks scattered throughout the community. Main vehicle access is provided by Highway 101 and University Avenue, with major roadways, including Willow Road, Bay Road, Bayshore Road, Pulgas Avenue, and Clarke Avenue. The city is serviced by eight SamTrans bus routes: school-oriented route 81; south county serving routes, 280, 281, 296, and OWL; routes EPX and 397 connecting to Caltrain stations; and the Dumbarton Express Shuttle. East Palo Alto is also within SamTrans' Ride Plus service area, providing on-demand, affordable transit services to residents.

East Palo Alto has changed drastically from historic conditions, starting out as a manufacturing area with Lester Cooley's brick factory and then moving towards an agricultural community with Japanese and Italian flower growers before World War II.[1] However, because the city was an unincorporated community until 1983 and is surrounded by tech companies, East Palo Alto is primarily a bedroom community with limited regional and visitor-serving retail development. Residents in the city primarily work in local retail, service jobs supporting the neighboring communities, or at tech companies in the surrounding Silicon Valley. East Palo Alto has struggled economically compared to its neighbors, although the city is actively working to balance economic growth with the needs of its residents to prevent displacement due to gentrification.

East Palo Alto Climate Change Community Team (CCCT)

The East Palo Alto CCCT formed in 2019 as part of San Mateo County's climate resilience and capacity building program. Composed of East Palo Alto residents, City officials, youth, and leaders from faith and business communities, the CCCT start with the people who are impacted by climate change, ensure community engagement and buy-in for projects, and address both environmental and economic needs of the community. With the help of Climate Resilient Communities, the CCCT conducted a climate change survey and Community-Led Vulnerability Assessment in 2020. Recent projects include the Rain Gardens and Water Cisterns in East Palo Alto, Measure AA Marshland Restoration, and creation of the East Palo Alto Community Resilience Hub.

East Palo Alto's residents have long been on the front lines of climate change and environmental justice issues, as the city is a densely populated, ethnically diverse community with a median income significantly lower than San Mateo County's average. Although the climate hazards facing the city are not unique to East Palo Alto, the systemic inequities faced by community members have made these issues worse, magnifying the impact of climate hazards.

East Palo Alto is home to a linguistically diverse population speaking Spanish, Tagalog, Tongan, Samoan, and other Asian or Pacific Islander languages. However, approximately 25 percent of residents are linguistically isolated, meaning that they predominately speak a language other than English and that they do not speak English well. This is notably 9 percent higher than the county. The city has a substantial immigrant population, as approximately 41 percent of its residents are foreign-born, compared to 35 percent in the county.

Economic disparities are also evident in the community, with approximately 12 percent of residents living in poverty, double the county's rate of 6 percent of residents. This is primarily due to historic redlining and disinvestment in the community, limited local job opportunities in the city, and the underfunding of schools compared to neighboring districts.[2] East Palo Alto faces a housing affordability crisis,[3] with the median household income in East Palo Alto of $103,248 being significantly lower than the county's median of $175,000. This economic strain is reflected in housing statistics: 45 percent of households are cost-burdened, meaning they spend over 30 percent of their income on housing, and 18 percent live in overcrowded conditions. Table 1 shows the demographics in East Palo Alto compared to all of San Mateo County.

Table 1. Demographic Profile for East Palo Alto Compared to San Mateo County

Demographic	East Palo Alto		San Mateo County	
	Number	Percentage	Number	Percentage
Population	29,520		754,250	
Children (under 18 years old)	6,774	22.90%	150,187	19.90%
Linguistically isolated persons	7,047	25.30%	116,306	16.30%
Foreign-born persons	11,971	40.55%	265,189	35.16%
Older adults (65 years and older)	2,819	9.50%	127,520	16.90%
Older adults living alone	368	4.60%	26,168	9.90%
Persons with disabilities	2,897	9.80%	65,466	8.70%
Persons working outdoors	2,769	9.38%	41,748	5.44%
Persons in poverty	3,595	12.20%	48,137	6.40%
Unhoused persons	169	-	1,092	-
Number of households	7,998		264,323	
Median household income	103,248	-	175,000	-
Cost-burdened households	3,520	45.09%	94,625	36.55%
Households without access to internet	974	12.20%	14,371	5.40%
Households without a vehicle	450	5.60%	14,752	5.58%
Overcrowded households	1,417	17.72%	19,366	7.33%
Rental households	4,185	52.33%	106,955	40.46%

Source: American Community Survey, 2022, *ACS 5-Year Estimates*.

Climate Hazards

Climate change is the long-term shift in average weather patterns, including significant alterations in temperature, rainfall, and sea levels over an extended period—typically decades or longer. Rising global temperatures are causing more frequent and intense heatwaves, storms, droughts, wildfires, and other hazards. These events frequently occur concurrently, resulting in cascading impacts that are progressively more difficult to manage, such as droughts amplifying wildfire risk or extreme heat exacerbating water scarcity. This section lays out the major climate change hazards affecting East Palo Alto and how these hazards are expected to change in the coming years and decades. These hazards are ecosystem pests, air quality and smoke, drought, extreme heat and warm nights, flooding, human health hazards, sea level rise and groundwater emergence, and severe weather.

Cascading and Compounding Effects

Cascading Effects: When an extreme event causes a series of secondary events that are larger than the initial impact.

Compounding Effects: When multiple hazards or drivers occur simultaneously, amplifying their collective impact.

Source: IPCC. 2019. *Extremes, Abrupt Changes and Managing Risk*.

Ecosystem Pests

Ecosystem pests are plant and animal species that can harm East Palo Alto's open spaces, riparian areas, and urban forest. Climate change is expected to worsen these problems by increasing the abundance and range of both native and non-native pests. Invasive plant species threaten local ecosystems by outcompeting native flora, disrupting habitats, and reducing biodiversity.

Warmer temperatures and shifting precipitation patterns can weaken plants and trees, making them more susceptible to infestation and infection. It also creates favorable conditions for invasive species to establish themselves, as extreme weather events disrupt native communities. In aquatic environments, rising temperatures and drought conditions decrease dissolved oxygen levels, causing harmful algal blooms and allowing invasive species to thrive, complicating management efforts. While East Palo Alto consists of an urban and built-up environment, the ecosystem pests could still result in lasting damage to the urban tree canopy that helps reduce the urban heat island effect and the marshlands and tidal flats that help protect the city from sea level rise and flooding.

Baylands Habitat Restoration Project

The Baylands Habitat Restoration project in the Ravenswood Open Space Preserve, formerly used as a salt production pond and municipal dump, is a multifaceted initiative aimed at restoring and enhancing the marsh-upland transition zone habitat along the San Francisco Bay Trail. The project includes habitat restoration, workforce development through training and internships, and encouraging community stewardship of the area. Restoring this habitat not only improves the habitat for local wildlife and draws visitors to the area, but also increases climate resilience by improving an area that can absorb stormwater during flooding and severe weather events.

Air Quality and Smoke

Air quality directly affects health, well-being, and everyday quality of life for all residents in East Palo Alto. According to the General Plan Health and Equity Element, air quality is a concern for East Palo Alto, with asthma related emergency visit rates for children almost double in the city compared to the county. Poor air quality poses significant health risks, such as respiratory and cardiovascular illness, and these concerns have become especially urgent due to the increasing frequency of wildfires in the region and other climate-related factors.[4] Air pollutants come from mobile sources such as cars and trucks, stationary sources like factories and other industrial sites, dust from construction sites, smoke from wildfires, and other sources. Climate change directly impacts and exacerbates air quality through increased temperatures, droughts, and wildfires. Ozone forms when pollutants from motor vehicles, industrial emissions, power plants, and refineries react with sunlight, and warmer temperatures speed up these reactions. Warmer temperatures also lengthen the growing seasons of plants and trees, increasing allergen production. Air quality significantly affects our quality of life and can lead to more health issues for persons with existing illnesses, strains healthcare, and restricts outdoor activities. Ensuring clean air is vital, especially for frontline populations in neighborhoods that already experience some of the highest air pollution levels in San Mateo County.[5]

Bay Area Air Quality Management District Programs

The Bay Area Air Quality Management District has several programs to reduce air pollution from multiple sources.

The **Spare the Air Program** issues alerts on days when air quality is expected to be poor due to high levels of ozone or particulate matter. On Spare the Air days, residents are encouraged to limit activities that contribute to air pollution, such as driving, using gas-powered equipment, or wood burning.

Employers with 50 or more full-time employees in the Bay Area are required to provide **Commuter Benefits Programs** to encourage the use of alternative modes of transportation, such as public transit, vanpool, or biking to reduce emissions from commuting.

Exposure to air pollutants such as ozone and particulate matter can lead to respiratory conditions, exacerbate asthma, and increase the risks of heart attacks, strokes, and certain types of cancer.[6] The financial burden of poor air quality in the Bay Area is estimated at $32 billion annually, which includes costs associated with premature deaths, healthcare expenses, reduced productivity, and other related issues.[7] The Bay Area Air Quality Management District has played a key role in monitoring and improving air quality throughout the region, resulting in notable progress even as population, traffic, and industrial activities have grown.[8] Despite these efforts, air quality hazards remain persistent threats in the region.[9]

Wildfire smoke has become an increasingly significant concern for air quality in East Palo Alto and the broader region. Wildfire smoke contains a complex mixture of gases and fine particulate matter, consisting of tiny particles that can penetrate deeply into lung tissue and impact cardiovascular health.[10] The health risks associated with wildfire smoke are particularly severe for frontline populations, including children, older adults, individuals with pre-existing respiratory or cardiovascular conditions, and low-resourced residents, who may experience more severe acute and chronic health effects.[11] The frequency of wildfires has been rising across California, driven by hotter and drier conditions associated with climate change, resulting in more frequent exposure to hazardous air quality conditions for many residents and visitors.

Drought

A drought is where conditions are drier than normal for an extended period, making less water available for people and ecosystems. While drought is a normal occurrence in California, prolonged drought conditions can harm ecosystems and the regional economy. Droughts do not typically cause direct loss of life or structural damage, but they can lead to critical environmental and economic harm, including increased water costs and degradation of urban forests and open space. Water demands, such as population growth and landscape irrigation, exacerbate these impacts, complicating water allocation and potentially leading to restrictions and quality issues.

Water Delivery in East Palo Alto

Most of the potable water used in East Palo Alto comes from the San Francisco Public Utilities Commission Regional Water System. Approximately 85 percent of the water supply to this system originates in the Hetch Hetchy watershed in Yosemite National Park and flows down the Tuolumne River. The remaining 15 percent of the water supply originates locally in the Alameda and Peninsula watersheds. The city also sources a small amount of groundwater from the San Mateo Plain subbasin of the Santa Clara Valley Groundwater Basin.

Climate change is likely to result in more frequent and severe droughts across the state. Overall, precipitation levels are expected to increase slightly in East Palo Alto, from a historical annual average of 16.3 to 17.9 inches by mid-century (2035 to 2064) and 19.9 inches by late-century (2070 to 2099). However, more years with extreme levels of precipitation, both high and low, are likely as a result of climate change. Reduced winter precipitation levels and warmer temperatures have greatly decreased the size of the Sierra Nevada snowpack (the volume of accumulated

snow), which in turn makes less fresh water available for communities throughout California.[12] More intense droughts are expected to compact and harden soils, so when rain does return, more water will run off as stormwater rather than infiltrate into soils, potentially causing downstream flooding. Higher temperatures will further increase evaporation, worsening drought conditions.

OneWatershed: Building Regional Climate Resilience

OneWatershed is a comprehensive framework that addresses the shared risks of climate change to water infrastructure and resources across San Mateo County, including stormwater, wastewater, and drinking water systems. This innovative approach emphasizes building adaptive capacity for climate impacts, with a particular focus on the county's most vulnerable communities. OneWatershed builds on years of climate resilience planning, harnessing resources and partnerships under a unified program to advance shared goals around overlapping climate risks. By taking a watershed-based perspective, OneWatershed enables coordinated planning and implementation of climate adaptation strategies that benefit both infrastructure systems and the communities they serve. The framework represents phase one of a multi-year strategy to build systematic and transformational change in how San Mateo County approaches integrated watershed management and climate resilience.

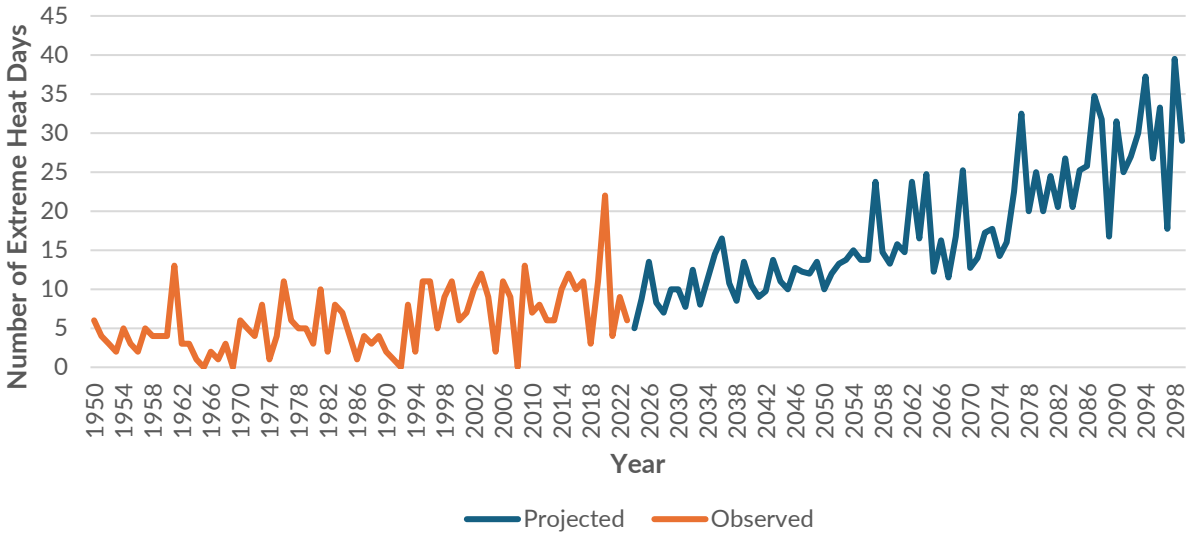
Extreme Heat and Warm Nights

Extreme heat is an increasingly serious issue for East Palo Alto, threatening public health, infrastructure, and the environment. Extreme heat days are defined as temperatures exceeding 98 percent of historical highs, and these events are becoming more frequent and intense due to climate change. Extended periods of extreme heat, known as heat waves, threaten community safety and drive up energy costs. An extreme heat day in East Palo Alto is one where the maximum temperature soars above 92.4 degrees Fahrenheit. As shown in **Figure 1,**[*] climate change is expected to increase extreme heat days in the city from a historic annual average of 5 days per year, to an average of 14 days per year by mid-century (2035 to 2064) and an average of 25 days per year by late-century (2070 to 2099).[13]

Figure 1. Observed and Projected Extreme Heat Days in East Palo Alto [†]

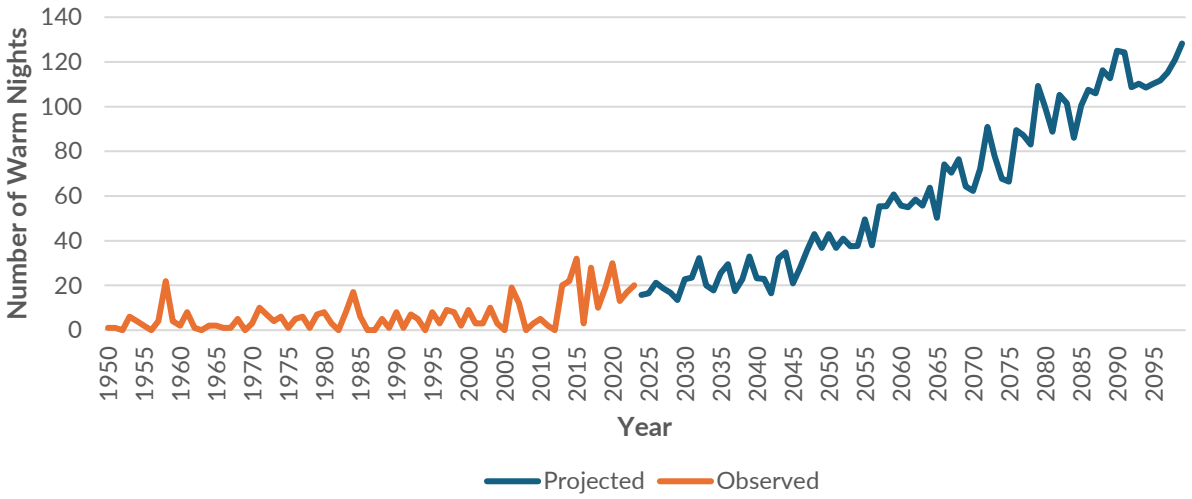
[*] The Cal-Adapt database at time of writing uses Representative Concentration Pathways (RCPs) to project future conditions. The projections listed in this report use RCP 8.5, which assumes global emissions continue to increase at least until the end of century, which is consistent with the International Panel on Climate Change Sixth Assessment Report.

† Figures 1 and 2 use observed data from the Cal-Adapt database, which provides data from 1950 to 2005, the nearest National Weather Service weather stations, which provides data from 2006 to 2023, and projected data from the Cal-adapt database, which provides data from 2024 to 2099. Due to the different database sources, the observed and projected data may not match.



When the daily minimum temperatures remain significantly above normal, warm nights can worsen an extreme heat day because overnight temperatures don't get low enough to provide the community with any relief from high temperatures. A warm night is when temperatures remain above 60.9 degrees Fahrenheit in East Palo Alto. As shown in **Figure 2**, warm nights are projected to increase from a historic 5 nights per year to 39 nights per year by mid-century and 100 nights per year by late-century.[14]

Figure 2. Observed and Projected Warm Nights in East Palo Alto

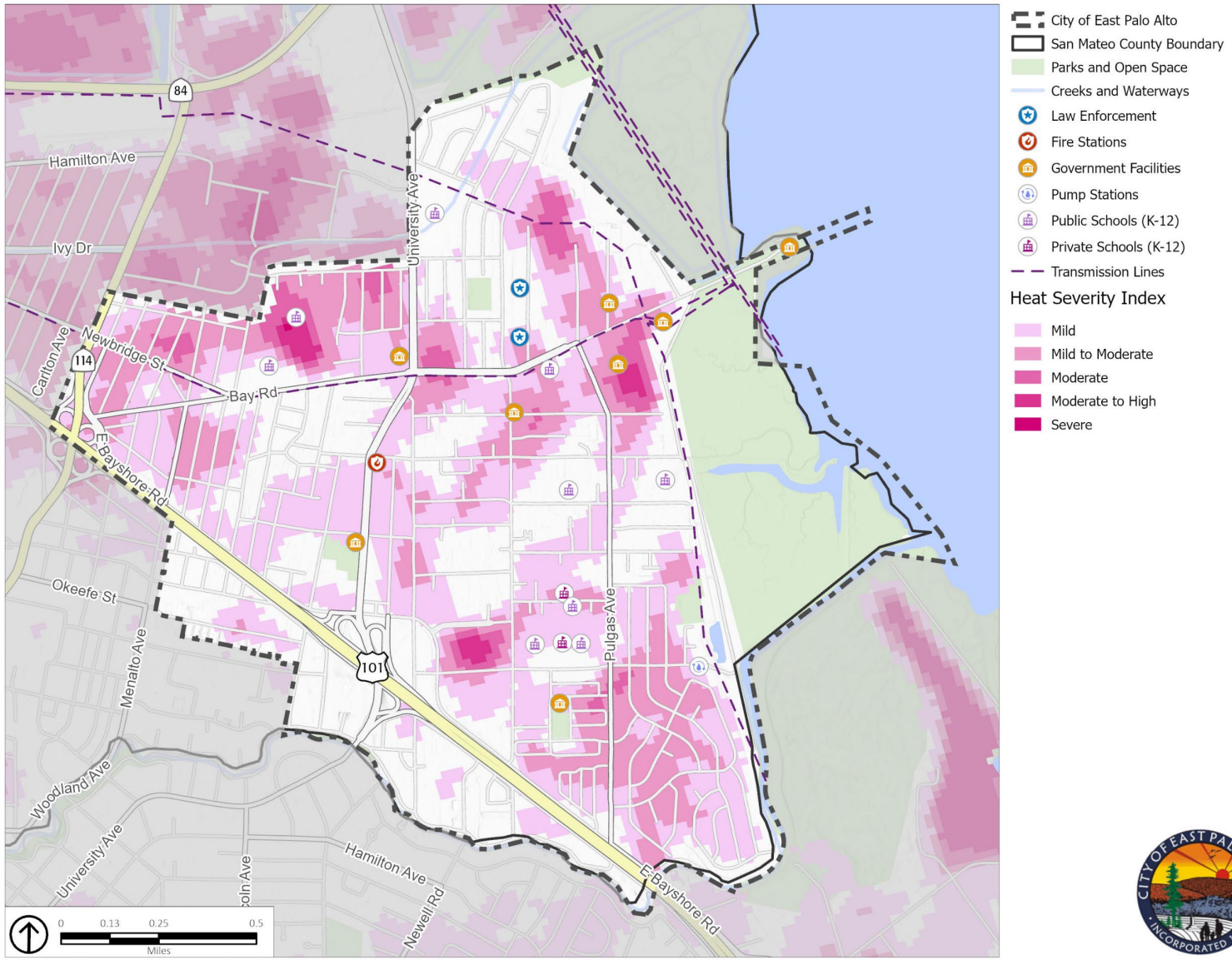


Extreme heat is one of the deadliest climate-related hazards nationwide, with the Center for Disease Control and Prevention noting a rise in heat-related deaths—from 297 in 2004 to over 2,300 in 2023.[15, 16] These numbers are likely a significant undercount, as they do not include deaths caused by other factors that are exacerbated by extreme heat. The rising frequency and

intensity of extreme heat events pose significant public health concerns, especially in areas such as East Palo Alto that have historically experienced milder temperatures due to proximity to the San Francisco Bay and are home to many residents without access to climate-controlled environments. Warmer temperatures and the urban heat island effect can exacerbate extreme heat impacts in densely populated areas, especially those that have limited tree canopy. **Figure 3** shows the areas of East Palo Alto that may experience higher temperatures on extreme heat days due to limited shade cover and presence of heat-absorbing materials. Areas most at risk include the neighborhood surrounding Cesar Chavez Ravenswood Middle School, the Gateway 101 Shopping Mall, and the commercial/industrial center along Bay Road towards Cooley Landing.

Even slight increases in temperature can overwhelm the ability of community members to cope with extreme heat and warm nights, straining public health systems and infrastructure. This leads to heightened risks of dehydration, heat-related illnesses, and respiratory issues, disrupting daily life and economic activity.[17] Extreme heat also stresses infrastructure, as heightened air conditioning demand risks overloading the power grid and causing outages, and very high heat can degrade transportation systems leading to delays and damage. Additionally, rising temperatures harm local ecosystems by increasing water temperatures in local lakes and streams, harming fish and plant species.

Figure 3. Heat Severity Index in East Palo Alto



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; ; The Trust for Public Land, 2019

Flooding

Flooding occurs when water surpasses the capacity of local water bodies to contain it, creeks to carry it, or soil to absorb it. This is a significant concern for East Palo Alto due to the proximity to the San Francisco Bay and San Francisquito Creek. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide, significantly threatening the health and life of community members and causing substantial damage to structures, landscapes, and utilities serving the city. The impacts of increased flooding go beyond immediate property damage. Flooding can lead to long-term public health problems if mold and mildew grow in buildings, displace communities if homes are destroyed or become uninhabitable, and increase economic burdens, such as rising home insurance costs.

Atmospheric Rivers

An atmospheric river is a long, narrow band of moisture in the atmosphere moving from the tropics that can cause heavy rain or snow when it moves over land. These storms are responsible for over half of California's water supply, but also the majority of the flooding and mudslide events across the state.

Sources: Emily Mendez. 2024. *A Climate Expert Explains Why Atmospheric Rivers Are Causing Historic Rainfall in California*. Lamont-Doherty Earth Observatory: Columbia Climate School.

Floods are a chronic issue in East Palo Alto and climate change is expected to make flood events worse due to fewer yet more intense rainfall events, in the form of atmospheric rivers. For example, what is currently a 200-year storm, or one that has a 1 in 200 chance of occurring each year, by 2100 could increase in frequency by 40 to 50 years (to a 1 in 150/160 chance each year).[18] This means that the 100-year and 500-year floodplains may expand, and the current floodplains may become 40- to 50-year floodplains. Climate change is also likely to increase the frequency and severity of droughts that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface than is absorbed into the ground, which can increase flooding downstream.

Floodplains and Flood Recurrence

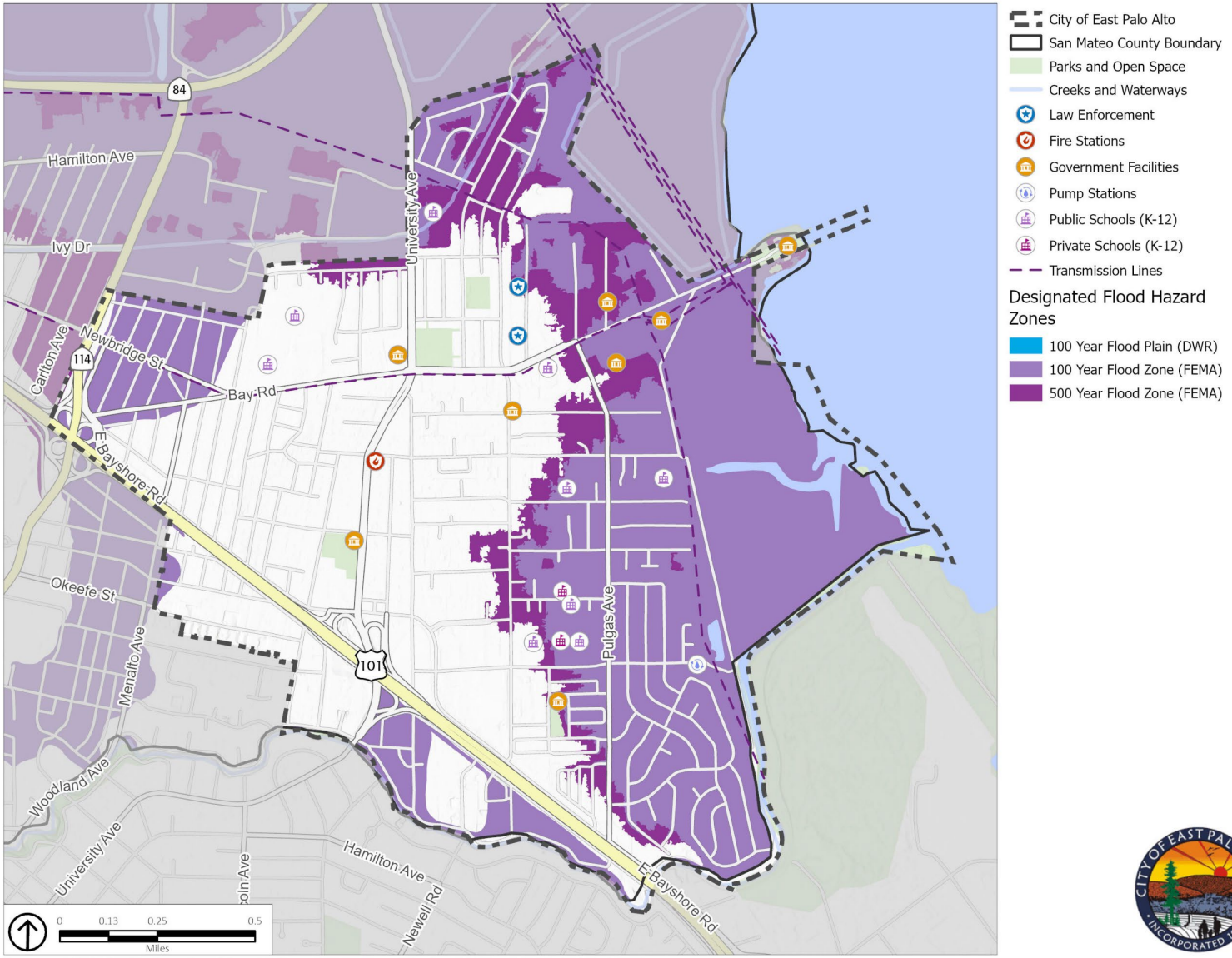
According to the Federal Emergency Management Agency (FEMA), a floodplain is any area of land that could be flooded by water from any source, but are often next to creeks, lakes, oceans, and ponds. The 100-year floodplain is the area that has a 1 percent (1 in 100) chance of being flooded in any given year. This would also be the area that would flood during a 100-year storm. The 500-year floodplain is the area that has a 0.2 percent (1 in 500) chance of being flooded in any given year due to a 500-year storm.

As shown in **Figure 4** and on the online PREP Map Viewer, flood prone areas in East Palo Alto include low-lying areas along the San Francisco Bay shoreline, areas along San Francisquito Creek south of Highway 101, and areas north of Bay Road along Newbridge Street. Approximately half of the parcels in East Palo Alto are in a mapped floodplain. Flooding also occurs outside of these mapped floodplains, especially in low-lying areas with inadequate drainage.

Climate change will likely cause these flood zones to expand as sea levels rise and the tide regularly moves farther inland. Many of these areas are residential neighborhoods with schools and community-serving facilities that could be damaged or destroyed by major flooding. There is also the risk of flooding in industrial and commercial areas, which could cause the movement of pollution and hazardous materials through the soil and groundwater.

Mural at Brentwood Academy. Source: San Mateo County

Figure 4. Flood Hazard Zones in East Palo Alto



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; ; FEMA; DWR, 2021

Human Health Hazards

Human health hazards, including bacteria, viruses, parasites, and other pathogens, pose significant concerns in East Palo Alto. These conditions can result in physical injuries, fatalities, mental health issues, and exacerbate pre-existing conditions like asthma and allergies. Rats, mice, ticks, and mosquitos are common vectors, meaning that they often spread the pathogens that can cause illness. Rising temperatures and changing precipitation patterns due to climate change promote the proliferation of disease-carrying vectors. Warmer, wetter conditions allow for increased populations of mosquitoes and ticks, extending their geographic range and spreading diseases like West Nile virus, dengue fever, and Lyme disease.[19] As temperatures rise and extreme weather events, such as heavy rainfall, become more frequent, these vectors can spread more broadly, transmitting diseases that threaten public health.[20]

Heatwaves, another increasing hazard due to climate change, can directly impact human health by causing heat-related illnesses and deaths, while also worsening respiratory conditions due to increased air pollution. The combination of these factors indicates that human health hazards will become more pervasive and severe as climate change progresses, making proactive public health measures even more critical. The implications of these health hazards extend beyond individual well-being, placing strain on healthcare systems, increasing economic burdens, and affecting mental health.

Sea Level Rise and Groundwater Emergence

As global temperatures rise, glaciers and other polar ice melt, causing sea levels to rise. High average temperatures can also cause ocean water to expand, causing further rising of sea levels. According to the 2024 California Ocean Protection Council's *State of California Sea Level Rise Guidance*, sea levels in East Palo Alto are projected to increase by as much as 0.4 feet (5 inches) by 2030, 1.3 feet (16 inches) by 2050, and 6.5 feet (78 inches) by 2100. However, sea levels could also rise faster than these projections with storm surge and King Tide events adding an additional 24 to 36 inches of temporary flooding that would move farther inland.[21]

As shown in **Figure 5** and on the online PREP Map Viewer, sea level rise will cause temporary and/or permanent inundation risks for over half of the East Palo Alto, especially in neighborhoods north of Bay Road and east of University Avenue. **Figure 5** illustrates the spatial data available through the Bay Conservation and Development Commission's Adapting to Rising Tides Initiative, that is closest to the projections listed above, which ultimately shows a conservative estimate of sea level rise. By 2050, many of the neighborhoods along Pulgas Avenue, Cooley Landing, and areas near Costano Elementary School would likely be permanently inundated by sea level rise, with 100-year storms temporarily flooding areas farther inland. This flooded area includes nearly all schools in East Palo Alto, police stations, four government facilities and community centers, and the pump station at the end of O'Connor Street.

Emergent groundwater is a consequence of sea level rise. It occurs when freshwater is pushed upward by denser saline water that travels farther inland, causing temporary or permanent inundation.[22] Higher groundwater levels, even if it does not emerge to the surface, can infiltrate storm drains, destabilize pipes, spread soil or groundwater contamination, undermine building foundations, corrode infrastructure not designed for saline groundwater, and increase liquefaction hazards.[23] Groundwater is expected to rise at the same rate as sea level rise, causing groundwater to emerge at the surface in low-lying areas.[24]

Liquefaction

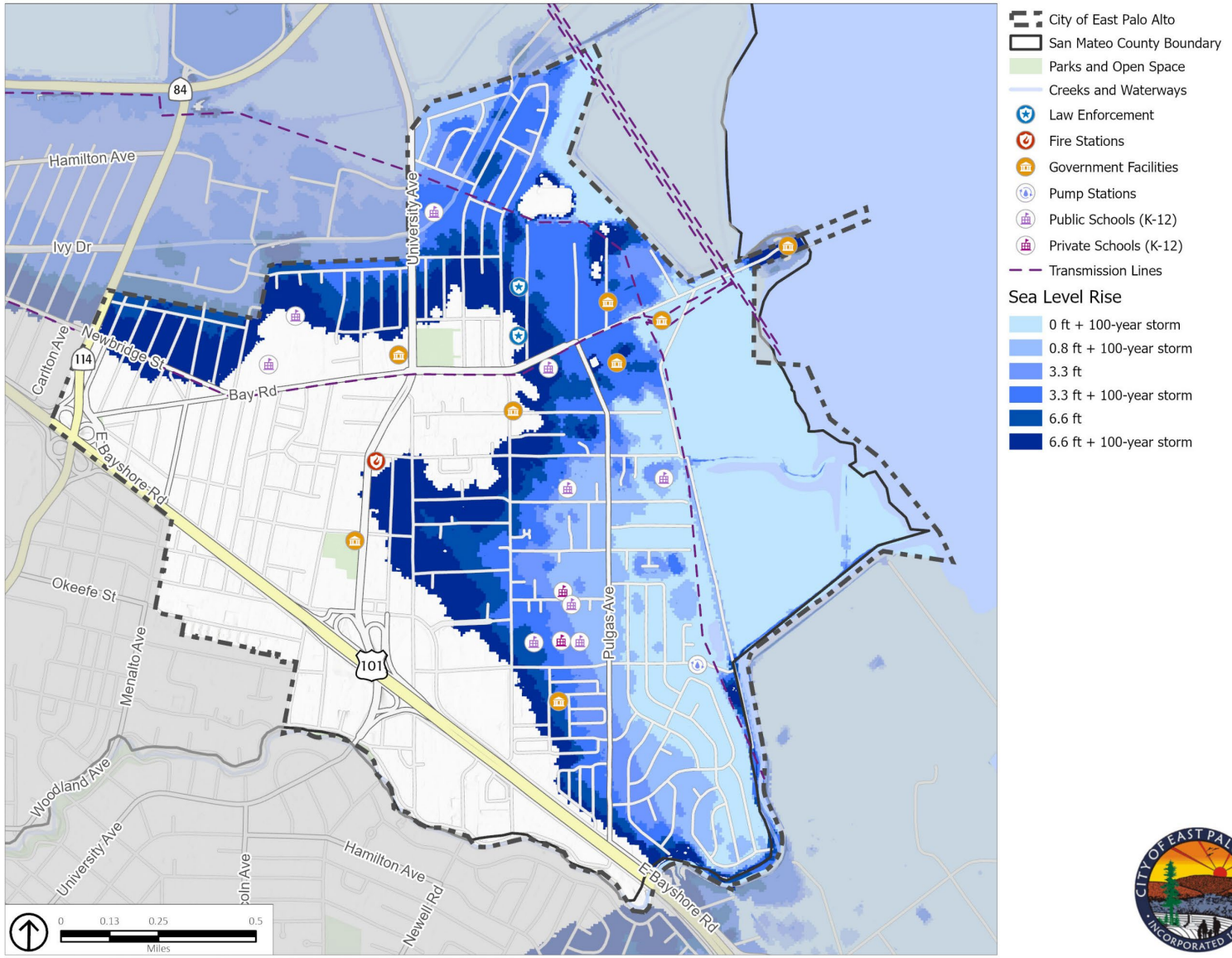
Liquefaction occurs when water-saturated soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a puddinglike liquid. Building and foundations lose strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people.

As shown in **Figure 6** and on the online PREP Map Viewer, by 2100 emergent groundwater will impact the majority of the city, including all schools, community-serving facilities, pump stations, and parks. The dozens of sites with current or past contamination indicated on the map are of most concern, as many are in residential neighborhoods and could release toxic materials into the water and soil that may have direct health effects on residents.

Though the exact level of future sea level rise is uncertain, it is expected to increase the frequency, duration, and magnitude of flood events and push groundwater to emergent levels farther inland. Sea level rise and emergent groundwater will interact directly with stormwater from inland sources, causing more severe flooding near creeks and at the outlets of drainage systems.

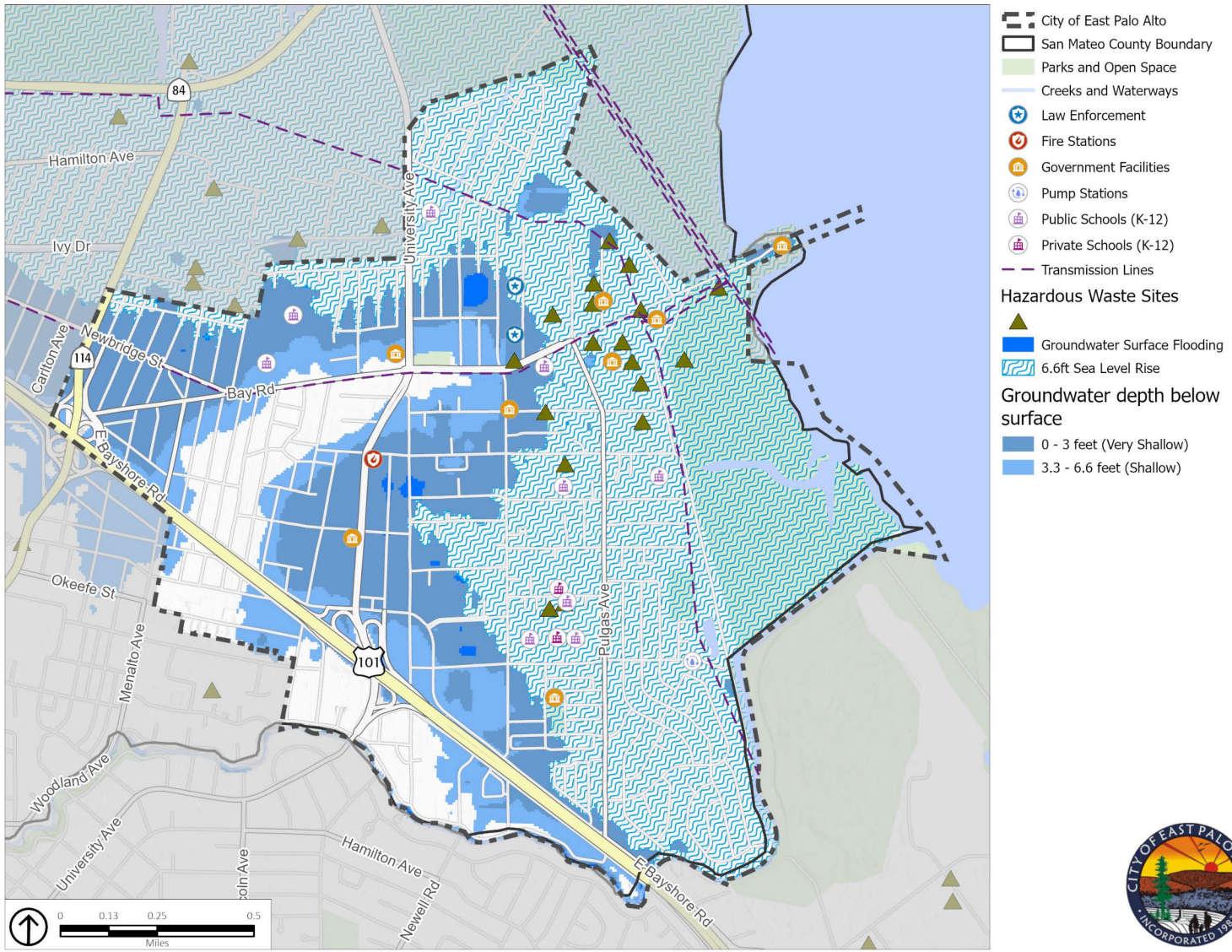
Marshlands on the San Francisco Bay in East Palo Alto

Figure 5. Sea Level Rise in East Palo Alto



Source: ESRI, 2023; County of San Mateo, 2023; PlaceWorks, 2023; ; USGS CoSMoS

Figure 6. Emergent Groundwater in 2100 in East Palo Alto



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

Severe Weather

Severe weather poses a significant threat to East Palo Alto, disrupting daily life, compromising safety, and affecting infrastructure and ecosystems. Severe weather is usually caused by intense storm systems, although types of strong winds can occur without a storm. The types of dangers posed by severe weather vary widely and may include injuries or deaths, damage to buildings and structures, and roads blocked by debris. Severe weather often produces high winds and lightning that can damage structures and cause power outages. Objects such as vehicles, unprotected structures like bus stops or carports, fences, telephone poles, or trees can also be struck directly by lightning, which may cause an explosion or fire. High wind events can also exacerbate the risk of wildfires in the region, which can harm local air quality in the city. The most common severe weather events that have historically impacted East Palo Alto are heavy rains (usually a result of atmospheric rivers), thunderstorms, and windstorms.

While average annual rainfall may increase only slightly in East Palo Alto, climate change is expected to cause an increase in the number of years with intense levels of precipitation. Heavy rainfall can increase the frequency and severity of other hazards, including flooding.

Key Findings

The following section presents the key findings of the Vulnerability Assessment for East Palo Alto, highlighting the people and community features that were identified as priority vulnerabilities. Priority vulnerabilities are the people, buildings, infrastructure, economic drivers, ecosystems and natural resources, and key services who should be considered as the City's priorities in adaptation and resilience planning. Identifying a population or a community asset as a priority vulnerability reflects the severity of climate change impacts and level of harm, but also considers other factors such as the size of the population, current and historic injustices and discrimination, the role that the asset plays in maintaining community-wide well-being, and the potential of the population or asset to be impacted by compounding or cascading effects of interacting hazards.

Priority Vulnerabilities

In addition to the severity of impacts from climate change and related hazards, other factors that affect whether a population or asset is considered a priority vulnerability include:

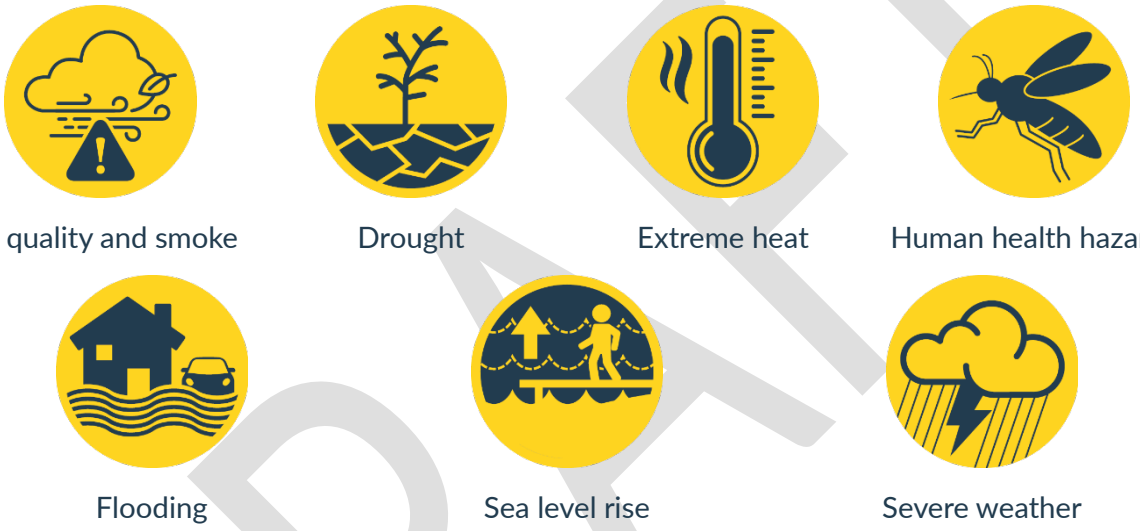
- Size of the population or the importance of the asset.
- Equity considerations and history of marginalization.
- Role in supporting community well-being.
- Community values and concerns.
- Ability to resist and recover from hazards.
- Potential for cascading and compounding impacts.

Overall, the hazards that pose the greatest risk to East Palo Alto include flooding, severe weather, and extreme heat and warm nights. Flooding is of particular concern because it can cut off access to roadways, move contamination in water and soils, and, in combination with sea level rise, expand the flood-prone areas throughout the city.

Climate change is expected to affect everyone and all locations in East Palo Alto to some degree and create additional challenges to overcoming the environmental justice issues already facing the community. However, some populations and other community assets are likely to be disproportionately affected, and it is these groups and assets that the Vulnerability Assessment identifies. This section does not describe all impacts from climate change and associated hazards. Rather, it identifies the populations and assets that the project team found priority vulnerabilities for the greatest number of hazards, based on the results of the Vulnerability Assessment. Other populations and assets not listed here may still face significant harm from climate change.

Low-Resourced Households

Most Vulnerable To:



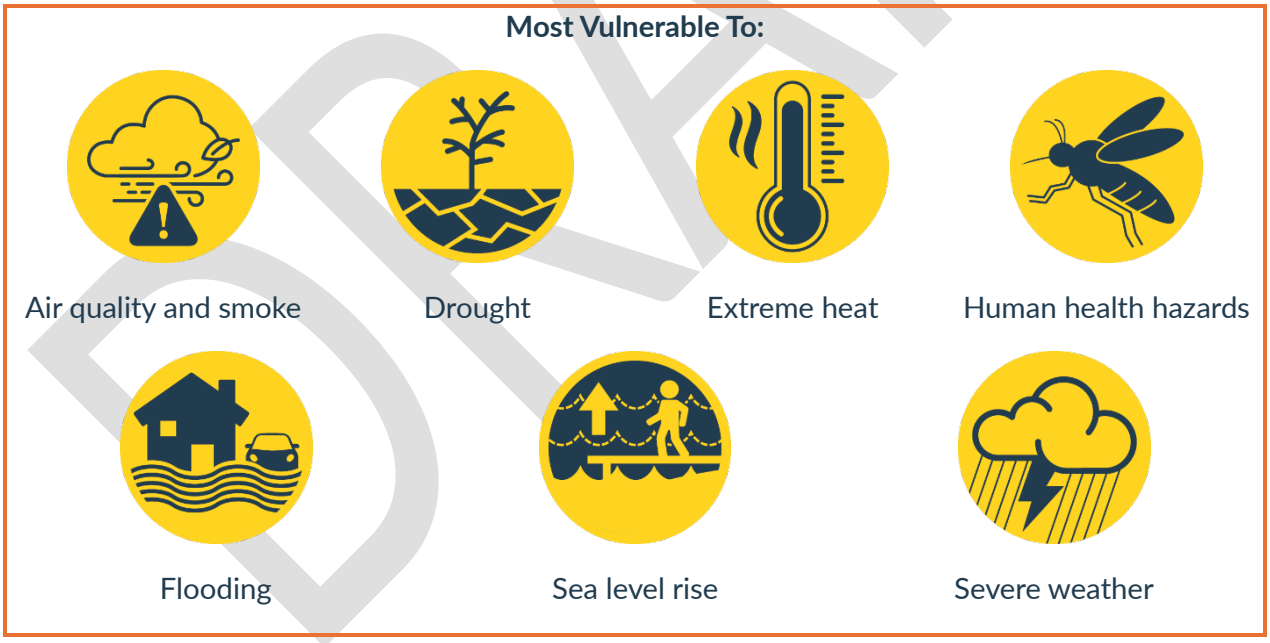
Low-resourced households are among the populations most at risk of climate change hazards throughout East Palo Alto. This includes cost-burdened households (those that pay more than 30 percent of their income on housing costs), low-income households, overcrowded households (households that have more than one person per room of the home), households on fixed incomes, persons without access to lifelines such as personal vehicles and internet, and households in poverty. Low-resourced households typically lack sufficient resources to invest in home repairs and weatherization improvements, air conditioning and efficient appliances, health care, and other means to prepare for and recover from hazardous events. Evacuations pose significant concerns for these households, as they may lack access to reliable transportation or the financial means to leave during emergencies, making it difficult to comply with evacuation orders during severe weather events.

Limited financial resources may prevent these households from affording adequate housing, which means they are more likely to be renters and live in older buildings with poor maintenance, structural damage, or inadequate sanitation. These conditions create an ideal environment for pests, which can carry harmful pathogens. Overcrowded households may have limited ability to cope with illnesses caused by vectors, extreme temperatures, or exposure to mold and mildew, as persons living in these households are in close proximity to others, causing illnesses to spread more easily. These households may be financially strained by medical costs and inability to work due to illness. During drought, low-resourced households may be especially vulnerable to increases in water price due to existing water affordability concerns and additional water conservation pricing and may be unable to afford water-efficient appliances to reduce water use.[25]

Community Resilient Communities

Community Resilient Communities (CRC) helped form the East Palo Alto Climate Change Community Team in 2019 as part of a San Mateo County climate resilience program. Since then, CRC has led the climate change survey, Community-Led Vulnerability Assessment, and is currently assisting with the East Palo Alto Community Resilience Hub, Breath of Air Campaign, and Rain Gardens & Water Cisterns in East Palo Alto, among other programs.

Older Adults



Older adults face a distinct set of vulnerabilities during emergencies, and it is essential to understand these challenges to protect this population effectively. Many older adults experience reduced mobility, impaired vision, and hearing loss that make it difficult to prepare their homes for severe weather or extreme heat events or evacuate quickly during flooding. For instance, attempting to evacuate during a severe storm while dealing with mobility impairments or vision

issues significantly increases their risk of harm. Chronic health conditions further exacerbate these vulnerabilities. Conditions such as heart disease, diabetes, and respiratory issues can be significantly worsened during crises, particularly when exposed to wildfire smoke or extreme heat. Additionally, many older adults depend on regular medication, and the unavailability of these medications during disasters can escalate an already dangerous situation into a life-threatening emergency.

Senior Programs in East Palo Alto

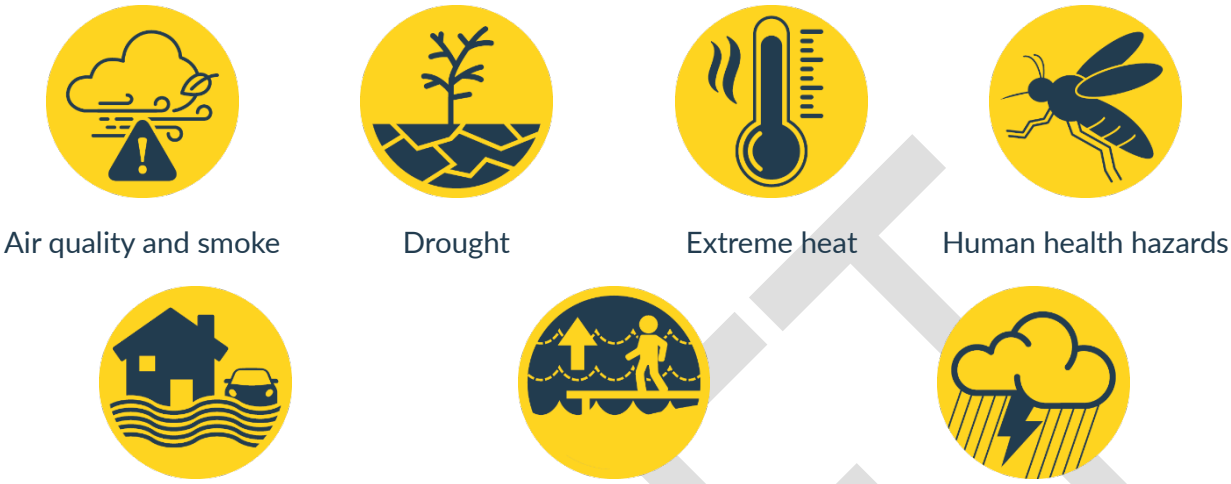
The City supports several senior-focused community programs throughout the community, including events such as Senior Prom and the Senior Lifestyles Expo, as well as services such as the Senior Lunch Program & Transportation and the Senior Advisory Committee. The goal of these programs and services is to reduce food insecurity and provide opportunities for Aging Adults to limit social isolation.

Economic and social factors also compound these risks. Older adults on average have lower incomes than middle-aged adults, and older adults in East Palo Alto are more likely to receive far less income than those in surrounding communities like Menlo Park, Palo Alto, and Atherton. This limits their ability to invest in necessary disaster preparedness measures, such as purchasing emergency supplies or making their homes more resilient to natural hazards; this ultimately can increase their vulnerability to hazard events. Some older adults are also unable to drive, leaving them dependent on external assistance if they need to evacuate. The digital divide is another key factor, given that some older adults may be less familiar with digital technology, making it difficult for them to receive timely alerts and critical information through smartphone alerts, social media, or text messaging.

These compounding vulnerabilities mean that older adults are particularly susceptible to hazards involving poor air quality, extreme heat, severe weather, and flooding. The relationship of physical limitations, chronic health issues, economic constraints, and limited access to information can converge to place their lives at considerable risk.

People of Color and Immigrant Communities

Most Vulnerable To:



People of color and immigrant communities are susceptible to severe outcomes from climate change hazards, owing to marginalization and discrimination, and in some cases distrust of government services and lack of a social support network. East Palo Alto is home to a diverse population with over 41 percent born outside of the United States and 25 percent not fluent in English, and therefore these communities in particular are high priority for the city.[26] Members of these communities have also historically been left out of planning and advocacy in the region, and therefore are at the forefront of environmental and climate justice issues in East Palo Alto.

Immigrant communities and people of color often encounter significant barriers when accessing vital resources during natural disasters. While they may seek out cooling centers and health services, concerns about citizenship status, racial discrimination, and language barriers can make them feel unsafe or unwelcome.[27] Many individuals in these communities work in outdoor occupations, exposing them to poor air quality, extreme heat, and vector-borne illnesses, and they may be unaware of health alerts due to linguistic isolation.

People of color and immigrants are more likely to live in neighborhoods with limited shade and tree cover, further exacerbating their vulnerability to extreme heat and high levels of stormwater runoff. Additionally, these communities face systemic issues such as racial discrimination, economic hardships, and often language barriers, which can hinder their access to high-quality housing and increase exposure to climate change hazards.[28, 29]

Organizations like Nuestra Casa, El Comite de Vecinos del Lado Oeste, and Anamatangi Polynesian Voices play a crucial role in assisting Spanish and Polynesian-speaking immigrants by helping them understand their rights, connecting them to safety net resources, and advocating to reduce language barriers. However, it can be challenging for some Pacific Island community members and non-English speakers to receive alerts in their native languages.[30, 31] Overall, the

interaction of these factors significantly limits immigrant communities' and people of color abilities to prepare for and respond to hazard or health emergency events, leaving them disproportionately affected by climate change.

Food Access

Most Vulnerable To:

Drought | Extreme heat | Flooding | Sea level rise

Regular access to healthy and affordable food is integral to supporting community well-being and many residents in East Palo Alto currently struggle to access healthy foods. Many residents may also rely on food distribution programs and emergency food assistance. Food access and insecurity is likely to worsen due to climate change. Regional drought may raise food prices and threaten the viability of community-driven initiatives like gardens. Infrastructure damage from flooding, including roadways, energy systems, and buildings, can severely disrupt grocery store and market supply chains, further limiting food access. Additionally, power outages from extreme heat or severe storms lasting more than 24 hours can lead to spoiled food, compounding the financial challenges faced by residents who have limited means.

Key food providers like the East Palo Alto Community Farmer's Market, Church of Christ, Ecumenical Hunger Program, Garden Market, and Collective Roots Community Garden are located in flood zones, making their facilities and distribution methods vulnerable to flooding and sea level rise, preventing access to food or damaging supplies. Although proactive hardening of grocery stores, markets, and the infrastructure supporting these facilities is possible, the city and the owners of these facilities may lack sufficient resources for preparation and swift recovery after a major hazard event.

Homes

Most vulnerable to:

Extreme heat | Flooding | Sea level rise | Severe weather

Homes, including single-family houses, duplexes, and apartments, are an essential part of every community. East Palo Alto, like other areas of the Bay Area and California, faces a chronic housing crisis fueled by high costs and a limited supply of housing. Over 60 percent of households in the city live in neighborhoods that are susceptible to displacement.[32] Local residents could be harmed by gentrification that drives up home prices, reducing affordable housing and increasing displacement of existing residents that are the foundation for the city's diverse and active community. Climate change threatens to worsen this already-severe problem in East Palo Alto.

Houses and apartment buildings throughout the city can be damaged or destroyed by flooding events, inundation from sea level rise, and severe storms. Even if initial damage is minor, standing or retained water can cause mold and mildew to grow, causing homes to become uninhabitable.[33] Although extreme heat events and poor air quality may not affect the structural integrity of homes, these events can cause unhealthy indoor air temperatures and quality, resulting in dangerous living conditions for occupants. If homes do become uninhabitable, residents can be displaced and may not be able to find alternative housing options. This is an important concern for East Palo Alto, which is surrounded by higher-income communities.

Transportation and Transit Infrastructure and Services

Most Vulnerable To:

The roads and highways, bridges, transit networks and facilities, and transportation services play a pivotal role in supporting community health, safety, and well-being in East Palo Alto. These systems span the city and connect East Palo Alto to the surrounding region, and are especially vulnerable to extreme heat, flooding, sea level rise, and severe weather. East Palo Alto also already has transportation constraints due to the few underpasses and overpasses available over Highway 101 to connect city residents to the surrounding region. During normal conditions, damage to transportation infrastructure and services prevents people from going about their daily lives, interrupts many key services, and disrupts freight and shipping, including vital supply chains that support both businesses and households. Damage to transit networks also significantly impacts mobility for those who rely on public transportation, and with few transit routes in East Palo Alto, this can lead to reduced access to jobs, healthcare, and other essential services. Such disruptions can result in physical, emotional, and economic harm to community members. During emergency events, the potential for harm is even greater, as damaged transportation networks can block evacuations, prevent or delay emergency response services, and significantly hinder deliveries of vital supplies.

Roadways can be damaged or blocked by flooding, debris from severe storms, and storm surge from sea level rise. Highway 101, University Avenue, Willow Road, Bay Road, and other local roads can be damaged or blocked by these hazards, isolating residents from goods and services. Sea level rise and flooding may damage pavement, potentially increasing road maintenance costs and creating unsafe driving, walking, and biking conditions. Extreme heat has the potential to impact road infrastructure and cause damage, including pavement and sidewalk concrete expansion that can result in cracks, increasing maintenance costs.

These hazards also directly impact transit services, such as buses, by disrupting access to transit routes and facilities, leading to reduced service reliability and longer travel times. Public transit disruptions along flooded or debris-filled streets and corridors could also hinder evacuation efforts for transit-dependent populations. While roadway improvements could alleviate these risks, they are likely to require substantial funding in a city that is already financially constrained, demand additional resources, and take a significant amount of time to complete. Flooding and emergent groundwater can also impact neighborhood access roads that are narrow and have poor drainage, causing long-term delays and requiring costly clean-up. If these transportation and transit services are disrupted due to hazards, it will have cascading effects throughout the entire community, impacting daily life, access to resources, and the overall resilience of all communities.

Tidal Marsh Habitat

Most Vulnerable To:

Ecosystem Pests | Extreme heat | Flooding | Sea level rise

Tidal marsh habitat in East Palo Alto surrounds Cooley Landing Park in the Ravenswood Open Space Preserve and the Don Edwards Wildlife Preserve. Tidal marshes provide an essential buffer between the San Francisco Bay and the developed areas of the city, absorbing storm surge and high tides to prevent flooding along the shoreline and damage to critical buildings and infrastructure. These areas also provide open space and park access for the community along the Bay Trail. Several existing factors play a role in the sensitivity of these ecosystems to changing conditions, such as fragmentation, existing pollution levels, invasive species, and built structures that may impede the natural adaptive migration of the ecosystems as sea levels rise and temperatures increase. Extreme heat can raise water temperatures, leading to harmful algal blooms and lower dissolved oxygen levels for aquatic life.

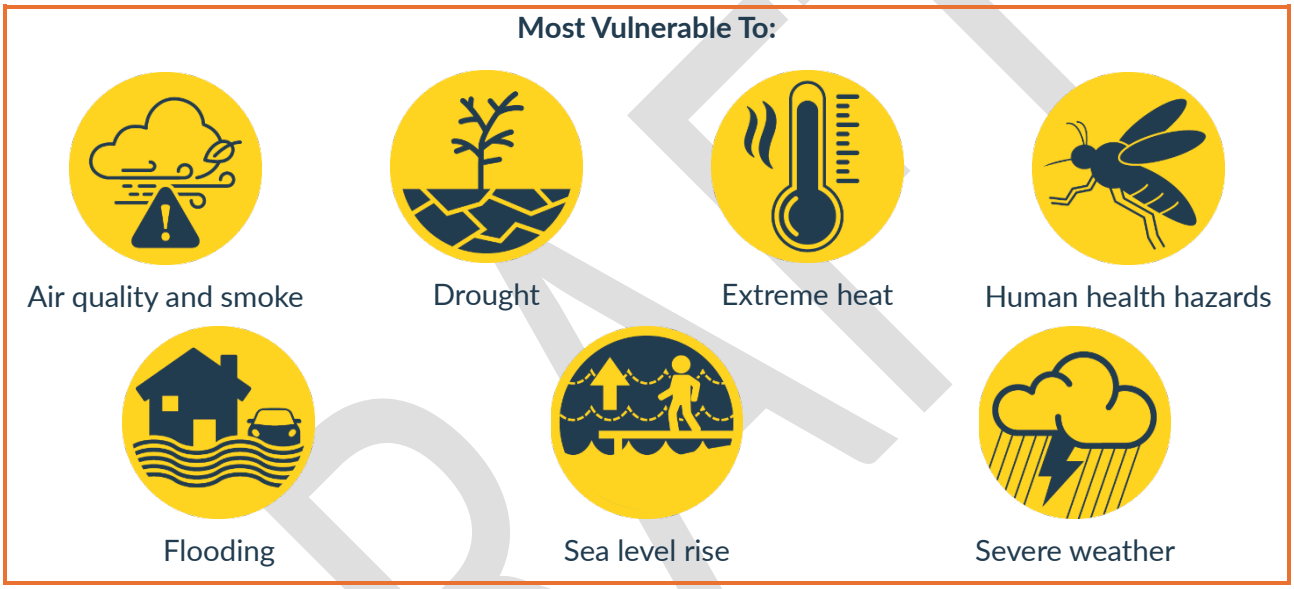
Tidal marsh habitat can be affected by an influx of water from sea level rise and flooding. Sea level rise can permanently inundate saltwater marsh, causing the conversion of the ecosystem

into mudflats.[34] Inland flooding from severe storms can cause sediment and contaminants to flow into these ecosystems, harming the plant life and causing algal blooms.

Other Priority Vulnerabilities

Although the following populations and assets are not identified as priority vulnerabilities, they are still significant and important to East Palo Alto and represent critical concerns to community members. It is essential that this report recognize these other priority vulnerabilities for the purpose of community planning and risk assessment efforts. Addressing these vulnerabilities proactively can help to mitigate their impacts and support the City's overall resilience.

Persons with Chronic Illnesses and/or Disabilities



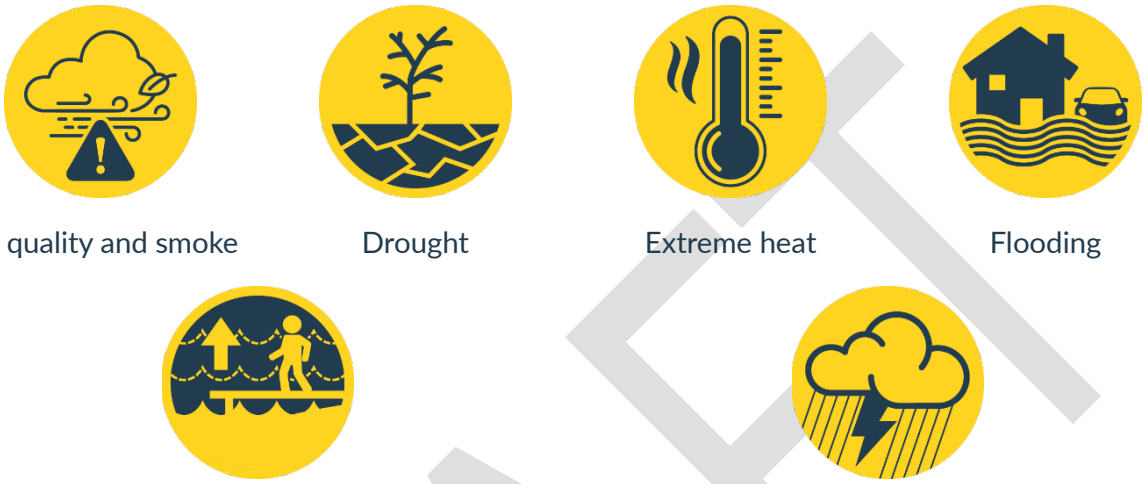
Almost 10 percent of people in East Palo Alto live with a disability and nearly 10 percent of the population have asthma or diabetes.[35, 36] Persons with chronic illnesses or disabilities may face barriers to receiving emergency alerts, evacuating, obtaining support resources, as well as installing appliances and making retrofits or structural improvements to their homes to improve resilience. They likely have weaker immune systems due to pre-existing conditions or medications that make it more difficult to fight off new illnesses. Allergens and vector-borne illnesses can exacerbate existing illnesses, creating difficulties in existing or new medical treatment. These individuals also experience increased sensitivity to the health effects of heat and poor air quality due to chronic illnesses or medications.

These individuals may be more likely to be injured or become ill due to flooding and may be reliant on medications or medical devices that may be lost, damaged, or rendered inoperable due to a flood. Those who rely on electricity to operate medical devices or store medication may be especially vulnerable in the event of a public safety power shutoff or other loss of power, which may become more likely during periods of extreme heat, severe weather, and flooding. Those

with disabilities face difficulties in preparing their homes and evacuating or traveling to higher ground before and during flooding and severe weather events.

Residents of Mobile Homes

Most Vulnerable To:



Residents of mobile homes in East Palo Alto, specifically Palo Verde Mobile Home Park, face significant vulnerabilities to climate change due to existing financial constraints or fixed incomes and less resilient homes. Many mobile homes lack dedicated ventilation systems, leading to higher indoor air temperatures and prolonged exposure to pollutants that can exacerbate health issues, such as asthma. Financial constraints faced by many of these residents hinder their ability to invest in necessary air quality improvements, water conservation measures, energy efficiency upgrades, making them more susceptible to heat and air quality-related illnesses, as well as harm from water use restrictions during droughts.

The Palo Verde Mobile Home Park is in a 500-year flood zone and will likely face flooding during a 100-year storm event due to sea level rise by 2050. The structural integrity of older mobile homes is often compromised, as they do not meet the same construction standards as traditional homes and may not be able to accommodate weatherization improvements. While programs like PG&E's Comprehensive Manufactured Home Program aim to enhance energy efficiency and resilience, the financial vulnerability of these residents often prevents them from accessing the resources needed to protect their homes and health effectively.

Unhoused Persons

Most Vulnerable To:


Air quality and smoke


Drought


Extreme heat


Human health hazards


Flooding


Severe weather

Unhoused individuals and families face significant health risks due to prolonged outdoor exposure to health hazards, including poor air quality from wildfire smoke, extreme temperatures during heat waves, vector-borne illnesses, inconsistent access to drinking water, and heightened vulnerability to extreme weather events like floods.[37] These individuals often lack access to necessities like water, sunscreen, and protective clothing, which increases their susceptibility to dehydration, heat stroke, respiratory infections, and other health issues. Climate change exacerbates these challenges due to a potential loss of belongings for unhoused persons and disruption of essential services such as homeless shelters, increasing the likelihood of mental health issues due to trauma from hazard events.[38]

The City of East Palo Alto has collaborated with San Mateo County and organizations like LifeMoves and Project WeHOPE to provide case management, shelter, and housing for unhoused residents. Additionally, the City has extended programs like RV Safe Parking and is streamlining permit processes to facilitate temporary shelter and overnight vehicle parking.[39] Despite these efforts, flooding, health hazards, and extreme weather continue to hinder the transition out of homelessness, further entrenching individuals in long-term homelessness.

Healthcare and Life Science

Most Vulnerable To:


Air quality and smoke


Drought


Extreme heat


Human health hazards

East Palo Alto has limited healthcare providers and life science companies, which can limit easy access to healthcare and exacerbate disparities in healthcare quality and access. However, many residents work in these economic sectors at sites in surrounding communities. As an economic driver, healthcare is most vulnerable to poor air quality, drought, extreme heat and heat waves, and vector-borne illnesses. The healthcare industry may see an influx of patients when these hazards occur, straining the healthcare system and causing extreme stress to those working in the industry.

The life sciences industry may face difficulties if facilities are flooded or disease outbreaks prevent workers living in East Palo Alto from going into offices and disrupt supply chains, but this industry is generally more resilient than the healthcare industry since the research and development in the life sciences industry is largely separated from medical care facilities and patients. The life science industry can also help combat human health hazards through new vaccines, medications, and technologies for managing climate-related health complications. During community-wide health emergencies, the demand for health services can rise significantly, often surpassing the available staff and resources. For instance, extreme heat may lead to an increase in patients with heat-related illnesses like heatstroke or dehydration, while severe weather can cause injuries that further strain emergency services. Infectious disease outbreaks may also overwhelm medical providers, making it difficult to provide adequate care to all residents.

Equity concerns are especially prominent in East Palo Alto, where healthcare access disparities and heightened vulnerabilities are common during emergencies. Many residents already face systemic barriers to healthcare, such as limited medical facilities in the city and challenges related to affordability and transportation to these facilities. When hazards like extreme heat or infectious disease outbreaks push these resources beyond capacity, marginalized communities are disproportionately affected. This puts a strain on those working in these fields, causing mental and physical burnout of workers.

The COVID-19 pandemic exposed these vulnerabilities, as healthcare systems were overwhelmed nationwide. Communities with fewer resources, such as East Palo Alto, faced even greater challenges accessing timely care.

Utility and Communication Services

Most Vulnerable To:

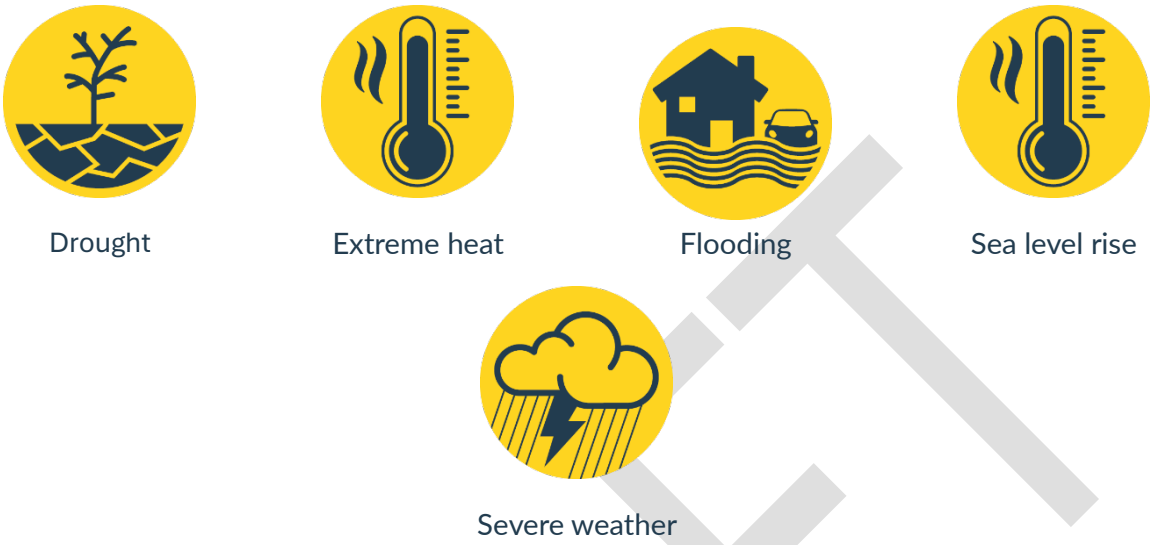
Extreme heat | Flooding | Sea level rise | Severe weather

East Palo Alto's electricity and communication services have existing constraints, such as lack of redundancy in electricity and internet infrastructure, making them highly vulnerable to the impacts of climate change. Extreme heat can reduce the performance and lifespan of exposed electrical equipment and increase demand for air conditioning, overloading the grid. This heightened demand leads to rolling power outages and damages to transmission lines, especially as new air conditioning units are installed in buildings previously without cooling systems. The combination of increased demand and reduced transmission efficiency makes brownouts and power loss more likely.

Flooding presents additional risks, threatening both above- and below-ground power and communication lines. Critical infrastructure, like Pacific Gas and Electric Company (PG&E) substations, gas pipelines, and overhead electric lines, are particularly vulnerable to flooding and sea level rise, and damage to these facilities could disrupt regional energy services. Severe weather, including high winds and heavy rainfall events, can cause power lines to be de-energized (public safety power shutoff or PSPS events) to prevent damage, leading to widespread outages that harm local services and economic activities. As this infrastructure is exposed to these climate hazards, critical services, public safety, and overall community well-being are put at greater risk. Strengthening and retrofitting local infrastructure, while possible in some cases, is costly and difficult to implement widely, especially since the City does not own, operate, or manage utility and communication infrastructure and services.

Riparian Habitats

Most Vulnerable To:



Riparian habitat in East Palo Alto includes areas along the San Francisquito Creek. These habitats provide numerous benefits, including flood control by absorbing excess rainwater and reducing the risk of flooding in nearby areas. This creek and the surrounding riparian areas offer critical habitat for diverse wildlife, supporting a variety of plant and animal species, some of which are rare or endangered. They provide essential breeding, feeding, and shelter areas for birds, fish, and other wildlife. Additionally, these habitats offer recreational opportunities, such as birdwatching, hiking, and educational activities, especially as the San Francisquito Creek flows out towards the Bay Trail, contributing to the well-being of the community.

Several existing factors play a role in the sensitivity of these ecosystems to changing conditions, such as fragmentation, existing pollution levels, trash and debris from upstream areas outside of East Palo Alto's jurisdiction, and built structures that may impede the natural adaptive movement of the ecosystems as sea levels rise, drought intensifies, and temperatures increase. Droughts and extreme heat can raise water temperatures, leading to harmful algal blooms and lower dissolved oxygen levels for aquatic life. Severe storms and flooding can be detrimental to streambanks and riparian areas, eroding natural streambanks and causing higher peak flows in channelized areas.

Next Steps

The Vulnerability Assessment is a key technical study needed to update the Safety Element. The Vulnerability Assessment helps community members, agency staff, and decision makers understand how climate change hazards may alter community conditions and what parts of the community (people and places) should be prioritized for adaptation and resilience. The findings from the climate change Vulnerability Assessment process will be used to inform the goals, policies, and actions that will be included in the Safety Element.

Glossary

Adaptation: Making changes in response to current or future conditions (such as the increased frequency and intensity of climate-related hazards), usually to reduce harm and to take advantage of new opportunities. [40] [41]

Adaptive Capacity: The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities. [42]

Cascading or Compounding Effects: Extreme events that link together hazards over days, weeks, or months, resulting in multiplied effects that cause secondary and sometimes tertiary damage, exceeding the damage of the initial hazard event.

Climate Change: A change in the state of the climate that can be identified by changes in the mean, and/or the variability, of its properties, and that persists for an extended period, typically decades or longer.

Community Asset: A valued feature of a community that may be harmed by climate change. Community assets may include buildings, infrastructure, community services, ecosystems, and economic drivers.

Exposure: The presence of people; infrastructure; natural systems; and economic, cultural, and social resources in areas that are subject to harm. [43]

Goal: An ideal future end state related to public health, safety, or general welfare.

Hazard: An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss. [44]

Impact: The effects (especially the negative effects) of a hazard or other conditions associated with climate change.

Policy: A specific statement that guides decision-making, indicating a commitment of the local legislative body to a particular course of action.

Program: An action, procedure, program, or technique that carries out a general plan policy.

Resilience: The capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and change from a disruptive experience. Community resilience is the ability of communities to withstand, recover, and to learn from past disasters to strengthen future response and recovery efforts.

Risk: The potential for damage or loss created by the interaction of hazards with assets such as buildings, infrastructure, or natural and cultural resources.

Vulnerability: The degree to which natural, built, and human systems are susceptible to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. [45]

Vulnerability Assessment: An analysis of how a changing climate may harm a community and which elements—people, buildings and structures, resources, and other assets—are most vulnerable to its effects based on an assessment of exposure, sensitivity, potential impact(s), and the community's adaptive capacity.

Appendix A: Methods

The Vulnerability Assessment considers the threats from all relevant natural *hazards*, which are events or physical conditions that have the potential to cause harm or loss and will emphasize changes to hazard frequency and severity due to climate change. The Safety Element update addresses natural and human-caused hazards, such as seismic hazards and hazardous materials. However, these hazards are not included in the Vulnerability Assessment, as climate change does not substantially change their frequency or severity. The Vulnerability Assessment also assesses *populations* and *assets* facing potential harm from the hazards. This includes the risk of physical damage to buildings and infrastructure, social vulnerability of persons likely to be disproportionately harmed by hazards, potential disruption to the city's economic engines, and loss of important services.

The Vulnerability Assessment is based on accurate and up-to-date information, including the Cal-Adapt database, the *California Adaptation Planning Guide* (2020), and the *San Mateo County Multijurisdictional Local Hazard Mitigation Plan* (2021). As outlined in the *California Adaptation Planning Guide*, the Vulnerability Assessment follows a four-step process:

1. **Identify Exposure.** In a Vulnerability Assessment, *exposure* is the presence of people, infrastructure, natural systems, and resources (economic, cultural, and social) in areas subject to harm. A *hazard*, also called a climate change hazard, is an event or physical condition that has the potential to cause types of harm or loss. This step includes confirming applicable hazards in the city, describing historical hazards, describing how hazards are expected to change, and mapping the hazard-prone areas.
2. **Analyze Sensitivity and Potential Impacts**. *Sensitivity* is the level to which changing climate conditions affect a population or community, species, natural system, government, asset, or resource. Potential *impacts* are the effects of a climate change hazard, or the combination of exposure to the hazard and sensitivity of a population or asset to it. For example, suppose an increase in extreme heat events is the hazard. In that case, the greater risk of heat-related illness in susceptible persons is the exposure, and the sensitivity is the degree of the impact from the exposure. Each population and asset in East Palo Alto is likely to experience different impacts. The project team assessed the sensitivities and potential impacts to each population or asset from each applicable climate change hazard.
3. **Evaluate Adaptive Capacity.** *Adaptive capacity* is the ability of people and assets to adjust to potential damage from climate change hazards, to take advantage of existing opportunities such as funding, tools, and resources, or to respond to the impacts of climate change. The project team assessed the adaptive capacity of each population or asset for each applicable identified hazard. The City is already implementing several measures to increase adaptive capacity, including the Municipal Code requirements, Capital Improvement Program, and Climate Action Plan strategies.

4. **Conduct Vulnerability Scoring**. *Vulnerability* is defined as the combination of impact and adaptive capacity as affected by the level of exposure to changing climate conditions. Following the process in the *California Adaptation Planning Guide*, the project team scored impact and adaptive capacity for each population and asset affected by each hazard on a scale of low, medium, and high, to identify priority vulnerabilities for populations and assets in East Palo Alto.

Appendix B: Populations and Assets

The City included the following populations and other assets in the Vulnerability Assessment. Each list includes a description and source of data needed to support the Vulnerability Assessment.

Populations

The City collected population data from the U.S. Census, the California Healthy Places Index, and the San Mateo County Homeless Point-in-Time Count. These 17 populations are:

1. Children and youth under 18 years of age: Approximately 24 percent of East Palo Alto's population is under 18.[46]
2. Cost-burdened/low-income/overcrowded households: Cost-burdened households are those paying 30 percent or more of their income towards housing expenses. The State identifies $149,100 as the low-income threshold for a household of four people in San Mateo County in 2023.[47] Overcrowded households include housing units that have more than 1.0 person per room (excluding bathrooms and kitchens). Approximately 19 percent of homes in East Palo Alto are overcrowded.[48]
3. Households in poverty: The federal poverty line for a household of four is $31,200 a year for a family of four. However, in San Mateo County, the acutely low poverty line (15 percent of area median income) is $26,250 for a household of four.[49, 50] Approximately 12 percent of East Palo Alto residents earn incomes at or below poverty.[51]
4. Immigrant communities/linguistically isolated persons: Communities consisting of foreign-born populations, including immigrants, refugees, and undocumented persons. Linguistically isolated persons include households without a member who is fluent in English. Approximately 43 percent of East Palo Alto's population was born outside of the United States, approximately 70 percent of whom are from Latin America and 10 percent of which are from Asia and the Pacific Islands, as of 2021. Approximately 26 percent of the population is not fluent in English.[52] Spanish and languages from the Pacific Islands (Tongan, Samoan, or other Asian or Pacific Islander language) are the primary languages in East Palo Alto among households that are not fluent in English.[53]
5. Under-resourced people of color: Persons identifying as a member of a racial and/or ethnic group and facing limited access to resources, such as financial, social, healthcare, or educational assistance.[54,55]
6. Outdoor workers: Workers in landscaping, construction, outdoor recreation, etc.
7. Persons experiencing homelessness: The San Mateo County 2022 One Day Homeless Count reported 169 total persons experiencing homelessness (all unsheltered) in East Palo Alto.[56]
8. Persons living on single-access roads (roads with only a single entry or exit point): Single access and road-constricted neighborhoods are along the eastern edge of the city.
9. Persons with chronic illnesses and/or disabilities: Approximately 9 percent of East Palo Alto's population has some form of disability.[57]

10. Persons without a high school degree: Approximately 36 percent of East Palo Alto's adult population has not obtained a high school degree or equivalent.[58]
11. Persons without access to lifelines: Persons without reliable access to a car, transit, or communication systems. Approximately 5 percent of East Palo Alto households do not have access to a personal vehicle.[59] Approximately 14 percent of East Palo Alto households do not have an internet subscription.[60]
12. Renters: Approximately 52 percent of East Palo Alto housing units are renter-occupied. Approximately 40 percent of renter households are four- or more person households, approximately 43 percent of these households contain children, and approximately 28 percent are single-parent households. [61]
13. Residents of mobile homes: Palo Mobile Estates and those not in mobile home parks.
14. Seniors (65+): Seniors constitute 8 percent of East Palo Alto's population.[62]
15. Seniors living alone: Approximately 4 percent of East Palo Alto households are made up of seniors living alone.[63]
16. Unemployed persons: East Palo Alto's civilian labor force unemployment rate is approximately 5 percent.[64]
17. University students: Approximately 7 percent of East Palo Alto's population is enrolled in college or graduate school.[65]

Infrastructure

The City gathered details on infrastructure from State and local geographic information system (GIS) data, the City website, the General Plan, and the *2021 San Mateo County Multijurisdictional Local Hazard Mitigation Plan*. These seven asset groups are:

1. Energy and communication infrastructure:
    - Transmission lines, including overhead power lines: Pacific Gas and Electric Company (PG&E).
    - Natural gas pipelines: PG&E.
    - Other PG&E infrastructure, including distributed infrastructure and communication infrastructure.
    - Solar installations.
    - Cell towers, radio sites, fiber-optic lines (i.e., Stanford/military), phone, and internet lines.
2. Flood control and stormwater infrastructure.
3. Vehicle fuel stations:
    - Electric vehicle charging stations: Five public charging stations[66]
    - Gas stations
4. Hazardous materials sites: 61 cleanup sites (23 where remediation activities have not finished) identified via the State Water Control Board's GeoTracker database;[67] 10 sites (one with active cleanup activities) identified via the Department of Toxic Substances Control's EnviroStor database.[68]
5. Transportation infrastructure:

- Freeways: US Highway 101 Bayshore Freeway.
- Major roads: University Avenue, Pulgas Avenue, Bay Road, Willow Road, West and East Bayshore.
- Bridges: East Bayshore Road/Highway 101 over San Francisquito Creek, West Bayshore Road over San Francisquito Creek, Newell Road over San Francisquito Creek, University Avenue bridge over Highway 101, Willow Road over Highway 101, Clarke Avenue pedestrian overcrossing, US101, University Avenue pedestrian overpass connecting West and East Bayshore across Highway 101 (planned).
- Transit facilities: Stops, bus shelters, and other facilities provided by the city and SamTrans.
- Airports: San Francisco International Airport, Palo Alto Airport in Palo Alto, and San Carlos Airport in San Carlos.

6. Parks and related recreational facilities:
    - City Parks: Bell Street Park, Jack Farrell Park, Joel Davis Park, Martin Luther King Junior Park, Pocket Park at East Bayshore, Pocket Park at Newbridge.
    - Regional Parks: Don Edwards San Francisco Wildlife Preserve/Baylands Nature Preserve, Ravenswood Open Space Preserve.
    - Special Facilities: City Room at YMCA, Community Room at City Hall, Cooley Landing Education Center.
    - Trails: Bay Trail, Cooley Landing Trail.
7. Water and wastewater infrastructure: Lift stations; stormwater pump stations; City-owned pumps (Gloria Way Well and Pad D), storm drains; sewer mains and lateral pipes; water mains, pipes and storage tanks, and reservoirs (including Hetch Hetchy, Calaveras, San Antonio, Crystal Springs, Pilarcitos, and San Andreas reservoirs).

Buildings

The City collected buildings data from Google Maps, the City website, and local agency websites and GIS records. These nine assets are:

1. Affordable housing: Includes subsidized housing and mobile homes, including Palo Mobile Estates, individual mobile homes, and housing developments owned by Eden Housing, BRIDGE Housing, and MidPen Housing.
2. Commercial and retail buildings: Ravenswood Shopping Center.
3. Government and community facilities: City Hall, East Palo Alto Library, East Palo Alto Community Development Department, City of East Palo Alto Corporation Yard, East Palo Alto Sanitary District office, East Palo Alto Housing & Community Services office, Menlo Park Fire District Fire Station, East Palo Alto Police Stations, East Palo Alto Senior Center, City vehicle storage facilities.
4. Grocery stores and food markets: Garden Market, Pal Market, Cardenas Market, Oakwood Market, Charlie's Market, One Stop Market, Cooley Avenue Market, Mega Mart (planned), and Country Time Market.

5. Medical and care facilities: East Palo Alto Care Center, Ravenswood Family Health Center, doctor's offices.
6. Homes and residential structures: Multifamily and single-family residences.
7. Public safety buildings: Menlo Park Fire Department, Police Department.
8. Schools:
    - Ravenswood City School District: Cesar Chavez Ravenswood Middle School, Costaño School of Arts, Los Robles-Ronald McNair Academy, Ravenswood City School District.
    - Private and charter schools: East Palo Alto Academy, East Palo Alto Charter School, Eastside College Preparatory School, KIPP Esperanza High School, Oxford Day Academy, The Primary School, La Scuola International School.
9. Shelters. Includes the Project WeHOPE Shelter.

Economic Drivers

The City determined important economic assets based on the *2022 Annual Comprehensive Financial Report* and land uses in the city. These five assets are:

1. Health services.
2. Education services.
3. Major employers: Amazon Web Services, Ravenswood City School District, Ravenswood Family Health Center, Ikea, Four Seasons Hotel – Silicon Valley, Home Depot, City of East Palo Alto, Eastside College Preparatory School, NTT i3, Nordstrom Rack, Ropes and Gray Law Firm.
4. Commercial and retail centers and warehouses.
5. Regional economic activities.

Ecosystems and Natural Resources

The City determined the ecosystems and natural resources based on information from the existing General Plan. These six are:

1. Low Tidal Marsh. Located along the Bay shoreline, primarily in the Baylands Nature Reserve.
2. High tidal marsh. Located along the Bay shoreline.
3. Groundwater. San Mateo Plain subbasin, part of the Santa Clara Valley Groundwater Basin.
4. Riparian habitats. Occur along San Francisquito Creek.
5. Tidal flats. Located within the Ravenswood Open Space Preserve.
6. Urban trees.

Key Services

These assets are based on typical services provided in cities throughout California, which are supported by the infrastructure and buildings listed previously. Key community services include the operation and functions needed to provide and maintain services. The Vulnerability

Assessment assesses the infrastructure and people needed to support them separately. These eight services are:

1. Education services: Ravenswood City School District, private schools, and childcare.
2. Emergency services: Menlo Park Fire Department, City of East Palo Police Department.
3. Energy delivery and communication services: Peninsula Clean Energy, PG&E, radio, television, cellular and landline phone, and internet.
4. Food access: Grocery stores, markets, small local farms, and community gardens.
5. Government administration and community services.
6. Public transit access: SamTrans, AC Transit, Senior Transportation Services.
7. Solid waste removal: Recology.
8. Water and wastewater: City of East Palo Alto/Veolia Water North America Operating Services LLC, Palo Alto Park Mutual Water Company, O'Connor Tract Co-op Water Company, West Bay Sanitary District.

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