UNION CITY 2040 GENERAL PLAN AMENDMENTS

SECTION 1: AMEND "DISASTER PREPAREDNESS AND EMERGENCY RESPONSE" INTRODUCTION, SAFETY ELEMENT, PAGE 202:

Existing language:

The City and other agencies in the region work collaboratively to ensure the community is prepared in the event of an emergency and to ensure an efficient and effective response and recovery. Currently, the City contracts with Alameda County Fire Department (ACFD) to provide fire and emergency response services. In partnership with the City, ACFD prepared a Comprehensive Emergency Management Plan (CEMP) that describes how the City will effectively prepare for, respond to, recover from, and mitigate against natural or human-caused disasters. ACFD is contracted to review and update the CEMP annually. More recently (2017), the City adopted a Local Hazard Mitigation Plan (LHMP), which includes a risk assessment and strategies to reduce the impacts of disasters on people, property, and the environment. Some of the strategies in the LHMP will inform the update to the CEMP. The LHMP is updated every five years. ACFD also has an Emergency Operations Plan and coordinates with other jurisdictions in the county to ensure a coordinated response plan.

Recognizing that the community plays an important role in responding to major disasters, the City encourages its residents and businesses to participate in the local Community Emergency Response Training (CERT) Academy. As part of the service contract, ACFD provides a CERT Program Coordinator to work closely with the CERT Board of Directors to provide trainings. The CERT Academy trains people to take care of themselves, their families, and their neighbors in the event of a disaster.

The policies of this section support the City's disaster preparedness and emergency response services and efforts to better prepare members of the community to respond to major emergencies or disasters.

Proposed amendment:

The City and other agencies in the region work collaboratively to ensure the community is prepared in the event of an emergency and to ensure an efficient and effective response and recovery. The City currently contracts with Alameda County Fire Department (ACFD) to provide fire and emergency response services. In partnership with the City, ACFD provides input into the City's Comprehensive Emergency Management Plan (CEMP) that describes how the City will effectively prepare for, respond to, recover from, and mitigate against all hazards. As of 2023, the City is in the scoping stage of updating the CEMP. In 2017, the City adopted a Local Hazard Mitigation Plan (LHMP), which includes a risk assessment and strategies to reduce the impacts of disasters on people, property, and the environment. Some of the strategies in the LHMP will inform the update to the CEMP. The LHMP is updated every five years. The multijurisdictional LHMP update is underway as of 2023. ACFD also has an Emergency Operations Plan and coordinates with other jurisdictions in the county to ensure a coordinated response plan.

Pursuant to Senate Bill (SB) 99, upon the next revision of the housing element on or after January 1, 2020, the safety element shall identify residential developments in any hazard area identified in the safety element that do not have at least two emergency evacuation routes. Therefore, the identification of residential developments considered vulnerable due to limited accessibility (i.e., less than two points of access) are provided in Appendix A, *Senate Bill 99 Evacuation Route Analysis*.

Recognizing that the community plays an important role in responding to major disasters, the City encourages its residents and businesses to participate in the local Community Emergency Response Training (CERT) Academy. As part of the service contract, ACFD provides a CERT Program Coordinator to work closely with the CERT Board of Directors to provide trainings. The CERT Academy trains people to take care of themselves, their families, and their neighbors in the event of a disaster.

The policies of this section support the City's disaster preparedness and emergency response services and efforts to better prepare members of the community to respond to major emergencies or disasters.

SECTION 2: AMEND "CLIMATE CHANGE: ADAPTATION AND RESILIENCY" INTRODUCTION, SAFETY ELEMENT, PAGE 214:

Existing language:

Climate change refers to changes in the average climatic conditions on earth as a whole, including changes in temperature, wind patterns, precipitation, and storm severity. The City of Union City recognizes that climate change poses a threat to the health and safety of residents in Union City.

The largest potential climate change impacts in Union City are expected to be increased flood risk due to sea level rise and increased number of extreme heat days.

California sea level appears to have risen by about seven inches over the 20th century and is predicted to continue to rise into the future. Union City is located adjacent to the San Francisco bay, and many areas in Union City are expected to be at risk of inundation with a rise in sea level expected by 2100. Although the exact extent and timing of sea level rise is still uncertain, scientists have modeled different scenarios of sea level rise. Portions of Union City are subject to potential inundation associated with a sea level rise of one to six feet above current Mean Higher High Water (MHHW) (see Figure S-6.1).

According to data available on CalAdapt, by the year 2100, Union City could also experience up to a 6 percent increase in average temperature and up to seven heat waves per year. As temperatures in Union City increase, vulnerable populations such as children, the elderly, people with existing illnesses, and people who work outdoors will face the greatest risk of heat-related illness. Other potential risks of climate change include decreased water supply as a result of decreased precipitation and increased number and severity of extreme weather events.

While there is some uncertainty about when, where, and to what extent the impacts of climate change will affect Union City's residents, businesses, and natural environments, planning for

these impacts now will ensure Union City is better prepared and more resilient in the face of future challenges. The policies in this section support efforts to adapt to climate change. Policies in the Resource Conversation Element specifically address the reduction of greenhouse gas emissions, which are evidenced to be the leading cause of climate change.

Permanent inundation of six feet (72 inches) is not likely to occur before 2100. The sea level rise scenario that is currently (2018) accepted as the most likely scenario projects 12 inches of rise by 2050 and 36 inches by 2100. The inundation maps are intended as a planning level tool to illustrate the potential for inundation and coastal flooding under future sea level rise scenarios; they do not represent the exact location or depth of flooding or shoreline overtopping. The maps are based on model outputs and do not account for all the complex and dynamic bay processes or future conditions, such as erosion, subsidence, future construction or shoreline protection upgrades, or other changes to the San Francisco bay or the region that may occur in response to sea level rise.

Proposed amendment:

Climate change refers to ~~changes in the average climatic conditions on earth as a whole, including changes in temperature, wind patterns, precipitation, and storm severity. The City of Union City recognizes that climate change poses a threat to the health and safety of residents in Union City.~~ long-term shifts in temperatures and weather patterns around the world, where present-day climate change is largely driven by human activities. Though climate change is a global issue, its impacts are felt locally.

~~The largest potential climate change impacts in Union City are expected to be increased flood risk due to sea level rise and increased number of extreme heat days.~~ Union City will likely be exposed to an array of climate change effects through the end of the century, including increased temperatures, changes in precipitation patterns, and sea level rise. These climate change effects are projected to exacerbate climate hazards like extreme heat, extreme precipitation and flooding, drought, and regional wildfires. Each of these climate hazards puts Union City at risk with an array of potential impacts. A summary is provided below, and further information can be found in Appendix B.

~~California sea level appears to have risen by about seven inches over the 20th century and is predicted to continue to rise into the future. Union City is located adjacent to the San Francisco bay, and many areas in Union City are expected to be at risk of inundation with a rise in sea level expected by 2100. Although the exact extent and timing of sea level rise is still uncertain, scientists have modeled different scenarios of sea level rise. Portions of Union City are subject to potential inundation associated with a sea level rise of one to six feet above current Mean Higher High Water (MHHW) (see Figure S-6.1).~~ Regarding increased temperatures, average annual maximum temperature in Union City is projected to rise from the historic average of 67.2 °F to a range of between 72.6 °F and 75.4 °F by 2099. Similarly, the city has historically experienced 4.3 average annual extreme heat days (i.e., days at or above 90.0 °F) and 0.2 heat waves (i.e., four or more consecutive extreme heat days). However, as a result of climate change, the city may experience up to 31.1 extreme heat days and 3.6 heat waves per year by 2099.

~~According to data available on CalAdapt, by the year 2100, Union City could also experience up to a 6 percent increase in average temperature and up to seven heat waves per year. As temperatures in Union City increase, vulnerable populations such as children, the elderly, people with existing illnesses, and people who work outdoors will face the greatest risk of heat-related illness. Other potential risks of climate change include decreased water supply as a result of decreased precipitation and increased number and severity of extreme weather events.~~ Average annual precipitation and extreme precipitation events (i.e., 1.1 inches over a two-day period) are also both projected to rise through 2099. The potential for more precipitation and a greater number of extreme precipitation events exacerbates the risk of localized flooding in the city. Additionally, sea level rise will worsen coastal flooding. While the exact extent and timing of sea level rise is uncertain, the likelihood of sea level rise happening is certain and should be prepared for accordingly.

Despite projections that Union City may experience an increase in average annual precipitation and extreme precipitation events, overall precipitation patterns are projected to change, with precipitation variability expected to increase substantially. California has a highly variable climate that is susceptible to prolonged periods of drought, and recent research suggests that extended drought occurrences (i.e., a "mega-drought") could become more pervasive in future decades, which may challenge the management of the region's water supplies.

Historically, attention to wildfire in the state has mostly focused on the Sierra Nevada region and Southern California, but recent large and destructive wildfires in the San Francisco Bay Area have rapidly shifted attention to the ongoing risks in this region, inclusive of Union City. The San Francisco Bay Area as a whole is projected to experience significant increases in the amount of average annual area burned by wildfires through 2099, putting Union City at increased risk, both directly and indirectly.

~~While there is some uncertainty about when, where, and to what extent the impacts of climate change will affect Union City's residents, businesses, and natural environments, planning~~ Overall, climate hazards that are projected to affect Union City are associated with a wide range of potential impacts on the city's populations, and the built environment. These potential impacts include, but are not limited to, air quality degradation, impacts to buildings and infrastructure, economic impacts, environmental impacts, impacts to health and safety (e.g., respiratory illnesses, heat-related illnesses, vector-borne diseases), impacts to water supply and quality, and disproportionate impacts on vulnerable populations. Planning for these impacts now will ensure Union City is better prepared and more resilient in the face of future challenges. The policies in this section support efforts to adapt to climate change. Policies in the Resource Conversation Element specifically address the reduction of greenhouse gas emissions, which are evidenced to be the leading cause of climate change.

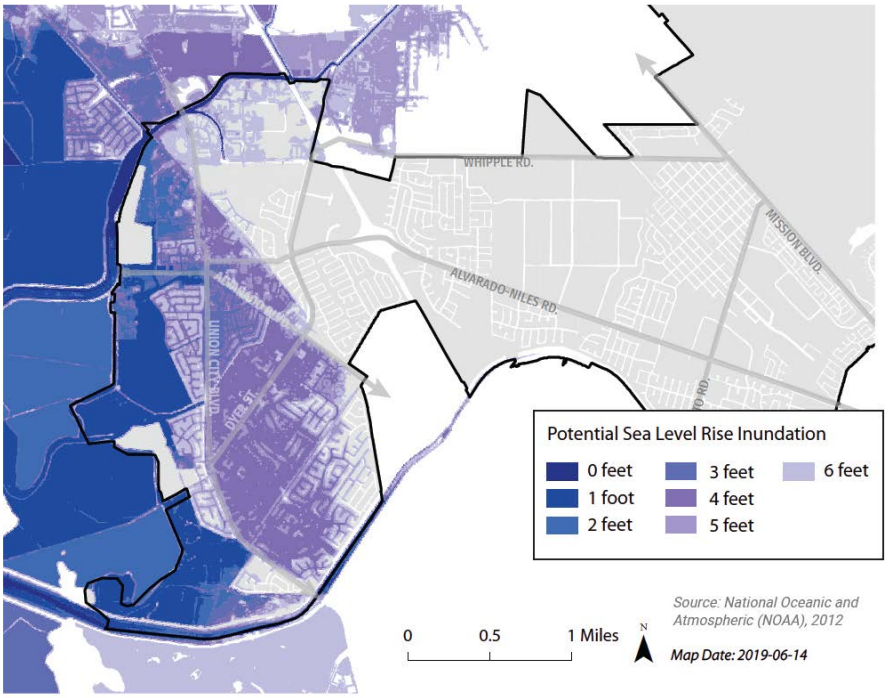
~~Permanent inundation of six feet (72 inches) is not likely to occur before 2100. The sea level rise scenario that is currently (2018) accepted as the most likely scenario projects 12 inches of rise by 2050 and 36 inches by 2100. The inundation maps are intended as a planning level tool to illustrate the potential for inundation and coastal flooding under future sea level rise scenarios; they do not represent the exact location or depth of flooding or shoreline overtopping. The maps are based on model outputs and do not account for all the complex and dynamic bay~~

~~processes or future conditions, such as erosion, subsidence, future construction or shoreline protection upgrades, or other changes to the San Francisco bay or the region that may occur in response to sea level rise.~~

SECTION 3: REPLACE "FIGURE S-6.1: MEAN HIGHER HIGH WATER (MHHW) SEA LEVEL RISE SCENARIOS BY 2100", SAFETY ELEMENT, PAGE 215:

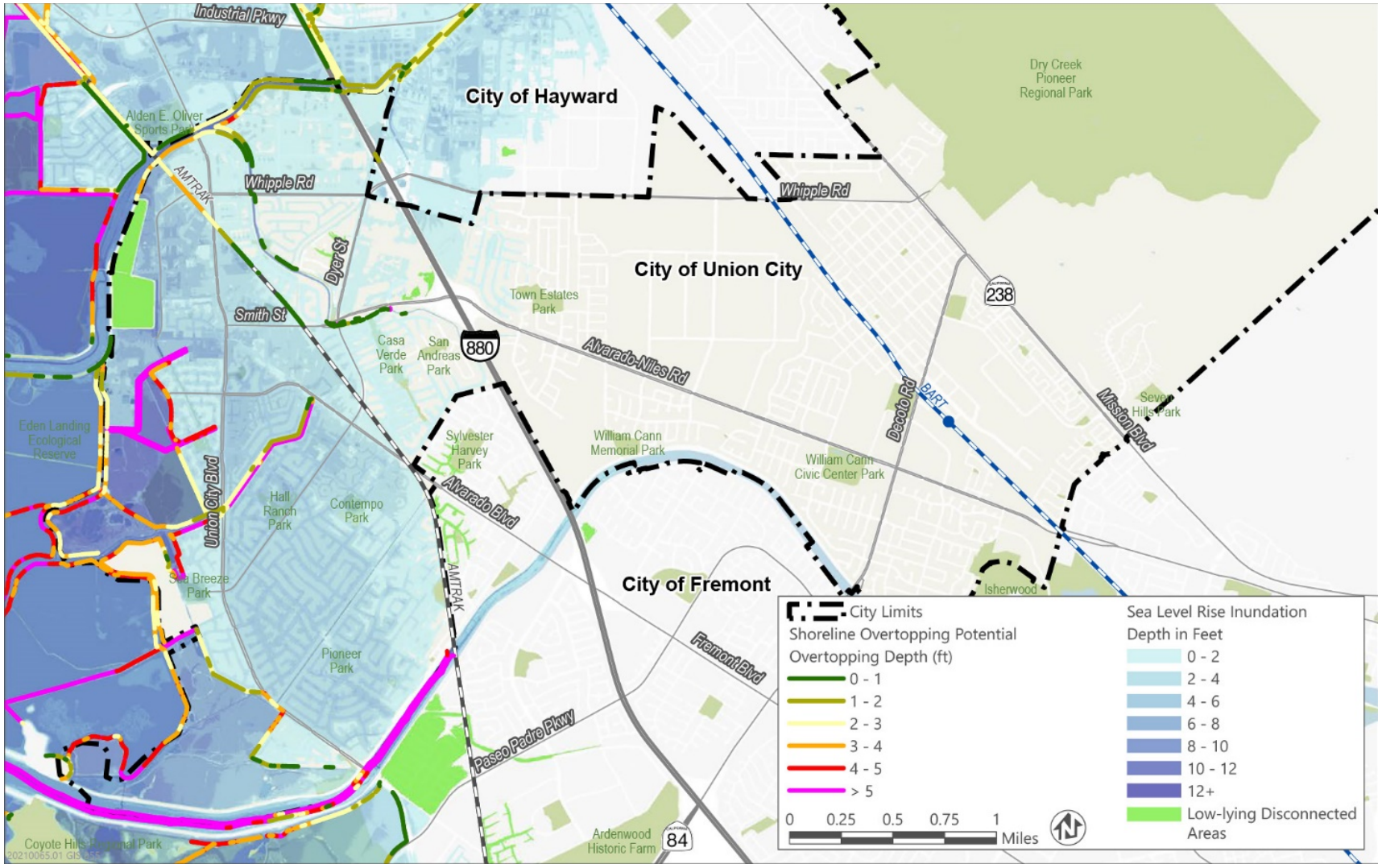
Existing figure:

Figure S-6.1: Mean Higher High Water (MHHW) Sea Level Rise Scenarios by 2100



Proposed figure:

Figure S-6-1: Projected Flooding With Sea Level Rise*



* Inundation Depth with Sea Level Rise of 52 Inches During a 100-Year Storm Event

SECTION 4: DELETE POLICY S-6.1, POLICY S-6.2, POLICY S-6.3, POLICY S-6.4, AND POLICY S-6.5, SAFETY ELEMENT, PAGE 216:

Existing language:

S-6.1 Coordination to Address Sea Level Rise

The City shall coordinate with regional, State, and Federal agencies to identify adaptation strategies to address flooding hazards associated with sea level rise in the San Francisco Bay.

S-6.2 Support Efforts by Flood Control District to Address Sea Level Rise

The City shall support efforts by Alameda County Flood Control and Water Conservation District to develop and implement local strategies to reduce flooding impacts associated with sea level rise.

S-6.3 Climate Change Vulnerability Assessment

The City shall continue to monitor the potential impacts from climate change and analyze the City's vulnerability to climate change in subsequent updates to the Hazard Mitigation Plan.

S-6.4 Resiliency Efforts

The City shall actively seek grant funding to develop and employ methods and practices to address and adapt to the potential impacts caused by climate change.

S-6.5 Public Education on Heat Waves

The City shall coordinate with Alameda County and other agencies to publicize programs and standards for preventing heat-related illness during heat waves, particularly for vulnerable populations.

Proposed language:

~~S-6.1 Coordination to Address Sea Level Rise~~

~~The City shall coordinate with regional, State, and Federal agencies to identify adaptation strategies to address flooding hazards associated with sea level rise in the San Francisco Bay.~~

~~S-6.2 Support Efforts by Flood Control District to Address Sea Level Rise~~

~~The City shall support efforts by Alameda County Flood Control and Water Conservation District to develop and implement local strategies to reduce flooding impacts associated with sea level rise.~~

~~S-6.3 Climate Change Vulnerability Assessment~~

~~The City shall continue to monitor the potential impacts from climate change and analyze the City's vulnerability to climate change in subsequent updates to the Hazard Mitigation Plan.~~

~~S-6.4 Resiliency Efforts~~

~~The City shall actively seek grant funding to develop and employ methods and practices to address and adapt to the potential impacts caused by climate change.~~

~~S-6.5 Public Education on Heat Waves~~

~~The City shall coordinate with Alameda County and other agencies to publicize programs and standards for preventing heat-related illness during heat waves, particularly for vulnerable populations.~~

SECTION 5: ADD POLICY S-6.1, POLICY S-6.2, POLICY S-6.3, POLICY S-6.4, POLICY S-6.5, AND POLICY S-6.6, SAFETY ELEMENT, PAGE 216:

Proposed language:

S-6.1 Integrate Climate Impacts

The City shall consider climate change impacts and adaptive responses in long-range planning decisions.

S-6.2 External Adaptation Coordination

The City shall collaborate with and support adaptive efforts of other neighboring jurisdictions, regional agencies, and community-based organizations to reduce climate change impacts.

S-6.3 Public Climate Hazard Education and Awareness

The City shall work to educate the public and promote community awareness of potential impacts and actions that can be implemented by residents and businesses to improve climate resilience.

S-6.4 Prioritize Protection of Vulnerable Populations

The City shall ensure that climate adaptation measures aimed at reducing climate risks prioritize protecting vulnerable populations to climate impacts and ensure that those measures do not lead to disproportionally adverse effects. Vulnerable populations include, but are not limited to, children, communities of color, linguistically isolated communities, low-income communities, individuals experiencing homelessness, workers in vulnerable occupations, and those with preexisting health issues.

S-6.5 Natural Infrastructure

The City shall address and prioritize climate adaptation through the use of natural infrastructure, such as urban tree plantings to mitigate extreme heat, where feasible.

S-6.6 Climate Action Plan

The City shall update and implement the City's Climate Action Plan to provide best management practices for adapting to climate change.

SECTION 6: ADD IMPLEMENTATION PROGRAM S-2.H, IMPLEMENTATION PROGRAM S-6.A, AND IMPLEMENTATION PROGRAM S-6.B, SAFETY ELEMENT, PAGE 225:

Proposed language:

S-2.H Implementation of Assembly Bill (AB) 747 and Senate Bill (SB) 99

The City currently contracts with Alameda County Fire Department (ACFD) to provide fire and emergency response services. In partnership with the City, ACFD provides input into the City's Comprehensive Emergency Management Plan (CEMP) that describes how the City will effectively prepare for, respond to, recover from, and mitigate against all hazards. As part of the CEMP, the City shall include capacity-based analysis of its evacuation network, consistent with the statutory requirements of AB 747. At a minimum, this analysis shall identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. Finally, as part of subsequent updates to the CEMP, the City shall address evacuation of existing residential developments within hazard areas with limited accessibility (i.e., less than two points of access) consistent with SB 99.

- Responsibility: City Manager's Office, Public Works, Economic and Community Development
- Time Frame: Upon each subsequent CEMP update

S-6.A External Adaptation Coordination

The City shall coordinate with other neighboring jurisdictions, regional agencies (e.g., Alameda County Flood Control and Water Conservation District, Alameda County Water District, Union Sanitary District), and community-based organizations, to identify, plan for, and implement adaptation strategies to address the potential impacts of climate hazards (e.g., sea level rise, flooding).

- Responsibility: City Manager's Office, Economic and Community Development
- Time Frame: Ongoing

S-6.B Public Climate Hazard Education and Awareness

The City shall develop a multi-pronged outreach and awareness strategy, partnering with regional and local jurisdictions and organizations to educate residents on their level of risk to climate hazards and actions they could take to become more climate resilient, including the promotion of existing incentive programs.

- Responsibility: City Manager's Office, Economic and Community Development
- Time Frame: Ongoing

SECTION 7: AMEND "GREENHOUSE GAS EMISSIONS REDUCTION" IMPLEMENTATION PROGRAM RC-7.A, RESOURCE CONSERVATION ELEMENT, PAGE 281:

Existing language:

RC-7.A Update the Climate Action Plan

The City shall periodically update the Climate Action Plan to address municipal operations, maintain compliance with GHG reduction targets set forth by the California Air Resources Board, and assess and modify existing CAP implementation programs.

- Responsibility: Economic and Community Development
- Time Frame: 2020 and every five years thereafter

Proposed language:

RC-7.A Update the Climate Action Plan

The City shall periodically update the Climate Action Plan to address municipal operations, maintain compliance with GHG reduction targets set forth by the California Air Resources Board, integrate climate adaptation, and assess and modify existing CAP implementation programs.

- Responsibility: Economic and Community Development
- Time Frame: 2020 and every five years thereafter

APPENDIX A

SENATE BILL 99 EVACUATION ROUTE ANALYSIS

Pursuant to Senate Bill (SB) 99, upon the next revision of the housing element on or after January 1, 2020, the safety element shall identify residential developments in any hazard area identified in the safety element that do not have at least two emergency evacuation routes. For the purpose of this analysis an "emergency evacuation route" is considered to be a vehicular access point which can be utilized during an emergency and provides a direct connection to the surrounding roadway network. The identification of residential developments within hazard areas with limited accessibility (i.e., fewer than two points of access), will aid Union City in identifying locations that could be vulnerable during an evacuation event and opportunities for improved connectivity and access.

The analysis utilized aerial imagery upon which the city's zoning designations and roadway network was overlayed to identify any residential development within the city with fewer than two vehicular access points. For the purpose of this analysis, a residential development is defined as an existing cluster of residences consisting of more than 30 dwelling units. This definition is generally consistent with Public Resources Code 4290.5 which requires the Board of Forestry and Fire Protection to identify existing subdivisions with more than 30 dwelling units which are at significant fire risk and lack a secondary egress route. Subsequently, the hazard zones within the city including the FEMA designated 100- and 500-year flood zones, and California Department of Conservation high landslide potential areas, and fault lines; were identified and mapped. Figure 1 identifies those hazard zones and all residential developments within the city with only one point of vehicular access. It should be noted that fire hazard severity zones are not shown on Figure 1 due to no recent data being available.

The residential developments located in hazard areas that have only one point of access are the most vulnerable communities if a circumstance were to occur requiring emergency evacuation; thus, are the focus of this analysis. However, it should be noted that all residential development within the city with less than two vehicular points of access, regardless of if they are also within a hazard zone, are included on Figure 1 for disclosure purposes.

As shown in Figure 1, there are a total of three residential developments in the city with fewer than two points of vehicular access. Of those three residential developments, the two developments located just east of State Route (SR) 238 on the eastern side of the city are within potential landslide zones and along active fault lines. It should be noted that, as detailed in the 2040 General Plan, while most of Union City is considered to be at low risk for wildfires, hillside areas in the eastern part of the city are at a higher risk. Therefore, there is a high likelihood that the two developments with fewer than two points of access within hazards zone identified above, are also within areas at a higher risk for wildfire.

FIGURE 1

SENATE BILL 99 RESIDENTIAL DEVELOPMENT IDENTIFICATION

Notes: Data downloaded from California Geological Survey in 2023, FEMA in 2022. Adapted by Ascent Environmental in 2023.

APPENDIX B

CLIMATE CHANGE VULNERABILITY ASSESSMENT

Introduction

This section provides a climate change vulnerability assessment, which summarizes various climate change effects and potential impacts that Union City may experience over the coming decades, evaluates Union City's current capacity to adjust and adapt to climate change (i.e., adaptive capacity), and characterizes Union City's overall vulnerability to climate change. A discussion of greenhouse gases (GHGs) and the causes of climate change is included in Section 10.7, Greenhouse Gas Emissions, of the Hazards and Public Safety chapter of the Union City General Plan Update 2019 Background Report.

Major Findings

- The historical average annual maximum temperature for Union City is 67.2 degrees Fahrenheit (°F), but is projected to rise to a range of between 72.6 °F and 75.4 °F by 2099, an increase range of 5.4 °F to 8.2 °F, depending on GHG emissions levels.
- The historical average annual number of extreme heat days (i.e., days at or above 90.0 °F) in Union City is 4.3 days, but is projected to rise to a range of 18.5 to 31.1 days by 2099, depending on GHG emissions levels. Additionally, heat waves (i.e., four or more consecutive extreme heat days) are projected to rise from a historical annual average of 0.2 heat waves to a range of 1.6 to 3.6 heat waves by 2099, depending on GHG emissions levels.
- The historical average annual precipitation in Union City is 19.6 inches, but is projected to rise to a range of 22.2 to 24.6 inches by 2099, an increase of 2.6 to 5.0 inches, depending on GHG emissions levels. Additionally, extreme precipitation is also projected to rise. The historical average annual number of extreme precipitation events (i.e., events having precipitation at or exceeding the 95th percentile, which equates to 1.1 inches over a two-day period) in Union City is 1.3 events, but is projected to rise to a range of 2.1 and 3.3 events by 2099, depending on GHG emissions levels. Extreme precipitation, coupled with sea level rise, will likely result in increased risk of flooding.
- Despite extreme precipitation being projected to rise through 2099, drought will also continue to be prevalent within Union City and across the state. Historically, precipitation in the San Francisco Bay Area exhibits "booms and busts," which refers to the existence of both very wet years and very dry years. This trend is expected to continue in the future, and extended drought occurrences may become more pervasive in future decades.
- The San Francisco Bay Area, inclusive of Union City, has historically experienced an annual average of 20,281 acres burned by wildfire. This number is projected to rise to a range of 25,381 to 27,065 acres burned by 2099, depending on GHG emissions levels.

Existing Conditions

Climate Change Background

Since the beginning of the Industrial Revolution in the late 18th century, human activities—primarily the combustion of fossil fuels for electricity, heat, and transportation—have released an excess amount of

GHGs into Earth's atmosphere. Significantly elevated levels of GHG emissions have intensified the greenhouse effect and have led to an unprecedented trend of human-caused (i.e., anthropogenic) warming of Earth's climate, among other climatic disruptions, known as climate change. There are many effects and associated impacts stemming from climate change that intersect with multiple facets of human society, and though it is a global issue, it is an issue that will be, and already is, experienced differently around the world. Over time, it has increasingly become a priority to address climate change at multiple scales as weather patterns become more extreme, temperatures continue to rise, and polar ice caps continue to melt.

The average global surface temperature is expected to increase approximately 8 °F by the end of the century unless additional efforts to reduce GHG emissions are made (IPCC 2021). Depending on future GHG emissions levels, average annual maximum daily temperatures in California are projected to increase between 4.4 °F and 5.8 °F by 2050 and by 5.6 °F to 8.8 °F by 2100 (Pierce et al. 2018, cited in OPR, CEC, and CNRA 2018a). Temperature changes in the San Francisco Bay Area are expected to be consistent with California as a whole, with projected increases between roughly 5 °F and 8 °F by the end of the century (OPR, CEC, and CNRA 2018b). These temperature changes, along with other climate change effects and climate hazards, are already being experienced by Union City, and the scale, frequency, and intensity of them are expected to worsen over time depending on the level of present and future GHG emissions (OPR, CEC, and CNRA 2018a).

Climate Change Effects

Climate change effects are caused by the initial impacts of increased GHG emissions, from which secondary effects result (i.e., climate hazards). The climate change effects analyzed for Union City include increased temperatures, changes in precipitation patterns, and sea level rise. Climate hazards, which are exacerbated because of individual changes or a combination of changes in climate change effects, include extreme heat, wildfire, extreme precipitation and flooding, and drought, and are discussed in the following section titled "Climate Hazards."

Though the precise extent of future climate change effects is uncertain, historical climate data and forecasted GHG emissions can be used to project climate change effects through near-term (current-2050), midterm (2040-2069), and long-term (2070-2099) timescales, unless noted otherwise for individual climate change effects. The time periods are established as 30-year time intervals to gather accurate data on average changes in the climate, which is typically measured over 30-year periods or longer. This results in overlap among some time periods. Due to annual fluctuations in climate variables, climate data on shorter periods may be less accurate and not reflect long-term averages (NOAA 2020). To assess potential climate change effects and climate hazards, the California Adaptation Planning Guide (APG) recommends using Cal-Adapt, a tool developed by the California Energy Commission (CEC) and the University of California, Berkeley Geospatial Innovation Facility that uses global climate simulation model data to identify how climate change might affect various geographies in California (Cal OES 2020). Cal-Adapt addresses the uncertainty in future GHG emissions by using Representative Concentration Pathways (RCPs) developed by the Intergovernmental Panel on Climate Change (IPCC). These RCPs depict two future emissions scenarios. RCP 4.5 represents a medium emissions scenario in which GHG emissions continue to rise through 2040 and then decrease to below 1990 levels by the end of the century. RCP 8.5 represents a high emissions scenario, or business-as-usual scenario, where GHG emissions continue to increase through the end of the century. As recommended by the APG, this analysis evaluates near-term and midterm climate change effects and their associated impacts under the high emissions scenario, as this takes a conservative approach and assumes a worst-case scenario. Additionally, changes in climate variables for these timescales are similar under both the medium and high emissions scenarios. Because long-term global GHG emissions trends are less certain and climate impacts vary more considerably between scenarios, a discussion of both the medium and high emissions scenarios is included for this timescale (OPR, CEC, and CNRA 2018a).

Cal-Adapt downscales global climate models to local and regional resolutions using the Localized Constructed Analogs statistical technique. Four of the models included have been selected by California's Climate Action Team Research Working Group as priority models for research contributing to the Climate Assessment. The first model, CanESM2, represents an "average" simulation. The second model, CNRM-CM5, represents a "cooler/wetter" simulation. The third model, HadGEM2-ES, represents a "warmer/drier" simulation. The fourth model, MIROC5, represents a "dissimilar" simulation that is most unlike the other three to produce maximal coverage of possible future climate conditions. To analyze projections for climate change effects and climate hazards in Union City, the average of the downscaled data provided by these four models were used. The boundaries of the study area for this analysis are the geographic boundaries of Union City.

Increased Temperatures

According to Cal-Adapt, the historic (1961-1990) average annual maximum temperature in Union City is 67.2 °F, and the historic average annual minimum temperature is 47.7 °F. As shown in Table 1, and as supplemented by Figure 1, both are projected to increase throughout the century. The average annual maximum temperature in Union City is projected to increase to 70.9 °F in the near-term and 72.5 °F in the midterm under high emissions. The average annual maximum temperature is projected to increase to 72.6 °F and 75.4 °F in the long-term under medium and high emissions, respectively. The average annual minimum temperature in Union City is projected to increase to 50.5 °F in the near-term and 52.1 °F in the midterm under high emissions. The average annual minimum temperature is projected to increase to 52.1 °F and 55.1 °F in the long-term under medium and high emissions, respectively (CEC 2022a). While temperatures are relatively low in Union City compared to other regions of the state, increased temperatures will influence other climate hazards that may result in adverse impacts.

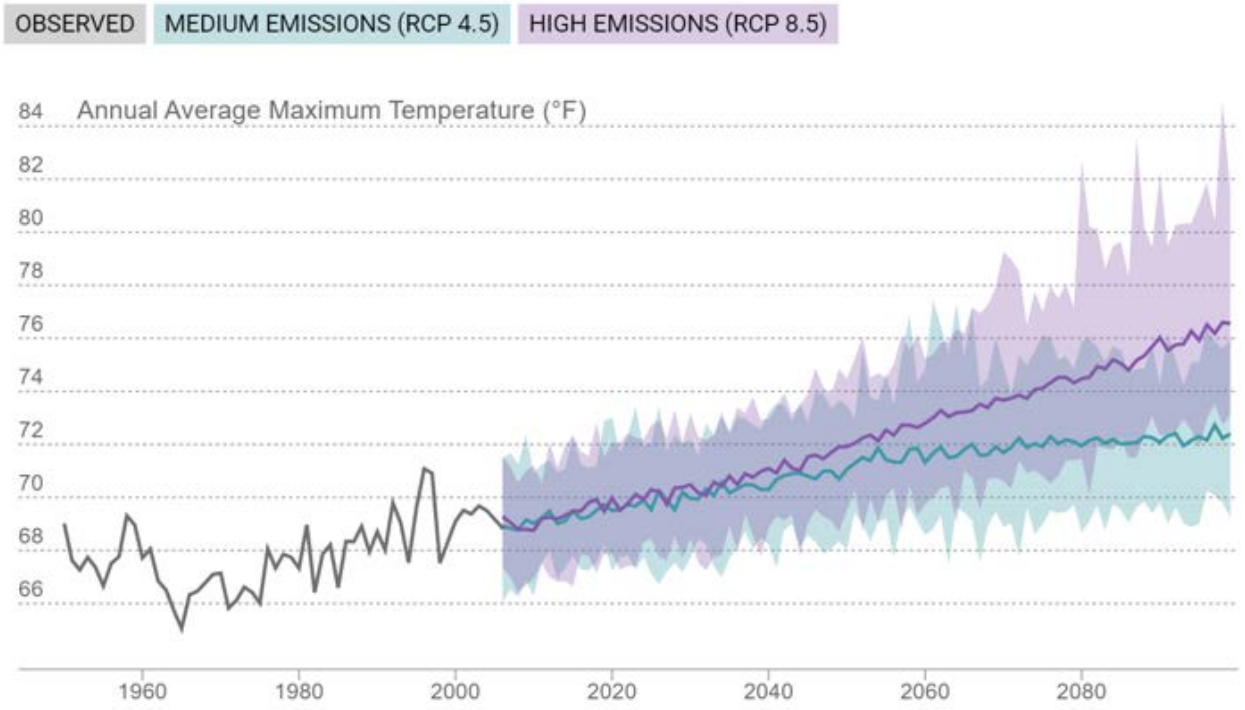
TABLE 1
CHANGES IN AVERAGE ANNUAL TEMPERATURE THROUGH 2099
Union City

Annual Averages	Historic (1961-1990)	Near-Term[1] (current-2050)	Midterm[1] (2040-2069)	Long-Term (2070-2099)	
				Medium Emissions	High Emissions
Maximum Temperature (°F)	67.2	70.9	72.5	72.6	75.4
Maximum Temperature Difference from Historic (°F)	N/A	+3.7	+5.3	+5.4	+8.2
Minimum Temperature (°F)	47.7	50.5	52.1	52.1	55.1
Minimum Temperature Difference from Historic (°F)	N/A	+2.8	+4.4	+4.4	+7.4

Notes: °F = degrees Fahrenheit; N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5
[1] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
Source: CEC 2022a.

FIGURE 1
OBSERVED AND PROJECTED AVERAGE ANNUAL MAXIMUM TEMPERATURE FROM 1950-2099

Union City



Notes: Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
Source: CEC 2022b.

Changes in Precipitation Patterns

According to Cal-Adapt, the historic average annual precipitation in Union City is 19.6 inches. As shown in Table 2, the average annual precipitation in Union City is projected to increase to 22.3 inches in the near-term and 22.2 inches in the midterm under high emissions. In the long-term, average annual precipitation is expected to increase to 22.2 inches under medium emissions, and 24.6 inches under high emissions (CEC 2022a).

While average annual precipitation in Union City is projected to trend upward in future years, overall precipitation patterns are also projected to change, with precipitation variability expected to continue, and potentially increase, over time across the San Francisco Bay Area, inclusive of Union City. Historically, precipitation in the San Francisco Bay Area exhibits "booms and busts," which refers to the existence of both very wet years and very dry years (OPR, CEC, and CNRA 2018b). The amount of precipitation that falls in any particular year is largely influenced by occurrences of large, discrete winter storms, which often provide a substantial fraction of the region's annual precipitation. When these storms happen, they will likely become more intense, and potentially more damaging, in the coming decades. In general, periods of precipitation are projected to be wetter, but on an annual basis, there will likely be fewer total days with precipitation. Further, climate projections show a likely increase in extreme dry events, which may result in severe and prolonged drought (OPR, CEC, and CNRA 2018b). Overall, the projected increase in average annual precipitation and changes in precipitation patterns through the end of the century will likely influence other climate hazards that may result in adverse impacts, similar to increased temperatures.

TABLE 2 CHANGES IN AVERAGE ANNUAL PRECIPITATION THROUGH 2099 Union City					
Annual Averages	Historic (1961-1990)	Near-Term[1] (current-2050)	Midterm[1] (2040-2069)	Long-Term (2070-2099)	
				Medium Emissions	High Emissions
Precipitation (inches)	19.6	22.3	22.2	22.2	24.6
Precipitation Difference from Historic (inches)	N/A	+2.7	+2.6	+2.6	+5.0

Notes: N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
[1] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
Source: CEC 2022a.

Sea Level Rise

Cal-Adapt provides probabilistic sea level rise projections under both medium and high emissions, which incorporate estimates of components that contribute to global and regional sea level rise (e.g., thermal expansion of seawater, glacier ice melt, glacial isostatic adjustments, etc.). The sea level rise projections under high emissions also incorporate relatively recent scientific findings on the potential for rapid demise of the West Antarctic Ice Sheet, which could dramatically accelerate sea level rise in the latter decades of this century. The probabilistic framework is helpful because, despite substantial advances in the science of sea level rise, significant uncertainty remains in mid- and late-century projections of sea levels. Probabilistic sea level rise projections provide a range of possible outcomes in a framework that enables decision-makers to choose a number that is appropriate for their level of risk tolerance. Sea level rise scenarios presented in Cal-Adapt include the 50th percentile (i.e., middle estimate), 95th percentile (i.e., high estimate), and 99.9th percentile (i.e., extreme estimate) (CEC 2022c).

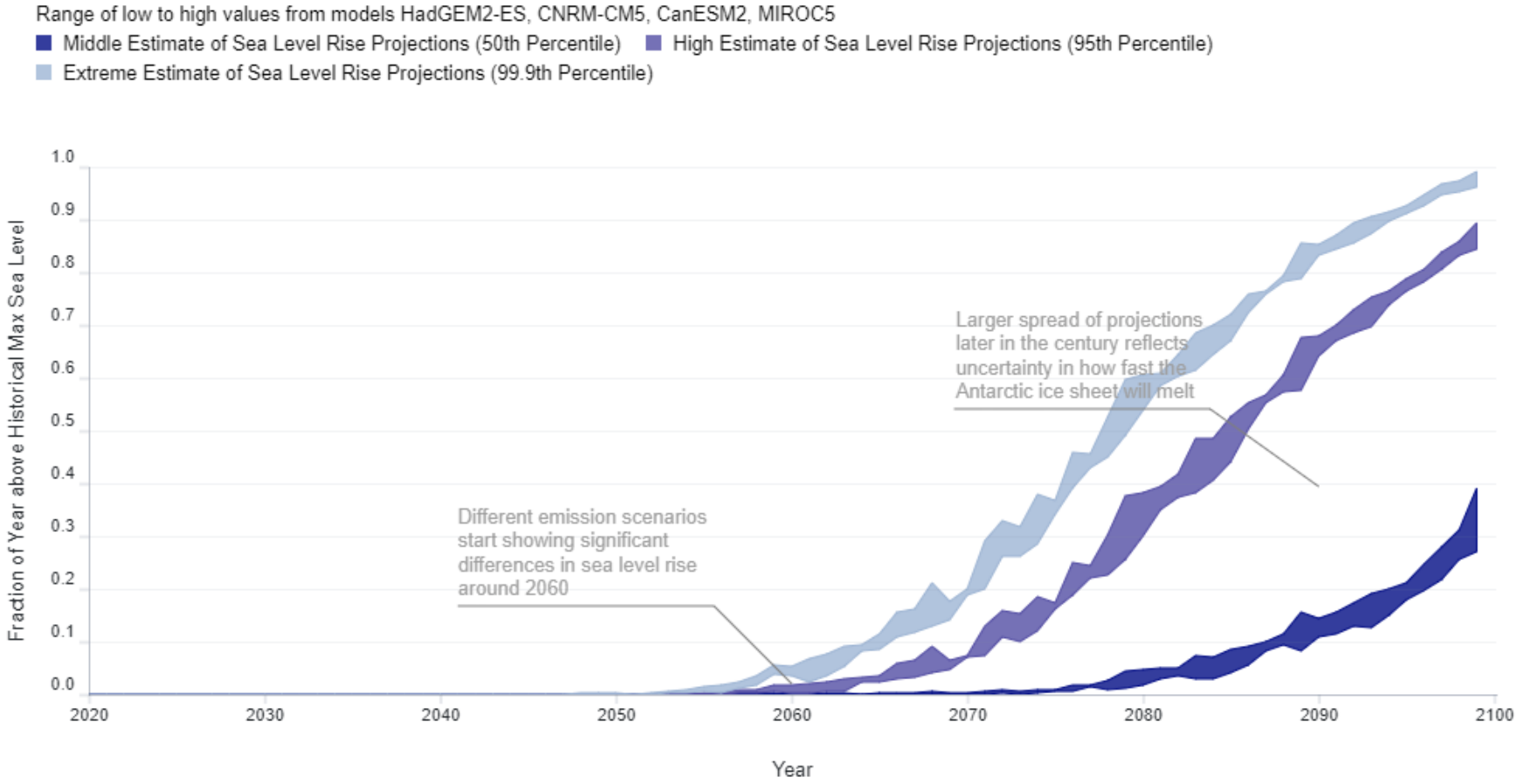
According to Cal-Adapt, the historic (1961-1990) maximum sea level at the San Francisco tide gauge station is 5.6 feet. The San Francisco tide gauge station was chosen for this analysis as it is the closest of 11-gauge stations across the state in proximity to Union City, and thus would provide the most relevant projections. Figure 2 displays the projected fraction of each year through 2099 that sea level would be over the historic maximum of 5.6 feet at the San Francisco tide gauge station under high emissions and each of the above noted sea level rise scenarios. As shown, it takes until roughly mid-century for each sea level rise scenario to start showing significant differences, but regardless of scenario, it is clear that sea level rise will occur. Sea level rise will influence future flooding in Union City, one of the climate hazards discussed later in this analysis, but it is worth noting that it also increases the risk of other hazards such as coastal erosion, seawater intrusion, and shoreline retreat.

Climate Hazards

Climate hazards are secondary effects that result from the initial impacts of increased GHG emissions (i.e., climate change effects), which include increased temperatures, changing precipitation patterns, and sea level rise. The climate hazards relevant to Union City discussed in this analysis include extreme heat, wildfire, extreme precipitation and flooding, and drought.

FIGURE 2
PROJECTED FRACTION OF YEAR THROUGH 2099 WITH SEA LEVEL ABOVE HISTORIC MAXIMUM SEA LEVEL UNDER A HIGH EMISSIONS SCENARIO

San Francisco Tide Gauge



Note: High Emissions = RCP 8.5.
Source: CEC 2022c.

Extreme Heat

The Cal-Adapt tool provides estimates of future instances of extreme heat events. Extreme heat events include extreme heat days and heat waves. Cal-Adapt defines an extreme heat day as a day when the daily maximum temperature exceeds the 98th historical percentile of daily maximum temperatures based on observed data from 1961-1990 between April and October. Heat waves are characterized as periods of sustained extreme heat and are defined by Cal-Adapt as four or more consecutive extreme heat days.

Extreme heat day thresholds vary significantly for different regions of the state due to various geographic, topographic, and climatological factors. The default extreme heat threshold for Union City is 90.0 °F, meaning 98 percent of all recorded maximum temperatures in this period (i.e., 1961-1990 between April and October) were below 90.0 °F. Historically (1961-1990), Union City experienced an average of 4.3 extreme heat days per year. As a result of rising temperatures from climate change, Union City is projected to experience 14.0 extreme heat days annually in the near-term and 18.5 extreme heat days annually in the midterm under high emissions. In the long-term, Union City is projected to experience 18.5 extreme heat days annually under medium emissions and 31.1 extreme heat days annually under high emissions. As a worst-case scenario, Union City has the potential to experience a maximum of 98 extreme heat days per year in the long-term under high emissions (CEC 2022d). While the worst-case scenario is unlikely to happen, it is important to consider for adaptation planning purposes. As shown in Table 3, the number of extreme heat days is already increasing from historic averages and will continue to increase through the end of the century.

While heat waves have historically been infrequent in Union City, with a historical average of less than one heat wave annually, climate change is expected to increase the frequency of heat waves. Under high emissions, Union City is projected to experience an average of one heat wave per year in the near-term and 1.7 heat waves per year in the midterm. Union City is projected to experience 1.6 heat waves per year in the long-term under medium emissions, and 3.6 heat waves per year in the long-term under high emissions. As a worst-case scenario, Union City has the potential to experience a maximum of 18 heat waves per year in the long-term under high emissions. The average number of days in the longest stretch of consecutive extreme heat days per year is also projected to increase substantially. Historically, the longest stretch of consecutive extreme heat days lasted for an average duration of approximately 2.3 days. The longest stretch of consecutive extreme heat days is projected to increase to an average of 4.2 days in the near-term and 5.2 days in the midterm under high emissions. In the long-term, the duration is projected to increase to an average of 4.9 days under medium emissions, and 7.8 days under high emissions (CEC 2022d). The projected number of heat waves and number of days in the longest stretch of consecutive extreme heat days is shown in Table 3.

TABLE 3
CHANGES IN EXTREME HEAT EVENTS THROUGH 2099
Union City

Annual Averages	Historic (1961-1990)	Near-Term[1] (current-2050)	Midterm[1] (2040-2069)	Long-Term (2070-2099)		
				Medium Emissions	High Emissions	High Emissions Maximum[2]
Number of Extreme Heat Days	4.3	14.0	18.5	18.5	31.1	98.0
Number of Heat Waves[3]	0.2	1.0	1.7	1.6	3.6	18.0

TABLE 3 CHANGES IN EXTREME HEAT EVENTS THROUGH 2099 Union City						
Annual Averages	**Historic (1961-1990)**	**Near-Term[1] (current-2050)**	**Midterm[1] (2040-2069)**	**Long-Term (2070-2099)**		
				Medium Emissions	**High Emissions**	**High Emissions Maximum[2]**
Number of Days in Longest Stretch of Consecutive Extreme Heat Days	2.3	4.2	5.2	4.9	7.8	27.0

Notes: N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
[1] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
[2] "High Emissions Maximum" refers to the maximum modeled value (i.e., worst-case scenario) within the long-term timescale under RCP 8.5.
[3] A heat wave is characterized as a period of sustained extreme heat and is defined by Cal-Adapt as four or more consecutive extreme heat days.
Source: CEC 2022d.

Wildfire

Historically, attention to wildfire in the state has mostly focused on the Sierra Nevada and Southern California, but recent large and destructive wildfires in the San Francisco Bay Area have rapidly shifted attention to the ongoing risks in this region, inclusive of Union City and Alameda County (OPR, CEC, and CNRA 2018b). Using a statistical model based on historical data of climate, vegetation, population density, and large fire history, Cal-Adapt provides projections for future annual mean acres that are anticipated to burn within the San Francisco Bay Area when wildfires do occur. It is important to note that Cal-Adapt does not account for current or planned wildfire management projects. Table 4 displays the projected change in average annual area burned within the San Francisco Bay Area under high emissions for the near-term and midterm timescales, and under both emissions scenarios, medium and high emissions, for the long-term timescale. The modeled historic average annual area burned in the San Francisco Bay Area is 20,281 acres. The average annual area burned in the San Francisco Bay Area is projected to increase to 23,141 acres in the near-term and 26,035 acres in the midterm under high emissions. The average annual area burned is projected to increase to 25,381 acres in the long-term under medium emissions, and 27,065 acres in the long-term under high emissions. As a worst-case scenario, the San Francisco Bay Area has the potential to experience 51,554 acres in average annual area burned in the long-term under high emissions (CEC 2022e). While the worst-case scenario is unlikely to happen, it is important to consider for adaptation planning purposes.

TABLE 4 CHANGES IN AVERAGE ANNUAL AREA BURNED THROUGH 2099 San Francisco Bay Area						
Annual Averages	**Historic[1] (1961-1990)**	**Near-Term[2] (current-2050)**	**Midterm[2] (2040-2069)**	**Long-Term (2070-2099)**		
				Medium Emissions	**High Emissions**	**High Emissions Maximum[3]**
Area Burned (acres)	20,281	23,141	26,035	25,381	27,065	51,554
Area Burned Difference from Historic (acres)	N/A	+2,860	+5,754	+5,100	+6,784	+31,273

Notes: N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
[1] Observed historical average annual area burned data were not available from Cal-Adapt; the modeled historical average annual area burned data under the Medium Emissions scenario, RCP 4.5, were available and used as proxy data.
[2] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
[3] "High Emissions Maximum" refers to the maximum modeled value (i.e., worst-case scenario) within the long-term timescale under RCP 8.5.
Source: CEC 2022e.

Extreme Precipitation and Flooding

In the Cal-Adapt tool, extreme precipitation events are defined as events where two-day rainfall totals are above an extreme threshold (i.e., days having precipitation at or exceeding the 95th percentile). For Union City, this threshold is approximately 1.1 inches over a two-day period. According to Cal-Adapt, Union City has historically experienced an average of 1.3 extreme precipitation events per year from 1961-1990. Under high emissions, Union City is expected to experience 1.8 extreme precipitation events per year in the near-term and 2.1 extreme precipitation events per year in the midterm. In the long-term, Union City is projected to experience 2.1 extreme precipitation events per year under medium emissions, and 3.3 extreme precipitation events per year under high emissions. Additionally, as a worst-case scenario, there is the potential to have as many as 13 extreme precipitation events per year in the long-term under high emissions (CEC 2022f). Changes in extreme precipitation events in Union City are shown in Table 5. Though the table displays an increase in the average annual number of extreme precipitation events through the end of the century, it is important to note that the quantity of extreme precipitation events in Union City may vary considerably year-to-year due to California's highly variable climate setting. However, as the climate continues to warm, atmospheric rivers, responsible for many of the extreme precipitation events across the state, will carry more moisture and may make extreme precipitation events more severe (Polade et al. 2017).

TABLE 5 CHANGES IN EXTREME PRECIPITATION EVENTS THROUGH 2099 Union City						
Annual Averages	**Historic (1961-1990)**	**Near-Term[1] (current-2050)**	**Midterm[1] (2040-2069)**	**Long-Term (2070-2099)**		
				Medium Emissions	**High Emissions**	**High Emissions Maximum[2]**
Number of Extreme Precipitation Events	1.3	1.8	2.1	2.1	3.3	13.0
Number of Extreme Precipitation Events Difference from Historic	N/A	+0.5	+0.8	+0.8	+2.0	+11.7

Notes: N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
[1] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
[2] "High Emissions Maximum" refers to the maximum modeled value (i.e., worst-case scenario) within the long-term timescale under RCP 8.5.
Source: CEC 2022f.

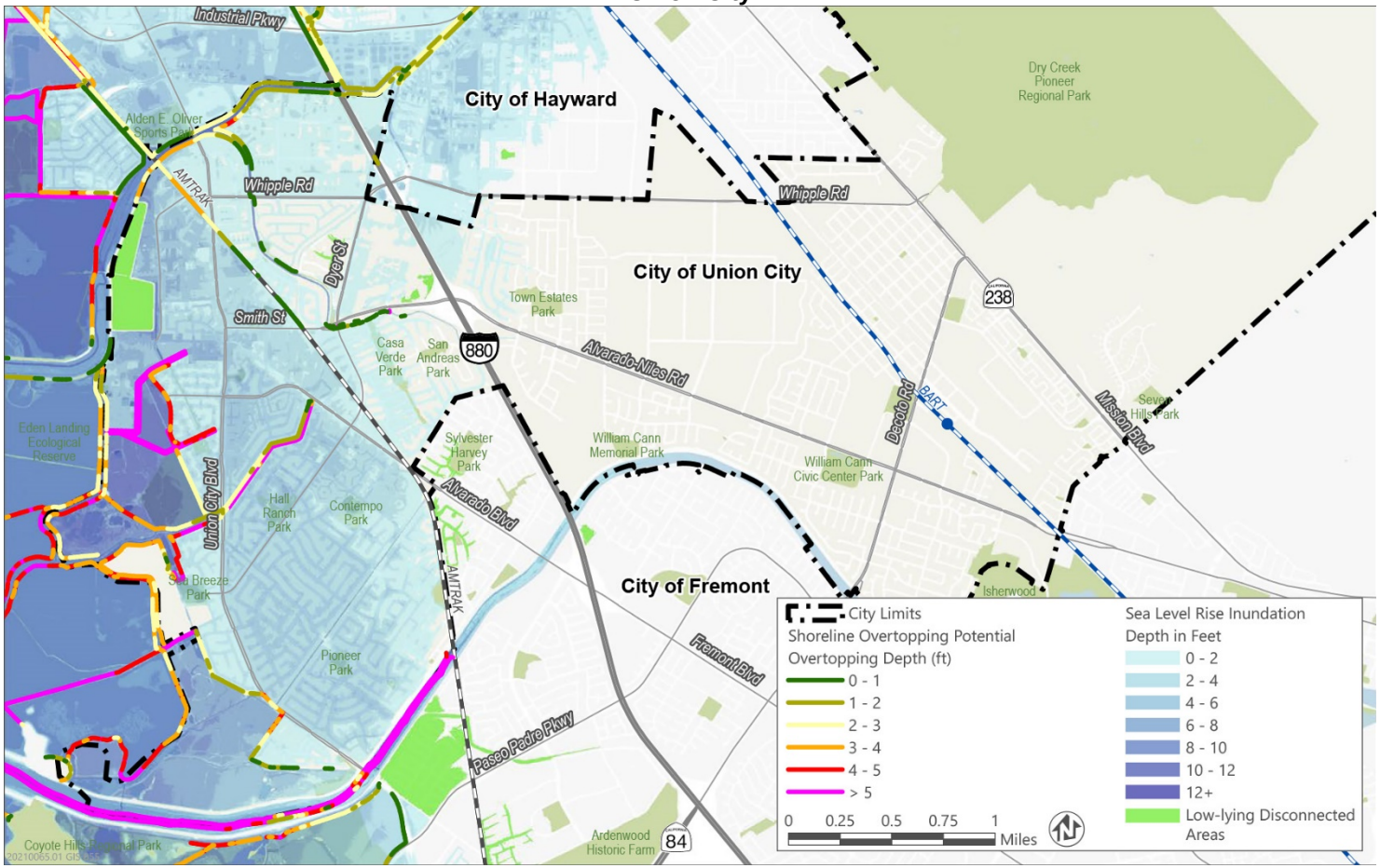
As the potential for more extreme precipitation events to occur on an annual basis increases through the end of the century, Union City may also experience an increase in the frequency and intensity of flood events. Though the occurrence of extreme precipitation events is a major source of flooding in Union City, and will increasingly be so in the future, it is not the only source. Sea level rise is another major source of flooding in Union City, as rising sea levels will not only put new areas at risk of coastal flooding but will also increase the likelihood and intensity of floods in areas already at risk. Figure 3 shows the projected maximum inundation depth in the county during a likely 100-year storm event and sea level rise of 52 inches. As shown, the western end of Union City near the San Francisco Bay would be most significantly affected in this, and any, sea level rise scenario.

Drought

As shown in Table 2 above, under both medium and high emissions scenarios, Union City is expected to experience slight overall increases in average annual precipitation through the end of the century. However, in addition to these slight increases in average annual precipitation, overall precipitation patterns are projected to change, with precipitation variability expected to increase substantially. The state as a whole, inclusive of Union City and the San Francisco Bay Area, has a highly variable climate that is susceptible to prolonged periods of drought, and recent research suggests that extended drought occurrences (i.e., a "mega-drought") could become more pervasive in future decades (CEC 2022g).

FIGURE 3
INUNDATION DEPTH WITH SEA LEVEL RISE OF 52 INCHES DURING A 100-YEAR STORM EVENT

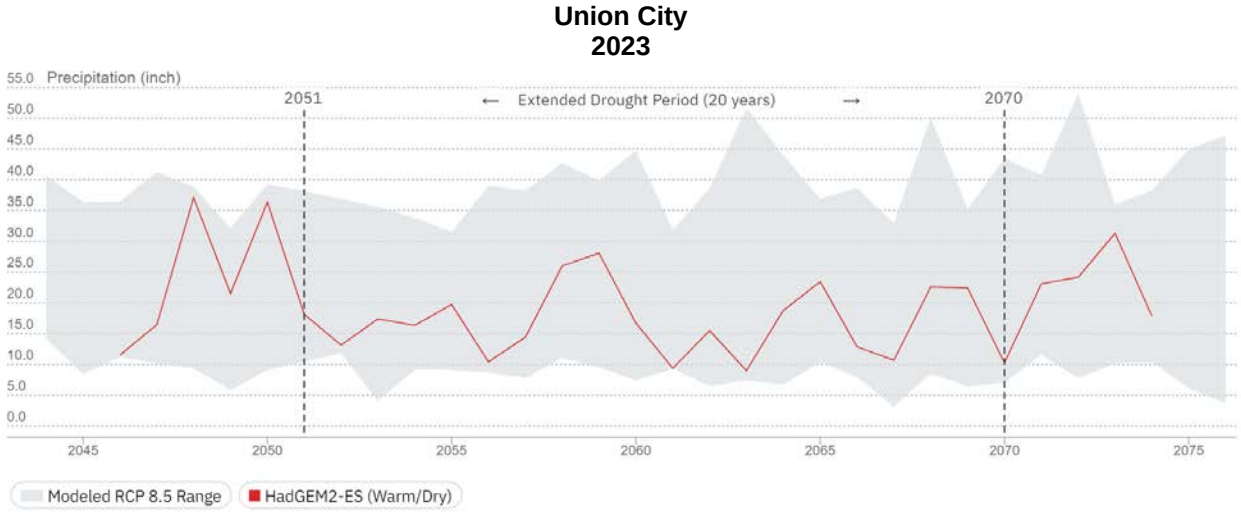
Union City



Source: Data downloaded from Bay Conservation and Development Commission in 2022. Adapted by Ascent Environmental in 2023.

Cal-Adapt uses data to simulate an extended drought scenario for all of California from 2051 to 2070 under high emissions and the HadGEM2-ES climate model, which represents a "warmer/drier" simulation. The extended drought scenario is based on the average annual precipitation over 20 years. This average value equates to 78 percent of the historical median annual precipitation averaged for the North Coast and Sierra California Climate Tracker regions. As shown in Table 2, Union City's observed historic (1961-1990) average annual precipitation is 19.6 inches. Under the anticipated extended drought scenario between 2051 and 2070, Union City's average annual precipitation would decrease to 16.8 inches, as shown in Figure 4 (CEC 2022g). Union City, along with the entire San Francisco Bay Area, is projected to experience extended drought periods like this as a result of climate change, and without effective adaptations, future droughts will challenge the management of the region's water supplies (OPR, CEC, and CNRA 2018b).

FIGURE 4
PROJECTED PRECIPITATION LEVELS UNDER AN EXTENDED DROUGHT SCENARIO AND HIGH EMISSIONS FROM 2051-2070



Note: High Emissions = RCP 8.5.
Source: CEC 2022h.

Potential Impacts

The above discussion on climate change effects and climate hazards provides a glimpse as to what each of those effects and hazards are projected to look like in Union City in the future. This section is intended to provide a brief overview of some of the major, overarching types of potential impacts that will likely result from each of the above climate change effects and climate hazards. Because of the broad array of potential impacts that exist as a result of climate change, this section should serve as a snapshot of some of the impacts that may affect Union City. There is potential for other impacts that are not presented here.

Air Quality Degradation

Climate change is expected to worsen air quality problems by increasing the frequency, duration, and intensity of conditions conducive to air pollution formation. Increased temperatures and extreme heat intensifies the photochemical reactions that produce smog, ground-level ozone, and fine particulate matter measuring 2.5 microns or smaller ($PM_{2.5}$) (CDPH 2017). Additionally, regional wildfire-linked air pollution, coupled with potential future drought conditions, can further degrade air quality in Union City. More information about the air quality in Union City can be found in Chapter 9, Natural and Cultural Resources.

Buildings and Infrastructure

Climate hazards have the potential to significantly impact Union City's buildings and infrastructure. Increased temperatures and extreme heat events are likely to affect Union City's built environment primarily through changes in energy use, as well as disproportionate impacts on individuals residing in units that do not have air conditioning. Cal-Adapt provides data on the shifts in Cooling Degree Days and Heating Degree Days, which are measurements used to assess the energy demand needed for cooling and heating buildings in different climate zones throughout California. A "degree day" does not equate to a single day of the year, but rather compares the average outdoor temperatures recorded for a location to a standard temperature (i.e., 65 °F). For example, if the average temperature for a day is 80 °F, the day has 15 Cooling Degree Days (80 – 65 = 15). Degree days are referenced in the State's Title 24 Building Energy Efficiency Standards to help design the energy demand needed for heating and cooling in the various climate zones throughout the state. To illustrate how climate change is likely to affect energy demand for heating and cooling in the future, Table 6 includes the relative shift in Cooling Degree Days and Heating Degree Days in Union City through 2099. As displayed, Union City is projected to have significant decreases in Heating Degree Days and significant increases in Cooling Degree Days through the end of the century, most notably with a 524.2 percent increase in Cooling Degree Days in the long-term under high emissions (CEC 2022h). These projections correlate to an overall significant increase in cooling costs through the end of the century, with a slight decrease in heating costs. Additionally, increased temperatures can exacerbate existing urban heat islands in densely populated areas, like Union City, adding to the risk of extreme heat (CDPH 2017).

TABLE 6
CHANGES IN HEATING AND COOLING DEGREE DAYS THROUGH 2099
Union City 2023

Annual Averages	Historic (1961-1990)	Near-Term[1] (current-2050)	Midterm[1] (2040-2069)	Long-Term (2070-2099)	
				Medium Emissions	High Emissions
Number of Heating Degree Days	3,001	2,213	1,882	1,871	1,362
Percent Change in Heating Degree Days from Historic (%)	N/A	-26.3	-37.3	-37.6	-54.6
Number of Cooling Degree Days	232	652	897	891	1,449
Percent Change in Cooling Degree Days from Historic (%)	N/A	+180.9	+286.5	+283.7	+524.2

Notes: N/A = not applicable; Medium Emissions = RCP 4.5; High Emissions = RCP 8.5.
[1] Projections for the near-term and midterm timescales are based on the High Emissions scenario, RCP 8.5, as recommended by the APG.
Source: CEC 2022h.

In addition to the impacts of increased temperatures and extreme heat on buildings and energy use, transportation systems will also be affected. Transportation infrastructure is designed and constructed to withstand certain variabilities in weather and temperature based on observations of historical weather trends for specific climate regions. The performance of transportation infrastructure may begin to decline when the severity of extreme heat periods exceeds historical ranges. For example, extreme heat could cause pavement discontinuities and deformation, increase the risk of buckling of highways and railroad tracks, and may cause premature deterioration of transportation infrastructure, decreasing transportation safety and creating higher maintenance costs (Caltrans 2018). Air conditioning units in buses are placed under increased stress and risk of failure when maximum daily temperatures reach 100 °F, which is a temperature threshold Union City has rarely exceeded historically but may exceed more frequently over time (Cambridge Systematics 2015). Further, while regional bridges are designed to expand during periods of extreme heat, projected increases in extreme heat events could go beyond design criteria, resulting in cracking and crushing of the roadway deck, as well as increased maintenance costs (Transportation Research Board 2008).

Flooding resulting from sea level rise or extreme precipitation events also has the potential to severely impact Union City's residential and nonresidential buildings and infrastructure, including critical infrastructure. There are approximately 4,175 acres (i.e., 33.9 percent of the total acreage) within Union City that fall within the 100-year floodplain, which is defined as an area that has a 1 percent chance (i.e., 1-in-100 chance) of experiencing a flood in any given year (City of Union City and City of Newark 2017). Transportation infrastructure, along with other critical facilities (e.g., electric distribution lines, police stations, community health centers) are at direct risk of flooding-induced scouring, which is the removal of sediment, such as sand and gravel, caused by swiftly moving water and compromising the integrity of the structure. Sea level rise, and more specifically, coastal flooding and storm surge, can dramatically affect transportation routes in Union City and the integrity of existing transportation infrastructure. The projected increases in annual precipitation and extreme precipitation events will likely increase the vulnerability of these structures in the future. Flooding can cause underground utilities, along with water and sewer systems, to be damaged, or otherwise adversely affected via high inflow and infiltration. Sea water backflow resulting from coastal flooding in the San Francisco Bay can impair coastal sanitation drainage systems during flood events, requiring costly upgrades and alterations. Facilities that are known to manufacture, process, store, or use hazardous materials could be damaged during flooding events. If damaged, these facilities, or containers holding these materials, could release chemicals that are detrimental to human health and the environment.

Increased regional wildfire risk also poses threats to Union City's buildings and infrastructure, both directly and indirectly. Union City has thousands of acres of open hillsides to the east that are at direct risk of wildfires (City of Union City and City of Newark 2017). While the areas at direct risk of wildfires in Union City are, in general, more sparsely populated, residential and nonresidential buildings and infrastructure are still present and can be adversely affected. Transportation infrastructure in Union City may not typically sustain significant damages during wildfire events, but wildfires can create conditions that result in the obstruction of roads and bridges due to fallen trees, downed power lines, and other debris.

Economic Growth and Stability

Economic impacts due to climate change will likely affect all sectors of the economy with negative consequences. A study conducted in 2008 by the University of California, Berkeley, and Next10, estimated that if no action is taken, potential statewide direct costs due to climate change-induced damage could exceed tens of billions of dollars annually, with even higher direct economic costs and placing trillions of dollars of real estate at risk. Consequently, the economic well-being of communities declines with higher risk and greater uncertainty about the future. Residents, businesses, and public agencies will likely see everyday costs for food and services increase. Costs will increase to cover energy, water, food, and health-related issues, leaving less money for discretionary household spending, business investment and profits, and government services.

Water is crucial for the economy, as virtually every sector relies on it to grow and ultimately sustain their business. Water costs will likely rise due to increased demands for potable, landscaping, and irrigation water use (e.g., metered water cost increases) and scarcity of and competition for water supplies. Some businesses claim water availability is a bigger challenge than energy security. Water shortages and reduced water quality may result in regulatory caps for water use and conflicts between local businesses and communities.

Food prices are expected to increase as the agricultural sector in California may experience lower yields and shifting crop patterns due to some climate hazards, such as extreme heat, drought, and extreme precipitation. Crops can become damaged from these climate hazards and operation costs may increase (e.g., irrigation water costs).

Workforce productivity may be more frequently disrupted by health impacts to residents and employees resulting from climate change via vector- and water-borne diseases, heat-related illnesses, and increased demand for and costs of health care. Industries that primarily conduct their activities outdoors (e.g., construction) may be at even higher risk as more frequent, unhealthy working conditions become more common (e.g., increased temperatures, air quality degradation, heat waves). Workers may be harmed when climate hazards, such as floods, may cause them to lose their jobs or sense of livelihoods. The indirect effects of climate change also may lead to similar outcomes, as businesses may physically move away from areas with greater climate risk to less risky areas.

Finally, property damage is another potential impact of climate hazards. Preparation for and adaptation to new and changing conditions will likely generate new costs that were not necessary to address similar concerns in the past. Residents, businesses, and other stakeholders in the city may see increased costs for maintenance and upgrades to address these issues, or to make repairs in the event of damage. As climate change generates changing conditions not often experienced in the past, preparation and adaptation will be more costly in terms of requiring new information, institutions, infrastructure, and behaviors.

Environmental Protection

Climate change effects will have broad impacts on local and regional ecosystems, habitats, and wildlife as temperatures increase, precipitation patterns change, and more extreme weather events occur. Although species have adapted to environmental changes for millions of years, a quickly changing climate could require adaptation on larger and faster scales than in the past. Similarly, the timing of many natural events, such as growing seasons and migrations, are linked to temperature, moisture availability, and amount of daylight. Changes in weather patterns and extreme events associated with climate change will disrupt these natural patterns. Species that cannot adapt are at risk of extinction. Even the loss of a single species can have subsequent impacts on other species connected through food webs and other relationships. Climate change is expected to radically and quickly change the ecosystems that many plants and animals rely on for survival.

Some species will be able to adapt to changing habitats by shifting their range or altitudes in order to adjust to rising temperatures. However, others might not be able to adapt fast enough to keep pace with the rate of climate change. Climate change may even allow some species to increase the range of habitat where they can live; however, plants and animals that need to move to survive may find wildlife corridors blocked or face competition from other species.

The risk of extinction could increase for many species, especially those that are already endangered or at risk due to isolation by geography or human development, low population numbers, or a narrow temperature tolerance range. Additionally, as species move to more favorable areas, new competitions for food and resources may form. Some species that thrive may be invasive (not native to a region) and could gradually drive out or even kill native species.

As temperatures increase, California vegetation is expected to change. Desert and grassland vegetation is projected to increase while forest vegetation is projected to generally decline. The natural cycle of plant flowering and pollination, as well as the temperature conditions necessary for a thriving locally adapted agriculture, may also be affected. Perennial crops, such as grapes, may take years to recover. Increased temperatures also provide a foothold for invasive species of weeds, insects, and animals.

The increased flow and salinity of water resources could seriously affect habitat and food sources for fish that are of both economic and recreational interest to residents. Native fish such as salmon are vulnerable to floods, which deposit silt on their eggs. Freshwater fish such as Coho salmon and steelhead trout are at risk of extinction as water temperatures rise with global temperatures. Other animals are affected by changing weather patterns and events.

Sea level rise would result in the erosion of beaches, bay shores, river deltas, marshes, and wetlands, and would increase the salinity of estuaries, marshes, rivers, and aquifers. This increased salinity has the potential to damage or destroy crops in low-lying farmlands, and has serious impacts on water supplies. Flooding also threatens natural resources.

Health and Safety

Respiratory Illness

Respiratory illnesses can be caused or exacerbated by several climate hazards, including extreme heat, wildfires, and drought. Most notably, regional wildfires can contribute to respiratory illnesses through smoke-related air pollution and $PM_{2.5}$. Burning structures and vehicles can also release high levels of toxins, creating greater health risks compared to vegetation fires. Drought conditions can lead to increased wildfire risk and soil erosion, thus also increasing the risk for causing or exacerbating respiratory illnesses.

Heat-related Illness

Increased temperatures and extreme heat exacerbated by climate change are one of the primary health concerns across California, and the entire population of Union City will be increasingly exposed to this climate hazard through the end of the century. Across the state, with no exception to Union City and Alameda County, extreme heat ranks amongst the deadliest of all hazards (CNRA 2022). Increased temperatures that manifest in sustained periods of extreme heat can directly impact Union City's populations through heat stroke and other heat-related illnesses of varying severity, and can increase the risk of cardiovascular disease, respiratory disease, kidney failure, and preterm births (CDPH 2017; LAO 2022). Non-fatal heat stroke, specifically, can result in severe mental status changes, seizures, loss of consciousness, and abnormal cardiac rhythm (Cal EPA and CDPH 2013). Additionally, extreme heat can exacerbate other pre-existing conditions in certain vulnerable populations, such as the medically fragile and chronically ill, and people that work long hours outdoors, such as those working in construction, transportation, or utility maintenance, are at heightened exposure and risk to increased temperatures and extreme heat.

Vector-borne Diseases

As climate change affects meteorological variables across California (e.g., temperature, humidity, precipitation), some areas could become more suitable habitats for insects, ticks, and mites that may carry diseases. Wetter regions are typically more susceptible to vector-borne diseases, especially human hantavirus cardiopulmonary syndrome, Lyme disease, and West Nile virus, though vector-borne diseases may also thrive during drought conditions. The amount and pattern of precipitation, as well as warmer winter weather, affects the abundance of vector habitat and food supply. Union City is projected to have warmer winters that may attract vector populations (e.g., mosquito inhabited still-water pools may become more prolific). Floods can also increase the food supply available to rodents that may transmit Lyme

disease, plague, tularemia, and rickettsial infections. In each of these cases, the increase in vector-borne disease occurrences is expected to impact public health and increase demand on health care systems. Overall, climate change alters the range, biogeography, and growth of vector-borne diseases (CDPH 2017).

Social Vulnerability

While all persons in Union City will experience impacts from climate change, some populations are more vulnerable to potential impacts due to a variety of factors. Vulnerable populations are those that "experience heightened risk and increased sensitivity to climate change and have less capacity and fewer resources to cope with, adapt to, or recover from climate impacts" (OPR 2018). These disproportionate effects are caused by physical, social, political, and economic factors, which are exacerbated by climate impacts. Some of these factors include race, class, sexual orientation and gender identification, national origin, and income inequality, among others (OPR 2018). These factors can often be the result of historic inequitable planning processes (Lynn et al. 2011).

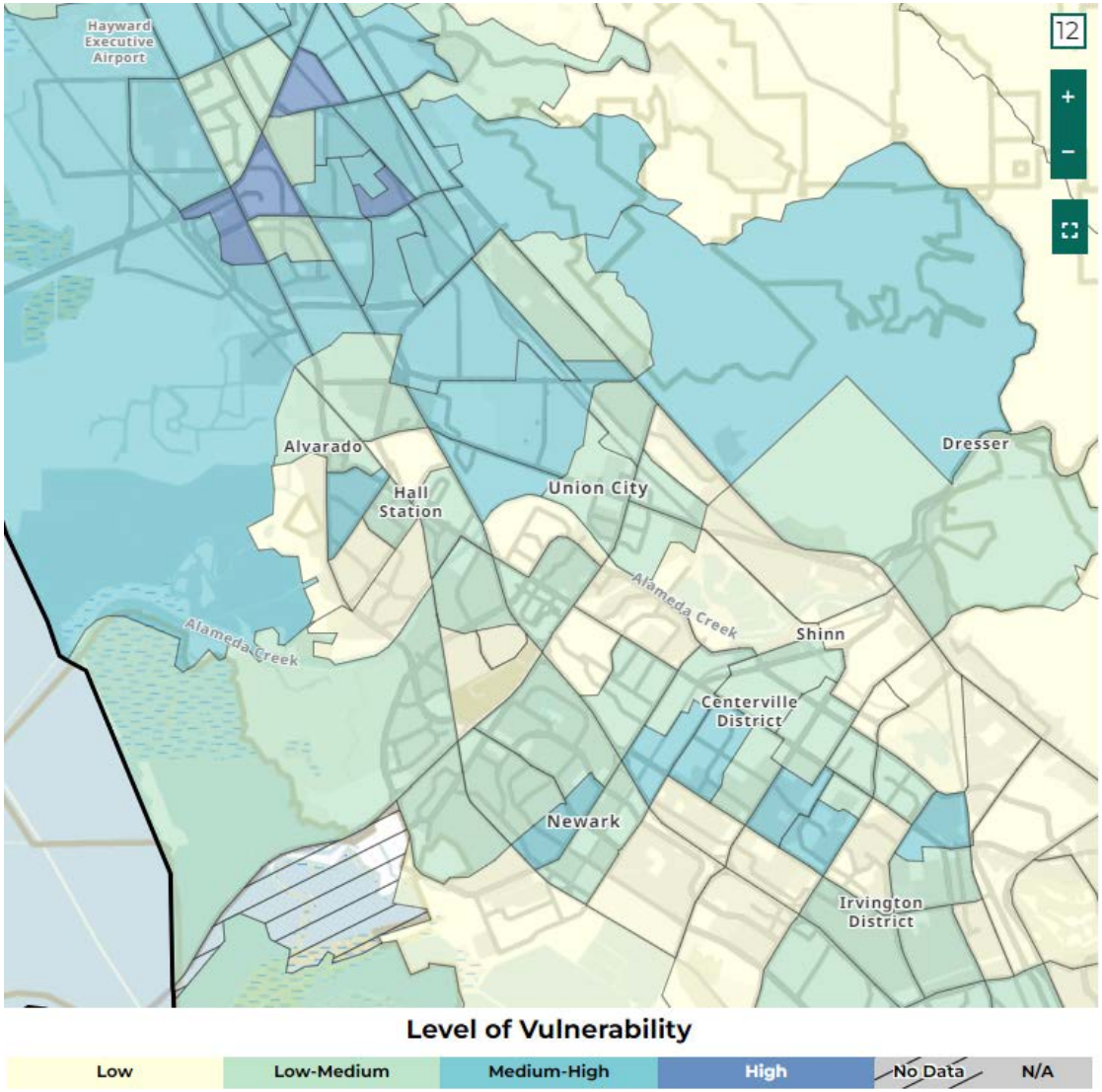
Within Union City, there exists an array of populations vulnerable to the effects of climate change. The Social Vulnerability Index (SVI), developed by the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry, is a tool intended to assist local planners in better preparing for and responding to hazards by identifying and mapping areas where populations are most likely to need support before, during, and after a hazardous event, including those linked to or exacerbated by climate change. The SVI groups 15 distinct census-derived factors (e.g., poverty, lack of vehicle access, crowded housing) into four themes (i.e., socioeconomic status, household composition/disability, race/ethnicity/language, housing type/transportation) that summarize the extent to which an area is socially vulnerable to hazards. Figure 5 displays the SVI for Union City. As shown, the most vulnerable populations are primarily in the central areas of the city, with a medium-high level of vulnerability. Areas to the west and east of the central city are rated with low -medium and low levels of vulnerability. Specific vulnerable populations in Union City include, but are not limited to, children, pregnant people, the elderly, communities of color, linguistically isolated communities, individuals experiencing homelessness, low-income individuals, individuals with access and functional needs, workers in vulnerable occupations, and those with preexisting health issues. It is important to plan for all groups that, for one reason or another, lack available resources or capacity to react or adapt to the impacts of climate change.

Water Supply and Quality

Climate change is expected to increase the pressure on and competition for water resources, worsening water supplies that are already scarce because of ongoing drought conditions. Decreased snowpack and spring stream flows and increased demand for water from a growing population and hotter climate could lead to increasing water shortages. Water supplies are also at risk from rising sea levels.

The San Francisco Bay Area is expected to experience reduced reservoir supplies and river flows as a result of increased temperatures and reduced snowpack in the Sierra Nevada. Conversely, the region may experience more intense rainfall events that could increase demand for reservoir capacity to provide for water capture and storage. As a result, water supplies are expected to decrease and water yields from reservoirs are expected to become more unreliable. As temperatures rise, water demands are expected to increase and could result in a longer season of peak treated water demands. Competition for water is expected to increase among cities, farmers, and the environment.

FIGURE 5
UNION CITY SOCIAL VULNERABILITY INDEX



Source: ATSDR 2022.

Changes to air and land temperatures will have an impact on the timing, amount, type, and location of precipitation and runoff. This will impact the quantity of water supplies, the management of those quantities, the quality of source water, and the demand for treated drinking water. Changes in source water quantity and quality may impact the treatment necessary to produce potable drinking water. These changes could result in additional required treatment processes and increased costs for treated drinking water.

Adaptive Capacity

Adaptive capacity refers to a community's current and future ability to address climate change and its associated effects and impacts. A review of Union City's existing policies, plans, programs, and resources, as well as those from relevant regional and State agencies and organizations, informed this assessment of Union City's current ability to minimize vulnerability to hazards and adapt to climate change over the long-term. While there is some level of existing adaptive capacity, these efforts do not comprehensively identify all the strategies and actions that will need to be implemented by Union City and other agencies to adequately address the full scope and magnitude of potential impacts from climate change. Climate change will increase the frequency and severity of some hazards in the future, requiring updates to emergency response and land use planning, new policies and programs, and new strategic partnerships.

Existing Planning Efforts

This section summarizes current State, regional, and local planning efforts that account for climate change and its associated effects, hazards, and impacts. It should be noted that though this section presents an array of planning efforts, it is not all-encompassing, as additional policies, plans, programs, and resources may be available that address climate change within Union City. This section should serve as a high-level overview, and the planning efforts that are reviewed and summarized are arranged alphabetically.

2017 Clean Air Plan: Spare the Air, Cool the Climate

Prepared by the Bay Area Air Quality Management District (BAAQMD) and adopted in 2017, the 2017 Clean Air Plan: Spare the Air, Cool the Climate (Clean Air Plan) encompasses the entire San Francisco Bay Area, inclusive of Union City, and focuses on two closely related goals, which includes protecting public health and protecting the climate. The Clean Air Plan describes a multi-pollutant strategy to simultaneously reduce emissions and ambient concentrations of ozone, $PM_{2.5}$, toxic air contaminants, as well as GHGs that contribute to climate change. Additionally, it describes a vision for a thriving region with clean air, a stable climate, a robust natural environment, and a prosperous and sustainable economy (BAAQMD 2017).

Adapting to Rising Tides, Bay Area: Regional Sea Level Rise Vulnerability and Adaptation Study

Prepared in March 2020, the *Adapting to Rising Tides, Bay Area: Regional Sea Level Rise Vulnerability and Adaptation Study* (ART Bay Area Report) presents a story of what consequences the San Francisco Bay Area may face as sea levels rise in the absence of coordinated, prioritized adaptation efforts. The ART Bay Area Report represents a commitment by many agencies to proactively manage the functionality and sustainability of critical regional assets in an uncertain future, and it speaks directly to the San Francisco Bay Area's most critical regional transportation and land use plan, *Plan Bay Area 2050* (ART 2020).

CAL FIRE Santa Clara Unit: Strategic Fire Plan

The *CAL FIRE Santa Clara Unit: Strategic Fire Plan* (SFP), prepared in 2022, identifies and prioritizes pre-fire and post-fire management strategies and tactics meant to reduce the loss of values at risk within the SRA and Mutual Threat Zones within the jurisdiction of the Santa Clara Unit (SCU), which includes Union City. Additionally, the SFP provides planning information on a Unit-wide scale; recognizes the

variation in fuels, weather, topography, and community/agency priorities present in each area the Unit serves; and recommends measures to reduce the ignitability of structures throughout the SCU's jurisdiction (CAL FIRE 2022).

California's Fourth Climate Change Assessment: San Francisco Bay Area Region Report

The *San Francisco Bay Area Region Report* (SFBA Report) of *California's Fourth Climate Change Assessment*, published in January 2019, is one of a series of nine regional climate vulnerability assessments in California that provide an overview of region-specific climate science and anticipated climate-related changes, specific strategies to adapt to climate impacts, and key research gaps needed to safeguard the region from climate change. The SFBA Report breaks down regional vulnerability by ecosystems and biodiversity, water resources, and communities and provides adaptation strategies applicable to Union City (OPR, CEC, and CNRA 2018b).

Caltrans Climate Change Vulnerability Assessments: District 4 Technical Report

The *Caltrans Climate Change Vulnerability Assessments: District 4 Technical Report* (District 4 Report), created in 2018, was developed for the California Department of Transportation (Caltrans) and summarizes the climate change-specific vulnerabilities of the portion of the State Highway System (SHS) located in Caltrans District 4, which encompasses Union City. The report is divided into sections by climate stressor (e.g., wildfire, temperature, precipitation) and each section presents how that climate stressor is changing, the data used to assess SHS vulnerabilities from that stressor, and the methodology for how that data was developed. Additionally, the District 4 Report outlines a recommended framework for prioritizing projects that might be considered by Caltrans in the future (Caltrans 2018).

Climate Change and Health Profile Report: Alameda County

Primarily produced by the California Department of Public Health (CDPH), the *Climate Change and Health Profile Report: Alameda County* (CCHPR) seeks to provide a county-level summary of information on current and projected risks from climate change and potential health impacts, which includes Union City. The CCHPR represents a synthesis of information on climate change and health for communities based on recently published reports of State agencies and other public data. It is part of a suite of tools that is being developed by CDPH to support local, regional, and statewide efforts of the public health sector to build healthy, equitable, resilient, and adaptive communities ready to meet the challenges of climate change (CDPH 2017).

Community Wildfire Protection Plan 2015 Update: Alameda County

The *Community Wildfire Protection Plan 2015 Update: Alameda County* (CWPP) was prepared by the Diablo Fire Safe Council. The CWPP provides a comprehensive, scientifically based analysis of wildfire related to the hazards and risk in the wildland-urban interface areas of Alameda County, inclusive of Union City. The CWPP follows the standards for community wildfire protection plans that have been established by the federal Healthy Forest Restoration Act by identifying and prioritizing fuel reduction opportunities across Alameda County, addressing structural ignitability, and collaborating with stakeholders (DFSC 2015).

Union City/Newark Multi-Jurisdictional Hazard Mitigation Plan

Prepared in 2017, the *Union City/Newark Multi-Jurisdictional Hazard Mitigation Plan* (MJHMP) is a federally compliant plan for hazard mitigation planning that intends to reduce risks from hazards, such as some of the climate hazards previously discussed. Federal regulations require periodic updates of hazard mitigation plans, and the MJHMP serves as an update to the 2010 version. The guiding principle of the MJHMP states: "through partnerships, maintain and enhance the disaster resistance of Union City and Newark by reducing the

potential loss of life, property, damage, and environmental degradation from natural disasters, while accelerating economic recovery from those disasters." (City of Union City and City of Newark 2017).

Union City Climate Action Plan

The Union City Climate Action Plan (CAP), adopted in 2010, was created with the target of reducing GHG emissions 20 percent below 2005 levels by the year 2020. The CAP examines sectors such as land use, transportation, buildings and energy, water conservation, and waste reduction, among others, and sets out strategies that require the full commitment and involvement of local residents and businesses to help the community move towards a lower carbon future. Though the focus of the CAP is to reduce GHG emissions, many of the strategies also intersect with climate change adaptation and are intended to make Union City a more attractive place to live through decreased traffic congestion, better air quality, cheaper energy and water bills, less waste, greener streets, and more local jobs. An update to the CAP is scheduled to begin in late 2023.

Urban Water Management Plan 2020-2025

The *Urban Water Management Plan 2020-2025* (UWMP), prepared by the Alameda County Water District (ACWD), which serves the vast majority of Union City residents, was developed in response to the State's Urban Water Management Planning Act, which requires that every urban water supplier prepare and adopt an urban water management plan and update the plan every 5 years. This version of the UWMP is the eighth plan adopted by ACWD's Board of Directors. The UWMP specifically outlines past, current, and future water use, sources of water supply and water supply strategy, groundwater management, demand management, and water recycling, and is required to account for climate change in risk assessments and future projections (ACWD 2021a).

Water Shortage Contingency Plan

The *Water Shortage Contingency Plan* (WSCP), which is a separately prepared chapter within the UWMP, serves to detail the generalized actions that ACWD would take in an actual water shortage emergency under various degrees of severity (ACWD 2021b). In addition to the generalized actions that ACWD would take in an emergency, the WSCP also includes a water supply reliability analysis and annual water supply and demand assessment procedures.

Summary of Existing Planning Efforts

Table 7 identifies the specific climate hazards covered under each of the plans and reports presented above. As shown in the table, multiple planning efforts address the climate hazards that are expected to affect Union City. Most of the policies provided in existing plans are broad-based strategies to reduce risk from climate change. Thus, it is important to note that an emphasis on specific and targeted policies should continue to be developed to improve the resilience of the most vulnerable populations and assets in Union City.

TABLE 7 SUMMARY OF EXISTING PLANNING EFFORTS Union City 2023					
Plan or Report	**Prepared By**	**Climate Hazards**			
		Extreme Heat	**Wildfire**	**Sea Level Rise[1], Extreme Precipitation and Flooding**	**Drought**
2017 Clean Air Plan: Spare the Air, Cool the Climate	BAAQMD	✓	✓		
Adapting to Rising Tides, Bay Area: Regional Sea Level Rise Vulnerability and Adaptation Study	BCDC			✓	
CAL FIRE Santa Clara Unit: Strategic Fire Plan	CAL FIRE		✓		
California's Fourth Climate Change Assessment: San Francisco Bay Area Region Report	OPR, CEC, and CNRA	✓	✓	✓	✓
Caltrans Climate Change Vulnerability Assessments: District 4 Technical Report	Caltrans	✓	✓	✓	
Climate Change and Health Profile Report: Alameda County	CDPH	✓	✓	✓	✓
Community Wildfire Protection Plan 2015 Update: Alameda County	DFSC		✓		✓
Union City/Newark Multi-Jurisdictional Hazard Mitigation Plan	City of Union City and City of Newark	✓	✓	✓	✓
Union City Climate Action Plan	City of Union City	✓	✓	✓	✓
Urban Water Management Plan 2020-2025	ACWD			✓	✓
Water Shortage Contingency Plan	ACWD				✓

Notes: ACWD = Alameda County Water District; BAAQMD = Bay Area Air Quality Management District; BCDC = Bay Conservation and Development Commission; CAL FIRE = California Department of Forestry and Fire Protection; Caltrans = California Department of Transportation; CDPH = California Department of Public Health; DFSC = Diablo Fire Safe Council; OPR, CEC, and CNRA = California Governor's Office of Planning and Research, California Energy Commission, and California Natural Resources Agency.
[1] Sea Level Rise was presented as a Climate Change Effect but is considered a Climate Hazard in this table.
Source: Ascent Environmental 2022.

In addition to the plans and reports presented above, there is an array of more specific policies, projects, and programs that strengthen the adaptive capacity of Union City to climate change effects and climate hazards. Some of these policies, projects, and programs are enacted by Union City, and some are enacted by Alameda County t or other regional partners. For example, Union City has an entire section of its Municipal Code dedicated to flood hazard reduction, including flood standards for new construction (e.g., anchoring, construction materials and methods, elevation and floodproofing), for utilities, and for subdivisions, among others. Additionally, Union City's award-winning "H Street Green Street Improvement Project," completed in 2018, was a sustainable redevelopment project that created low-impact, green infrastructure that mimics natural systems to provide essential stormwater drainage, increased groundwater recharge, and intends to reduce the urban heat island effect, among many other benefits (City of Union City 2022). A broader, county-level program that is intended to save lives during hazard events (e.g., floods, extreme heat, wildfire) is known as "AC Alert." AC Alert is a mass notification system that residents within Alameda County, including Union City, can opt into and is capable of rapidly disseminating hazard-related alerts by voice, text, or email, as well as messaging Nixle subscribers, posting to social media pages, and sending FEMA wireless alerts (County of Alameda 2022). This is an important program, as robust and far-reaching alert or warning systems is essential in saving lives, especially in the context of climate change and worsening hazards. There are many additional policies, projects, and programs that address climate hazards within Union City, but the ones presented here are intended to provide a brief insight into the various types of activities that are being conducted to make Union City more resilient in the face of climate change.

When it comes to climate change, Union City's adaptive capacity is largely influenced by its multi-pronged approach of enacting local policies and projects, collaborating on local and regional plans and reports, and coordinating with the Alameda County government and other regional organizations to effectively manage programs that are intended to protect Union City's populations and assets. Over time, each of these plans, reports, policies, and programs should continue to be reevaluated and strategically reworked to account for changing hazard profiles influenced by climate change.

Climate Change Vulnerability

Climate change vulnerability is based on the magnitude of risk to and potential impacts on populations, the built environment, and community functions, while considering the current level of adaptive capacity in place to mitigate these impacts. Though potential impacts associated with climate change will always exist to some degree, the severity of those impacts can be diminished by improving adaptive capacity to better account for changing hazard profiles. Union City's vulnerability to climate change and its associated effects and impacts should be reassessed and monitored over time to inform the development and prioritization of adaptation strategies that may be implemented by the City and partner agencies. Existing planning efforts will need to be continually built upon to minimize the level of vulnerability to climate change experienced within the city.

Regulatory Setting

Federal

Executive Order 14008. Executive Order (EO) 14008, titled "Tackling the Climate Crisis at Home and Abroad" and signed by President Biden on January 27, 2021, officially had the United States rejoin the Paris Agreement, created a Special Presidential Envoy for Climate, and called for the development of a climate finance plan. Additionally, EO 14008 tackles climate action plans, data, and information products to improve adaptation and increase resilience, and calls for sustainable infrastructure and millions of green jobs, among other actions to mitigate and adapt to the effects and impacts of climate change.

Federal Emergency Management Agency. In March 2003 the Federal Emergency Management Agency (FEMA) became part of the U.S. Department of Homeland Security. FEMA's continuing mission within the new department is to lead the effort to prepare the nation for all hazards and effectively manage Federal response and recovery efforts following any national incident. FEMA also initiates proactive mitigation activities, trains first responders, and manages the National Flood Insurance Program and the U.S. Fire Administration.

U.S. Environmental Protection Agency. EPA is responsible for developing and enforcing regulations that implement environmental laws enacted by Congress. EPA is responsible for researching and setting national standards for a variety of environmental programs, and delegates to states and tribes the responsibility for issuing permits, monitoring, and enforcing compliance. EPA provides technical information related to adaptation planning and supports numerous adaptation efforts throughout the country.

State

Assembly Bill 1482. Assembly Bill (AB) 1482, passed in 2015, required the California Natural Resources Agency (CNRA) to update the State's climate adaptation strategy by July 1, 2017, and every three years thereafter. The most recent update of the strategy, released in 2021, builds on successful elements of previous strategies, and reflects recent efforts to double down on protecting communities, the economy, and nature from the impacts of climate change. This update: 1) organizes the state's climate adaptation efforts around six outcome-based resilience priorities and increases the ability to measure progress; 2) breaks down silos and unifies collective climate adaptation efforts across all sectors and regions; and 3) makes it easier for Californians to understand and contribute to California's climate resilience agenda.

Senate Bill 379. Senate Bill (SB) 379 requires all cities and counties to include climate adaptation and resiliency strategies in the next update of their general plans beginning January 1, 2017. The update must include a vulnerability assessment that identifies the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts; a set of adaptation and resilience goals, policies, and objectives based on the information specified in the climate vulnerability assessment for the protection of the community; and a set of feasible implementation measures designed to carry out the goals, policies, and objectives identified pursuant to the adaptation objectives.

Key Terms

The following key terms used in this chapter are defined as follows:

Atmospheric River. A meteorological phenomenon that draws water vapor from the Pacific Ocean near the equator and transports it to the western coast of the United States.

Climate Change. An unprecedented trend of human-caused (i.e., anthropogenic) warming of Earth's climate, among other climatic disruption.

Climate Change Adaptation. Adaptation is preparing for climate change impacts that are expected to occur, by making adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects that are aimed at minimizing harm or taking advantage of beneficial opportunities.

Emissions Scenario. A plausible representation of the future development of emissions of substances that are potentially radioactively active (e.g., greenhouse gases, aerosols), based on a coherent and internally consistent set of assumptions about driving forces (e.g., demographic and socioeconomic development, technological change) and their key relationships. Concentration scenarios, derived from emissions scenarios, are used as input into a climate model to compute climate projections.

Extreme Heat Days. A day where the maximum temperature exceeds the 98^{th} historical percentile of maximum temperatures (based on daily temperature data between 1961-1990).

Extreme Precipitation Events. Events where two-day rainfall totals are above an extreme threshold (i.e., days having precipitation at or exceeding the 95th percentile

Flood. A temporary rise in flow rate and/or stage (elevation) of any watercourse or stormwater conveyance system that results in runoff exceeding normal flow boundaries and inundating adjacent, normally dry areas.

Greenhouse Effect. The earth's natural warming process. Certain atmospheric gases that trap heat in the atmosphere, causing the greenhouse effect, are referred to as greenhouse gases.

Greenhouse Gas. Any gas that absorbs infrared radiation in the atmosphere. GHGs contribute to the greenhouse effect. Some GHGs such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The principal GHGs that enter the atmosphere because of human activities include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Chlorofluorocarbons (CFCs), and fluorinated gases [hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)].

Heat-related Illness. A group of physically related illnesses caused by prolonged exposure to hot temperatures, restricted fluid intake, or failure of temperature regulation mechanisms of the body. Disorders of heat exposure include heat cramps, heat exhaustion, and heat stroke.

Heat Waves. Heat waves are a prolonged period of excessive heat. A heat wave is defined as four or more consecutive extreme heat days.

Invasive Species. An introduced species that invades natural habitats.

Precipitation. The amount of rain, snow, hail, etc., that has fallen at a given place within a given period, usually expressed in inches or centimeters of water.

Sea level rise. An increase in the mean level of the ocean. Eustatic sea level rise is a change in global average sea level brought about by an alteration to the volume of the world ocean. Relative sea level rise occurs where there is a net increase in the level of the ocean relative to local land movements. Climate modelers largely concentrate on estimating eustatic sea level change. Impact researchers focus on relative sea level change.

Vector-borne Diseases. Diseases transmitted between hosts by a vector organism such as a mosquito or tick (e.g., malaria).

Vulnerability. The degree to which a system is exposed to, susceptible to, and (un)able to cope with and adapt to the adverse effects of climate change, including climate variability and extremes.

Wildfire. A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie.

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