Attachment D

City of San José Climate Vulnerability Assessment

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

raimi + associates

January 8, 2025
City of San José Climate Adaptation and Resilience Plan

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Executive Summary

The City of San José Climate Vulnerability Assessment ("Vulnerability Assessment") identifies probable impacts of projected change in climate on the City of San José's ("City") populations, buildings, critical facilities, utility infrastructure, and transportation infrastructure. The vulnerabilities discussed in this document will be addressed through the development of adaptation strategies in the next phase of work for the San José Climate Adaptation and Resilience Plan (CARP). The purpose of the CARP is to increase the City's resilience – or capacity to prepare for, cope with, and recover from – climate hazards. The Vulnerability Assessment and the CARP effort overall complement but are distinct from other City plans with address climate mitigation (Climate Smart San José), hazard mitigation planning, and emergency operations.

Climate is the long-term behavior of the atmosphere – typically represented as averages over 30-year periods – for a given time of year. Although the climate fluctuates naturally, human emissions of carbon dioxide and other greenhouse gas emissions (GHGs) are driving unprecedented changes in the climate system. This assessment uses climate projections for temperature and precipitation based on a high emissions climate change scenario from the Intergovernmental Panel on Climate Change known as Representative Concentration Pathway (RCP) 8.5. This high emissions scenario would result in warming of more than 8 degrees Fahrenheit (°F) by 2100 and is regarded as an unlikely, "worst-case" climate scenario.[1]

Table ES- 1 below summarizes the projected citywide climate hazards.

ES- 1. Summary of Climate Hazard Trend Projections

Hazard	Projected Trend
Extreme Heat	Higher temperatures and more frequent heat waves.
Flood	Longer dry periods punctuated by more extreme precipitation events.
Sea Level Rise	Sea levels are expected to rise up to 1.3 feet by mid-century and 6.5 feet by late-century according to the latest projections from the California Ocean Protection Council (OPC).
Drought	More severe; longer dry spells and decline in average snowpack.
Wildfire	Increase in likelihood of occurrence and intensity.

The Vulnerability Assessment applies vulnerability ratings to assets and populations in the City by analyzing their hazard exposure, sensitivity, and adaptive capacity. The assessment of infrastructure (critical facilities, utilities, transportation) draws upon quantitative and qualitative data from a variety of sources including Silicon Valley 2.0, plans from City departments, and plans and assessments from pertinent agencies. The assessment of populations relies on the Draft Environmental Justice (EJ) Communities identified by the City for the new Environmental Justice Element of Envision San Jose 2040 General Plan, which uses data from CalEnviroScreen 4.0, the census, and locally specific data sets. The summary of each asset or population's vulnerability to climate hazards is summarized in ES-2.

[1] *IPCC, 2019.*

ES- 2. Summary of Asset Climate Vulnerabilities

Asset	Hazard Vulnerability Score				
	Heat	Flood	Sea Level Rise	Drought	Wildfire
Critical Facilities	Moderate	High	High	Minimal	Moderate
Buildings	Moderate	High	Moderate	Minimal	Moderate
Water and Wastewater Infrastructure	Low	High	High	Minimal	Moderate
Water Supply	High	Low	Moderate	High	Low
Substations & Power Generation Facilities	Moderate	High	High	Minimal	Low
Transmission Lines	Moderate	Moderate	Moderate	Minimal	Low
Roads and Highways	Moderate	High	High	Minimal	Minimal
Transit	Moderate	High	Moderate	Minimal	Low
Electric Vehicle Charging Network	Moderate	High	Moderate	Minimal	Low
Airport	Moderate	High	Minimal	Minimal	Low
Populations (All)	Moderate	Moderate	Low	Minimal	Moderate
EJ Communities (Draft)	High	High	Moderate	Minimal	High

Note: See page 3 for definitions of vulnerability rankings.

Key Findings

Critical Facilities and Infrastructure

Critical facilities are a subset of the city's total buildings. They are structures that will prevent serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities during emergencies. If they are destroyed or damaged or if functionality is impaired, these vital services will be jeopardized.

- The critical facilities and buildings asset types have the greatest vulnerability to **flooding**. Buildings can experience some physical damage and damage to building systems (electrical), but most importantly flooding in and around critical facilities can prevent employees from maintaining operations. In the case of fire stations and hospitals, this could have major consequences on the health and safety of San José residents.

Based on the vulnerability assessment of critical facilities and infrastructure, potential adaptation strategies can be identified as follows:

- Conduct **detailed assessments of City-owned critical facilities** that are exposed to climate change hazards. This applies to flood, as well as extreme heat and poor air quality exacerbated by wildfire and heat (for the purposes of serving as cooling centers, clean air facilities, or other place of refuge as needed). Because this assessment is only a screening-level analysis, it does not take into account the physical condition of a building or its site characteristics. For every building this will be different, affecting how much damage it could incur from a hazard event and what kind of alterations can be implemented to increase its adaptive capacity.

Transportation

Transportation infrastructure is vulnerable to climate change hazards; with likely impacts including physical infrastructure damage and reduced access. This can have negative effects on everyday commute travel, movement of goods and services, and likely severe consequences on evacuation procedures. The vulnerability of transportation infrastructure in San José to climate change hazards is as follows:

- **Roads and Highways** are most vulnerable to flooding, extreme precipitation, sea level rise and, storm surge which could have severe impacts on access to roads and consequently essential services. More frequent flooding can also result in damage of roads and highways and may require increased maintenance and repair.
- **Transit** is most vulnerable to flooding and extreme precipitation and wildfire. These hazards could cause transit infrastructure damage and service disruptions. Severe damage to infrastructure may result in longer term access issues and can limit evacuation access for those without vehicles.
- **Electric Vehicle Charging Network** is most vulnerable to flooding and extreme precipitation as the charging infrastructure could get damaged or may become inaccessible. Vulnerabilities related to other climate hazards will likely affect evacuations for those with electric vehicles.

Based on the vulnerability assessment of the transportation infrastructure, potential adaptation strategies can be identified as follows:

- Citywide adaptation measures to **higher temperatures and extreme heat** include implementing energy efficiency and conservation efforts to reduce stress on electricity systems during heatwaves to avoid power outages[2] and reducing heat island effects by using cool pavements and increasing the urban tree canopy.[3]
- Citywide adaptation measures to **flooding and extreme precipitation** can include elevating or relocating transportation assets in the long term and preparing for flood events with quick-build measures including inflatable flood barriers and preparing traffic and transit rerouting plans for areas most vulnerable to flooding in the near term. Nature-based solutions to increase the absorption or diversion of water from transportation assets as they can provide long term water quality, habitat, and other co-benefits.
- Citywide adaptation measures to **sea level rise and storm surge** are similar to the those for flooding.
- Citywide adaption measures to **drought** include low-water trees, landscaping in parks, and plantings along streets and highways.[4]
- Citywide adaptation measures to **wildfire** include emergency preparedness that includes having recommended evacuation routes in parts of the City with high wildfire risk. Additionally, infrastructure in these areas can be upgraded to become more heat resistant to build wildfire resilience.

[2] *US EPA, 2024*
[3] *US EPA, 2023*
[4] *Caltrans, 2023*

Populations

Everyone who lives and works in San José can experience negative impacts from climate change hazards, but many residents have social vulnerabilities and biological sensitivities that affect exposure to climate hazards and sensitivity to impacts. Residents of Environmental Justice Communities, mobile home parks, and those who are homeless face greater vulnerability to hazards, particularly flood, heat, and poor air quality.

- **Older adults, children, and people with pre-existing health conditions** are extremely vulnerable to the potentially deadly impacts of heat, wildfire smoke, and flooding.
- **Low-income households** face higher vulnerability to all hazards because they have less financial ability to prepare for hazard events and to bounce back from impacts. Low-income households may also have other characteristics which exacerbate vulnerability, such as working outdoors, being an older adult on a fixed income, and renting rather than owning their home.
- **Mobile home parks** house populations who may be more vulnerable based on socioeconomic characteristics, including age and income. Mobile homes themselves are already more vulnerable to impacts of heat, wildfire smoke, and flooding based on their design and structural components. Furthermore, many mobilehome parks lie in the floodplains and some are projected to experience inundation from sea level rise, making mobile homes extremely vulnerable.

Based on the vulnerability assessment of populations some preliminary adaptation strategies can be identified as follows:

- Activate facilities that can serve as community resiliency centers that provide **cooling, clean air, and other services** in Draft EJ Communities during times of extreme heat and poor air quality. Activated facilities should be pre-identified and always be in the same place so that residents and other community members know where to go, trust City guidance about accessing the facilities, and feel comfortable coming to them. This is particularly important for communities that may have lower levels of trust or familiarity with government institutions, such as language-isolated communities and unhoused residents.
- Strengthen outreach and education with the primarily **Spanish- and Vietnamese-speaking communities** that reside in the 100- and 500-year floodplains. Conduct outreach and education about flood preparedness, improve emergency notification procedures, and expand community partnerships
- Develop adaptation measures to address the physical vulnerability of **mobile home parks** and the social vulnerabilities of their residents.

1. Introduction

The City of San José Climate Vulnerability Assessment (Vulnerability Assessment) is a screening level evaluation of the climate change hazards that affect the city. San José is an urban area of 180.2 square miles nestled in a valley at the foot of the Santa Cruz and Diablo Mountain Ranges in Santa Clara County. The most northern portion of the City comes up against the southern end of the San Francisco Bay with an elevation at sea level. Several creeks cross through the City draining from hillsides to the east and west. San José has a Mediterranean climate with warm, very dry summers and cool, relatively rainy winters. The city's geographic characteristics and the impacts of climate change contribute to the incidence and increasing intensity of hazards including extreme storms and flooding, sea level rise and storm surge, extreme heat, drought, and wildfire.

The City has a diversity of socioeconomic and environmental hazard exposure conditions that create areas designated as Draft Environmental Justice (EJ) communities. The Draft EJ Communities are centrally located census tracts in the city, with a majority in areas including Central and Downtown San José. Residents of these areas often live in older homes with less protection from high heat or do not have economic resources to adapt their properties to respond to changing climate conditions. Residents may also live in multi-family properties that do not have modern cooling and air filtration systems.

These background conditions generate the various physical and social vulnerabilities that are evaluated in this assessment.

Purpose of the Vulnerability Assessment

Residents and the physical infrastructure in San José are already experiencing impacts from climate change. In the past decade, record-breaking temperatures and severe flooding of local creeks led to hospitalizations and evacuations across the city.

The purpose of the Vulnerability Assessment is to better understand how climate change will affect residents and infrastructure in the city of San José. Vulnerability is the degree to which an asset is susceptible to damage from a given climate hazard. Vulnerability is a combination of exposure – which indicates if an asset is located in an area projected to experience a climate hazards – and sensitivity – which is the degree to which an asset could be damaged if it is exposed to climate hazards. The Assessment is used to inform the development of targeted climate change adaptation strategies and measures to reduce identified vulnerabilities and increase the community's resilience. The Assessment is for policy and screening-level analysis only. It does not consider the physical condition of facilities or their site characteristics.

Vulnerability Assessment Framework

The San José Climate Vulnerability Assessment uses a multi-step process: (1) identify potential climate hazards, (2) determine the impact of these hazards on key assets and populations within the city, and (3) assess the ability of assets and populations to adapt to each climate hazard. This analysis identifies areas of vulnerability where adaptation strategies are lacking and aids the City in developing new plans and actions to mitigate the negative impacts of climate change.

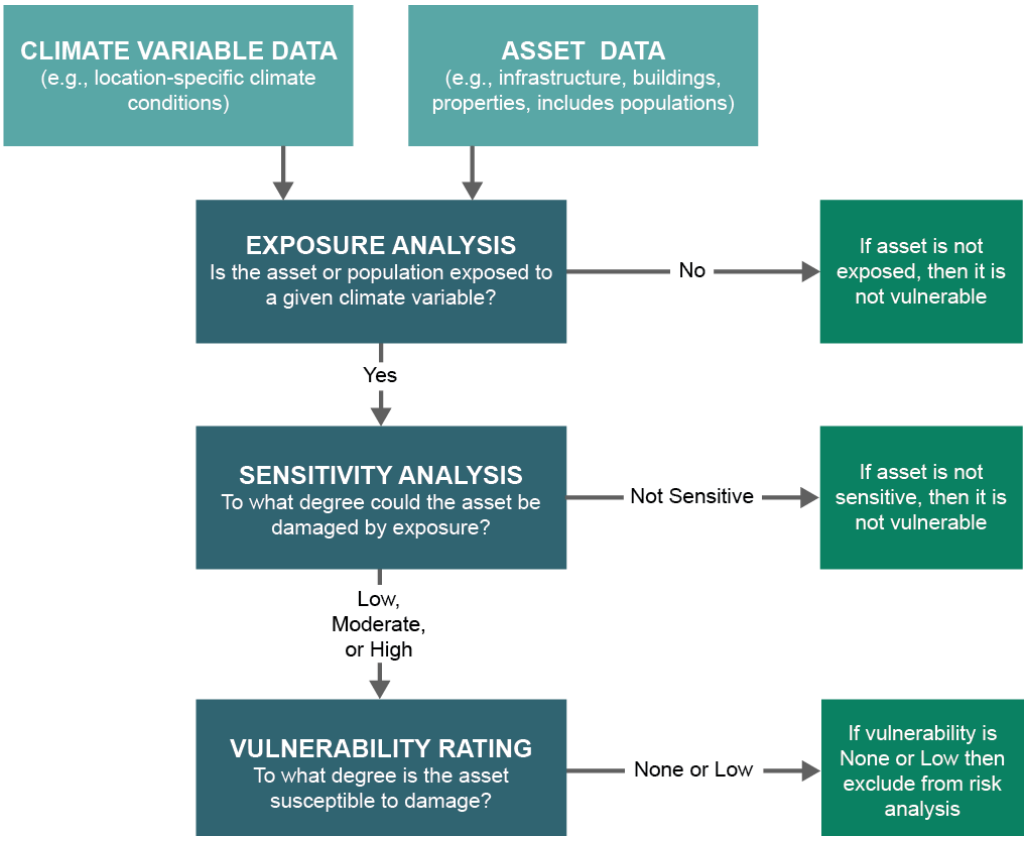
Methodology

This vulnerability assessment is guided by the California Adaptation Planning Guide's guidance for completing vulnerability studies,[5] which consists of four elements:

1. Identifying and mapping climate hazard exposures affecting the community,
2. Identifying assets and populations that may be exposed to the hazard (exposure analysis) and the asset's sensitivity to the hazard (sensitivity analysis),
3. Evaluating the community's ability to mitigate the effects of the climate hazards on the assets, based on exposure, sensitivity, and the available adaptations (adaptive capacity analysis), and
4. Scoring vulnerability based on the three layers of analysis conducted.

Error! Reference source not found. illustrates the process of calculating vulnerability.

Figure 1. Vulnerability Diagram



Source: SV 2.0

Assets and Populations Evaluated

The first step of the vulnerability assessment involves collecting data on climate hazards and assets. This process primarily used the SV 2.0 Tool, which includes certain asset types. The vulnerability of asset types not included in the SV 2.0 Tool is described qualitatively. Table 1 lists the asset categories and types included in the vulnerability assessment.

[5] *CalOES. 2020*

Table 1. Assets and Populations Included in the Vulnerability Assessment

Asset Category	Asset Type
Critical Facilities and Buildings	Critical facilities (fire and police stations, emergency shelters, medical facilities) *, building footprints
Water Infrastructure	Water treatment plants, wastewater treatment plants, reservoirs, dams*, water canals*, groundwater recharge ponds*, pipelines*, water purification center*, pump stations*
Electrical Infrastructure	Energy generation facilities, substations, transmission lines, distribution lines*
Roads and Highways	Highways, local roads
Transit	Heavy rail track and facilities, light rail track and facilities, bus routes and facilities*
Electric Vehicle Charging Network	Public and private EV charging stations*
Airport	San José Mineta International Airport*
Populations	All residents and visitors, vulnerable populations (identified by Draft EJ Communities)

Denotes asset types **not included in SV 2.0 and are assessed qualitatively*

The evaluation of exposure, sensitivity, and adaptive capacity of assets and populations is informed by SV 2.0 and an in-depth review of local and regional climate vulnerability studies, including but not limited to the following:

- San José Annex of the Multijurisdictional Hazard Mitigation Plan (MJHMP)[6]
- Valley Water Climate Change Action Plan[7]
- Valley Water Supply Master Plan 2040[8]
- Silicon Valley 2.0 Climate Adaptation Guidebook[9] (which describes how to use the SV 2.0 Tool)
- PG&E's Climate Adaptation and Vulnerability Assessment[10]
- San José Clean Energy Integrated Resource Plan[11]
- San José City Infrastructure Strategy[12]

Vulnerability Ratings

Vulnerability ratings were assigned to assets and vulnerable populations based on the likelihood of exposure to a given climate hazard and the consequences of exposure.

- **Minimal:** Assets and communities are unaffected by a climate hazard, either because the hazard is not likely to occur or because they will not be impacted if it does occur.
- **Low:** Hazard is somewhat likely to occur and will result in minor impacts to physical infrastructure and minimal impacts to communities.

[6] *County of Santa Clara, 2023*
[7] *Santa Clara Valley Water District, 2021*
[8] *Santa Clara Valley Water District, 2019*
[9] *County of Santa Clara Office of Sustainability, 2015*
[10] *PG&E, 2024*
[11] *San José Clean Energy, 2022.*
[12] *City of San José, 2023*

    - For example, extreme heat could cause brownouts at the Regional Wastewater Facility but its operations will not be disrupted because it has backup power as required by the Regional Water Board.

- **Moderate:** Hazard is likely to occur and will result in significant but not irreversible damage to physical infrastructure and minor inconveniences for communities.
    - For example, flooding is likely to occur and could lead to overtopping of roadways and damage to critical facilities. These impacts could trickle down to the community, leading to road closures (longer commute times) and power outages.

- **High:** Hazard is very likely to occur and will result in physical, costly or irreparable damage to infrastructure or severe health and safety risks to socially vulnerable communities.
    - For example, extreme heat is very likely to occur and will disproportionately affect the health of older or low-income individuals and outdoor workers.

Limitations

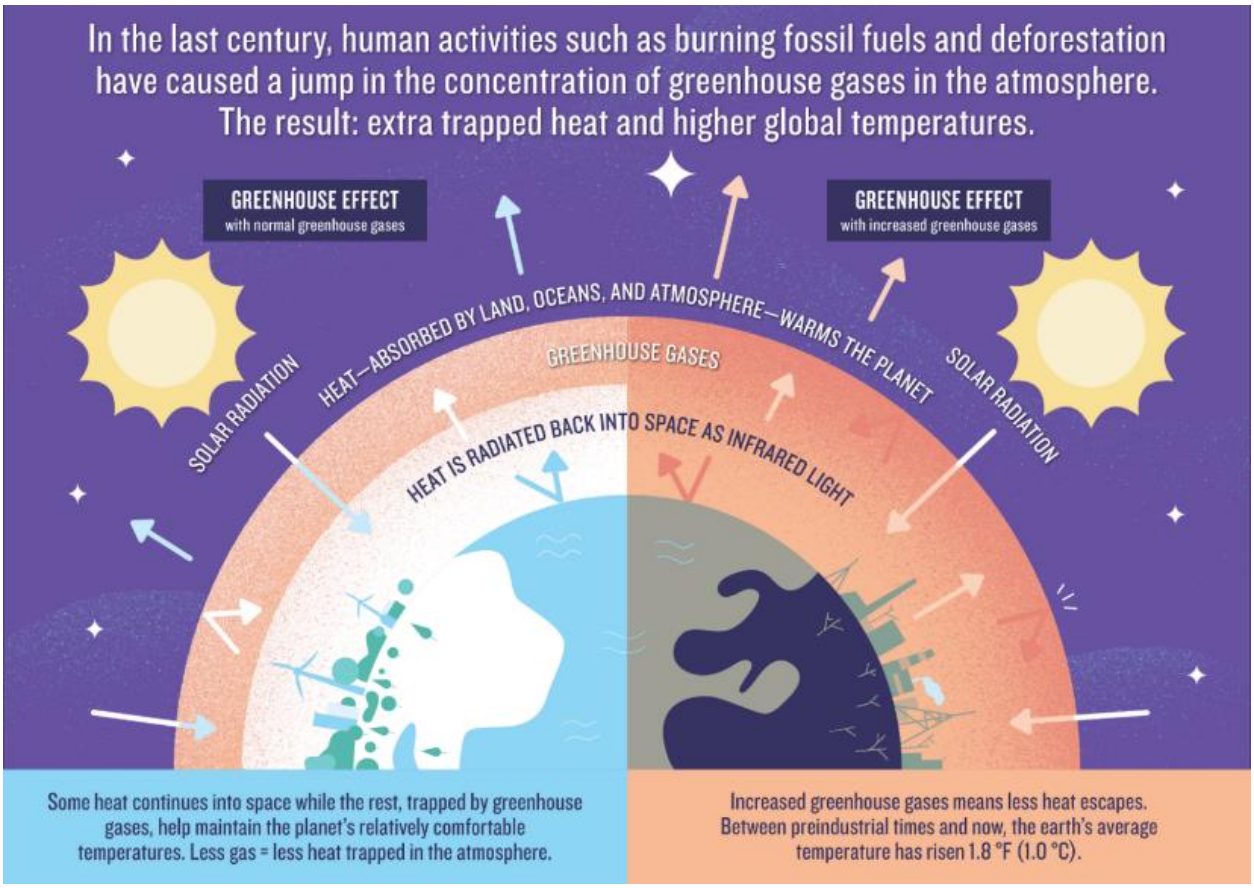
This study relied on asset and climate data in the SV 2.0 tool and a literature review of existing vulnerability assessments to fill in gaps. This approach has several limitations, including:

- Specific exposure information for individual assets was not always available. Certain asset types within the general asset categories included in this portion of the vulnerability assessment (critical facilities, water infrastructure, and electrical infrastructure) were not available.
- The MJHMP and City Infrastructure Strategy reference critical facilities but do not include detailed facility-level descriptions of vulnerabilities. Identification of specific facilities exposed to certain climate hazards was mapped for the purposes of this vulnerability assessment using publicly available data on the City's Open GIS Portal, which is not as comprehensive as the list of critical facilities assessed in the MJHMP. Sensitive data such as police facilities and other critical facilities is often kept private for safety purposes.

2. Climate Hazards in San José

Climate is the long-term behavior of the atmosphere – typically represented as averages over 30-year periods – for a given time of year. This includes average annual temperature, snowpack, or rainfall. Although the climate fluctuates naturally, human emissions of carbon dioxide and other greenhouse gas emissions ("greenhouse gases") are driving unprecedented changes in the climate system. Greenhouse gases trap heat in the atmosphere, resulting in warming over time as shown in Figure 2. This atmospheric warming is leading to other changes in the earth systems, including changing patterns of rainfall and snow, melting of glaciers and ice, and warming of oceans.

Figure 2. The Greenhouse Effect



Source: NRDC, 2019

Climate hazards can affect communities through damaging, acute events (known as "shocks") or chronic occurrences that negatively impact assets over longer periods of time (known as "stressors"). Exposure analysis determines whether, and to what degree, an asset will be exposed to a particular climate hazard. The following chapter details the historic and predicted trends for climate hazards in San José, including extreme heat, flooding, sea level rise, drought, and wildfire.

Climate Science and Modeling

Climate hazards are assessed using the Silicon Valley 2.0 (SV 2.0) Climate Change Preparedness Tool. The SV 2.0 tool was developed in 2020 to characterize climate change for 15 cities in Santa Clara County, including San José. SV 2.0 draws on climate data from Cal-Adapt, the Federal Emergency Management

Agency's (FEMA) National Flood Hazard Layer, and the San Francisco Bay Area Adapting to Rising Tides (ART) program.[13]

This assessment uses climate projections for temperature and precipitation based on a high emissions climate change scenario known as Representative Concentration Pathway (RCP) 8.5. This scenario represents a future in which emissions continue to increase through 2050 and plateau around 2100, resulting in radiative forcing of 8.5 watts per square meter. This high emissions scenario would result in warming of more than 8 degrees Fahrenheit (°F) by 2100 and is regarded as an unlikely, "worst-case" climate scenario. For instance, scientific consensus is that reaching 1.5 degrees Celsius (°C) (2.7°F) above preindustrial levels could trigger multiple tipping points. and the current increase in global temperature is 1.2°C.[14] The California Governor's Office of Land Use and Climate Innovation recommends using RCP 8.5 for a conservative planning approach that allows decision-makers to understand the worst-case future scenario.

Table 2 below summarizes the citywide climate hazard projections which are described in more detail in the following sections.

Table 2. Summary of Climate Hazard Trend Projections

Hazard	Projected Trend
Extreme Heat	Higher temperatures and more frequent heat waves
Flood	Longer dry periods punctuated by more extreme precipitation events
Sea Level Rise	Sea levels are expected to rise up to 1.3 feet by mid-century and 6.5 feet by late-century according to the latest projections from the California Ocean Protection Council (OPC).
Drought	More severe; longer dry spells and decline in average snowpack.
Wildfire	Increase in likelihood of occurrence and intensity.

Extreme Heat

Historical Events and Trends

The average summer temperature in San José is 70°F, with average daily highs of 81°F.[15] In the past few decades, San José has been experiencing higher temperatures and more intense heat waves. During heat waves in July 2017 and September 2022 temperatures reached all-time highs of 108°F and 109°F. The 2022 heat wave from September 1st to 10th led to an increase in mortality statewide, with deaths increasing 5 percent in California.[16] At the peak of the heat wave on September 7th, a Pacific Gas and Electric Company (PG&E) substation failure led to a power outage at Santa Clara Valley Medical Center. Several buildings, including the Intensive Care Unit and emergency room, lost power for several hours after backup generators failed. Seven patients had to be transferred to other hospitals and nine were

[13] *Kassem et al., 2021*
[14] *Armstrong McKay et al., 2022*
[15] *timeanddate, 2024*
[16] *Milet et al., 2023*

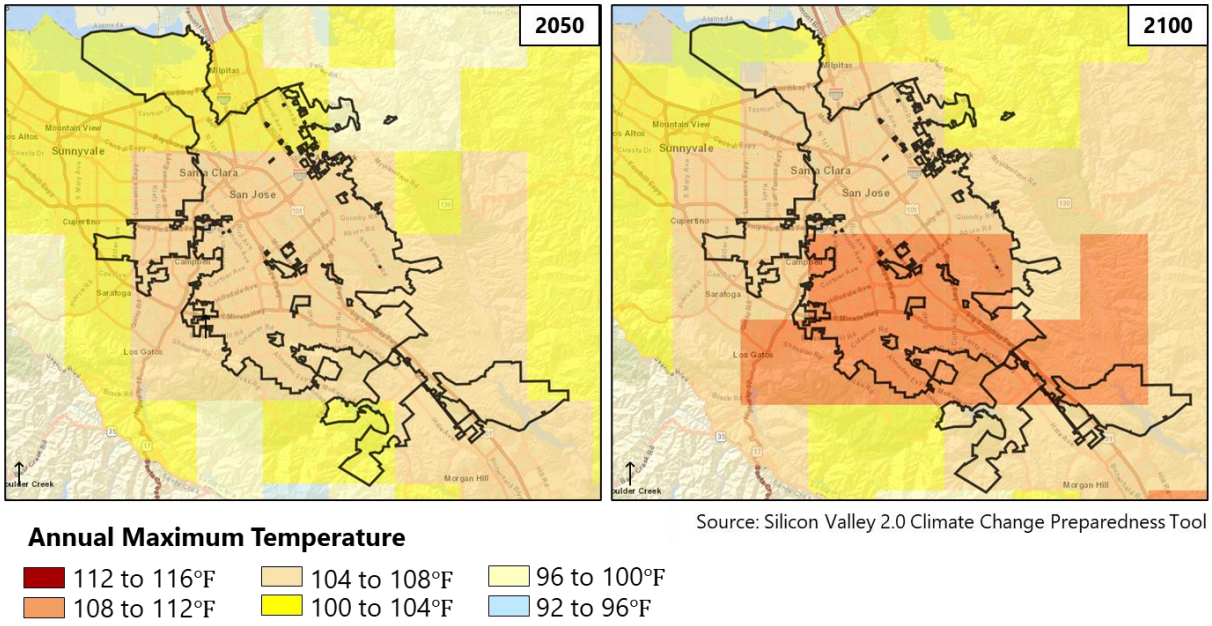
moved internally.[17] Though no people were injured, this instance demonstrates the importance of ensuring infrastructure and energy systems are resilient to elevated temperatures.

Future Projections

San José is projected to experience higher average temperatures and more frequent heat waves. Figure 3 shows projected maximum temperatures in mid-century (2035-2064) and late-century (2070-2099). Maximum temperatures are projected to reach up to 112°F by mid-century, 3°F higher than the current hottest temperature ever recorded.[18] Temperatures are projected to be highest in the western and southern portions of San José. Annual average maximum temperatures, the average of the highest temperatures every day in a year, are projected to increase from 70°F historically (1961-1990) to 74°F by mid-century and 77°F by late-century (2070-2099).[19]

The number of days with extreme heat[20] (days with maximum temperatures over 93.7°F) per year is also projected to increase from 4 days historically to 14 days by mid-century and 27 days by late-century. Heat waves, on average, could become 6°F warmer.[21] The number of days per year with warm nights (days with minimum temperatures above 63.9°F) is projected to increase from 8 nights to 33 nights by mid-century and 69 nights by late-century.[22]

Figure 3. Annual Maximum Temperature in Mid-Century and Late-Century under a High Emissions (RCP 8.5) Scenario



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Exposure to extended high minimum temperatures can reduce the ability of the human body to recover from high maximum temperatures, elevating the risk of heat-related illnesses and fatalities. Extreme heat can lead to rolling blackouts and power loss across the City, cause infrastructure stress and deterioration, and elevate the risk of heat stress and illness, particularly for people with underlying health conditions

[17] *del Castillo, 2022*
[18] *Santa Clara County Office of Sustainability, 2019*
[19] *Cal-Adapt, 2018*
[20] *The threshold for extreme heat or warm nights is the 98th percentile value of historical daily maximum/minimum temperatures (from 1961–1990, between April and October) observed at a location.*
[21] *Lee, 2023*
[22] *County of Santa Clara Office of Sustainability, 2018*

(described in further detail in Section 5).[23] Rising temperatures also impact the delicate balance of temperature and precipitation conditions of the ecosystem, harming the area's biodiversity. Plants and animals may become stressed and in turn become more susceptible to pests and diseases. The timing of events, for example when certain plants flower, may shift and could become out of sync with the other organisms that rely on them.[24]

Flooding

Inland flooding occurs when heavy rainfall causes rivers or creeks to overtop their banks. Flooding can also occur if drainage systems fail or are insufficient to handle large amounts of precipitation.

Historical Events and Trends

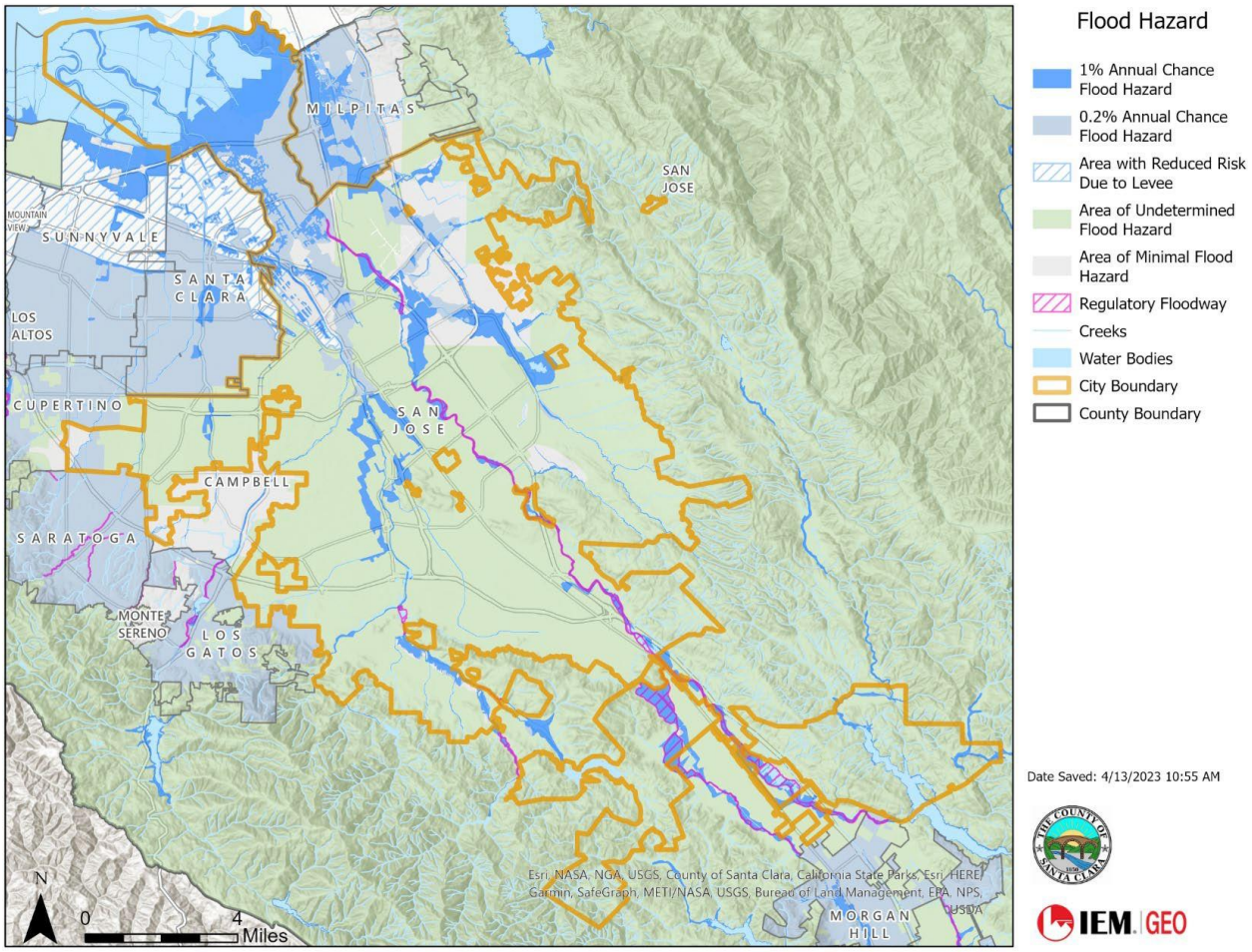
Major waterways in San José include the Los Gatos, Guadalupe, and Alamitos Creeks draining of the Santa Cruz mountains and Coyote Creek draining of the Diablo Range, and Fisher Creek flowing out of the Coyote Creek Valley. All watersheds (Coyote, Guadalupe, Lower Penitencia, San Tomas Aquino, Calabazas, and Baylands) drain to the southern San Francisco Bay. Within these watersheds, approximately 35,500 storm drains receive and discharge runoff into a creek.[25]

San José has experienced many instances of severe flooding along these waterways, often driven by winter storms. The most recent of these disaster-level events include floods in the winter of 1996-1997, February 2017, January 2021 and 2022, March 2023, and February 2024.[26] Notably, in February 2017 heavy atmospheric rivers led to overbanking along Coyote Creek, requiring nearly 11,000 residents to evacuate.[27] During this flood, one sewage pump station was flooded, suspending sanitary sewer service for a day. Most recently, in February 2024, an atmospheric river storm led the City to issue an evacuation order along the Coyote, Los Gatos, Penitencia, and Ross Creeks. Additionally, more than 20,000 residents lost power. Since the major flood event in 2017, Santa Clara Valley Water District (Valley Water) initiated the Coyote Creek Flood Protection Project to build floodwalls and levees to protect the embankment along nine flood-prone miles of the creek.[28] The project is expected to be completed in 2025 and will provide protection from floods up to the level that occurred in February 2017, equivalent to approximately a 5% flood (20-year event).

FEMA develops flood risk maps that inform flood insurance policy in urban areas. FEMA maps are developed through historic meteorological and hydrologic data and updated frequently based on land use changes. Figure 4 shows the current FEMA flood hazard map for San José from the 2023 Santa Clara County Multijurisdictional Hazard Mitigation Plan (MJHMP). The 1% annual chance flood hazard area (or 100-year floodplain) is concentrated in the northern part of San José near the San Francisco Bay, and adjacent to creeks or tributaries in the southern part of the City. As of 2022, an estimated 11% of the City's population (111,750 residents) live in the 100-year floodplain in properties with a combined total value of nearly $16 billion. In addition, 38 essential facilities, 87 transportation assets including highway bridges and light rail facilities, 38 other community asset facilities, and 48 hazardous materials sites lie within the 100-year floodplain.[29]

[23] *County of Santa Clara, 2023*
[24] *Governor's Office of Planning and Research, 2024*
[25] *City of San José Environmental Services Department, 2024*
[26] *County of Santa Clara, 2023*
[27] *Bay City News, 2017*
[28] *Valley Water, 2022*
[29] *County of Santa Clara, 2023*

Figure 4. City of San José Flood Hazard Area



Source: Santa Clara County MJHMP, 2023

Future Projections

In the future, California is not projected to experience changes in annual rainfall amounts, but the state is projected to fluctuate between longer precipitation extremes. Longer dry periods will be punctuated by more extreme precipitation events.[30] Annual precipitation in San José from 1961-1990 was 14.46 inches.[31] Annual rainfall in San Jose is not project to change, with projections for mid-century and late-century precipitation estimating between 10 and 19 inches of annual rainfall.[32]

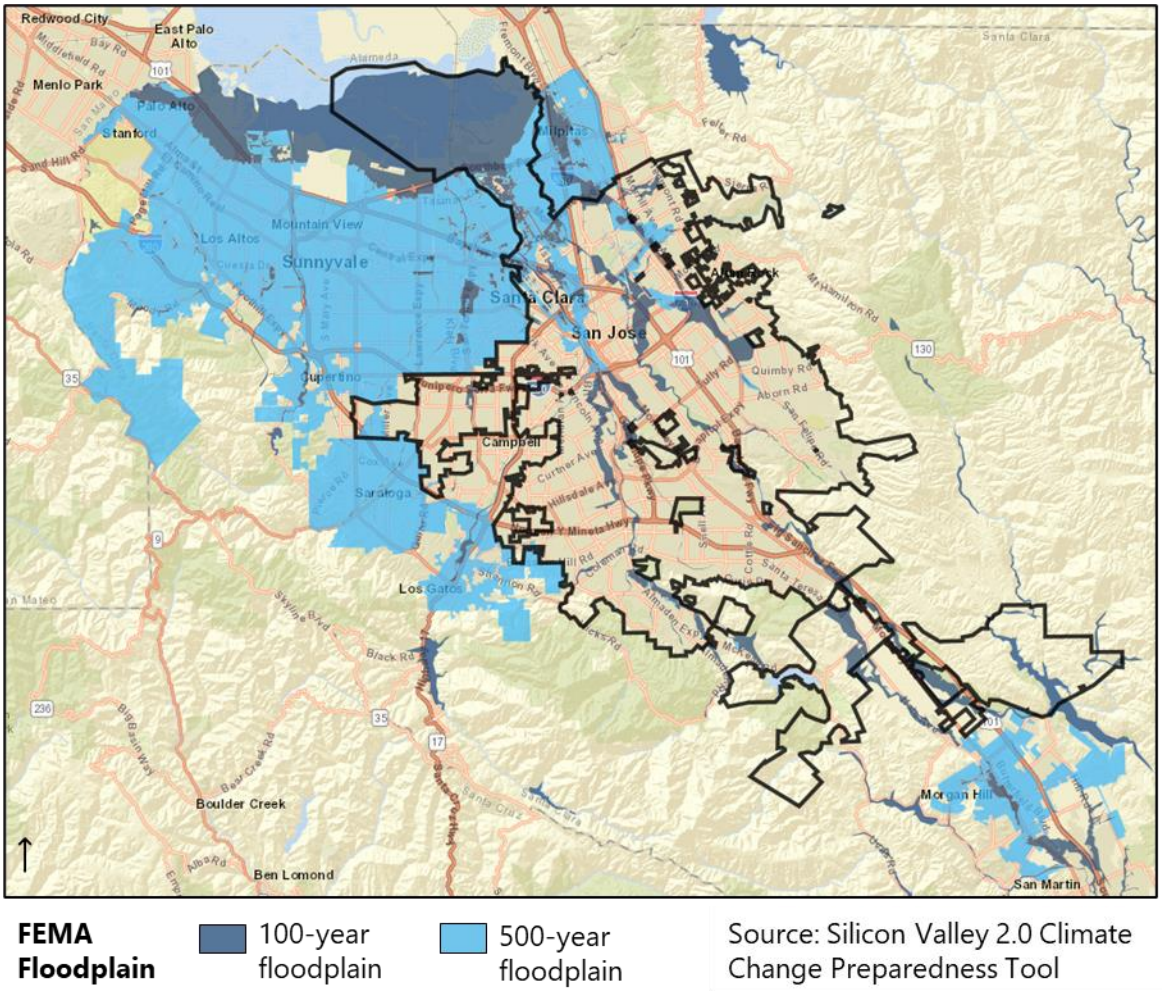
However, storm events with a 1% probability of occurring today are projected to occur 10 times more frequently in 2060.[33] The greatest amount of one-day precipitation is projected to increase from 1.5 inches historically to 1.7 inches in mid-century and 1.8 inches in late-century.[34] More frequent intense storms can cause rivers and streams to swell and overflow, leading to flooding of buildings and infrastructure. Additionally, when rain falls too quickly for soil to absorb, excess water becomes runoff that can exacerbate flooding. These extreme events are projected to be followed by longer droughts. Drought

[30] *County of Santa Clara Office of Sustainability, 2015*
[31] *County of Santa Clara, 2023*
[32] *Cal-Adapt, 2018*
[33] *County of Santa Clara Office of Sustainability, 2015*
[34] *Cal-Adapt, 2018*

conditions and wildfires dry out soil and make it less permeable, increasing runoff and enhancing flood risk.

While climate models can characterize future precipitation patterns, predicting where flooding will occur is difficult, due to nuances in local topography and stormwater infrastructure. Climate scientists rely on historic flood data and hydrologic analyses to identify flood hazard zones where future flooding is likely to occur. The SV 2.0 Tool uses the FEMA historic 100- and 500-year floodplains, spatially modified to exclude areas where flood protection projects (namely, the Lower Berryessa Creek Flood Protection Project, Permanente Creek Flood Protection Project, Upper Berryessa Creek Flood Protection Project, and Sunnyvale East and West Channels) to determine flood exposure.[35] Note that given the projected increase in heavy precipitation events, areas currently adjacent to floodplains (but not identified as floodplains in Figure 5 may experience more frequent flooding.

Figure 5. The 100-year (1% annual chance) Floodplain and 500-year (0.2% annual chance) Floodplain in San José



[35] *Kassem et al., 2021*

Sea Level Rise

Rising temperatures are melting glaciers and ice sheets and causing thermal expansion of water in the ocean, leading to sea level rise. Elevated sea levels can exacerbate storm surge, resulting in more extensive and frequent flooding.[36] Storm surge can block stormwater pipes or prevent rivers from discharging into the Bay or ocean, leading to backflow or overtopping. Sea level rise is also expected to increase the erosion of the San Francisco Bay. Flooding from sea level rise is driven by elevated ocean levels rather than by heavy precipitation (as is the case with the flooding discussed in the previous section) and is concentrated along the Bay shoreline.

Historical Events and Trends

San José, like much of the San Francisco Bay Area (Bay Area), has experienced a slow but gradual increase in sea level in the past decades. Sea levels have risen nearly eight inches in the last century in Santa Clara County.[37]

Future Projections

Sea levels are expected to rise up to 1.3 feet by mid-century and 6.5 feet by late-century according to the latest projections from the California Ocean Protection Council (OPC) (Table 3).[38] Storm surge – the abnormal rise in sea level during a storm – is exacerbated by sea level rise, as higher water levels and strong winds push waves further onshore.[39] Table 3 shows the projected amount of sea level rise for permanent inundation and 100-year storm surge in the San Francisco Bay Area for a medium emissions, high-risk tolerance ("likely") scenario and high-emissions, low risk tolerance ("worst-case") scenario. The likely scenario has a 66% chance of occurring and the worst-case scenario has a 0.5% chance of occurring. According to the OPC's Sea Level Rise 2024 Guidance, a high-risk tolerance scenario should be used for non-critical assets and a low-risk tolerance scenario should be used when designing or planning critical assets.[40]

Table 3. OPC 2018[41]/2024[42] SLR Projections at San Francisco Tide Station Relative to the Year 2000

Year	Emissions Scenario	Permanent SLR		100-year Storm Surge	
		OPC 2018/2024 Projection (feet)	ART Inundation Layer (feet [inches])	OPC 2018 Projection	ART Inundation Layer (feet [inches])
Current	Baseline	0	0	3.9	4 [48]
2050	Moderate	1.1 /0.8	1 [12]	5.0	5.5 [66]
	High	1.9 /1.3	2 [24]	5.8	5.5 [66]
2100	Moderate	3.4 /3.1	3 [36]	7.3	7 [84]
	High	6.9 /6.5	7 [84]	10.8	10.9 [131]

[36] *California Ocean Protection Council, 2024*
[37] *Santa Clara Valley Water District, 2021*
[38] *California Ocean Protection Council, 2024*
[39] *Santa Clara County Office of Sustainability, 2019a*
[40] *California Ocean Protection Council, 2024*
[41] *California Ocean Protection Council, 2018*
[42] *California Ocean Protection Council, 2024*

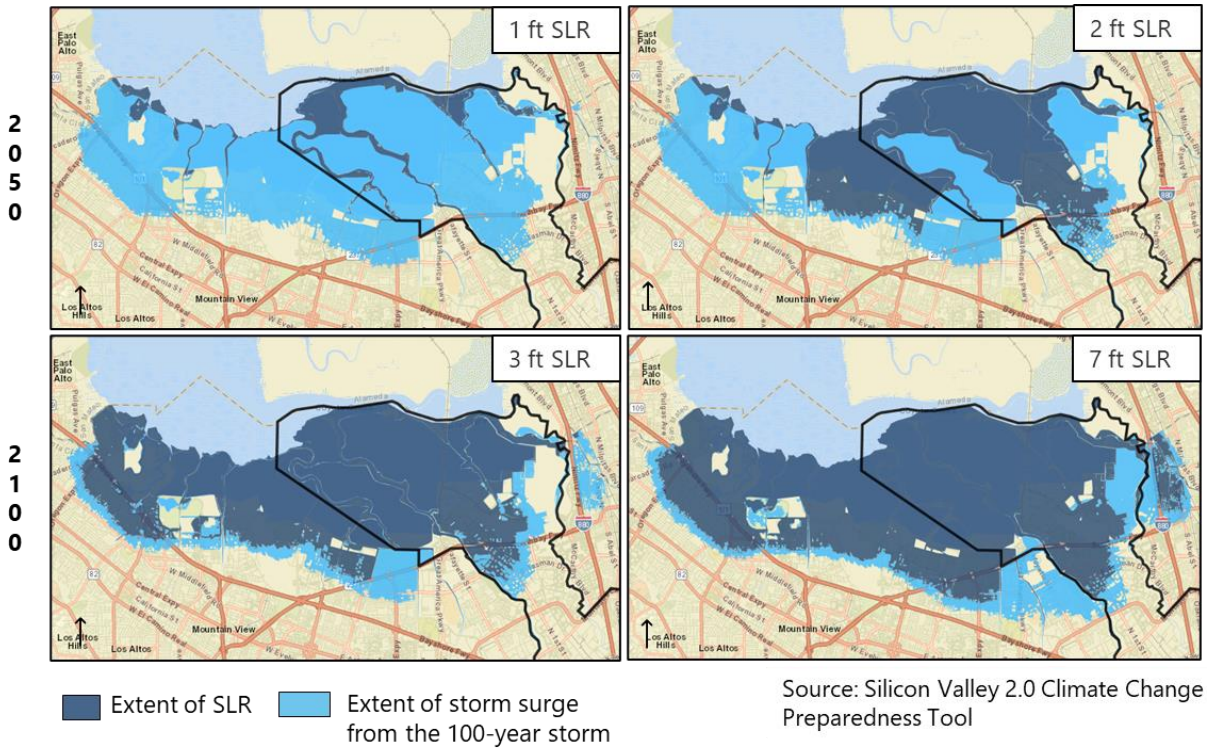
Figure 6 shows the extent of sea level rise and storm surge inundation for each scenario for mid-century and late century. Sea level rise inundation data comes from the Bay Conservation and Development Commission's Adapting to Rising Tides (ART) program. ART shows the extent of inundation or flooding associated with sea level rise scenarios ranging from one to 12 feet.[43] Since ART data is only available in 1-1.5-foot increments, the sea level rise data in the maps does not correspond directly to the sea level rise projection. The sea level rise and storm surge maps were modified before being added to SV 2.0 to exclude inundation due to the construction of the Lower Berryessa Creek Flood Protection Project.[44] Table 3 shows how the OPC projections were matched to the closest inundation layers available from ART. The maps in Figure 6 are based on OPC 2018 projections, since those are the scenarios available in SV 2.0. For future plans, the sea level rise projections from 2024 should be used (since SV 2.0 was last updated in 2021, these projections were not available).

The northern part of San José is projected to be inundated by storm surge from the 100-year storm in 2050. By 2100, more of the area flooded by the 100-year storm is projected to be permanently inundated by sea level rise. An estimated 33,000 residents in Santa Clara County (1.7% of the population) currently live in areas that are projected to be inundated by sea level rise and the 100-year storm in mid-century. This increases to 86,000 residents (4%) by late-century.[45]

Sea level rise may mobilize contaminants and expose vulnerable populations to metals and petrochemicals.[46] Saltwater intrusion into surface water and groundwater aquifers poses a risk to much of the freshwater supply for the Bay Area. Sea level rise and storm surge may inundate areas that are not identified as flood hazard zones on FEMA maps, as discussed in the previous section. This could inundate residential homes, businesses, electrical equipment, and open spaces. Rising sea levels also mean that San José's mudflat and tidal marsh habitats will need more sediment to stay at the elevation needed to survive. A study by the San Francisco Estuary Institute has found that "tidal marshes and mudflats are unlikely to receive enough sediment naturally to survive sea-level rise this century."[47]

[43] *San Mateo County, 2017*
[44] *Kassem et al., 2021*
[45] *County of Santa Clara, 2023*
[46] *California Governor's Office of Planning and Research et al., 2019*
[47] *San Francisco Estuary Institute, 2021.*

Figure 6. Extent of Projected Sea Level Rise for Mid-Century and Late-Century under Medium and High-Risk Scenarios



Note: The scenarios shown in these maps do not align perfectly with the projections shown in Table 3. Rather, since sea level rise projections are only available in 1-ft increments, they show the closest representation of future SLR using data available in SV 2.0.

Drought

Drought is a prolonged period of below-average precipitation that often leads to water scarcity. The severity of drought is often dependent on the amount of groundwater and surface water stored in aquifers and reservoirs. Drought can lead to water shortages, reduced stream flow, crop damage, habitat loss, and reduced water quality. In some cases, reduced water levels leave less water available to dilute contaminants, which can increase the concentration of pollutants in water. This can lead to health impacts for people who drink the water and the plants and animals who live in aquatic ecosystems.

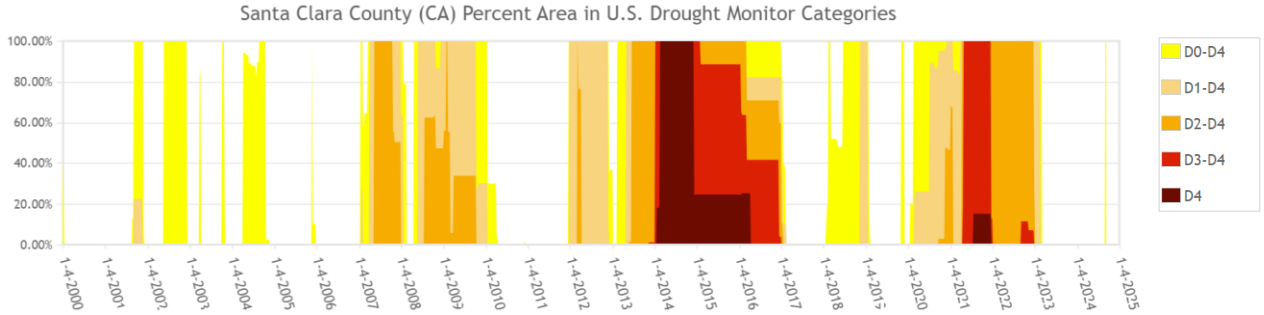
Historical Events and Trends

Santa Clara County has experienced four prolonged periods of drought since 1975.[48] The most severe drought in the last 1,200 years occurred from 2012 to 2016 (the dark red in Figure 7), during which record high temperatures and low precipitation led to a statewide emergency and water restrictions to limit water use by 20%.[49] Drought is one of multiple factors including heat, tree decline, and removal, that contributed to losses in the city's urban forest from 2012 to 2018. In that time period (which included the period of severe drought), the city's canopy cover decreased by 1.82 percent.[50]

[48] *Santa Clara County Office of Emergency Services, 2017*
[49] *Santa Clara Valley Water District, 2021*
[50] *City of San José, 2022*

From 2020-2021, 90% of the Southwest and California was in a severe drought due to high temperatures and very low rainfall in the spring and summer of 2020. Record low snowpack in the Sierra Nevada mountains led to reservoir levels at 34-50% of capacity.[51] Valley Water and water retailers service San José implemented water conservation programs and restrictions, such as limits on outdoor watering days and prohibitions of the use of potable water for decorative fountains.

Figure 7. US Drought Monitor Time Series



Source: US Drought Monitor

Future Projections

Droughts are projected to become more severe as average annual temperatures rise and dry spells between precipitation events become longer. The maximum length of a dry spell, or consecutive days with less than one millimeter of precipitation, is projected to increase from 119 days historically to 129 days in mid-century and 134 days in late-century. Average snowpack in the Sierra Nevada mountains is projected to decline by 30-60% in mid-century and by over 80% in late-century.[52] Drought severity is dependent on moisture deficiency and the size of the affected area. Valley Water estimates in their 2040 Master Plan that existing water supplies are enough to meet future demand through 2040 but will not meet needs in the event of one or multiple severe droughts.[53]

While drought on its own usually does not impact grey infrastructure or public health, it can be a contributing factor for large-scale wildfires. Prolonged periods of drought dry out vegetation and can impact the health of trees, priming them to burn when combined with hot, windy conditions.

Wildfire

Wildfires are uncontrolled fires that burn in forests, grasslands, and other largely unpopulated areas. Most wildfires in California start from human activities, but their spread is influenced by fuel availability, wind, and weather conditions. The eight largest and most deadly wildfires in California have occurred in the past decade.

Although wildfires pose a great direct threat to property and people, the secondary impacts can be just as damaging. Wildfire smoke produces particulate matter that contributes to air pollution and reduced visibility. People, particularly those with underlying health conditions, are strongly advised to stay indoors on days with poor air quality because of wildfire smoke, which can penetrate deep into lungs and cardiovascular systems. Additional information about social vulnerabilities to wildfire is provided in Section 5.

[51] *National Integrated Drought System, 2021*
[52] *California Governor's Office of Planning and Research et al., 2019*
[53] *Santa Clara Valley Water District, 2019*

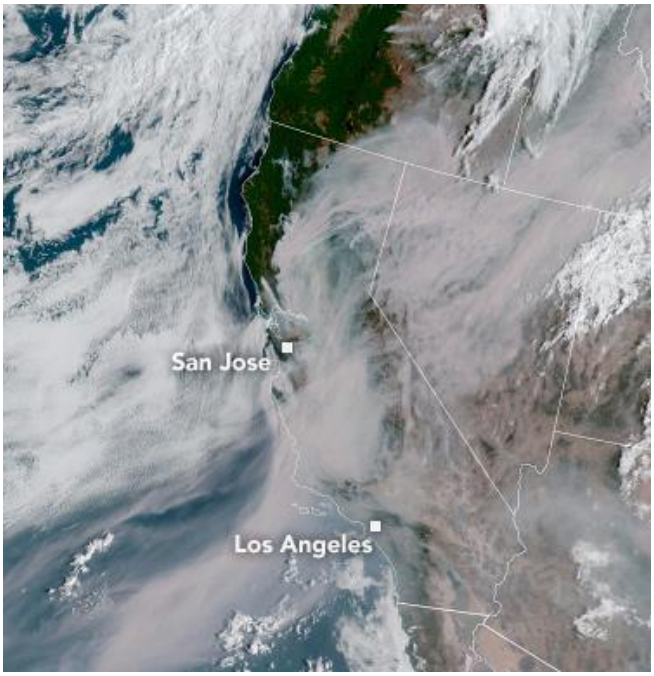
Wildfire can also impact ecosystems in and around San José even though it unlikely that they will occur within the city boundaries. Wildfires in surrounding areas can pollute water bodies with ash and chemicals from firefighting foams and equipment.[54]

Historical Events and Trends

The California Department of Forestry and Fire Protection (CAL FIRE) classifies areas as fire hazard severity zones based on fire history, flame length, terrain, local weather, and potential fuel over a 50-year period., San José is surrounded by high fire severity zones, but the City itself is not in a fire severity zone and has experienced very few wildfires inside City limits.[55] A few small brush fires occurred in San José in July 2019, and June and August 2020.

The City's proximity to high fire severity zones has led to poor air quality from wildfire smoke and occasional evacuation orders for portions of the population.[56] The 2018 wildfire season (during which the Bay Area only experienced impacts from wildfire smoke) led to costs of $1.5 billion in Santa Clara County and over $7.8 billion in the nine counties making up the Bay Area because of mortality, work time lost, and medical expenses.[57] During the 2020 fire season, large "fire complexes" blanketed the Bay Area in smoke (the gray plume visible in from space in Figure 8). The largest fire at the time was the SCU Lightning Complex (August 2020) which led to the evacuation of tens of thousands of people in the East San Jose foothills.[58] Across the Bay Area the skies were orange and Northern California had the worst air quality in the entire world.

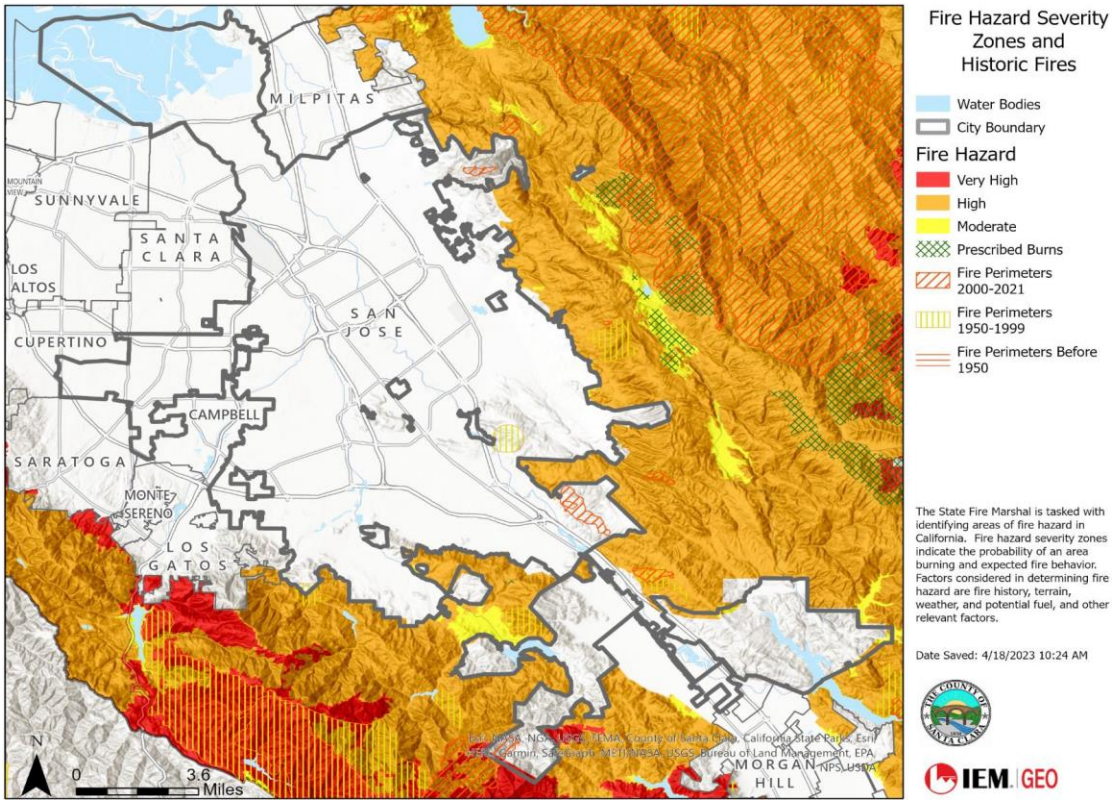
Figure 8. Wildfire Smoke Shrouds the Bay Area (2020)



Source: NASA Earth Observatory

[54] *California Water Boards, 2024.*
[55] *CAL FIRE, 2023*
[56] Wadsworth, 2020
[57] Bay Area Council Economic Institute, 2021
[58] *Wadsworth, 2020*

Figure 9. City of San José Fire Hazard Severity Zones



Source: Santa Clara County MJHMP, 2023

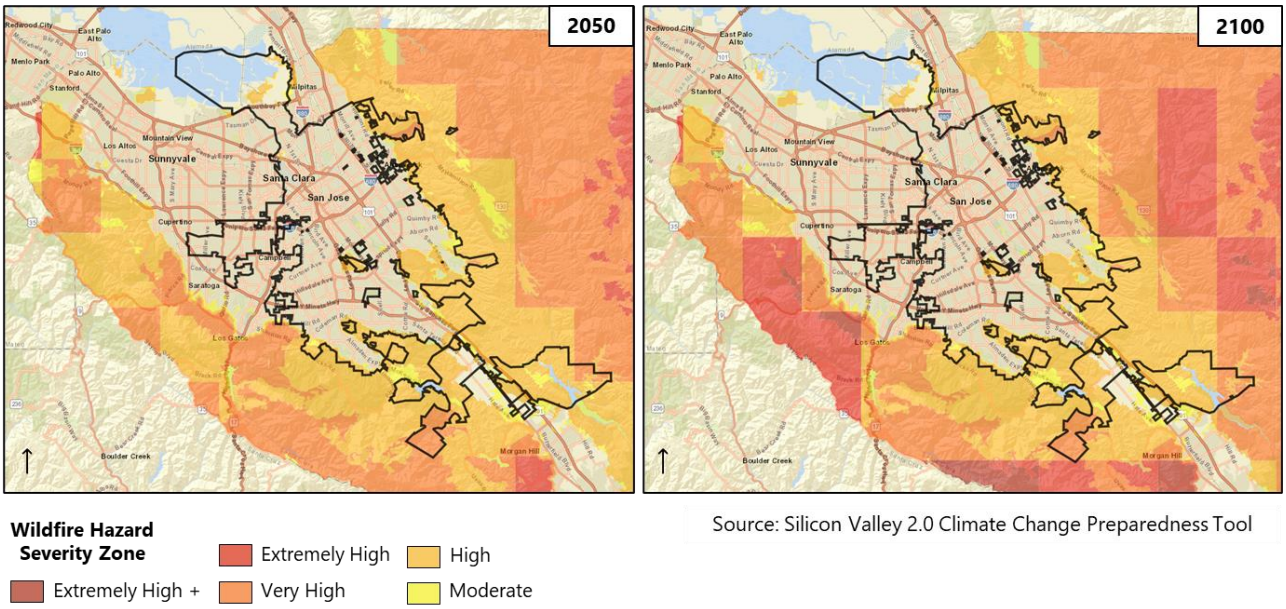
As development is expands into foothills surrounding San Jose, infrastructure and the built environment are exposed to greater high wildfire risk. As of 2022, approximately 46,000 residents (4% of the total population) live in areas at risk to wildfire and 16,122 structures worth $487 million are in high wildfire risk areas.[59]

Future Projections

Fire danger is affected by human behavior, vegetation, wind, temperature, humidity, and atmospheric stability. Fire seasons are projected to begin earlier and end later due to drier and warmer conditions. Furthermore, longer dry periods with more intense precipitation events can lead to conditions ripe for wildfires, since vegetation has ample time to grow. This builds up vegetation that can lead to longer and more intense wildfires.[60] Wildfire risk to property will increase as development spreads into wildfire risk areas, a trend that has already started and is projected to continue in San José.[61] Figure 10 shows the wildfire severity increasing in the areas surrounding San José from mid-century to late-century, and in portions of the City like Almaden Valley, Santa Teresa, and eastern Milpitas.

[59] *County of Santa Clara, 2023*
[60] *California Governor's Office of Planning and Research et al., 2019*
[61] *County of Santa Clara, 2023*

Figure 10. Wildfire Hazard Severity Zones for Mid-Century and Late-Century under a High Emissions (RCP 8.5) Scenario



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Wildfire Hazard Severity Zone

- Extremely High +
- Extremely High
- Very High
- High
- Moderate

3. Vulnerability of Critical Facilities and Infrastructure

This assessment analyzes the vulnerability of the City of San José's assets and city populations to the climate hazards that are projected to affect the San José. These hazards include extreme heat, extreme precipitation and flooding, sea level rise and storm surge, drought, and wildfire. The Vulnerability Assessment draws on the findings of regional vulnerability assessments and the SV 2.0 Tool to evaluate vulnerability for critical facilities, water infrastructure, electrical infrastructure, transportation, and socially vulnerable communities.

Critical Facilities and Buildings

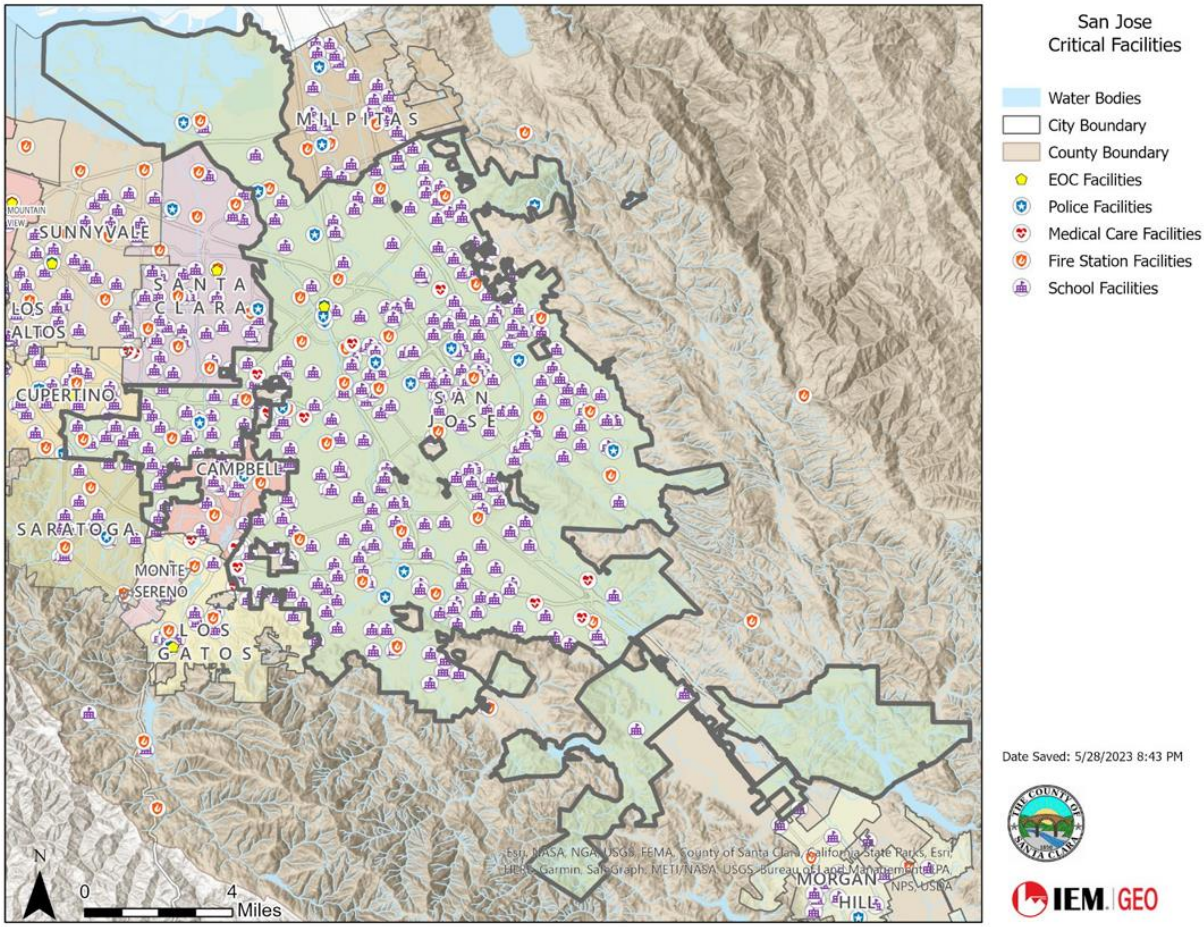
Asset Overview

The city has 21.3 square miles of building footprints, categorized as industrial, residential, and commercial. Table 4 summarizes their hazard exposures. Critical facilities are a subset of the city's total buildings. They are structures that will prevent serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities during emergencies. If they are destroyed or damaged or if functionality is impaired, these vital services will be jeopardized. There are 387 critical facilities included in this assessment, including 35 fire stations, seven hospitals, one police department, and 344 schools. The 2023 HMP includes a slightly different set of critical facilities made up of 130 fire and police stations, emergency shelters, fleet, pump station, and medical facilities (Figure 11).

Table 4. SV 2.0 (2017) Building Vulnerability to Climate Hazards in 2050 and 2100, High Emissions Scenario

Asset Type	Timeframe		Extreme Heat	Riverine Flooding*		Sea Level Rise		Sea Level Rise + 100-Year Storm Surge		Wildfire
				100-year flood	500-year flood	Likely 2050: 1 ft 2100: 2 ft	Worst-Case 2050: 3 ft 2100: 7 ft	Likely 2050: 1 ft SLR + 4.5 ft 2100: 2 ft SLR + 3.5 ft	Worst-Case 2050: 3 ft SLR + 4 ft 2100: 7 ft SLR + 4 ft	
Buildings Total: 21.3 square miles	2050	% of total bld. area	100%	13%	27%	0%	2%	3%	4%	0%
	2100	% of total bld. area	100%	13%	27%	2%	3%	4%	5%	0%

Figure 11. City of San José Critical Facilities



Source: Santa Clara County MJHMP, San Jose Annex 2023. Note: EOC refers to Emergency Operations Center.

Climate Change Vulnerabilities

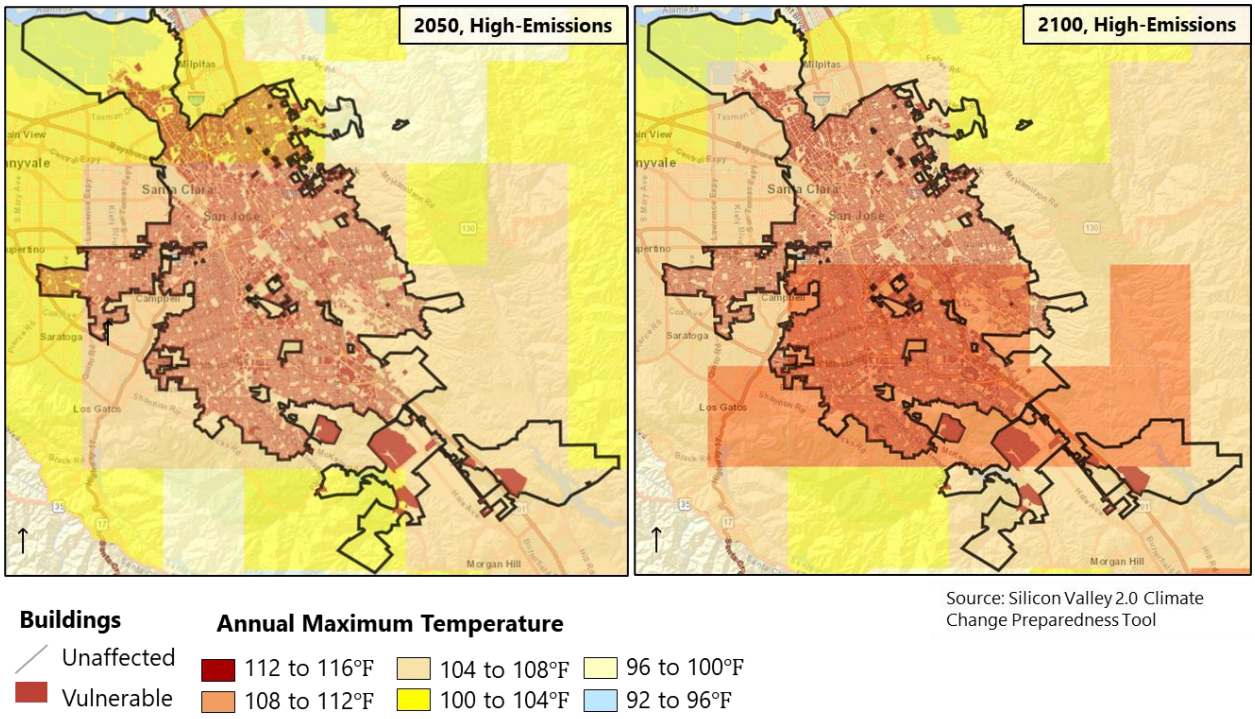
Higher Temperatures and Extreme Heat

Critical facilities and buildings have **moderate** vulnerability to extreme heat. Vulnerabilities to higher temperatures and extreme heat to critical infrastructure and buildings include:

- **Power outages:** Physical facilities themselves are not typically damaged by extreme heat and can usually maintain function during high temperatures. However, is crucial that critical facilities can function under all circumstances. Energy use at many critical facilities is likely to increase during heat events due to heightened air conditioning use. Power outages and rolling blackouts may impact critical facilities with no or inadequate backup power. According to the City Infrastructure Strategy, 97 of the 130 critical facilities have fuel backup sources powered by either diesel or propane, but the remaining have no backup power.[62]

[62] *San José, 2023*

Figure 12. Building Vulnerability to Extreme Heat in Mid-Century and Late-Century



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Flooding and Extreme Precipitation

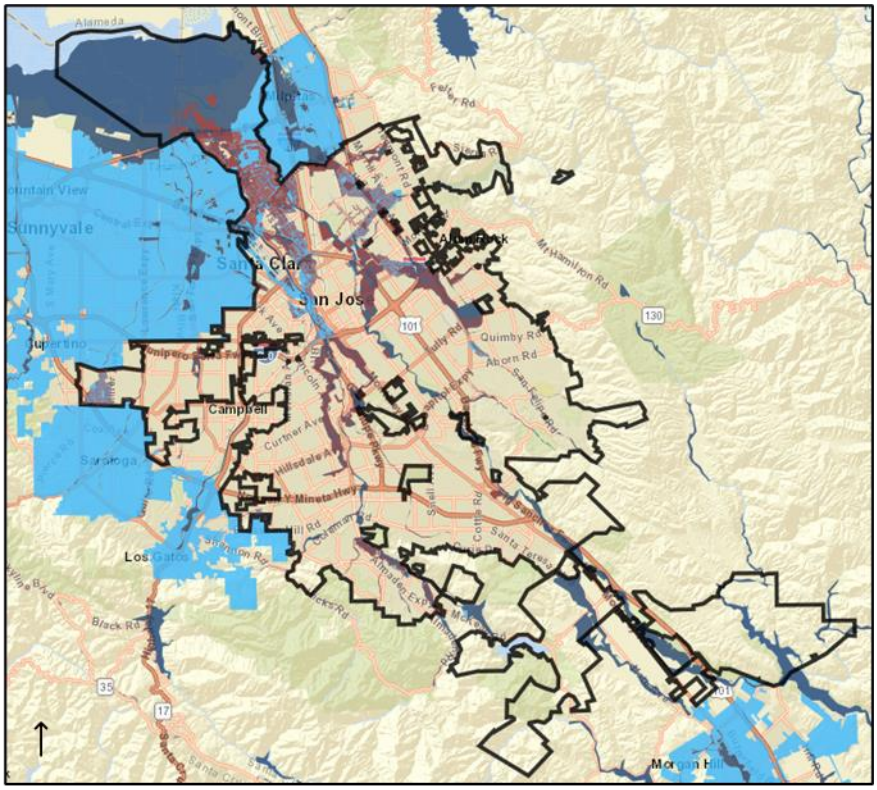
Buildings have **high** vulnerability to flooding. Approximately 13% of buildings are in the 100-year floodplain, and increases to 27% in the 500-year floodplain (Table 4 and Figure 13).

Critical facilities have **high** vulnerability to flooding. Approximately 5% of all critical facilities are located in the 100-year floodplain, which has a 1% annual chance of flooding (Figure 14).[63] Critical facilities in the 100-year floodplain include 18 schools and two fire stations (Stations 25 and 34). In addition, 20% of critical facilities are located in the 500-year floodplain, which has a 0.2% annual chance of flooding each year. This includes eight fire stations (Stations 2, 15,19, 20, 21, 24, 29, and 30), 69 schools, one medical center, and the San Jose Police Department. According to SV 2.0, 13% of all buildings (13,262 structures) in San José are in the extent of the 100-year floodplain and 27% (23,318 structures) are in the extent of the 500-year floodplain (Figure 13). Vulnerabilities to flooding and extreme precipitation to critical infrastructure and buildings include:

- **Reduced access:** Inundation of critical facilities and roads can prevent employees from operating critical facilities. For instance, a firefighter will have trouble accessing an inundated fire station and operating equipment (such as a fire truck) may not be possible. Similarly, hospital employees and patients will not be able to reach the hospital to provide or receive medical attention if roads are flooded.
- **Physical damage:** Flooding can severely damage ground-level electrical components of critical facilities, which could prevent them from operating.
- **Electrical and health hazards:** Water creates electrical hazards and can lead to fungal or bacterial growth on equipment that is harmful to human health.

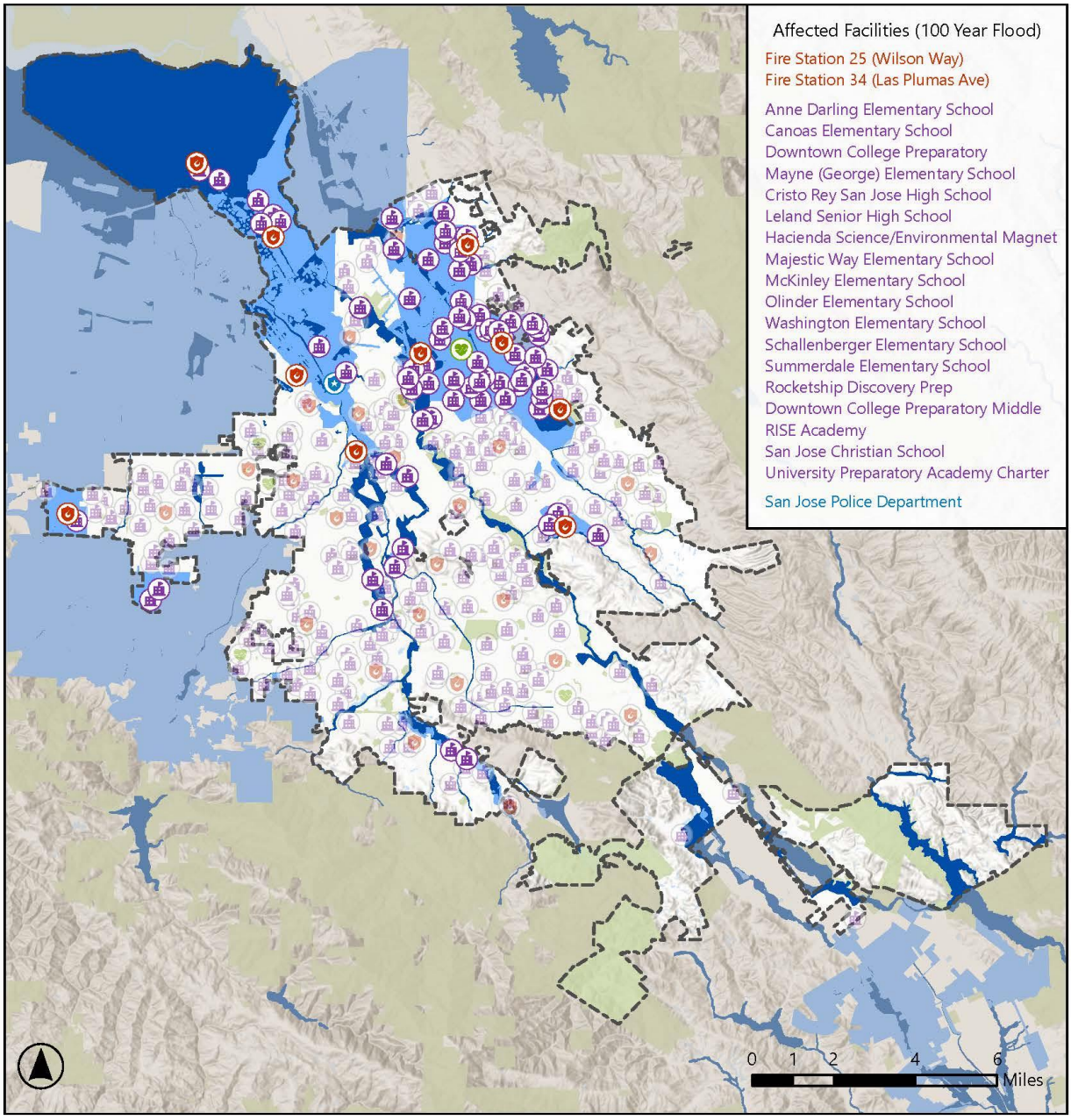
[63] *County of Santa Clara, 2023*

Figure 13. Building Vulnerability to Flooding



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Figure 14. Critical Facilities in Flood Zones



Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD), FEMA

Sea Level Rise and Storm Surge

Buildings have **moderate** vulnerability to storm surge. Approximately 3% of buildings in San José have high vulnerability to 1 foot of sea level rise and storm surge by 2050 in the "Likely" scenario (Table 4and Figure 15). A majority of these buildings are industrial (39%), offices (26%), or residential (21%). In by 2100 in the "likely" end of century scenario, approximately 4% of buildings in San José have high vulnerability to 3 feet of sea level rise and storm surge. A majority of these buildings are industrial (40%), offices (24%), or residential (24%).

Critical facilities have **high** vulnerability to sea level rise and storm surge. Any critical facilities located north of State Route 237 are likely to be inundated by storm surge from the 100-year flood in 2050 and subject to permanent inundation by 2100 (Figure 15). Under a high-emissions "likely" sea level rise scenario, by late-century, three critical facilities are vulnerable to sea level rise: two schools (Mayne (George) Elementary School and RISE Academy) and one fire station.

Impacts to critical facilities from sea level rise are similar to flooding, with the added risk that corrosion of electrical equipment from saltwater can accelerate asset deterioration.

Figure 15. Building Vulnerability to Sea Level Rise ("Likely" Scenario) in Mid-Century and Late-Century

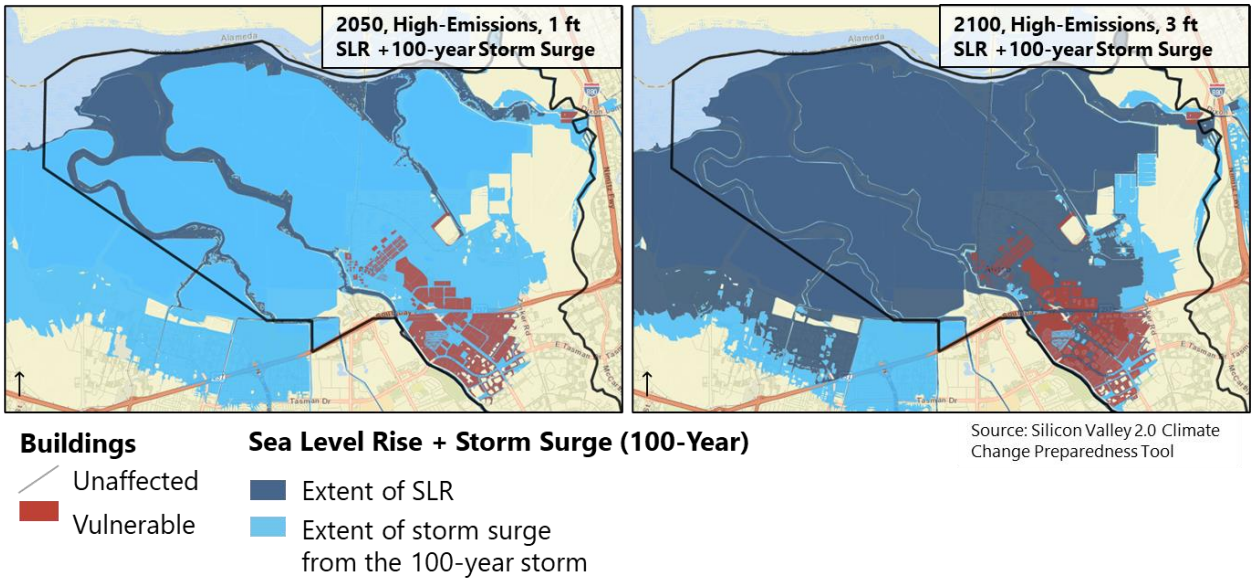
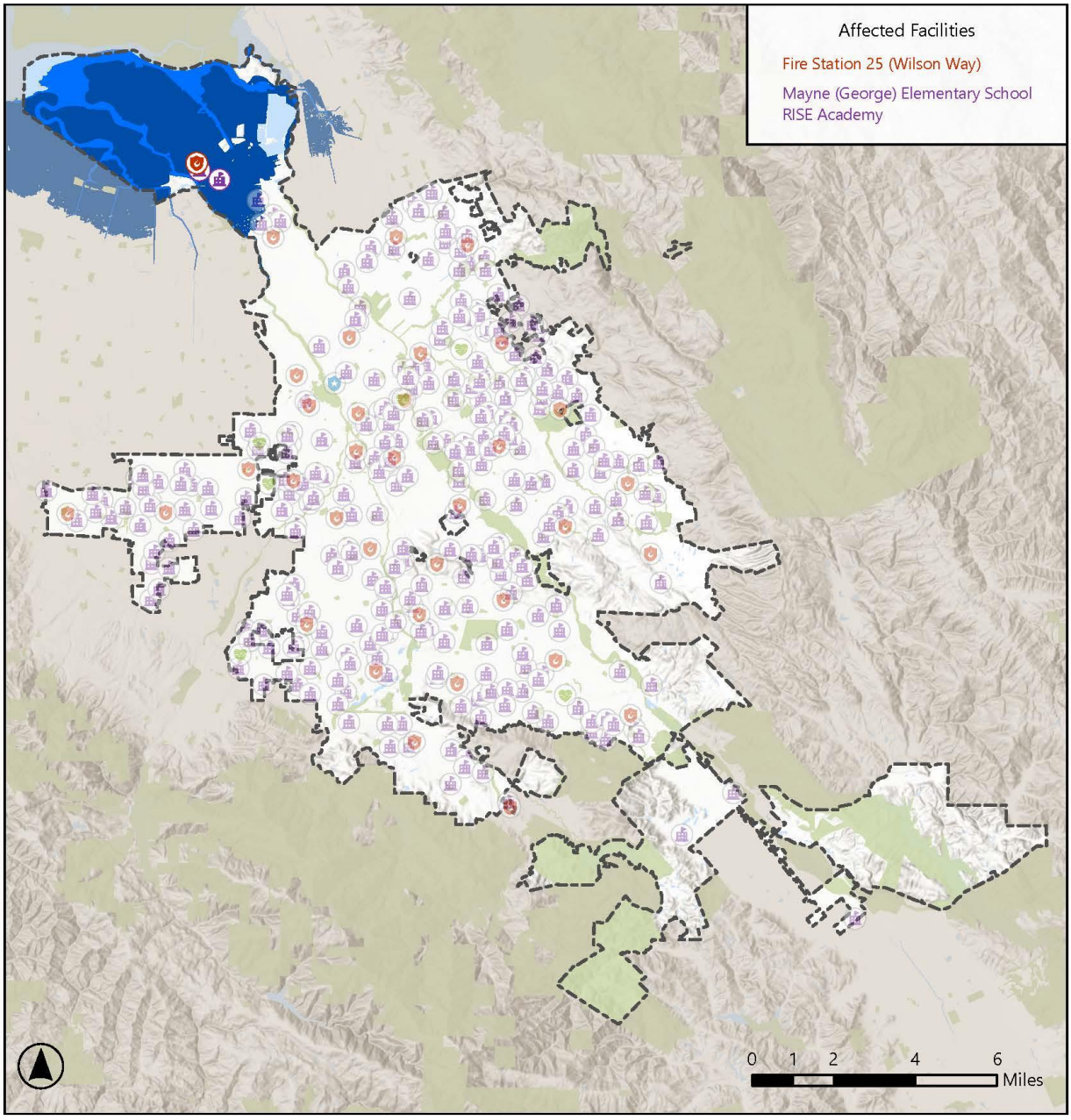


Figure 16. Critical Facilities exposed to SLR



Drought

Critical facilities and buildings have **minimal** vulnerability to drought. Common vulnerabilities associated with buildings and drought include:

- **Subsidence:** In some cases, drought-driven subsidence causes building foundations to shift. However, this is not likely in San José, and critical facilities are expected to be operational during a drought.
- **Landscaping restrictions:** Water conservation measures may impact landscaping and water use at critical facilities, but these measures are not expected to disrupt operations.

Wildfire

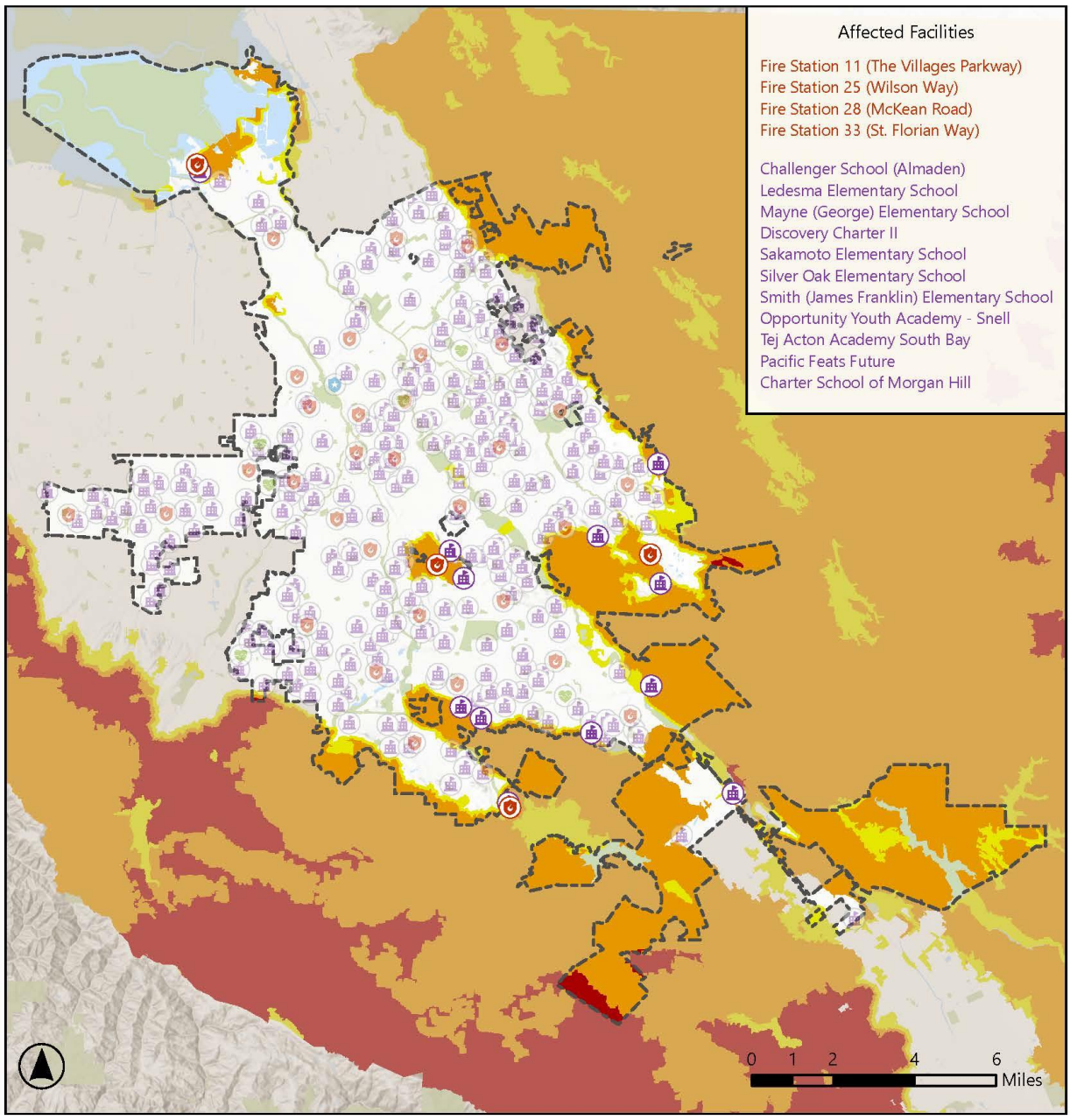
Critical facilities and buildings have **moderate** vulnerability to wildfire. Overall, there is relatively little wildfire risk in San José, but critical facilities in a high wildfire risk area (near Alviso, Santa Teresa County Park, or on the outskirts of the City) may be destroyed or damaged in the event of a wildfire. Many foothill areas have dead-end roads or other transportation limitations that could impede an evacuation if a wildfire occurs nearby.[64] There are four fire stations (Stations 11, 25, 28, and 33) and 11 schools in a high fire hazard severity zone (Figure 17).

Impacts to critical facilities from wildfire include:

- **Power outages:** Prolonged loss of power during a wildfire could result in backup systems for critical facilities being depleted, resulting in disruption of operations to hospitals and fire and police stations, endangering public health and safety.
- **Reduced air quality and visibility:** Wildfire smoke and poor air quality can increase emergency room and hospital visits.
- **Increased energy and maintenance costs:** Wildfire smoke can clog HVAC filters, reducing their efficiency and requiring them to work harder to maintain temperature control and increasing energy costs. Cleaning the filters requires more frequent maintenance.

[64] *County of Santa Clara, 2023*

Figure 17. Critical Facilities in Fire Hazard Severity Zones



Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD), CalFire

Adaptation Efforts to Date

- Santa Clara Valley Healthcare (SCVH) signed a Climate Pledge in May 2023 to reduce its carbon footprint and become net-zero by 2050. The pledge requires SCVH to develop a climate resilience plan for critical operations by the end of 2023, with a focus on disadvantaged communities.[65] SCVH includes Santa Clara Valley Medical Center and O'Connor Hospital in San José and St. Louise Regional Hospital in Gilroy, as well as several clinics across Santa Clara County.
- The 2023 MJHMP action SJ-5 requires the City to assess the needs of critical facilities and procure backup power generators for facilities without a redundant power supply.[66]
- The City operates at least five cooling centers at the following community centers: Mayfair, Camden, Seven Trees, Roosevelt, and Cypress.[67] All community centers offer residents access to bottled water, free Wi-Fi, and outlets to charge devices.[68]

Water and Wastewater Infrastructure and Supply

Asset Overview

Valley Water supplies potable water to a large portion of Santa Clara County, including San José. Most of Valley Water's water comes from snowpack in the Sierra Nevada mountains through the Hetch-Hetchy water system. About 40% of Valley Water's supply is imported from the State Water Project (SWP) and Central Valley Project (CVP), water conveyance systems in California that provide water for residential, agricultural, and industrial use. An additional 30% of Valley Water's supply comes from local surface and ground water, 10% from the San Francisco Public Utility Commission's (SFPUC) Regional Water System, r, and 5% is recycled. [69]

Currently, Valley Water operations include 10 dams, 17 miles of open surface water canals, five water supply diversion dams, 393 acres of groundwater recharge ponds, 91 miles of controlled in-stream recharge, 142 miles of pipelines, three drinking water treatment plants, one advanced water purification center, and three pump stations.[70] Most of Valley's Water infrastructure is described qualitatively along with impacts on water supply based on Valley Water's past studies, including Valley Water's Climate Change Action Plan.[71]

The San José-Santa Clara Regional Wastewater Facility (Facility) is located in the Alviso area of San José and is operated by the City's Environmental Services Department. The Facility is owned by the City of San José and the City of Santa Clara and serves eight cities in the Silicon Valley. In addition to the 2013 Plant Master Plan, the Facility is included in SV 2.0 and is depicted in maps in this section. Its vulnerability to different climate hazards are shown in

[65] *County of Santa Clara Health System, 2023*
[66] *County of Santa Clara, 2023*
[67] *Silicon Valley Strong, 2020*
[68] *Delaney, 2022*
[69] *Santa Clara Valley Water District, 2019*
[70] *Santa Clara Valley Water District, 2019*
[71] *The Climate Change Action Plan identified 49 unique climate change vulnerabilities that would affect Valley Water's operations. It does not assess water infrastructure's vulnerability to different climate hazards.*

Table 5.

Table 5. SV 2.0 (2021) Regional Wastewater Facility Vulnerability to Climate Hazards in 2050 and 2100, High Emissions Scenario

Asset Type	Timeframe		Extreme Heat	Riverine Flooding*		Sea Level Rise		Sea Level Rise + 100-Year Storm Surge		Wildfire
				100-year flood	500-year flood	Likely 2050: 1 ft 2100: 2 ft	Worst-Case 2050: 3 ft 2100: 7 ft	Likely 2050: 1 ft SLR + 4.5 ft 2100: 2 ft SLR + 3.5 ft	Worst-Case 2050: 3 ft SLR + 4 ft 2100: 7 ft SLR + 4 ft	
Regional Wastewater Facility Total: 783 acres	2050	Acres	None	563	762	None	None	39	38	None
		% of total	0%	72%	97%	0%	0%	5%	5%	0%
	2100	Acres	None	563	762	9	142	142	752	None
		% of total	0%	72%	97%	1%	18%	18%	96%	0%

Climate Change Vulnerabilities

Higher Temperatures and Extreme Heat

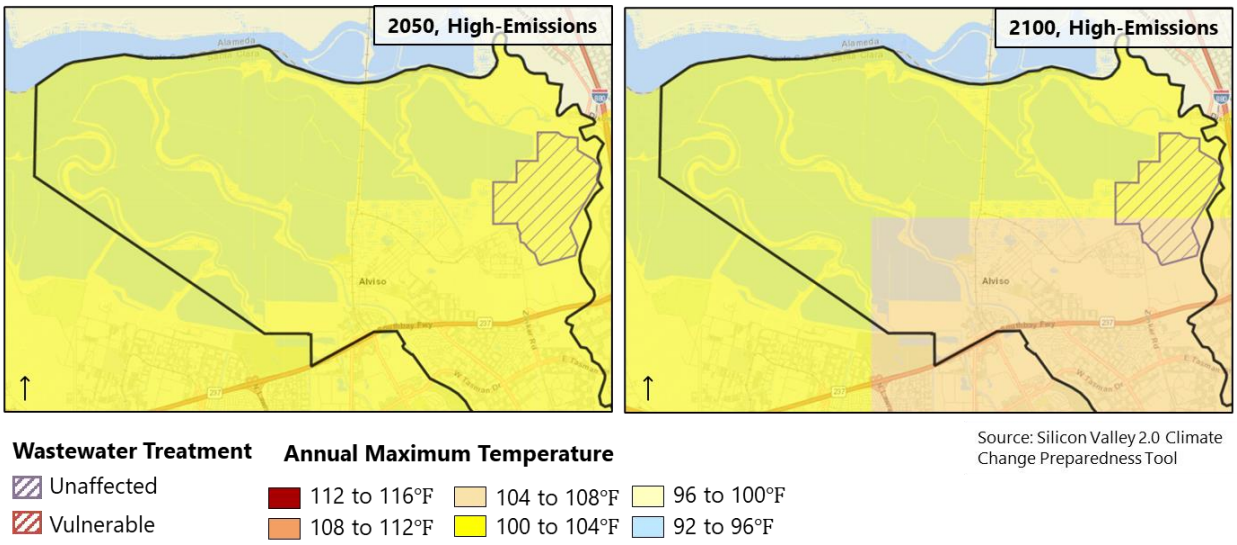
Water and wastewater infrastructure has **low** vulnerability to high temperatures and heat. While certain components of water infrastructure may experience heat-related impacts, damage is expected to be minimal. High temperatures and extreme heat may increase the likelihood of blackouts or brownouts, however important facilities like the Regional Wastewater Facility are prepared to operate in those conditions. The Regional Water Board requires the Facility to have sufficient reliable power to operate critical functions during temporary power outages as a condition of its permit.[72]

Water supply has **high** vulnerability to high temperatures and heat. Vulnerabilities of water supply to heat include:

- **Evaporating supply:** Less water will be available from local and imported surface water due to rising temperatures increasing evaporative losses.[73]
- **Toxins in water bodies:** Reservoirs are sensitive to changes in precipitation and temperature, which can lead to increased algal blooms that create toxins. Algal blooms are also harmful to aquatic plants and animals, as they affect the levels of oxygen and sunlight in the water that are necessary to keep the ecosystem functioning.
- **Reduced water quality:** The equipment in oxygenation systems may malfunction during heat events. Additionally, higher temperatures reduce the solubility of oxygen in water and lead to thermal stratification, requiring oxygenation systems to work harder to distribute oxygen evenly.

[72] *City of San José, 2013*
[73] *Santa Clara Valley Water District, 2021*

Figure 18. Regional Wastewater Facility Vulnerability to Extreme Heat in Mid-Century and Late-Century



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Flooding and Extreme Precipitation

Water and wastewater infrastructure has **high** vulnerability to flooding. Flooding is not expected to impact water supply so it has **low** vulnerability to flooding. Vulnerabilities of water and wastewater infrastructure to flooding include:

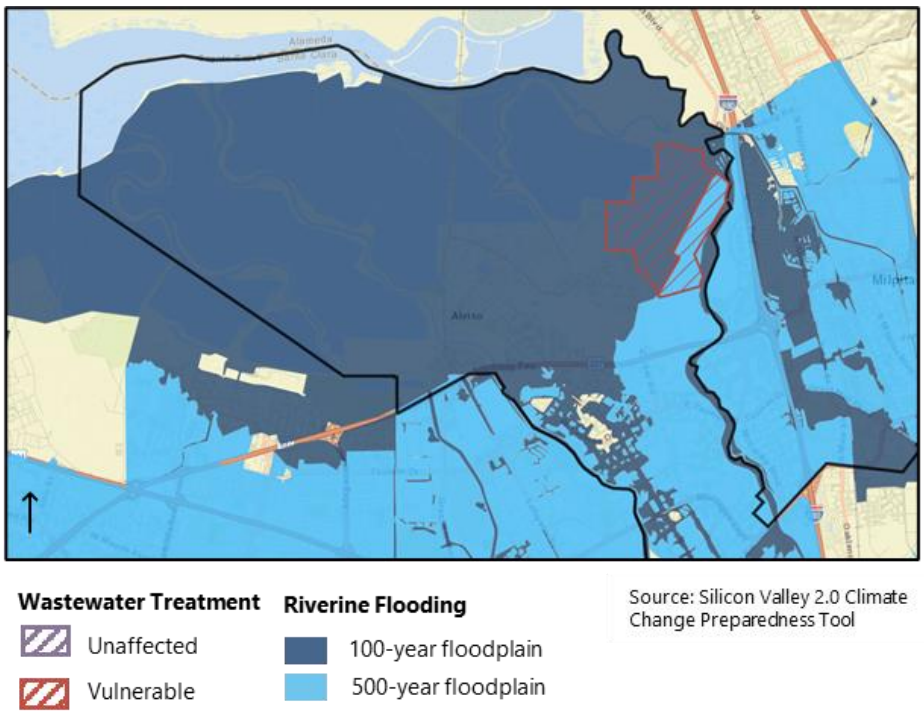
- **Exceeded reservoir storage capacity:** More precipitation falling as rain instead of snow may exceed the storage capacities of reservoirs, since runoff will be concentrated in the winter and early spring and will not be staggered throughout the spring and summer.[74] It is difficult for reservoirs to capture water during intense storms because they are more likely to reach capacity and spill, requiring operators to release water to make room for storm flows.[75]
- **Damages to flood protection structures exposed to flooding:** Existing flood protection structures are built to withstand flows and depths from past flood events, not more powerful floods that are likely to result from more intense storms. The capacity of reservoirs and other water infrastructure is more likely to sustain damages during flood events.
- **Damage to flood conveyance infrastructure:** More intense storms produce debris that can block flood conveyance infrastructure facilities and streams. Runoff can increase sediment loads in reservoirs, increasing turbidity, and leading to issues with conveyance equipment not designed to handle higher sediment loads.

Damage to Regional Wastewater Facility: SV 2.0 indicates that 72 percent of the Facility's land area would be exposed to flooding during a 100-year flood event and 97 percent during a 500-year flood event

[74] *Valley Water, 2019*
[75] *Valley Water, 2019*

- Table 5). Some components of the Facility can be elevated, but most cannot. Flooding will damage electronic systems in the Facility and make them inoperable.[76]

Figure 19. Wastewater Treatment Plant Vulnerability to Flooding Based on Historical Floodplains



Sea Level Rise and Storm Surge

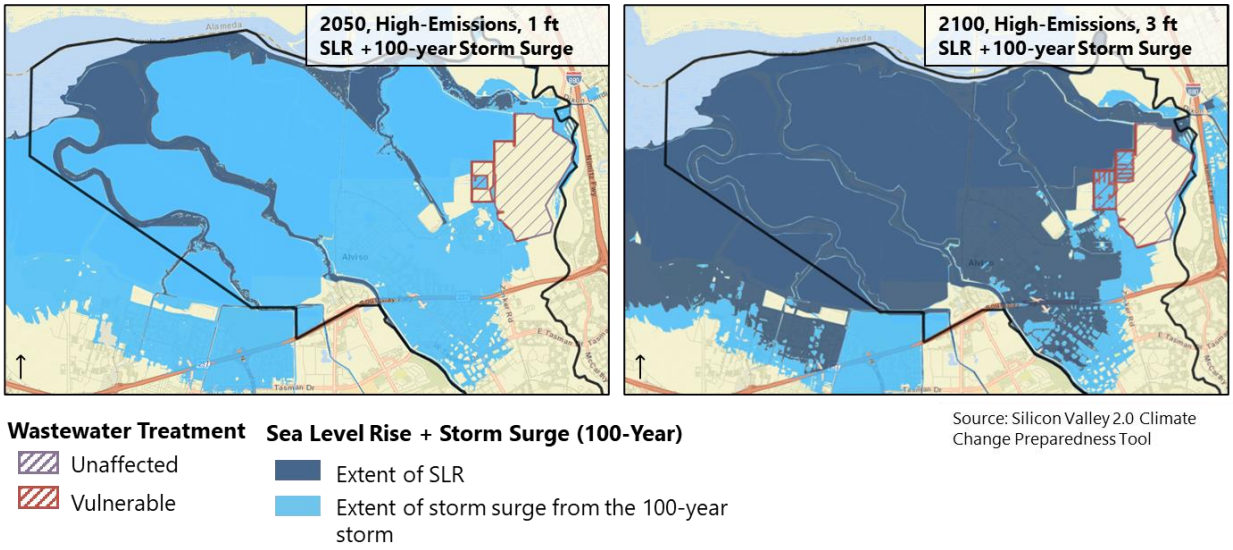
Water and wastewater infrastructure has **high** vulnerability to sea level rise.

- **Increased salinity:** Sea level rise can increase salinity of water in the Delta, reducing the amount of available water for import.
- **Higher purification and treatment costs:** Sea level rise threatens water purification and treatment assets, including the Silicon Valley Advanced Water Purification Center and the San José Santa Clara Regional Wastewater Facility, which are located on the edge of the San Francisco Bay in northern San José and is currently exposed to sea level rise and storm surge. With 4.6 ft of SLR, the Water Purification Center could experience 3.3 feet of flooding during the 1% annual chance storm event (without infrastructure improvements).[77]
- **Reduced operational capacity:** Operational capacity is threatened by floods, which may prevent access to work areas and disrupt the supply chain.
- **Environmental contamination and health impacts:** If the Regional Wastewater Facility is flooded, partially treated or untreated sewage may be released to the environment. People who are exposed to contaminated water may experience a range of health impacts, including gastrointestinal issues, skin infections, E. coli, salmonella, and more.

Water supply has **moderate** vulnerability to sea level rise. Many of the impacts to water infrastructure also impact water supply.

[76] *City of San José, 2013*
[77] *Silicon Valley 2.0*

Figure 20. Regional Wastewater Facility Vulnerability to Sea Level Rise and Storm Surge in Mid-Century and Late-Century



Source: Silicon Valley 2.0 Climate Change Preparedness Tool

Drought

Water supply has **high** vulnerability to drought.

- **Reduced water supply**: Valley Water noted in their 2021 Climate Change Adaptation Plan that future droughts are the primary challenge to water supply.[78]
- **Increased reliance on groundwater**: Drought conditions increase evaporation, leading to less available surface water and increasing reliance on groundwater.
- **Subsidence:** Groundwater may be relied on to meet demand, resulting in groundwater depletion and overdraft, leading to subsidence. Drought can also cause groundwater contamination, as the concentration of existing pollutants increases as less water is available.
- **Less inflow for recycled water production:** Conservation efforts during drought can reduce amount of wastewater available for recycling.
- **Greater water restrictions for habitat conservation purposes:** Less available surface water may trigger more stringent regulations from CA Department of Fish and Wildlife to preserve habitat available for riparian and aquatic species. This could impact water reliability.

Water infrastructure has **minimal** vulnerability to drought since it is not expected to be impacted by drought.

Wildfire

Water and wastewater infrastructure has **moderate** vulnerability to wildfire. Vulnerabilities of water infrastructure to wildfire include:

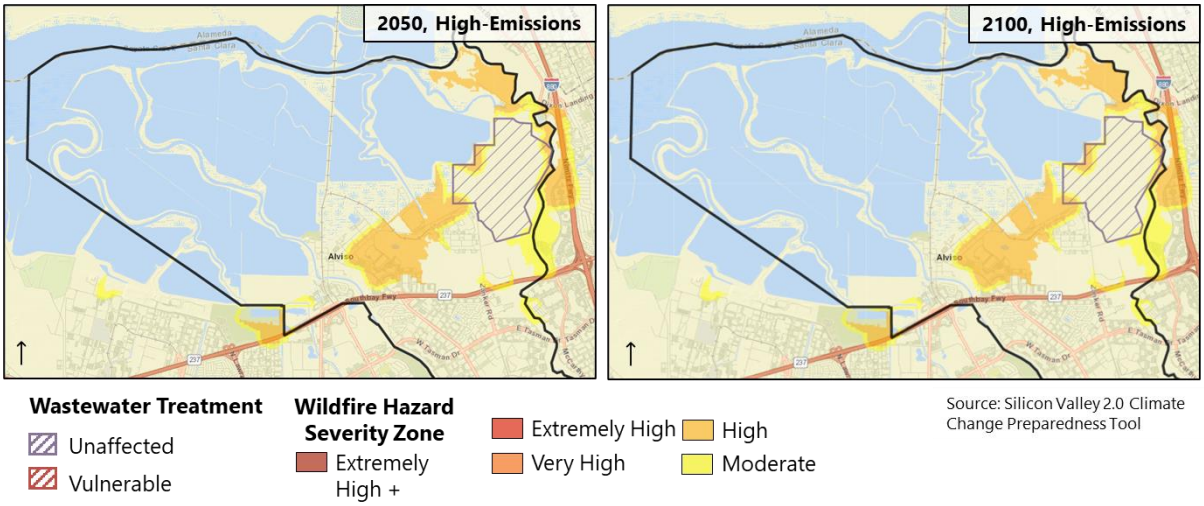
- **Reduced water quality in water supply and aquatic ecosystems:** If a wildfire melts plastic pipes and destroys infrastructure. Firefighting foams and equipment can also leech chemicals into water bodies.[79]

[78] *Santa Clara Valley Water District, 2021*
[79] *California Water Boards, 2024*

- **Reduced storage capacity:** Following a wildfire, debris and sediment can clog channels, decreasing channel capacity to pass flows. Sediment buildup can also reduce storage space in reservoirs and reduce groundwater recharge.
- **Electrical outages:** Power shutoffs from wildfire risk can affect equipment and damage pump and conveyance systems.

Water supply has **low** vulnerability to wildfire. Indirect impacts may result from increased turbidity in water supplies due to ash and other wildfire debris, leading to decreased water quality and higher purification and maintenance costs.

Figure 21. Regional Wastewater Facility Vulnerability to Wildfire in Mid-Century and Late-Century



Adaptation Efforts to Date

- The City of San José and Valley Water are aware of the threats that climate change poses to water supply and infrastructure. The City Infrastructure Strategy notes that San José is evaluating multiple water supply projections, including expanding water purification in Santa Clara County and is working with the San José Water Company on a memorandum for Water Supply Resiliency.[80]
- The South San Francisco Bay Shoreline Adaptation Project will protect north San José and the San José-Santa Clara Regional Wastewater Facility from a 100-year coastal storm and rising seas. The project also will restore tidal marsh and create new trails and pedestrian bridges to increase public accessibility to the shoreline.
- The City enacts limits on outdoor irrigation for residents and businesses during droughts.[81] The City also has a permanent wastewater prevention ordinance that holds owners and managers responsible for repairing leaks in pluming, sprinkler, and irrigation systems and that prevents people from using water in ways that result in runoff.[82]
- In 2024, Valley Water began construction of flood walls along nine miles of Coyote Creek to provide protection from floods up to the level that occurred in 2017, equivalent to a 5% annual chance flood event. The walls are part of a retrofit for Anderson Reservoir that includes a larger tunnel to discharge water down Coyote Creek.

[80] *City of San José, 2021*
[81] *City of San José, n.d.*
[82] *City of San José, 2024*

- The City's Green Stormwater Infrastructure Plan explains how to use a Geographic Information System-based tool to guide the implementation of green stormwater projects.[83] The goal of these projects is to implement sustainable drainage practices within the City's urban core and growth areas to maximize treatment, infiltration, and stormwater runoff from impervious surfaces.
- Valley Water is partnering with the State Coastal Conservancy and the U.S. Army Corps of Engineers to construct a series of levees and restore tidal marsh to protect the wastewater treatment facility and other infrastructure from a 100-year storm and rising sea levels.[84] Construction is estimated to be completed by 2025.
- Valley Water's 2040 Water Supply Master Plan includes strategies to enhance water conservation efforts, including:
  - Incentivizing the use of advanced metering infrastructure, customer side leak repairs, graywater programs, and the installation of rain barrels, cisterns, rain gardens, stormwater capture basins, and a flood aquifer.
  - Developing 24,000 acre-feet per year (AFY) of additional recycled water by 2040.
  - Optimizing the use of existing supplies and infrastructure by enlarging the Pacheco Reservoir, connecting Contra Costa Water District's system to Bethany Reservoir through the Transfer-Bethany Pipeline, and increasing groundwater recharge capacity through the South County Recharge project.[85]
- Improvements for flood and sea level rise were made to the Regional Wastewater Facility as described in the Plant Master Plan, including:
  - Creation of 61 acres of freshwater wetlands on the Facility property to offer added capacity for holding water. These wetlands prevent the release of effluent into the Bay in the case of a flood or extreme precipitation event.
  - An overflow channel to bypass the freshwater wetland in case of major wet-weather events.
  - Construction of nearly 800 acres of salt marsh habitat, mudflats, and upland habitat to provide flood protection.[86]

Electrical Infrastructure

Asset Overview

Electrical infrastructure in San José includes 18 power generation facilities, 29 electrical substations, and 134 miles of transmission lines. Distribution lines are not included in the tables and maps for electrical infrastructure, however vulnerabilities associated with transmission lines can be assumed to apply to distribution lines as well. In addition to the SV 2.0 tool, the Vulnerability Assessment draws from PG&E's 2024 system-wide Climate Change Adaptation and Vulnerability Assessment. The assessment was conducted to comply with the California Public Utilities Commission's ruling directing investor-owned utilities to assess climate risks to operations and services.[87]

The SV 2.0 tool evaluates the vulnerability of power generation facilities, substations, and transmission lines to climate hazards. Vulnerability of energy assets included in the SV 2.0 Tool to each climate hazard is shown in Table 6.

[83] *City of San José Environmental Services Department, 2019*
[84] *Santa Clara Valley Water District, 2023*
[85] *Valley Water, 2019*
[86] *City of San José, 2013*
[87] *PG&E, 2024*

Table 6. SV 2.0 (2021) Electrical Asset Vulnerability to Climate Hazards in 2050, High Emissions Scenario

Asset Type	Timeframe		Extreme Heat	Riverine Flooding*		Sea Level Rise		Sea Level Rise + 100-Year Storm Surge		Wild-fire
				100-year flood	500-year flood	Likely 2050: 1 ft 2100: 2 ft	Worst-Case 2050: 3 ft 2100: 7 ft	Likely 2050: 1 ft SLR + 4.5 ft 2100: 2 ft SLR + 3.5 ft	Worst-Case 2050: 3 ft SLR + 4 ft 2100: 7 ft SLR + 4 ft	
Power Generation Facilities Total: 18	2050	#	None	4	9	None	None	2	2	None
		% of Total	0%	22%	50%	0%	0%	11%	11%	0%
	2100	#	None	4	9	None	3	3	4	None
		% of Total	0%	22%	50%	0%	17%	17%	22%	0%
Sub-stations Total: 29	2050	#	None*	4	9	None	1	3	3	None
		% of Total	0%	14%	31%	0%	3%	10%	10%	0%
	2100	#	None*	4	9	1	4	4	6	None
		% of Total	0%	14%	31%	3%	14%	14%	21%	0%
Transmis-sion Lines Total: 134 miles	2050	Miles	134	29	46	None	None	None	None	None
		% of Total	100%	21%	34%	0%	0%	0%	0%	0%
	2100	Miles	134	29	46	None	None	None	None	None
		% of Total	100%	21%	34%	0%	0%	0%	0%	0%

** Note: Though SV 2.0 identified that no sub-stations were vulnerable to extreme heat, qualitative data from lived experience of the 2020 heat event indicated there is vulnerability in this sector. See narrative for High Temperatures and Extreme Heat below.*

Climate Change Vulnerabilities

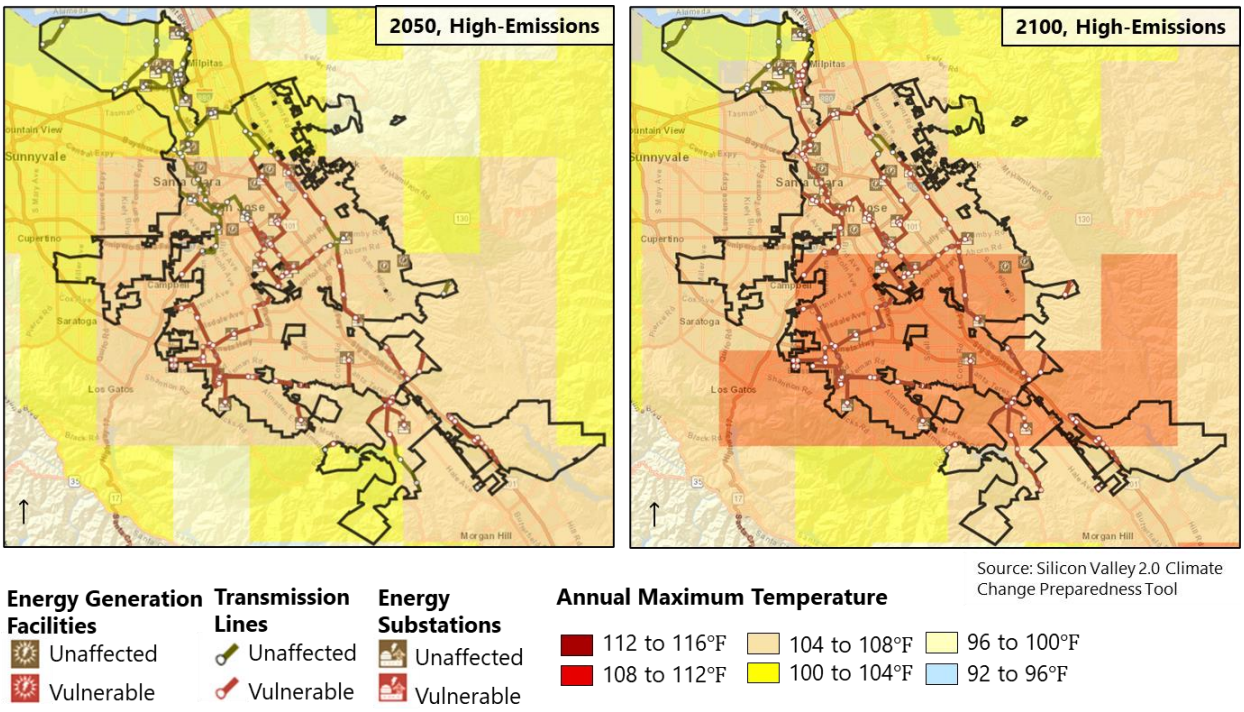
Higher Temperatures and Extreme Heat

Electrical infrastructure has **moderate** vulnerability to extreme heat. As depicted in Figure 22, transmission lines have moderate vulnerability to extreme heat in mid-century and late-century. Though not shown in the maps, distribution lines, generation facilities, and substations also have **moderate** vulnerability to extreme heat due to the following risks:

- **Increased power demand:** During heat waves, demand surges due to increased air conditioning needs, which may require utilities to implement load shedding, the deliberate reduction or shutdown of electricity in certain areas to prevent power lines from being overloaded. Load shedding is implemented to prevent the entire power grid from shutting down. Heat events may lead to outages at substations and power generation facilities, preventing them from operating.

- **Exceeded operating temperatures:** Most electrical infrastructure is designed to withstand certain operating temperatures. Exceedance of these thresholds (most likely from sustained above-average temperatures for several days) can cause equipment to malfunction or breakdown. Transformers in substations and generation facilities are particularly sensitive to high temperatures.[88] In 2020, the downtown substation experienced issues during the prolonged heat wave that led to long power outages.
- **Reduced useful lifespan:** Higher temperatures can accelerate asset physical deterioration and reduce operational lifetimes.
- **Line sag:** High temperatures also create line sag (as heat expands metal materials in power lines), which may cause electrical arcing (when electricity jumps from the line to a nearby object), leading to power outages and damages.

Figure 22. Energy Infrastructure Vulnerability to Extreme Heat in Mid-Century and Late-Century



Flooding and Extreme Precipitation

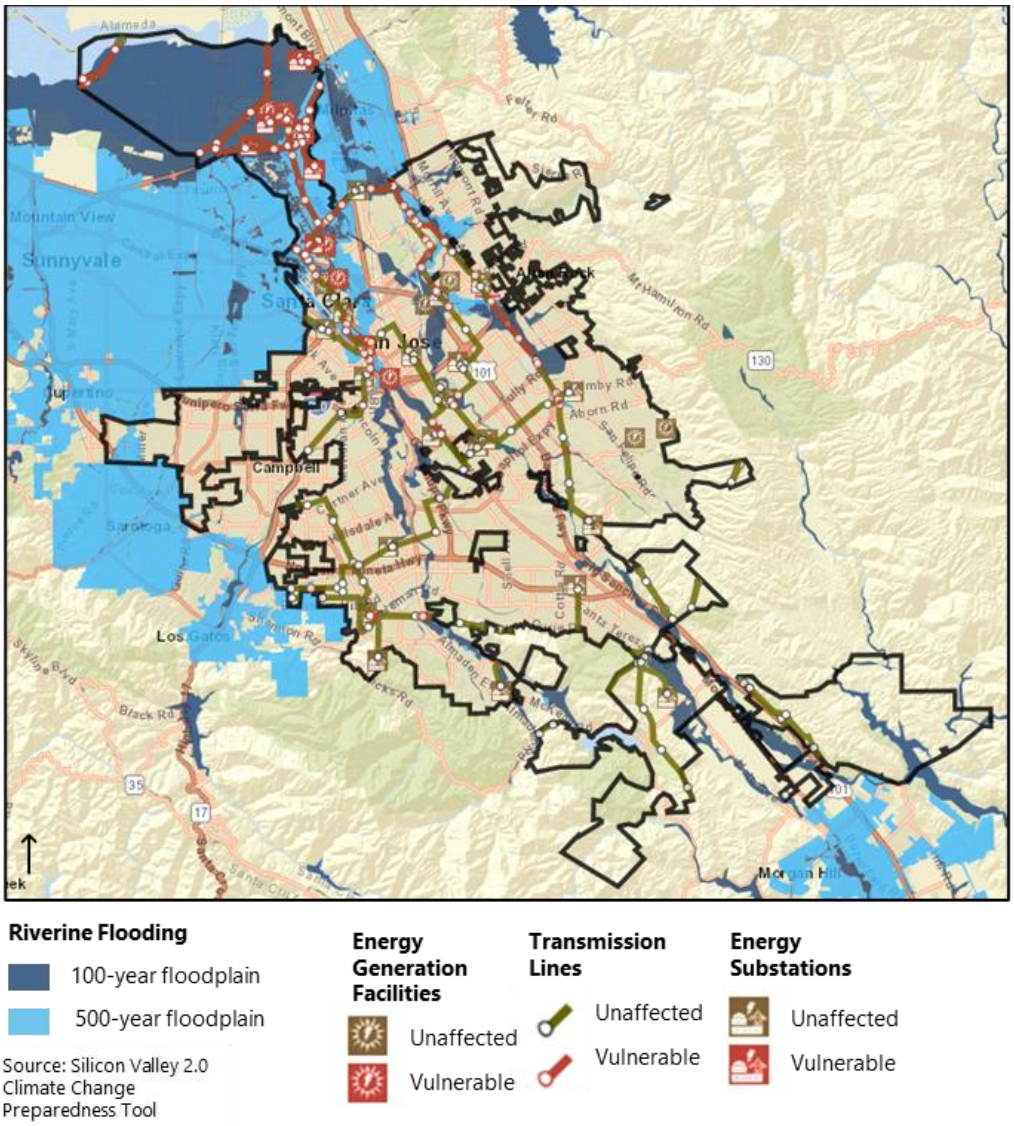
Substations and power generation facilities have **high** vulnerability to flooding. In particular, the 4 power generation facilities and four substations in the 100-year floodplain and 5 power generation facilities[89] and five substations[90] in the 500-year floodplain are vulnerable to flooding. Assets outside of the floodplain are less likely to be inundated, but still may experience damages associated with flooding from unprecedented heavy rainfall and debris flows. Vulnerabilities of substations and power generation facilities to flooding include:

[88] *PG&E, 2024*
[89] *Power generation facilities in the 100- or 500-year floodplains are operated by: San José Convention Center, Gridley Main Two, County of Santa Clara, Agnews, Los Esteros, San José/Santa Clara WW2, Newby Island 2, Newby Island 1.*
[90] *Substations in the 100- or 500-year floodplain are operated by: PG&E (2), SVP (2), and "Other" (1).*

- **Physical damage:** Ground level equipment (e.g. pad-mounted transformers, communications equipment, circuit breakers, batteries) can be damaged by floods.
- **Impeded access:** Flooding may prevent maintenance crews from accessing damaged assets.
- **Electrical and health hazards:** Water creates electrical hazards and can lead to fungal or bacterial growth on equipment harmful to human health.
- **Debris flows:** Heavy flows triggered by heavy precipitation events can damage ground level electrical equipment and prevent operators from reaching assets.
- **Reduced structural stability:** Saturated soil is less stable and may cause foundations to tilt.

Transmission lines have **moderate** vulnerability to flooding. There are 29 miles of transmission lines in the 100-year floodplain and an additional 17 miles of transmission lines in the 500-year floodplain. The primary threat to transmission lines is from erosion and debris flows during flood events eroding the earth around pole bases, reducing structural integrity.

Figure 23. Energy Infrastructure Vulnerability to Flooding Based on Historical Floodplains

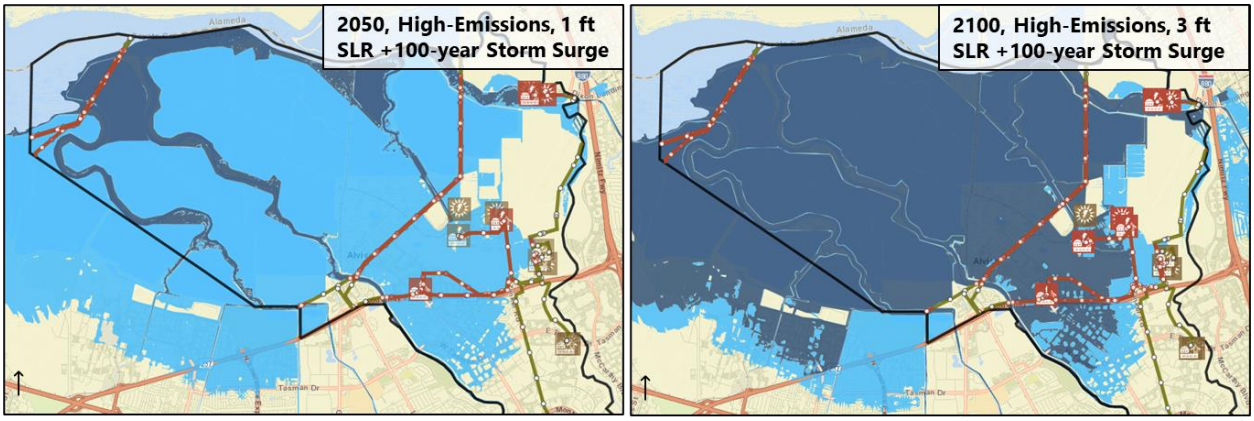


Sea Level Rise and Storm Surge

Substations and power generation facilities have **high** vulnerability to sea level rise and storm surge. With 1 foot of flooding and the storm surge from the 100-year storm, energy generation at Newby Island 1 and 2 and 3 substations are projected to be inundated. By late-century, with 3 feet of sea level rise and storm surge, one more substation and the San José-Santa Clara Regional Wastewater Facility are projected to be exposed. Impacts to substations and power generations from sea level rise and storm surge are the same as flooding, except that saltwater can corrode electrical equipment. Figure 24 shows the vulnerability of electrical infrastructure to sea level rise and storm surge.

Transmission lines have **moderate** vulnerability to sea level rise and storm surge. Impacts from sea level rise and storm surge are the same as flooding, except that steel towers in tidal areas may experience corrosion from saltwater. PG&E notes this is already an issue for towers in the San Francisco Bay.[91] However, transmission lines themselves are overhead so should continue to be functional should inundation occur.

Figure 24. Energy Infrastructure Vulnerability to Sea Level Rise in Mid-Century and Late-Century



Drought

Electrical infrastructure has **minimal** vulnerability to drought.

Wildfire

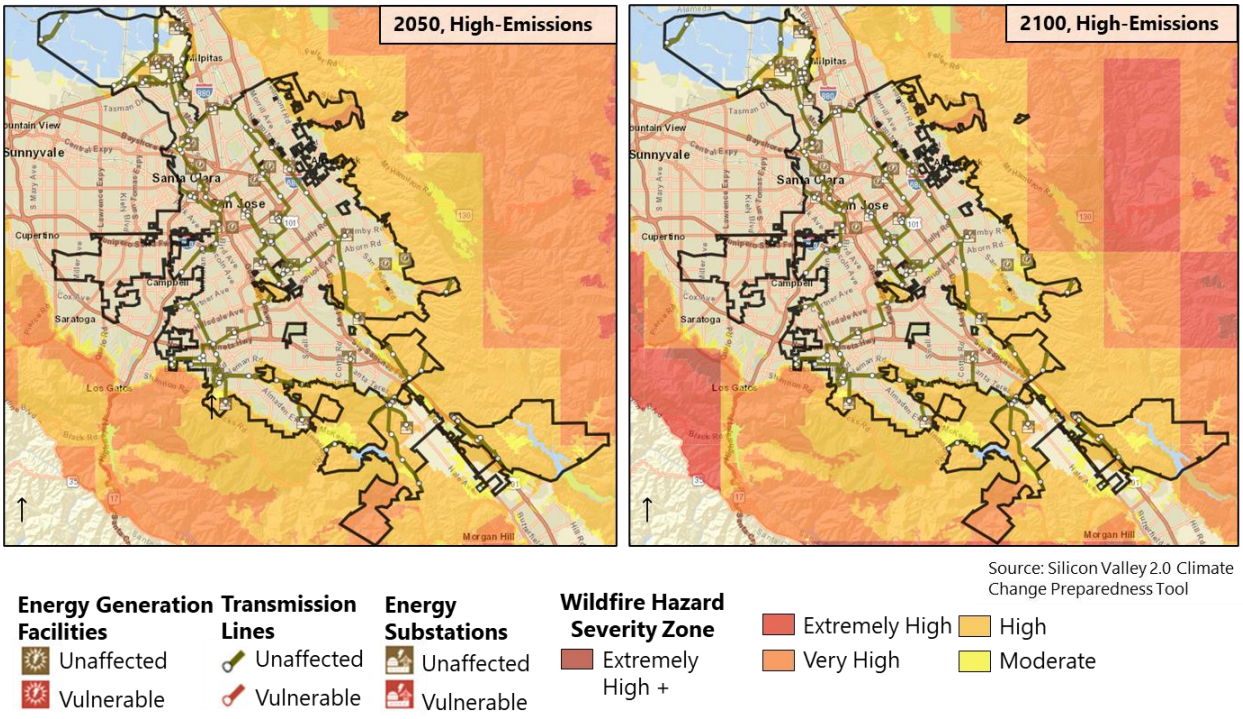
Overall, electrical infrastructure in San José has **low** vulnerability to wildfire. However, the impacts of wildfire on electrical infrastructure can be severe if exposure does occur, leading to infrastructure damage, rolling blackouts, and in some cases, sparking new wildfires. Vulnerabilities to electrical infrastructure include:

- **Destruction of asset:** Assets in high wildfire risk areas could be completely damaged or destroyed by a wildfire. Damage to PG&E's electrical infrastructure increases the likelihood of a Public Safety Power Shutoff in San José.

[91] *PG&E, 2024*

- **Line arcing:** Soot accumulation on insulators can cause leaked currents, and wildfire smoke can lead to arcing between lines.[92]

Figure 25. Energy Infrastructure Vulnerability to Wildfire in Mid-Century and Late-Century



Adaptation Efforts to Date

PG&E has taken steps to reduce climate impacts to infrastructure. These include:

- Completing a Climate Adaptation and Vulnerability Assessment (CAVA) in 2024 that identifies vulnerabilities to electrical and power systems and equitable strategies for enhancing utility resilience to climate hazards, particularly in disadvantaged communities.
- Updating substation design requirements from 109°F to 118°F so that substations are built to withstand higher temperatures.

The City of San José's Energy Department, which operates San José Clean Energy, are building out electrical infrastructure to scale up renewable power and storage to meet the City's goal of becoming carbon neutral by 2030. This includes:

-
- Contracting for more than 850 megawatts of renewable energy and reliability resources.[93]
- Increasing charging infrastructure citywide and developing an action plan to support vehicle conversion and electrification of the City's fleet. [94]

[92] *PG&E, 2024*
[93] *San José Clean Energy Integrated Resource Management Plan*
[94] *City of San José, 2023*

- Offering programs to incentivize residential building electrification and solar and battery storage installations and evaluating the City's permitting and engagement processes to identify areas for building and vehicle electrification. [95]
- Building a demand-side energy resource through its demand response program Peak Rewards to help reduce peak load during grid stress. Adding renewable energy storage systems and contracts.[96]

[95] *City of San José, 2024*
[96] *City of San José 2023*

4. Vulnerability of Transportation Assets

Transportation infrastructure in San José is made up of local roads, arterials, and highways, public transit facilities and vehicles (including buses, light rail, heavy rail, and stations and buildings), electrical vehicle charging stations, and the San José Mineta International Airport. The SV 2.0 tool was used to evaluate the vulnerability of highways, local roads, bridges, bikeways, heavy rail track, and light rail track to climate hazards. In addition to the SV 2.0 tool, this assessment draws from Valley Transportation Authority (VTA) Climate Action and Adaptation Plan's Vulnerability Findings to identify vulnerabilities of transit infrastructure to climate hazards.

Roads and Highways

Asset Overview

Roads in San José consist of local roads, arterials, and highways (not including freeways). Roads are constructed from asphalt or concrete and include lighting and other electrical equipment. This assessment does not evaluate pedestrian or bicycle facilities such as sidewalks or bike lanes.

Table 7. SV 2.0 (2021) Road and Highway Vulnerability to Climate Hazards in 2050 and 2100, High Emissions Scenario

Asset Type	Time frame	Extreme Heat	Riverine Flooding		Sea Level Rise		Sea Level Rise + 100-Year Storm Surge		Wildfire
			100-year flood	500-year flood	Likely	Worst Case	Likely	Worst Case	
Highway Total: 215 miles	2050	215 mi 100%	28 mi 13%	49 mi 23%	None	21 mi 1%	36 miles 2%	36 mi 2%	None
	2100	215 mi 100%	28 mi 13%	49 mi 23%	2 miles 1%	4 mi 2%	4 miles 2%	6 mi 3%	None
Local Roads Total: 2,869 miles	2050	2,869 mi 100%	273 mi 10%	473 mi 17%	None	21 mi 1%	36 miles 1%	36 mi 1%	None
	2100	2,869 mi 100%	273 mi 10%	473 mi 17%	24 mi 1%	39 mi 1%	39 mi 1%	54 mi 2%	None

Climate Change Vulnerabilities

Higher Temperatures and Extreme Heat

Roads and highways have **moderate** vulnerability to extreme heat. Higher temperatures and extreme heat can have citywide effects on roads and highways. The vulnerabilities of roads and highways to higher temperatures include the following:

- **Physical Infrastructure Damage:** Elevated temperatures can cause asphalt pavement to soften and expand which can create rutting and potholes. This is especially exacerbated in areas with high truck traffic.[97]
- **Traffic Movement Disruption:** If electrical outages are caused due to area-wide brownouts, traffic signals and streetlights could be affected, temporarily disrupting traffic movement. Physical damage on roads and highways could also lead to traffic delays and potentially collisions.
- **Contributes to the Urban Heat Island Effect and Poor Air Quality:** Roads and highways significantly contribute to urban heat because their pavement absorbs and re-emits solar radiation, increasing the surrounding temperatures. This also contributes to poor air quality, as high temperatures react with the exhaust from fossil-fuel powered cars to create smog.

Roads and highways have moderate adaptive capacity for extreme heat as there are measures that can be implemented for adaptation, but they vary in cost and effort. Some adaptation strategies include modifying roads by using materials that are more heat tolerant, which may be costly, implementing energy efficiency and conservation efforts to reduce stress on electricity systems during heatwaves to avoid power outages,[98] and reducing the heat island effect by using cool pavement for roads (which absorb less solar energy) and increasing street trees/landscaping.[99]

Flooding and Extreme Precipitation

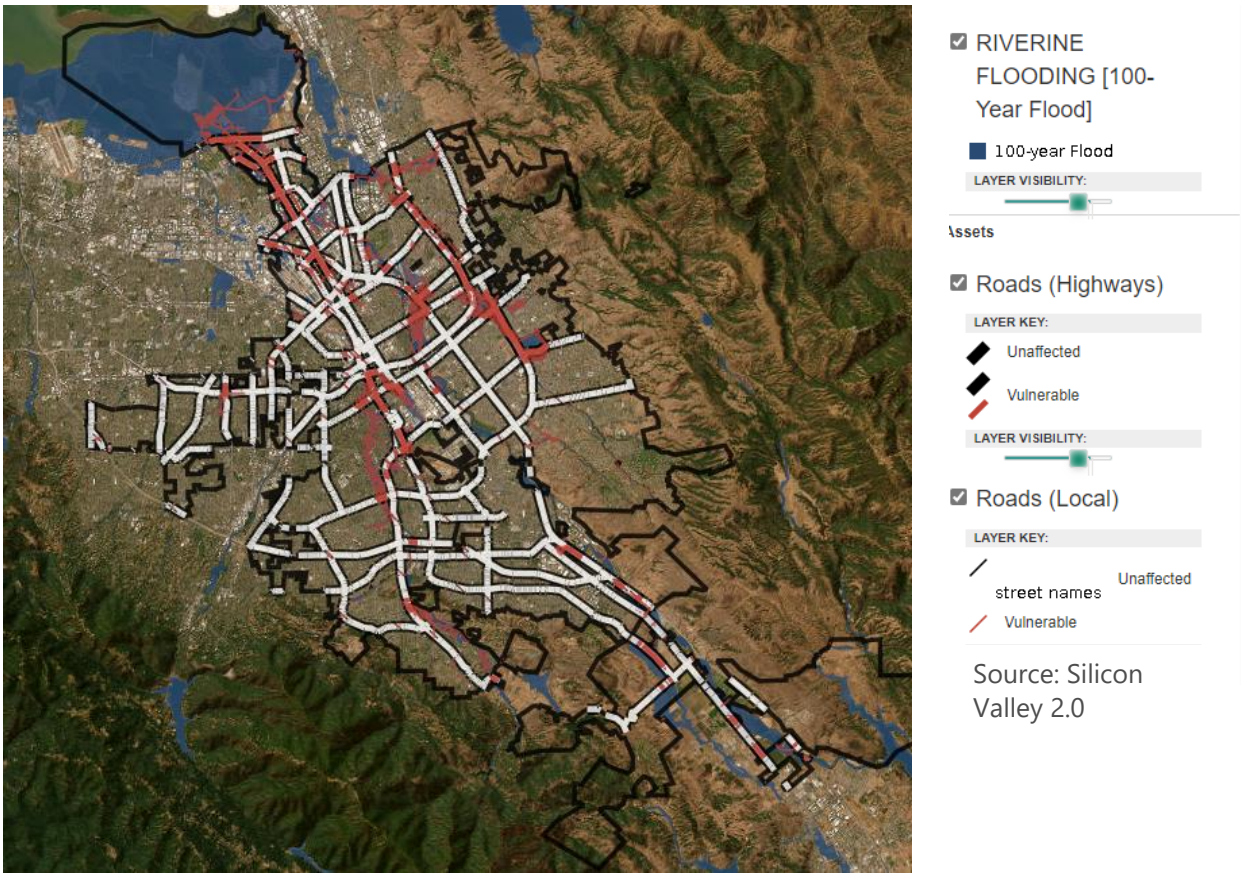
Roads and highways are **highly** vulnerable to flooding and extreme precipitation. As shown in Figure 26, riverine flooding can cause flooding and expose more inland areas to inundation. As a result, 28 miles of highways and 273 miles of local roads in San José are in the 100-year flood zone.[100] The vulnerabilities of roads and highways to flooding include the following:

- **Physical Infrastructure Damage:** Flooding can lead to erosion degradation of the road, subgrade, and drainage systems.
- **Access Issues:** Depending on the depth of inundation and vehicle clearances, impacts of flooding may vary from a minor slow-down of traffic to rendering the road unusable during a flood event (for example, roads with lower clearance height may not be able to use the roads at all).
- **Pollutant Runoff:** Heavy metals, oils, other toxic substances, and physical debris that are present on roads and highways can be carried in runoff to the creeks, rivers, and eventually the Bay. These can pollute soils, surface waters, ground water, aquatic ecosystems, and public health.[101]

Roads have more adaptive capacity when it comes to temporary flooding. These measures include flood-proofing the road using inflatable flood barriers and temporarily rerouting traffic. However, frequent temporary flooding of roads can cause degradation, which would require additional maintenance to maintain functionality.

[97] *USDOT, 2012*
[98] *US EPA, 2024.a*
[99] *US EPA. 2023*
[100] *Source: Silicon Valley 2.0 Climate Change Preparedness Tool. Based on maps provided by the Federal Emergency Management Agency depicting current flood hazard data, which were used as a proxy to illustrate potential future flooding.*
[101] *US EPA, 2024.b*

Figure 26: Roads & Highways: Flooding Vulnerability



Source: Silicon Valley 2.0

Sea Level Rise and Storm Surge

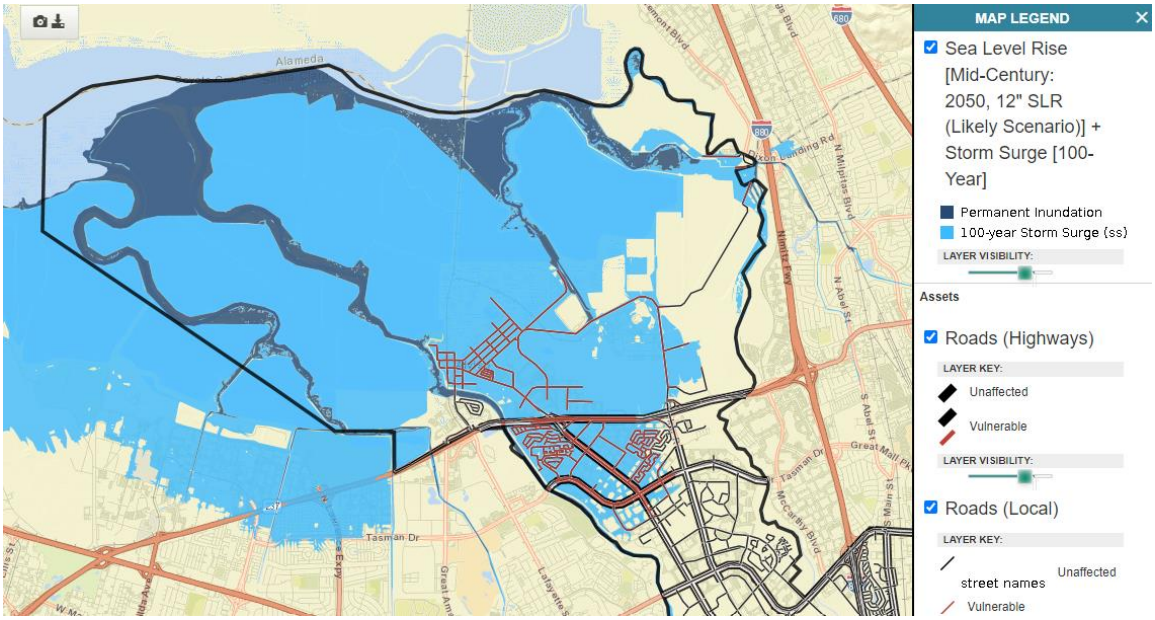
Roads are **highly** vulnerable to sea level rise and storm surge. The California Ocean Protection Council (OPC) estimates a 1.1 feet rise in sea levels by 2050.[102] With twelve inches of sea level rise (including a 100-year storm surge), 0.03 miles of highway and 36 miles of local roads in San José are projected to be inundated (Figure 27). All the roads and highways that will be impacted are in north San José in the Alviso neighborhood. Additionally, 29 miles of bikeways are projected to be inundated with twelve inches of sea level rise.

Similar to the impacts of flooding, the impacts of sea level rise would affect access and usage of the roads and can lead to erosion and degradation. Furthermore, some roads in San José would likely be permanently inundated due to sea level rise and could become unusable in the absence of adaptation efforts. Additional roads along the coast including roads outside of San José's jurisdiction will likely also be impacted by sea level rise and storm surge causing access issues and delays through San José.

Roads have low ability to change in response to permanent inundation, as the cost of elevating or relocating a road is high.

[102] *California Ocean Protection Council, Sea-Level Rise Guidance (2018), Table 1. (State of California Sea-Level Rise Guidance)*

Figure 27. Roads and Highways exposed to SLR + Storm Surge



Source: SV 2.0

Drought

Roads and highway have **minimal** vulnerability to drought. However, long-term effects of droughts can include reduced water levels underground which can cause subsidence that might ultimately affect the structure of roads and highways.

Wildfire

Road and highway infrastructure has **minimal** vulnerability to wildfire. However, at the county level, the road and highway infrastructure is **highly** vulnerability to wildfire, with 26 percent of streets (1,815 miles) identified as highly vulnerable to wildfires in Santa Clara County. This includes highways and regional connectors that could affect access and cause vehicle delays in San José. Traffic signals and other related equipment face the same vulnerability to wildfires if there are power outages.

Adaptation Efforts to Date

Ongoing adaptation planning efforts for roads and highways include the following:

- The City of San Jose's Better Bike Plan established goals to integrate green stormwater infrastructure into high quality bikeways projects and shift mode share by encouraging biking.
- The VTA Climate Action and Adaptation Plan, determined adaptive policies relating to roads and highways including the following:
    - Consider including climate-resilient design features such as special sealants and other materials on roadways to help prevent roadways from softening during extreme heat and specific pavement options to reduce the heat island effect of parking lots. This is planned through updating policies (e.g., Green Building Policy) and design manuals, such as VTA's CDT Manual and the Design Criteria Manual for Stormwater and Landscaping.
    - Implement and monitoring the benefits of pilot "cool pavement" projects that use lighter materials or lighter colored aggregate in asphalt paving mixes.

Transit

Asset Overview

The transit system in San José consists of bus stops, facilities (which include stations, station platforms, station shelters, park and ride lots, transit centers, and administration and operations buildings), bus and paratransit routes, light rail (VTA Light Rail), and heavy rail (Caltrain, BART, Amtrak, and freight) (Figure 28). [103] The transit system also relies heavily on labor to maintain operations. Climate change impacts that affect accessibility may cause labor shortages that affect the operations of the transit system. Furthermore, due to the regional nature of transit, resilience of the larger transit network at the county and region level are necessary for the functioning of the transit system in the City of San José.

Table 8. SV 2.0 (2021) Transit Vulnerability to Climate Hazards in 2050 and 2100, High Emissions Scenario

Asset Type	Time frame	Extreme Heat	Riverine Flooding		Sea Level Rise		Sea Level Rise + 100-Year Storm Surge		Wildfire
			100-year flood	500-year flood	Likely	Worst Case	Likely	Worst Case	
Heavy Rail Track Total: 73 miles	2050	73 miles 100%	17 miles 23%	73 miles 35%	0.4 miles 1%	4 miles 6%	5 miles 7%	5 miles 7%	None
	2100	73 miles 100%	17 miles 23%	73 miles 35%	5 miles 6%	5 miles 7%	5 miles 7%	6 miles 8%	None
Light Rail Track: 66 miles	2050	66 miles 100%	18 miles 27%	27 miles 42%	None	1 mile 2%	4 miles 6%	4 miles 6%	None
	2100	66 miles 100%	18 miles 27%	27 miles 42%	1 mile 2%	4 miles 6%	4 miles 6%	6 miles 9%	None

Figure 28: VTA System Map

[103] *Classification of transit assets based on VTA Climate Action and Adaptation Plan.*

Source: VTA

Climate Change Vulnerabilities

Higher Temperatures and Extreme Heat

The transit system has **moderate** vulnerability to extreme heat events. Extreme heat can cause power outages or an unstable electricity supply and breakdown of transit systems. Exposure of transit systems to extreme heat may result in potential interruptions to economic activity, increases to operational costs, and loss of tax revenue.

- **Physical Infrastructure Damage:** Extreme heat is already a major issue for the light rail system, particularly specific components like the overhead catenary system (OCS), brakes, and tracks. OCS sagging, overheating brake systems, and heat-related track kinks can lead to significant and costly damage, resulting in service disruptions until necessary repairs are completed. Park and Ride lots are also vulnerable to extreme heat. Substations are already experiencing impacts from extreme heat, so an increase in extreme heat days as a result of climate change could lead to overheating of equipment and power outages, which could cause significant disruption throughout VTA's service area. Extreme heat events can also affect station equipment and systems causing disruption to all stations. River Oaks Administrative Campus is especially vulnerable to extreme heat as it contains heat-sensitive IT equipment.
- **Service Disruptions:** an increase in extreme heat days because of climate change could lead to overheating of equipment and power outages, which could cause significant transit service disruption throughout the City.

- **Labor and Ridership Health:** Lack of cooling at bus stops and stations can expose passengers and employees to high levels of heat which can have dire health and safety consequences. Within transit facilities and trains and buses, extreme heat can put stress on cooling systems that are necessary to keep passengers and transit operators safe. All paratransit destinations are exposed to extreme heat which can pose a safety concern for paratransit users.

Transit systems have moderate ability to adapt to extreme heat. While some impacts from extreme heat can be repaired, more frequent extreme heat events may cause increased maintenance and repairs.

Flooding and Extreme Precipitation

The transit system is **highly** vulnerable to flooding and extreme precipitation. Figure 29 shows the countywide bus route exposure to urban and inland flooding. 100% of lines 44, 85, 89, 288, 288L and 288 M have potential exposure to temporary urban/inland flooding and over 50% of bus lines 20, 21, 22, 40, 47, 51, 52, 53, 55, 59, 84, 87, 104, 287, 288, 522, ACE Purple, ACE Brown, and ACE Violet have potential exposure to inland flooding (Figure 29). 16 miles of heavy rail track and 18 miles of light rail track would be inundated due to riverine or inland flooding (Figure 30). Flooding is also estimated to expose transit facilities such as Cerone Bus Division, River Oaks Administrative Campus, Guadalupe Light Rail Division, and stations such as Baypointe, Borregas, Champion, Crossman, Fair Oaks, Lockheed Martin, Tasman). Several of VTA's Light Rail Routes such as the Green Line, the Orange Line, and the Blue line are moderately vulnerable to temporary urban/inland flooding.

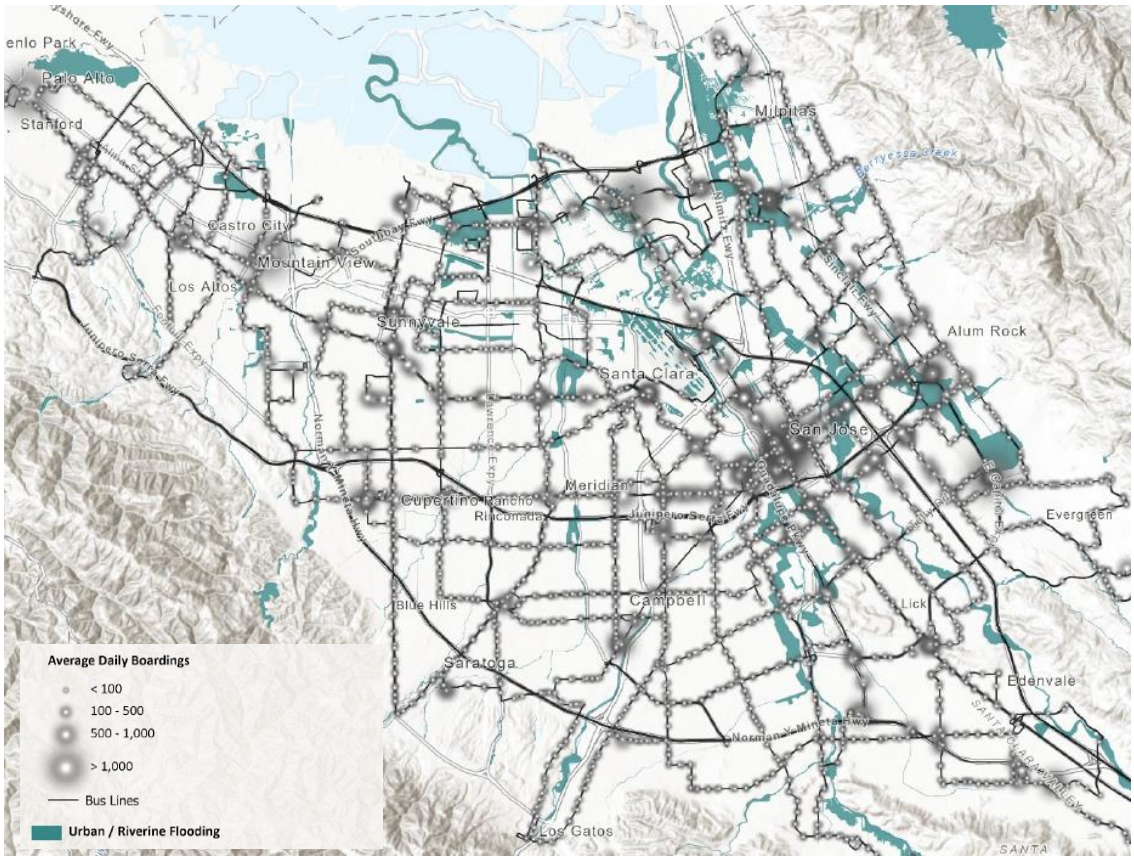
Widespread flooding of the transit network can cause service disruption in the form of transit delays and potentially rendering some routes unserviceable. Although flooding risk is lower in San José compared to other cities along the San Francisco Bay in the county, the effects of flooding can be expected to have consequences on service throughout the region including in the City of San José.

The vulnerability of various transit assets to flooding and precipitation are as follows:

- **Physical Infrastructure Damage:** In addition to impact on operations, frequent flooding can have severe consequences for assets including transit facilities, light rail tracks, trains, and buses. These consequences include electrical impacts, physical damage to bus and rail infrastructure, and maintenance disruption (caused by limited access during climate hazard events along with increased efforts to maintain service or repair damages). Furthermore, all three facilities for VTA are located in San José and are vulnerable to temporary flooding including the Guadalupe Light Rail Division which is VTA's only rail yard that provides comprehensive services (e.g., storage, parts, maintenance) for light rail. VTA's core communications system and dispatching center is also located at this facility. Any disruption to the accessibility of this yard would effectively hinder light rail service as well as communication support for VTA's Bus service.[104]
- **Service Disruption:** Some downward effects of moderate flooding include disruptions to daily life and jobs as people dependent on transit for commuting to work have limited mobility. Additionally, flooding can cause disruptions to freight service. Furthermore, throughout the county, 11 paratransit stops are at risk from temporary coastal flooding and 13 locations are at risk for temporary urban/inland flooding.
- **Freight and Evacuation Disruptions:** In the scenario of severe flooding, inundation of rail tracks can cause disruption of the transport of freight and necessary goods. If the flood event calls for evacuation, rail and bus service disruption can cause delays in evacuation efforts particularly for people without personal vehicles.

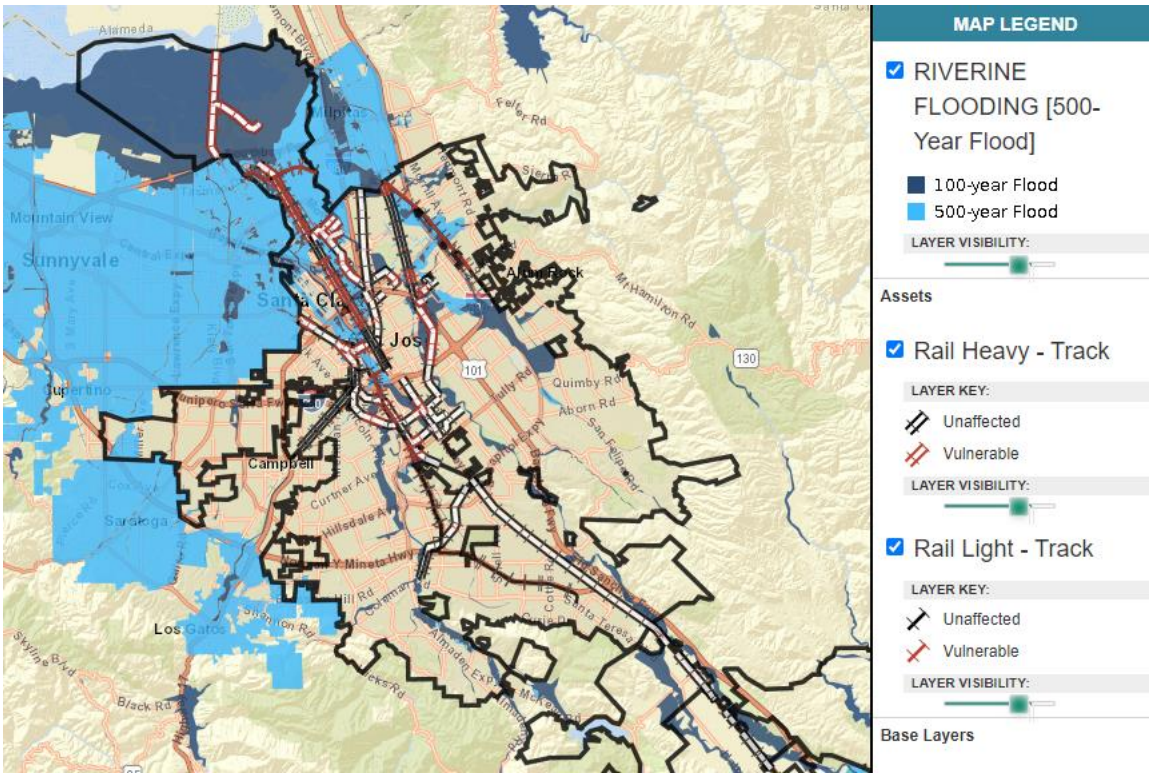
[104] *VTA, 2024*

Figure 29. Countywide Bus Route Exposure to Flooding (100-year)



Source: VTA CAAP

Figure 30. Light Rail & Heavy Rail Exposure to Flooding (100-year and 500-year)



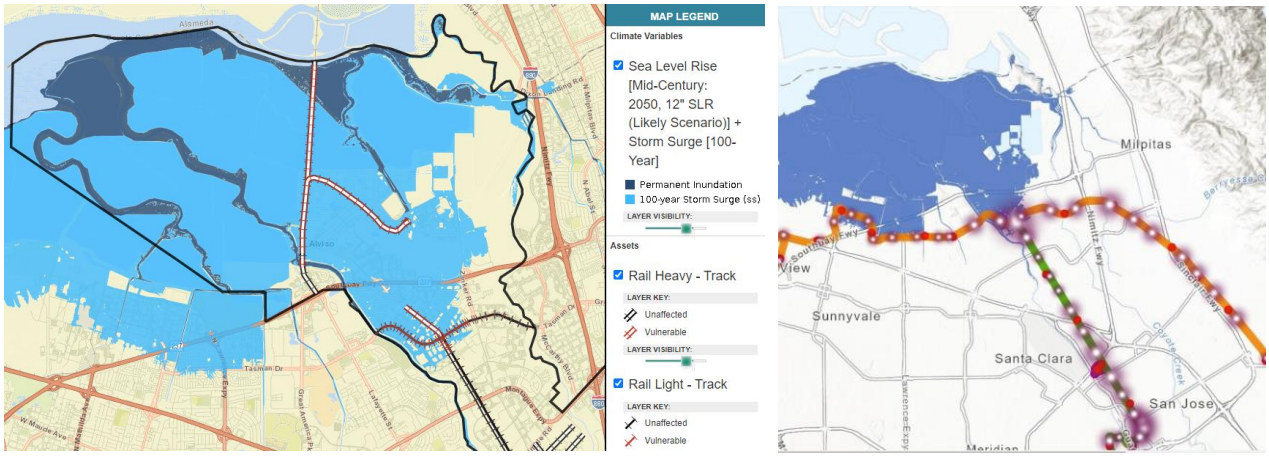
Source: SV 2.0

Sea Level Rise and Storm Surge

The transit system is **moderately** vulnerable to sea level rise and storm surge. With twelve inches of sea level rise, 5 miles of heavy rail track and 4 miles of light rail track would be inundated Figure 31. Champion, Tasman, and Baypointe light rail stations are either in or very close to the extent of SLR inundation.

The impacts of sea level rise and storm surge on the transit system are the same as the impacts of flooding, with the possibility of additional damage due to corrosion due to saltwater and the possibility of permanent flooding of routes and tracks in inundated areas.

Figure 31. Light and Heavy Rail Exposure to 12" SLR + Storm Surge



Source: SV 2.0, VTA CAAP

Drought

Transit infrastructure has **minimal** vulnerability to drought. Subsidence caused by droughts can affect roads, rails, and transit facilities in ways that may disrupt service and require additional maintenance and repair.

Wildfire

While the City of San José has relatively **low** exposure to wildfires, the transit system of Santa Clara County has **high** vulnerability to wildfires. Due to the regional nature of transit, wildfire impacts in areas in the county will directly affect operations in San José. The vulnerability of various transit assets to wildfire county-wide are as follows:

- **Physical Infrastructure Damage:** Facilities and stations can have electrical and IT equipment that are highly vulnerable to wildfires. Three stations in San José are vulnerable to wildfire including Bascom, Children's Discovery Museum, San Fernando stations.[105] These findings are based on "Fire Threat" classification data from CAL FIRE, which shows a moderate degree of fire threat in these areas. Additional stations and facilities outside of the City will that are also vulnerable to wildfires will have adverse effects on service throughout the county including San José.
- **Service Disruption:** 27 bus stops throughout the county are highly vulnerable to wildfires, which could cause service disruptions for transit riders in the city.[106]

Adaptation Efforts to Date

Ongoing adaptation planning efforts for transit include the following:

- In 2022, VTA rolled out a fleet of zero-emission, battery electric buses funded by a grant from California Energy Commission's Clean Transportation Program.[107] These buses also served by a microgrid that will allow VTA to continue operating its battery electric buses even in event of a disaster that takes down the electric grid for an extended period. VTA has set the goal to have a fully zero-emission fleet by 2040.
- VTA received funding from Federal Transit Administration (FTA) in 2022 to install on-route chargers and additional depot chargers for its battery electric buses.[108] The on-route charging pilot is expected to start in 2024- 2025.
- The VTA Climate Action and Adaptation Plan, identified adaptation planning efforts relating to transit including the following:
    - Identify alternative transit routes and modes of transportation and develop protocols for service disruptions or temporary closures during climate hazard events (e.g., wildfire, flooding), ensuring effective communication with riders and VTA staff.
    - Enhance intermodal connectivity between different forms of transportation to provide multiple options for riders and VTA staff, which can include improving transfer facilities, developing multimodal hubs, and optimizing transit schedules to facilitate seamless transfers.
    - Where feasible, increase shading and using heat-mitigating materials around VTA facilities, such as in park-and-ride lots, bus and paratransit stops, stations, transit centers, facility entry areas, pedestrian walkways, and bicycle facilities.

[105] *VTA, 2024*
[106] *VTA, 2024*
[107] *VTA, 2022b*
[108] *VTA, 2022a*

- Ensure light rail, bus, and paratransit fleets are equipped with thermal insulation coatings and tinted windows.

Electric Vehicle Charging Network

Asset Overview

An electric vehicle charging network is the infrastructure system of public and private charging stations designed to recharge electric vehicles (EVs). This network plays a crucial role in utilization of EVs and supporting the adoption of EVs by providing convenient and accessible places for drivers to charge their cars. The City of San José currently has 53 EV charging stations in operation, primarily in downtown public parking garages.[109]

Climate Change Vulnerabilities

Higher Temperatures and Extreme Heat

The electric vehicle charging network is **moderately** vulnerable to extreme heat and higher temperatures. Extreme heat may have an impairing effect on EV charging infrastructure due to potential power outages. Additionally, higher temperatures and extreme heat can affect the functioning on EVs in the following ways:

- **Physical Infrastructure Damage:** Higher ambient temperatures can degrade battery performance and increase thermal management requirements. Lithium batteries charge more slowly in the heat, lengthening vehicle recharge times.
- **Restrict Range of Movement:** Higher temperatures can reduce the range of EVs and may cause disruption in an evacuation scenario.

Flooding and Extreme Precipitation

The Electric vehicle charging system is **highly** vulnerable to flooding and extreme precipitation. Floods can disrupt EV charging infrastructure in the following ways:

- **Physical Infrastructure Damage:** Flooding may cause individual chargers to go out of service due to water damage. Even if chargers were suitably weatherized or installed at a height as per siting recommendations, they could be rendered unusable due to water logging in the parking area, presenting a hazard to potential users. [110]
- **Reduced Access:** Flooding in parts of the City can make it difficult for drivers to navigate roads and make chargers inaccessible.

Sea Level Rise and Storm Surge

The electric vehicle charging network has **moderate** vulnerability to sea level rise and storm surge.

The impacts of sea level rise on the EV charging system are the same as flooding and can be exacerbated as the flooding in this case can be permanent. Additionally, salt water can corrode the EV charging equipment. The widespread impacts of sea level rise and storm surge to the charging network would need to be assessed based on the quantity and spatial pattern of charging stations at the risk of inundation.

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[109] *City of San José Department of Transportation, n.d.*
[110] *Raman, Gururaghav et al., 2022*

Drought

The electric vehicle charging network has **minimal** vulnerability to drought.

Wildfire

The electric vehicle charging network has **low** vulnerability to wildfire. There is little to no direct wildfire exposure in the city, though they could be affected by local or regional power outages caused by wildfires outside the city's boundaries.

In the event of a wildfire, the electric vehicle charging network's vulnerability would depend on the resilience of the charging stations infrastructure and their ability to charge during a power outage. Additionally, sparse public charging networks and long recharging times may also pose a challenge to electric vehicle drivers in an evacuation scenario.

Adaptation Efforts to Date

The following planning efforts have to do with the expansion of the electric vehicle charging network, which could increase adaptive capacity because there are more places to charge if chargers in one area of the city become unusable or are temporarily down. They include the following:

- The City of San Jose's Clean Energy Program provides online resources on charging at home, charging on the road, and a link to an interactive map that shows the locations of public charging stations.111
- The City's Planning, Building, and Code Enforcement Department implemented a streamlined residential permitting process to facilitate the installation of home charging systems.
- The City is also the beneficiary of a California Energy Commission grant that will provide for the purchase of three all-electric vehicles at a price comparable to conventional vehicles of the same type.

Airport

Asset Overview

The Norman Y. Mineta San José International Airport (SJC) is located on an approximately 1,000-acre site approximately two miles north of downtown San José. The Airport is generally bounded by U.S. 101 to the north, the Guadalupe River and State Route 87 to the east, Interstate 880 to the south, and Coleman Avenue and De la Cruz Boulevard to the west.[112] The City is the owner and operator of SJC, meaning the City has the ability to control size and type of airport facilities. SJC is an important point of connection for the Silicon Valley to statewide, national, and internation destinations, as well as cargo airlines.[113]

Climate Change Vulnerabilities

Higher Temperatures and Extreme Heat

Similarly to critical facilities and buildings, SJC has **moderate** vulnerability to extreme heat. Vulnerabilities to higher temperatures and extreme heat include:

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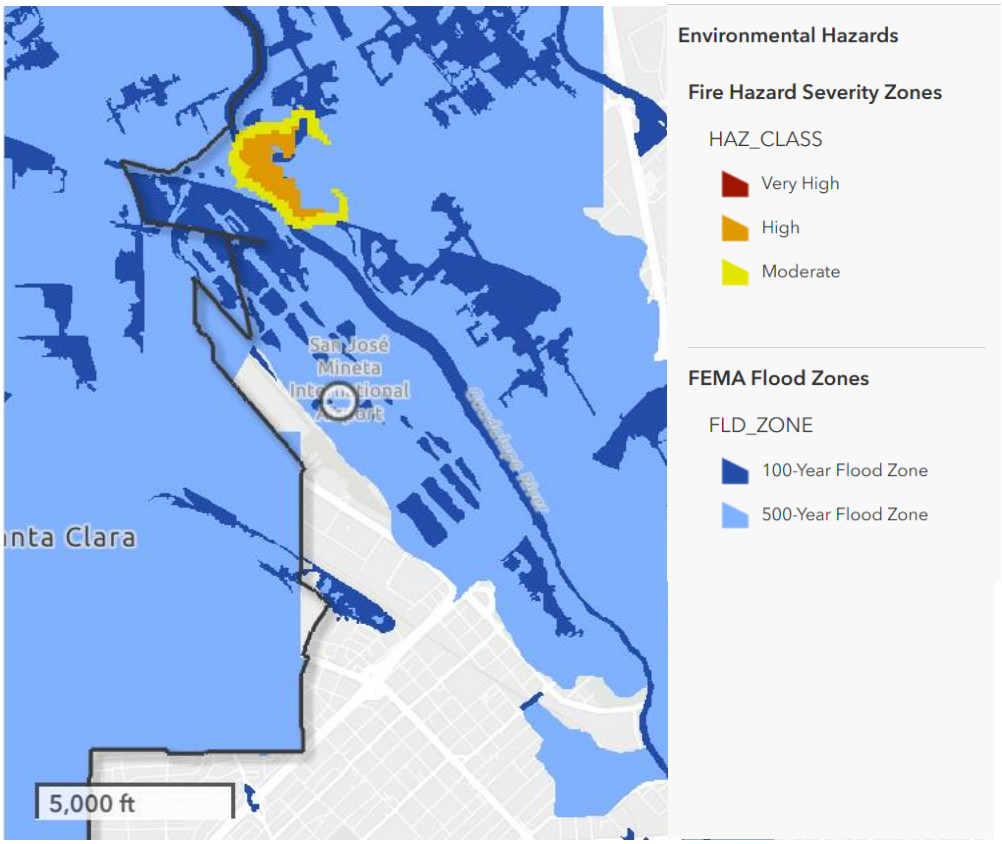
[111] City of San Jose Clean Energy Program | EV Charging *https://sanjosecleanenergy.org/ev-charging/*
[112] *City of San José Airport Department, 2020*
[113] *City of San José Airport Department, 2020*

- **Power outages:** Physical facilities themselves are not typically damaged by extreme heat and can usually maintain function during high temperatures. However, is crucial that airport facilities have energy to maintain operations. Power outages could occur due to larger issues in the grid associated with increased energy use for cooling during heat wave events. Although extremely inconvenient for potentially thousands of people, power outages are likely to be temporary and not result in loss of life.

Flooding and Extreme Precipitation

SJC has **high** vulnerability to flooding and extreme precipitation as it is directly west of the Guadalupe River and is exposed to the 100- and 500-year floodplains. Per Figure 32, the grassy areas in between the runways and service roads (particularly on the northern and southern ends) are in the 100-year floodplain. The entirety of the SJC terminals, runways, service roads, and parking lots are exposed to the more extreme 500-year flood.

Figure 32. SJC and FEMA Floodplains



Vulnerabilities to flooding and extreme precipitation include:

- **Flooding of runways and facilities:** Water could pool on the runways and flood terminals, parking lots, and other airport facilities. Flights could be delayed, grounded, or rerouted if runways cannot be used safely. Facilities could experience temporary closures and sustain water damage. Flooding occurs in the Terminal A Parking Garage Basement.
- **Power outages:** Flooding and storms could cause localized power outages that inturrupt airport operations.

- **Damage to electrical infrastructure:** Water could damage electrical systems and infrastructure that is outdoors (such as landing lights and other light systems) as well as indoors if panels and equipment are not elevated.

Sea Level Rise and Storm Surge

SJC faces **minimal** impacts from sea level rise as it is located farther inland than the extent of inundation and storm surge in a 100-year flood.

Drought

SJC faces **minimal** impacts from drought. Common vulnerabilities that could affect the airport buildings, runways, and facilities include:

- **Subsidence:** In some cases, drought-driven subsidence causes building foundations to shift or could cause paved surfaces to crack and shift. However, this is not likely in San José.

Wildfire

SJC has **low** vulnerability to wildfire. Though there is a small patch of land near the northeastern tip of the runways identified with High FHSZ, SJC is in a highly urbanized area. A fire in the area would likely be put out before it could get large enough to impact the airport. Airport operations could be impacted by wildfire:

- **Power outages**: SJC could be affected by local or regional power outages caused by wildfires outside the city's boundaries.
- **Low visibility**: Wildfire smoke could cause flights to be delayed or re-routed due to low visibility.

Adaptation Efforts to Date

- There are 20 backup generators to power SJC's most critical systems, such as air traffic control.[114]
- An airport-wide Utility Study is currently being conducted. It entails a full assessment of current electrical infrastructure at SJC, future capacity needs for planned development projects through 2037 (aligns with current Airport Master Plan), CONRAC/Rental Car Facility EV Charger capacity needs/demand, EVTOL (Electric Aircraft Needs), Potential for onsite renewables and microgrids, Central Utility Plant assessment/feasibility to switch from natural gas to electric, and feasibility and ROM estimates to tie into future San José Power substation.
- A ground transportation island project will likely begin in 2025 to improve the ground transportation island near the Terminal A Parking Garage. One component it will address is the historic flooding in the Terminal A Garage Basement.
- The Airport Sustainability Management will be revised starting in 2025.

[114] *Gary, 2022*

5. Vulnerability of Populations in San José

The assessment of population vulnerabilities focuses on the impact of present climate hazards on the general population of San José, with added emphasis of the effects on sub-populations that have higher vulnerability to climate change. Social vulnerabilities and biological sensitivities of a population can affect exposure to climate hazards and their sensitivity to impacts. Both gradual climate change and climate events can expose people to a wide range of stress-inducing and hazardous situations (i.e. emergency evacuations, more illnesses due to increased air pollution and aeroallergen concentration, increased energy costs during extreme heat events), which can result in greater negative health outcomes. Older adults, young children, and people with chronic diseases and disabilities are generally more sensitive to impacts from the effects of climate change, such as droughts, extreme heat, and poor air quality. In addition, low-income populations, including homeless populations and communities of color, are generally more likely to be exposed to hazards events, are more sensitive to these hazards, and have the least amount of resources to cope or adapt. Maps overlaying vulnerable communities with climate hazards are in Appendix A.

Identifying Vulnerable Populations in San José

Draft Environmental Justice Communities

There are many social, economic, and environmental factors that influence community and individual vulnerability to climate impacts and their ability to adapt to climate change Understanding how place, demographics, and socioeconomic status contribute to climate change vulnerability helps in identifying the avenues for policy, infrastructural, and/or programmatic interventions.

This assessment uses the Draft Environmental Justice (EJ) Communities[115] identified in the EJ Element of Envision San Jose 2040 General Plan, anticipated to be adopted in 2026. The Draft EJ Communities are census tracts identified to comply with Senate Bill (SB) 1000, which requires cities and counties to identify "low-income area[s] that [are] disproportionately affected by environmental pollution and other hazards that can lead to negative health effects, exposure, or environmental degradation."[116] The Draft EJ Communities designation is based on environmental hazard vulnerability indicators at the census tract level related to physical characteristics, socioeconomic status, language isolation, and living environment.

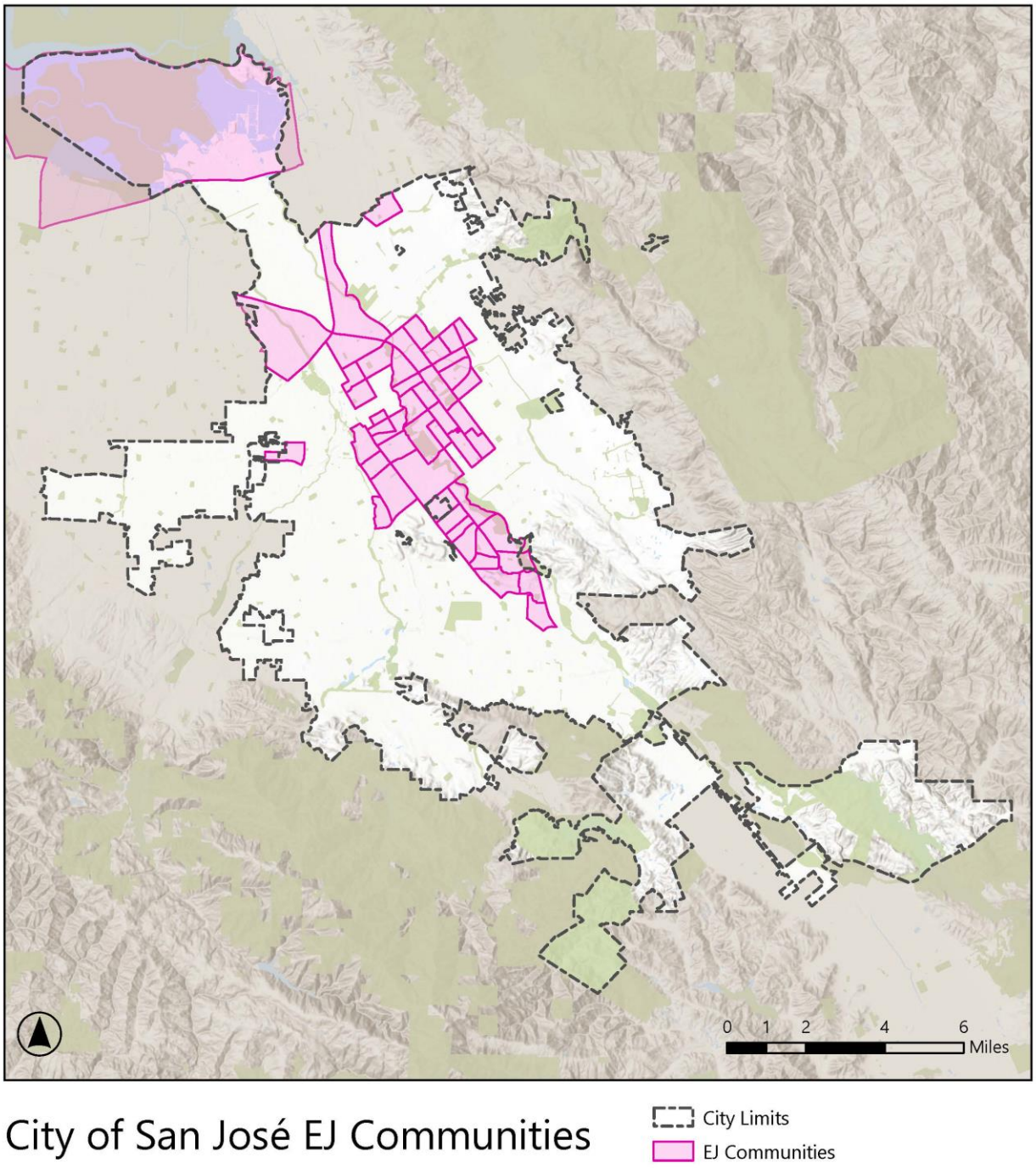
49 census tracts were identified as Draft EJ Communities through this process and shown in Figure 33.[117] The census tracts are concentrated in the following areas:

- Downtown San José (Council District 3)
- Central San José (Council District 7)
- The northern portion of South San José (Council District 2)
- East San José in the vicinity of I-680 and Highway 101 (Council District 5)

[115] *Note: The EJ communities used for this assessment are a draft as of September 2024. EJ Communities are subject to change.*
[116] https://oag.ca.gov/system/files/media/sb-1000-best-practices-en.pdf
[117] *Identified tracts subject to change through development of the Environmental Justice Element (anticipated adoption in 2026)*

- North San José east of I-880 and around the airport
- Alviso

Figure 33. Draft Environmental Justice Communities



Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD).

Additional Contributors to Population Vulnerabilities

The populations of unhoused residents and people living in mobile homes are considered in the analysis of Draft EJ Communities because areas with higher concentrations of these populations are located within identified tracts. However, these factors are discussed in more detail in this section because residents face unique sensitivities to climate change hazards due to their living situation.

Homelessness

The 2023 San José Point-In-Time Count found that there are 6,266 unhoused residents in the city. The greatest number of unhoused residents live in District 7 (approximately 23 percent) and District 3 (approximately 22 percent).[118] A vast majority (70 percent) of the individuals are unsheltered, with the most common type of accommodations being outdoors, in a vehicle, or in a structure not meant for habitation. Homelessness overlaps with many other indicators of social vulnerability, including income, race and ethnicity, and health.

Previous flood events in the city have illustrated the climate vulnerability of unhoused residents living in encampments near creeks and waterways. In 2023 and 2024, atmospheric rivers caused waterways to swell and necessitated the evacuation (and even water rescues) of homeless residents living around Guadalupe River, Penitencia Creek, and Ross Creek.[119,120]

Mobilehomes

San José has the largest number of mobilehome households in any city in California. The city has 59 mobilehome parks with an estimated 10,836 mobile homes that house approximately 35,000 residents.[121] Mobilehomes are a more affordable method of home ownership and are sometimes age-restricted to people 55 and older, so these areas may have populations that are more vulnerable due to age and/or income.

Many mobile homes, especially older models, were built with thin walls, single-pane windows, and insufficient insulation in walls, floors, and ceilings. This results in higher heat gain in the summer as compared to conventional homes. Older mobile homes may have gaps or poorly sealed windows, doors, and seams, which makes it harder to maintain cool indoor temperatures or filtered indoor air.

Maps overlaying the locations of mobilehome parks with climate hazards and the EJ Communities tracts are in Appendix A. Additional mapping is available online at https://arcg.is/1n0jjO.

Higher Temperatures and Extreme Heat

All San José residents are vulnerable to higher temperatures and extreme heat. Vulnerabilities to heat include:

- **Heat illness, cardiac strain, pulmonary strain, and/or death due to extreme heat events and poor air quality**: Any person can experience acute debilitating or life-threatening heat-related illnesses regardless of age, sex, or health status if they are exposed to extreme heat (especially if participating in physical activities) and cannot cool down. In addition to acute illness, warm nights have negative impacts on sleep and reduce peoples' ability to recover from extreme heat. This can increase stress on peoples' bodies and increase chances of having a heart attack or stroke.

[118] *City of San José Department of Housing, 2023*
[119] *Kadah, 2024.*
[120] *Kadah, 2023.*
[121] *City of San José Planning Division, n.d.*

- **Decreased time spent outdoors:** When temperatures are high, people are advised to avoid physical activity outside. Residents are likely to spend less time outdoors for recreation or physical activity.
- **Increased risk of vector-borne illnesses:** Mosquitos can transmit illnesses like West Nile virus. The area that various mosquito species can thrive in grows as temperatures warm.

Residents in Draft EJ Communities have high vulnerability to higher temperatures and extreme heat. The following factors result in residents of Draft EJ Communities experiencing increased susceptibility to heat illness, cardiac strain, pulmonary strain, and/or death associated with extreme heat:

- **Age and health status (older adults, children, and people with underlying health conditions)**:
  - Older adults, children, and people with some underlying health conditions have a reduced ability to regulate their body temperature.
  - Older adults have higher rates of underlying health conditions, like high blood pressure, diabetes, and kidney disease, that can increase likelihood of heat illness.
  - Heat accelerates the process that result in the production of low-level zone, an air pollutant that can exacerbate symptoms for people who have asthma or other respiratory conditions.
  - Older adults and people with underlying health conditions are more likely to use medical devices or refrigerators for medication, which can be shut off in the event of a blackout or brownout during an extreme heat event.
- **Homelessness**: Unhoused residents are more exposed to extreme heat because they have limited shelter (i.e. no shelter, tents, vehicles) to provide a cooler environment during hot days and nights. Unhoused residents also have less access to clean drinking water to stay hydrated and prevent heat illness.[122]
- **Low-income**:
  - Heat waves and warm nights cause households to consume more energy if they are running fans and/or air conditioning for long periods of time. Even though there are programs to assist low-income households with energy costs, low-income households may face higher energy costs which are difficult for them to absorb.
  - Low-income individuals are likely to have less access to healthcare. This is associated with higher rates of underlying health conditions (like high blood pressure, diabetes, asthma), which in turn increase the likelihood of heat illness.
- **Working outdoors:** People who work outdoors, such as landscapers, construction workers, and agricultural workers, conduct strenuous physical activity for extended periods of time in the heat. Without preventative measures like frequent breaks to cool down, this can lead to heat illness and death.
- **Linguistic isolation**: Individuals or households that are linguistically isolated may not have access to emergency notifications or information about what to do/where to go during an extreme heat event.
- **Older housing**: Older housing is less likely to have air conditioning and may not be up to modern standards (like insulation, double-paned windows) which can help homes stay cooler.
- **Mobilehomes**: Many mobile homes, especially older models, were built with thin walls, single-pane windows, and insufficient insulation in walls, floors, and ceilings. This results in higher heat gain in the summer as compared to conventional homes. Older mobile homes may have gaps or poorly sealed windows, doors, and seams, which makes it harder to maintain cool indoor temperatures.

Mapping including age, low-income status, age of housing, percentage renters, and linguistic isolation are also available at the San José CARP Vulnerability Assessment Mapping.

[122] *Ko, 2024*

Flooding and Extreme Precipitation

All San José residents who are exposed to flood and extreme precipitation are **moderately** vulnerable to its impacts. Flooding can cause health hazards that impact anyone who is exposed to them, including:

- **Increased risk of illnesses:** If floodwaters come into contact with raw sewage, they can contain pathogens like E. coli and some hepatitis viruses. Damp conditions in flooded buildings can cause mold to develop, triggering or exacerbating respiratory illness in individuals (especially vulnerable populations).
- **Injury or death from floodwaters:** Any resident can get swept up in flood waters if they live in affected areas or if they are driving through flooded roads.

Residents in Draft EJ Communities have **high** vulnerability to flooding and extreme precipitation. Their vulnerability is increased based on the following indicators:

- **Age and health status (older adults, children, and people with underlying health conditions)**:
  - Older adults, children, and people with underlying health conditions are more likely to rely on others to evacuate from their home during a flood or extreme precipitation event. Without assistance they may be more susceptible to injury or death.
  - Older adults and people with underlying health conditions are more likely to use medical devices or refrigerators for medication which can be shut off in the event of a blackout or brownout during a flood or extreme precipitation event.
  - People who have respiratory conditions such as asthma may experience worse symptoms if flooding causes mold and mildew to develop in their home.
- **Homelessness**: Unhoused residents are more exposed to extreme precipitation. They may have no shelter at all, live in a tent, or live in a vehicle, all of which do not provide adequate from rain and wind and could by caught up in flood waters. Unhoused residents living in encampments along creeks and waterways are especially vulnerable to flooding. In 2019, roughly 350 encampments existed at any one time along the city's waterways.[123]
- **Low-income**: Flood damage is not a part of most home insurance policies. Low-income homeowners may not be in a financial position to purchase flood insurance, leaving them with the financial burden of expensive home repairs which they may also not have resources to pay for.
- **Renters:** Renters cannot receive funds from FEMA to repair their homes in the case of flooding (they can purchase flood insurance policies that cover the contents of their personal property). They must depend on their landlords to repair their homes, which can be precarious because a) they cannot control how long the repairs take, and b) landlords could raise rents afterwards.
- **Linguistic isolation**: Individuals or households that are linguistically isolated may not have access to emergency notifications or information about what to do/where to go during a flood or extreme precipitation event. In almost all of the Draft EJ Communities that are exposed to the 100-year floodplain, the language most spoken at home is either Spanish or Vietnamese.
- **Mobile homes**: Several of the mobile home parks in San Jose are located in areas that are projected to flood from the 100-year storm event. This can lead to various degrees of property damage to the mobile structures. Severe flooding could lift the structures from their foundations, causing structural damage and loss of property. There is also the potential for water, power, and sewage connections to disturbed or broken, rendering the homes or potentially the larger development uninhabitable for short or even longer periods of time. Mobile homes built before 1976 (before HUD standards were implemented) may be difficult to repair or replace due to outdated designs and materials. Mobile

[123] *US HUD, 2020*

homeowners can receive financial assistance from FEMA (Federal Emergency Management Agency) after a disaster, but the process and the amount of aid they may be eligible for depends on various factors including that the mobile home must be a primary residence, there needs to be proof of ownership, the event must be declared a Federal disaster.

The overlap of the 100-year floodplain and the 500-year floodplain with the Draft EJ Communities and mobilehomes is mapped in Appendix A. Mapping including age, low-income status, age of housing, percentage renters, and linguistic isolation are also available at the San José CARP Vulnerability Assessment Mapping.

Sea Level Rise and Storm Surge

The only community identified with exposure to SLR is Alviso. All residents of Alviso could experience damage to their property and/or residences when inundated, but vulnerability is **low** because it affects a small portion of the city residents.

Residents in Draft EJ Communities have **moderate** vulnerability to flooding from SLR. Their vulnerability is increased based on the following indicators:

- **Low-income:** Low-income households may not have the financial means to fix flood damage to their properties or implement preventative measures. Compared to the other communities identified in the Draft EJ Communities designation, Alviso has a comparatively low proportion of low-income households.
- **Mobilehomes:** There are several mobile home parks located in proximity to the Bay and potentially vulnerable to sea level rise including: Somerset Estates, Lamplighter, Oak Crest Estates, and Silicon Valley Village (Westwinds). Sea level rise poses a long-term concern regarding the ability to maintain structural integrity if soils become saturated. Access issue may also occur if there is intermittent flooding that inundates roadways. Storm surge would result in similar outcomes as are described for flooding.

The overlap of the 2050 and 2100 SLR extent with the Draft EJ Communities is mapped in Appendix A. Mapping including age, low-income status, age of housing, percentage renters, and linguistic isolation are also available at the San José CARP Vulnerability Assessment Mapping.

Drought

All populations in San José, including residents in EJ Communities, face **minimal** vulnerabilities to drought. During a drought the City enacts water conservation efforts which can cause people to change their behaviors (i.e. watering their landscaping less) but do not pose a threat to their health or create a permanent negative impact to their daily lives.

Wildfire

All San José residents have **moderate** vulnerability to wildfire. Vulnerabilities to wildfire, particularly smoke, applicable to all residents include:

- **Pulmonary and/or cardiac stress from smoke**: Studies have linked wildfire smoke exposure to an increased risk of sudden cardiac arrest, heart attacks, and coronary artery disease.[124] The increase is most notable for older adults (65 and older), but can affect all people exposed.

[124] *American Heart Association. 2023.*

- **Decreased time spent outdoors:** When conditions are smoky, people are advised to avoid physical activity outside. Residents are likely to spend less time outdoors for recreation or physical activity.

Residents in EJ Communities have **high** vulnerability to wildfire smoke. Direct exposure to wildfire risk is minimal for the EJ Communities, as only one (Alviso) is has any direct overlap with the Fire Hazard Severity Zones (FHSZ). Draft EJ Communities' vulnerability to wildfire smoke is increased based on the following indicators:

- **Age and health status (older adults, children, and people with underlying health conditions)**:
  - Older adults, children, and people with some underlying health conditions are more susceptible to cardiac and respiratory strain due to smoke exposure. Smoke in the air exacerbates symptoms for people who have asthma or other respiratory conditions.
  - Older adults, children, and people with underlying health conditions are more likely to rely on others to evacuate from their home during a wildfire. Without assistance they may be more susceptible to injury or death.
  - Older adults and people with underlying health conditions are more likely to use medical devices or refrigerators for medication which can be shut off in the event of a blackout, brownout, or Public Safety Power Shutoff (PSPS) during a wildfire.
- **Homelessness**: Unhoused residents are more exposed to wildfire smoke because they cannot close themselves off from the outside air in an insulated shelter.
- **Low-income**: The Draft EJ Communities are not directly exposed to the FHSZ, however they will be impacted by wildfire smoke.
  - Low-income individuals are likely to have less access to healthcare. This is associated with higher rates of underlying health conditions (like high blood pressure, diabetes, asthma), which can put them at higher risk of experiencing cardiac and pulmonary effects from wildfire smoke.
  - Low-income individuals may have jobs where they work outdoors, increasing their exposure to smoke (see next bullet point).
- **Working outdoors:** People who work outdoors, such as landscapers, construction workers, and agricultural workers, conduct strenuous physical activity for extended periods of time in smoky conditions. Even with preventative measures like using a respirator or face mask, they likely have higher amounts of smoke inhalation than people working indoors.
- **Linguistic isolation**: Individuals or households that are linguistically isolated may not have access to emergency notifications or information about what to do/where to go during wildfire evacuation or smoky conditions.
- **Older housing**: Older housing may not be up to modern standards for insulation, air filtration which can help keep smoke out of the home.
- **Mobilehomes**: Several mobile home parks located in or directly adjacent to High FHSZ around Communications Hill: Mill Pond I and II Mobile Home Parks, Chateau La Salle, California Hawaiian Mobile Estates, Mountain Springs Mobilehome Park, and Mountain Shadows Mobilehome Park. Residents of mobile homes located outside of fire hazard areas are exposed to harm from wildfire smoke. Mobile homes may have outdated or less effective air filtration systems. Older mobile homes may have air leaks around doors and windows that allow for the infiltration on smoke into the living area.

The overlap of the FHSZ with the Draft EJ Communities and mobilehomes is mapped in Appendix A. Mapping including age, low-income status, renters, and linguistic isolation are also available at the San José CARP Vulnerability Assessment Mapping.

Adaptation Efforts to Date

The following is a summary of the City's climate change adaptation efforts that are already underway.

- The City operates at least five cooling centers at the following community centers: Mayfair, Camden, Seven Trees, Roosevelt, and Cypress.[125] All community centers offer residents access to bottled water, free Wi-Fi, and outlets to charge devices.[126] During the October 2024 heat wave, cooling centers activated at the Camden Community Center, Emma Prusch Farm Park, and Roosevelt Community Center.[127]
- The City Department of Transportation and Parks, Recreation and Neighborhood Services Department received a $6.6 million grant to catalog, prune, plant, and care for trees along streets and in parks located in neighborhoods identified as "disadvantaged" by the federal government.[128]
- The City's Office of Emergency Management webpage contains ample information to be prepared, supplied, trained, informed, and involved for emergencies. The "Be Informed" section provides information in English, Spanish, Vietnamese, and Chinese (written in Traditional Chinese, but can be read by both Cantonese and Mandarin speakers).
- The City is in the process of implementing the following actions from the 2017 MJHMP Annex:
  - Assess needs, specify appropriate equipment, and procedure backup power generators for critical facilities and operate 10 Disaster District Offices and a minimum of 60 shelter locations that would support 250 persons each.
  - Sponsor the formation and training of Community Emergency Response Teams (CERT) for employees and residents.
  - Provide public outreach for, as well as encourage and support homeowners to retrofit structures (such as brace and bolt of mobile home structures) of vulnerable structures. (The MJHMP Annex classifies this as a measure for Earthquake, however bracing mobilehomes can also help them withstand storms and winds).
  - Eliminate homeless encampments within waterways.
- The City's 2024 MJHMP Annex contains the following actions to increase the adaptation of all residents and vulnerable populations:
  - Assess options, fund, and implement a public notification and mass warning system(s) with redundant features throughout the City to reach 90% of the affected population in multiple languages within 10 minutes of notification.
  - Develop and maintain public education materials and outreach in multiple languages to ensure the public is knowledgeable regarding hazard disaster preparedness.
  - Ensure temporary homeless shelters are prepared to conduct outreach and shelter in the event of flooding and extreme temperature events.

[125] *Silicon Valley Strong, 2020*
[126] *Delaney, 2022*
[127] *City of San José, 2024a*
[128] *City of San José, 2023a*

6. Summary

The Climate Vulnerability Assessment identifies probable impacts of projected change in climate on the City of San José's buildings, critical facilities, utility infrastructure, transportation, and populations (Table 9). The vulnerabilities discussed in this document will be addressed through the development of adaptation strategies and an adaptation plan in the next phase of work that aim to increase San José's resilience to climate hazards.

Table 9. Summary of Asset Vulnerability to Climate Hazards

Asset	Hazard Vulnerability Score				
	Heat	Flood	Sea Level Rise	Drought	Wildfire
Critical Facilities	Moderate	High	High	Minimal	Moderate
Buildings	Moderate	High	Moderate	Minimal	Moderate
Water and Wastewater Infrastructure	Low	High	High	Minimal	Moderate
Water Supply	High	Low	Moderate	High	Low
Substations & Power Generation Facilities	Moderate	High	High	Minimal	Low
Transmission Lines	Moderate	Moderate	Moderate	Minimal	Low
Roads and Highways	Moderate	High	High	Minimal	Minimal
Transit	Moderate	High	Moderate	Minimal	Low
Electric Vehicle Charging Network	Moderate	High	Moderate	Minimal	Low
Airport	Moderate	High	Minimal	Minimal	Low
Populations (All)	Moderate	Moderate	Low	Minimal	Moderate
EJ Communities (Draft)	High	High	Moderate	Minimal	High

Key Findings

Critical Facilities and Infrastructure

Critical facilities are a subset of the city's total buildings. They are structures that will prevent serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities during emergencies. If they are destroyed or damaged or if functionality is impaired, these vital services will be jeopardized.

- The critical facilities and buildings asset types have the greatest vulnerability to **flooding**. Buildings can experience some physical damage and damage to building systems (electrical), but most importantly flooding in and around critical facilities can prevent employees from maintaining operations. In the case of fire stations and hospitals, this could have major consequences on the health and safety of San José residents.

Based on the vulnerability assessment of critical facilities and infrastructure, potential adaptation strategies can be identified as follows:

- Conduct **detailed assessments of City-owned critical facilities** that are exposed to climate change hazards. This applies to flood, as well as extreme heat and poor air quality exacerbated by wildfire and heat (for the purposes of serving as cooling centers, clean air facilities, or other place of refuge as needed). Because this assessment is only a screening-level analysis, it does not take into account the physical condition of a building or its site characteristics. For every building this will be different, affecting how much damage it could incur from a hazard event and what kind of alterations can be implemented to increase its adaptive capacity.

Transportation

Transportation infrastructure is vulnerable to climate change hazards; with likely impacts including physical infrastructure damage and reduced access. This can have negative effects on everyday commute travel, movement of goods and services, and likely severe consequences on evacuation procedures. The vulnerability of transportation infrastructure in San José to climate change hazards is as follows:

- **Roads and Highways** are most vulnerable to flooding, extreme precipitation, sea level rise and, storm surge which could have severe impacts on access to roads and consequently essential services. More frequent flooding can also result in damage of roads and highways and may require increased maintenance and repair.
- **Transit** is most vulnerable to flooding and extreme precipitation and wildfire. These hazards could cause transit infrastructure damage and service disruptions. Severe damage to infrastructure may result in longer term access issues and can limit evacuation access for those without vehicles.
- **Electric Vehicle Charging Network** is most vulnerable to flooding and extreme precipitation as the charging infrastructure could get damaged or may become inaccessible. Vulnerabilities related to other climate hazards will likely affect evacuations for those with electric vehicles.

Based on the vulnerability assessment of the transportation infrastructure, potential adaptation strategies can be identified as follows:

- Citywide adaptation measures to **higher temperatures and extreme heat** include implementing energy efficiency and conservation efforts to reduce stress on electricity systems during heatwaves to avoid power outages[129] and reducing heat island effects by using cool pavements and increasing the urban tree canopy.[130]
- Citywide adaptation measures to **flooding and extreme precipitation** can include elevating or relocating transportation assets in the long term and preparing for flood events with quick-build measures including inflatable flood barriers and preparing traffic and transit rerouting plans for areas most vulnerable to flooding in the near term. Nature-based solutions to increase the absorption or diversion of water from transportation assets as they can provide long term water quality, habitat, and other co-benefits.
- Citywide adaptation measures to **sea level rise and storm surge** are similar to the those for flooding.
- Citywide adaption measures to **drought** include low-water trees, landscaping in parks, and plantings along streets and highways.[131]

[129] *US EPA, 2024*
[130] *US EPA, 2023*
[131] *Caltrans, 2023*

- Citywide adaptation measures to **wildfire** include emergency preparedness that includes having recommended evacuation routes in parts of the City with high wildfire risk. Additionally, infrastructure in these areas can be upgraded to become more heat resistant to build wildfire resilience.

Populations

Everyone who lives and works in San José can experience negative impacts from climate change hazards, but many residents have social vulnerabilities and biological sensitivities that affect exposure to climate hazards and sensitivity to impacts. Residents of Environmental Justice Communities, mobile home parks, and those who are homeless face greater vulnerability to hazards, particularly flood, heat, and poor air quality.

- **Older adults, children, and people with pre-existing health conditions** are extremely vulnerable to the potentially deadly impacts of heat, wildfire smoke, and flooding.
- **Low-income households** face higher vulnerability to all hazards because they have less financial ability to prepare for hazard events and to bounce back from impacts. Low-income households may also have other characteristics which exacerbate vulnerability, such as working outdoors, being an older adult on a fixed income, and renting rather than owning their home.
- **Mobile home parks** house populations who may be more vulnerable based on socioeconomic characteristics, including age and income. Mobile homes themselves are already more vulnerable to impacts of heat, wildfire smoke, and flooding based on their design and structural components. Furthermore, many mobilehome parks lie in the floodplains and some are projected to experience inundation from sea level rise, making mobile homes extremely vulnerable.

Based on the vulnerability assessment of populations some preliminary adaptation strategies can be identified as follows:

- Activate facilities that can serve as community resiliency centers that provide **cooling, clean air, and other services** in Draft EJ Communities during times of extreme heat and poor air quality. Activated facilities should be pre-identified and always be in the same place so that residents and other community members know where to go, trust City guidance about accessing the facilities, and feel comfortable coming to them. This is particularly important for communities that may have lower levels of trust or familiarity with government institutions, such as language-isolated communities and unhoused residents.
- Strengthen outreach and education with the primarily **Spanish- and Vietnamese-speaking communities** that reside in the 100- and 500-year floodplains. Conduct outreach and education about flood preparedness, improve emergency notification procedures, and expand community partnerships
- Develop adaptation measures to address the physical vulnerability of **mobile home parks** and the social vulnerabilities of their residents.

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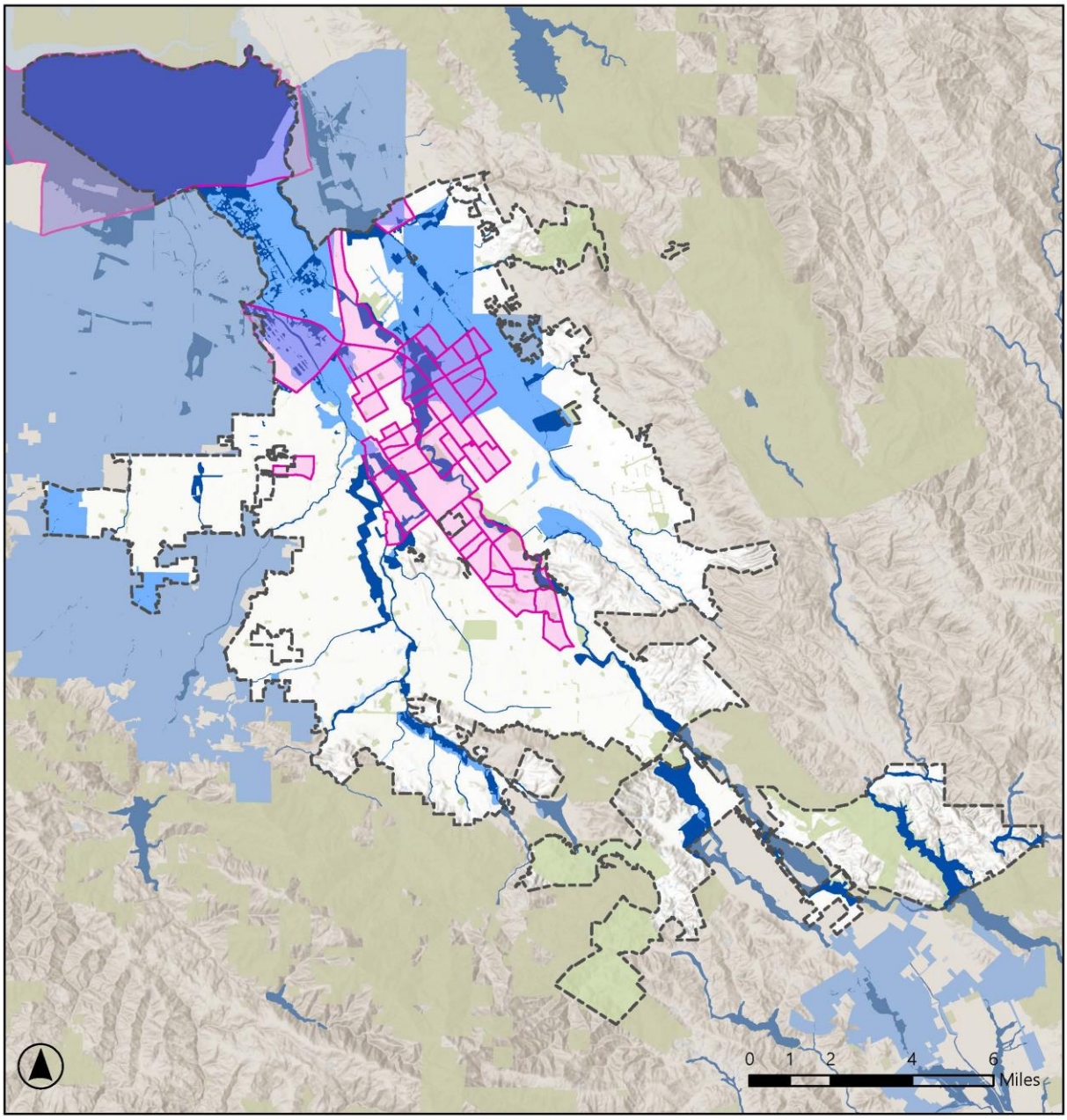
Appendix A: Vulnerable Populations Mapping

This Appendix contains maps of the Draft EJ Communities and mobilehome parks overlaid with hazards that have a geospatial footprint. Additional combinations of maps can be viewed using the San José CARP Vulnerability Assessment Mapping web app at https://arcg.is/1n0jjO. It contains the Draft EJ Communities, climate hazards, and other data which can be toggled on and off to make innumerable combinations of maps:

- Draft EJ Communities tracts
- Mobilehome park footprints
- Income: percentage of residents (in Draft EJ Communities only) who are low-income per the adjusted income indicator developed for the EJ Communities index
- Housing: Median year housing built and percent of units renter occupied
- Language: Language spoken at home and linguistic isolation
- Age: Resident age (ranges)
- Hazards: Fire Hazard Severity Zone (FHSZ), FEMA Flood Zones, sea level rise inundation layer from the Adapting to Rising Tides.

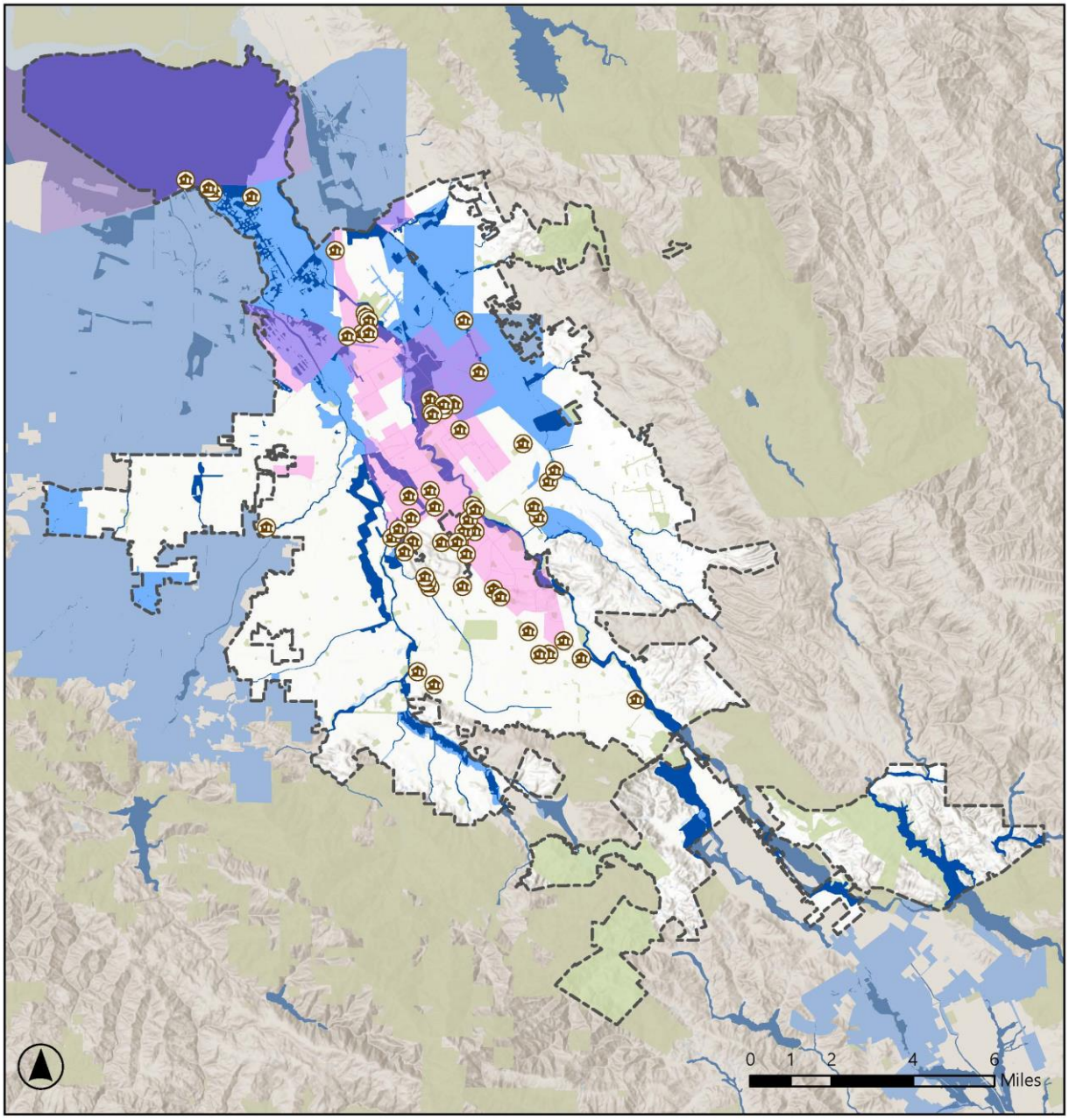


EJ Communities and Flood Hazard Zones

City Limits
EJ Communities

FEMA Flood Zones
100-Year Flood Zone
500-Year Flood Zone

Sources: City of San Jose, CARI 3.0, California Protected Areas Database (CPAD), FEMA

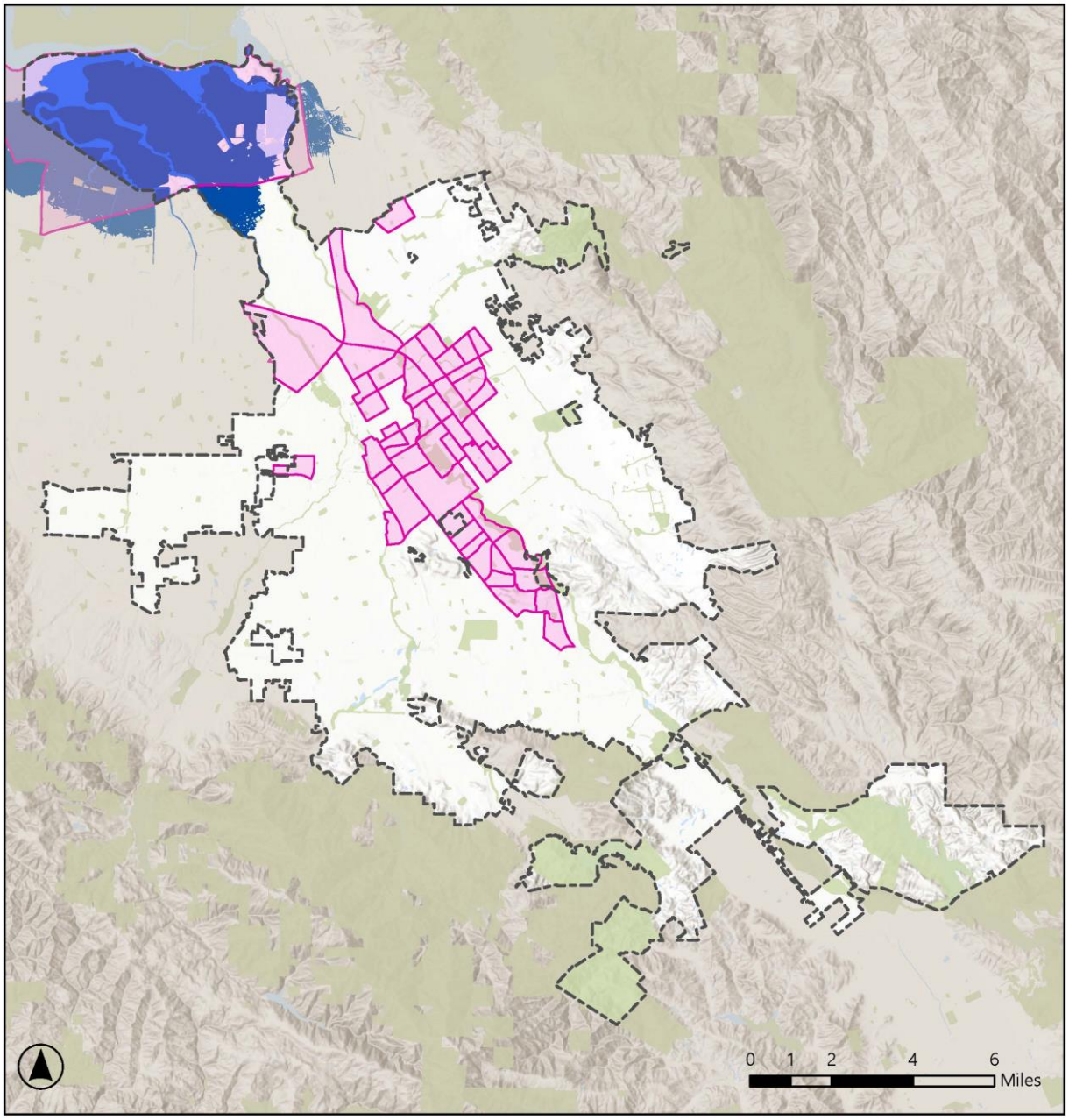


Mobilehome Parks and Flood Hazard Zones

City Limits
EJ Communities
Mobilehome Parks

FEMA Flood Zones
100-Year Flood Zone
500-Year Flood Zone

Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD), FEMA

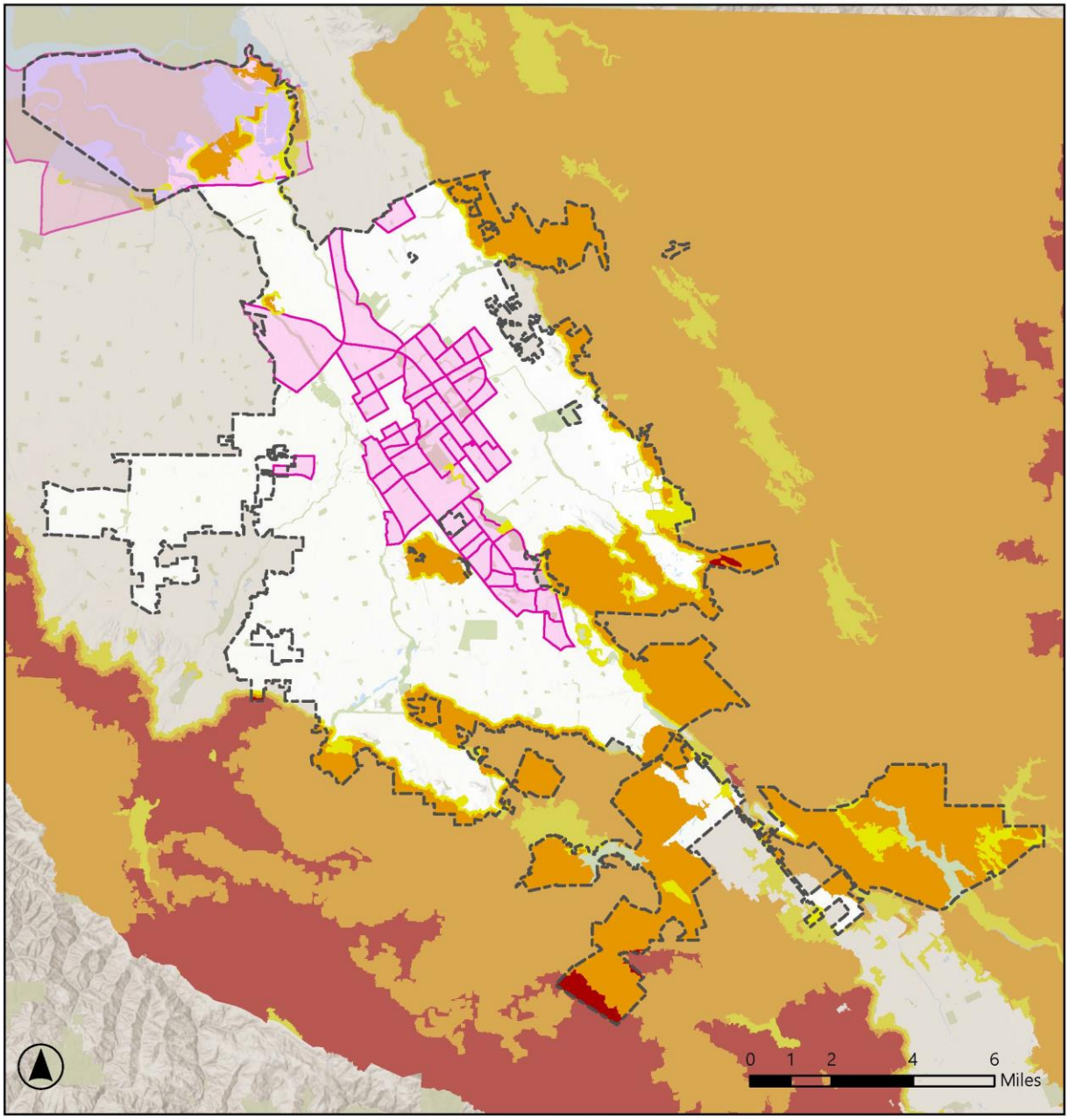


EJ Communities and Sea Level Rise* Zones

City Limits
EJ Communities
2050 Extent of SLR (High SLR/Low Risk Tolerance)
2100 Extent of SLR (High SLR/Low Risk Tolerance)

*Note: SLR extent does not include storm surge.

Sources: City of San Jose, CARI 3.0, California Protected Areas Database (CPAD), Adapting to Rising Tides

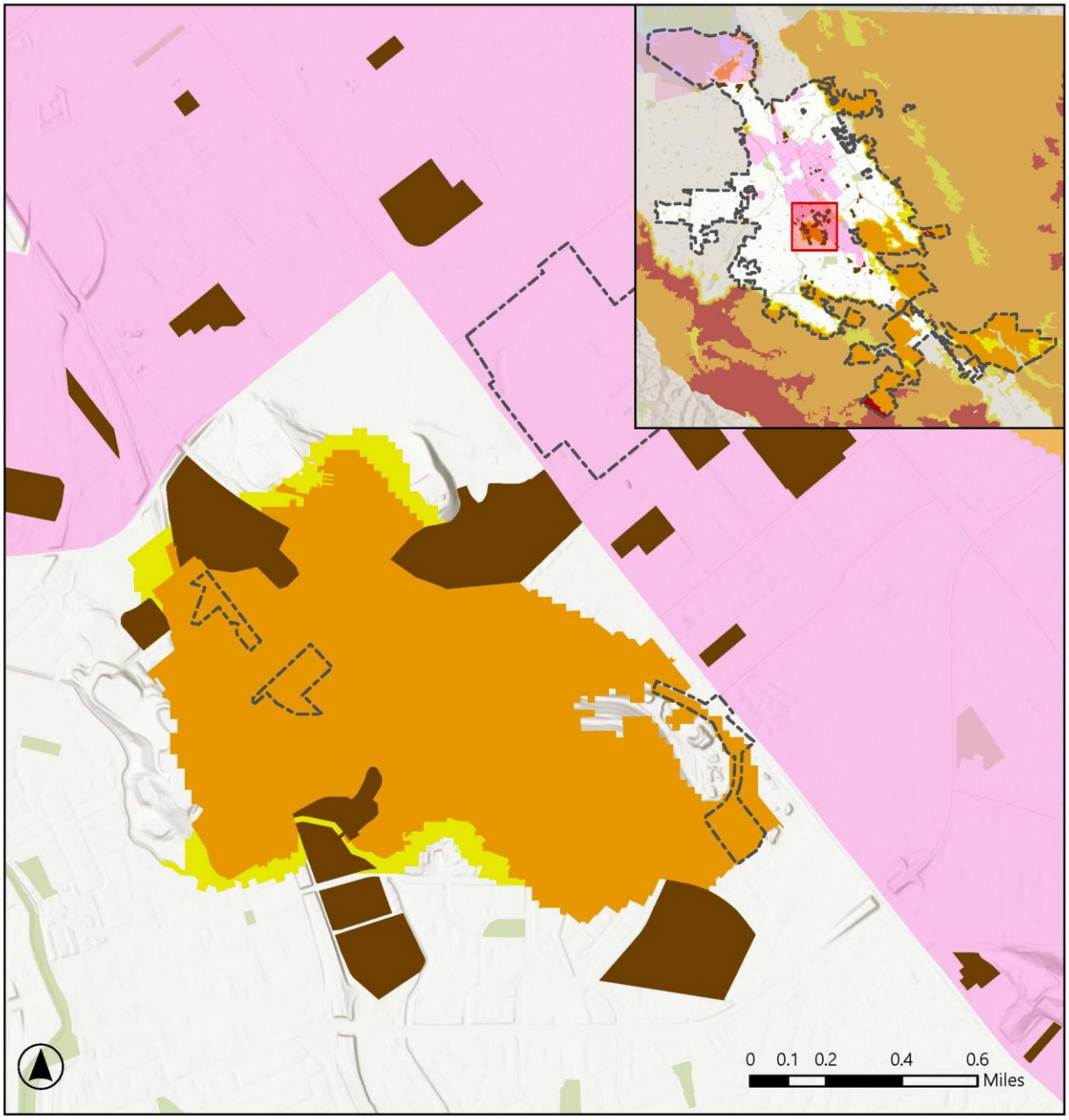


EJ Communities and Fire Hazard Severity Zones

City Limits
EJ Communities

Fire Hazard Severity Zones
Very High
High
Moderate

Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD), CalFire



Mobilehome Parks and Fire Hazard Severity Zones

City Limits
Mobilehome Parks
EJ Communities

Fire Hazard Severity Zones
Very High
High
Moderate

Sources: City of San Jose, CARI 3.0,
California Protected Areas Database (CPAD), CalFire