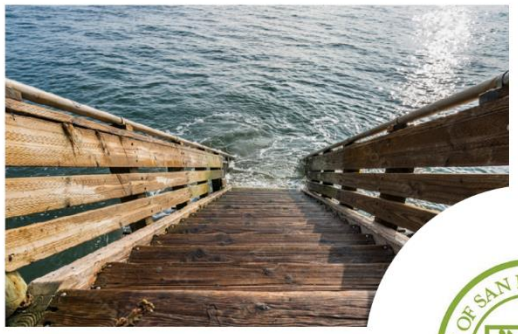

City of Ventura

Climate Change Vulnerability Assessment

July 2022

Prepared by

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1 Introduction

1.1 Background on Climate Change

This report evaluates how climate change may impact vulnerable community members, natural resources, buildings and facilities, and services and infrastructure in the City of Ventura. This report is consistent with Government Code § 65302 (as amended by Senate Bill (SB) 379) which requires cities, counties, and unincorporated areas across California to prepare a Climate Change Vulnerability Assessment to inform updates to the Public Safety Element of the General Plan. Understanding Ventura's vulnerabilities to climate change provides a foundation to develop required climate adaptation goals, policies, and implementation programs for the City's Public Safety Element. This report consists of the following:

Causes of Climate Change

Climate change is caused by the addition of excess greenhouse gases (GHGs) to the atmosphere, which traps heat near the earth's surface raising global average temperatures in what is referred to as the greenhouse effect. This increase in average temperatures across the globe affects sea level rise, precipitation patterns, the severity of wildfires, the prevalence of extreme heat events, water supply, and ocean temperatures and chemistry (NASA 2022). According to the Intergovernmental Panel on Climate Change (IPCC), GHGs are now higher than they have been in the past 400,000 years, raising carbon dioxide levels from 280 parts per million to 410 parts per million in the last 150 years (IPCC, 2021). The dramatic increase in GHGs is attributed to human activities beginning with the industrial revolution in the 1800s, which represented a shift from an agrarian and handicraft-based economy to one dominated by industry and machine manufacturing (NASA 2022).

1.2 City of Ventura Snapshot

The City of San Buenaventura is in Ventura County, California. Ventura is a coastal City set against the Pacific Ocean, undeveloped hills, and flanked by the Ventura River along its western edge and the Santa Clara River along its southern edge. The City is surrounded by the Transverse Range which are part of a large ecosystem comprised of hillsides, rivers, and seven miles of shoreline that provide rich habitat for many species. The Ventura region has been inhabited for thousands of years, initially by the Chumash, and was incorporated into a city in 1866 (County 2022).

The City borders the Pacific Ocean to the west, Oxnard to the south, Santa Paula to the east and Casitas Springs to the north. The County boundaries extend from Santa Barbara to Los Angeles along state route 101 and the City of Ventura encompasses an area of 32.09 square miles. In 2020, the City's population was 106,276 (County 2022).

For most of the 20th Century, Ventura was economically sustained by its role in the region's oil and agriculture industries. Today, the City of Ventura supports more diversified land uses with protected open spaces, managed parks, and extensive recreation opportunities. Beaches, museums, the harbor, the neighboring Channel Islands, and downtown areas attract over a million visitors annually. Oil and agriculture continue to provide economic stability, with diminishing importance, and County government currently remains the City's largest employer (City 2005).

1.3 Report Overview

1. **Introduction** provides a lexicon of terms used throughout the report and describes the methodology and key data sources used to prepare the Climate Change Vulnerability Assessment.
2. **Exposure to Climate Hazards** outlines climate drivers, relevant climate hazards, historical hazards events, how hazards are expected to change, and includes figures mapping climate hazards spatially across the City of Ventura.
3. **Sensitivity** identifies populations and assets most at risk to climate change.
4. **Adaptive Capacity** summarizes plans, policies, and programs that help the City of Ventura cope with climate hazard events.
5. **Vulnerability Analysis** describes potential impacts for each hazard based on sensitive community, natural, and built assets, with consideration given to their adaptive capacity. The chapter includes vulnerability scores of low, medium, or high for each population group and asset. See Vulnerability Scoring Methodology section below for more detail.
6. **Conclusion** presents the key findings of this report.

1.4 Lexicon

Several words and phrases are used throughout the plan to illustrate climate vulnerabilities within Ventura.

- **Adaptation.** The process of adjustment to actual or expected climate and its effects, either to minimize harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate (IPCC, 2012).
- **Adaptive Capacity.** Ventura's ability to cope with and adjust to the impacts of climate change (Cal OES 2020).
- **Asset.** Referential to a resource, structure, facility, or service that is relied on by a community.
- **Cascading Impact.** Climate hazard caused impacts that compromise infrastructure or disrupt critical services (i.e., power supply or water conveyance) broadening the scope of impact past a singular subject to reliant subsystems and populations (Collins et al. 2019).
- average events occur simultaneously and increase the scope of impact or severity of the event; an additional risk brought about by increased frequency of events from climate change (Seneviratne et al. 2012).
- **Impact.** Effects on natural and human systems including effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure by interactions of climate hazards and the vulnerabilities of the effected (IPCC 2012).
- **Mitigation.** An act or sustained actions to reduce, eliminate, or avoid negative impacts or effects (Cal OES 2020).
- **Resilience.** The capacity of an entity (an individual a community, an organization, or a natural system) to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience (Cal OES 2020).

- **Climate Driver.** A change in the climate which acts as the main source of change for subsequent climate hazards. Climate drivers relevant to the City and discussed in this report are temperature and precipitation.
- **Climate Hazard**. A dangerous or potentially dangerous condition created by the effects of the local climate (Cal OES 2020). Climate hazards of concern for the City of Ventura are extreme heat, warm nights, chill hours, drought, wildfire, landslides, tule fog, riverine and stormwater flooding, and air quality.
- **Compounding Risk.** When two or more extreme events or
- **Sensitivities**. The degree to which a species, natural system, community, asset, or other associated system would be affected by changing climate conditions (Cal OES 2020).
- **Vulnerable Populations.** Vulnerable populations experience heightened risk and increase sensitivity to climate change and have less capacity and fewer resources to cope with, adapt to, or recover from climate impacts (Cal OES 2020).
- **Vulnerability.** The propensity or predisposition to be adversely affected (IPCC 2012).

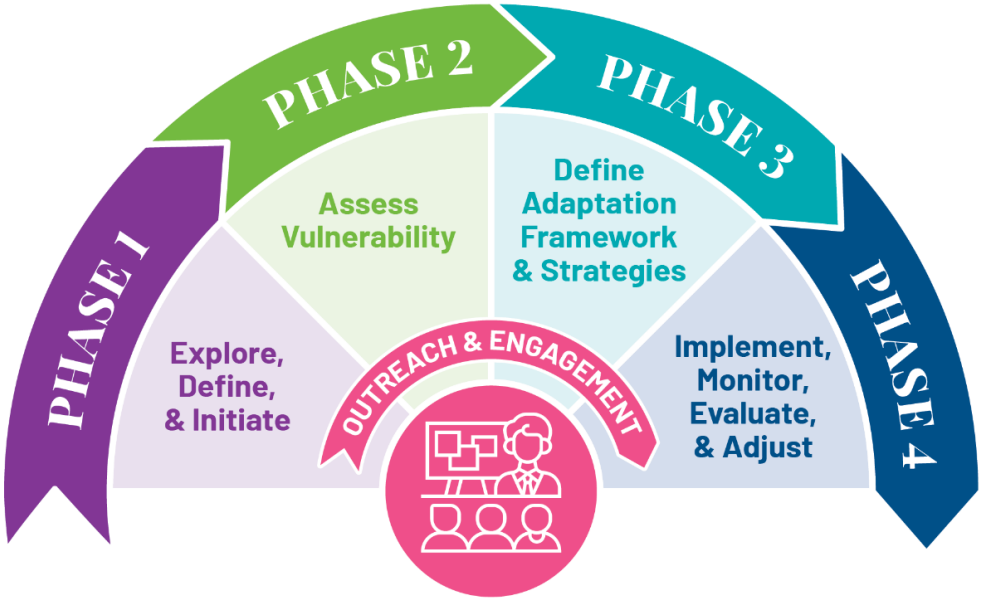
1.5 Vulnerability Assessment Methodology

The following section details state guidance, methods, and sources used in the production of this report.

California Adaptation Planning Guide Phases

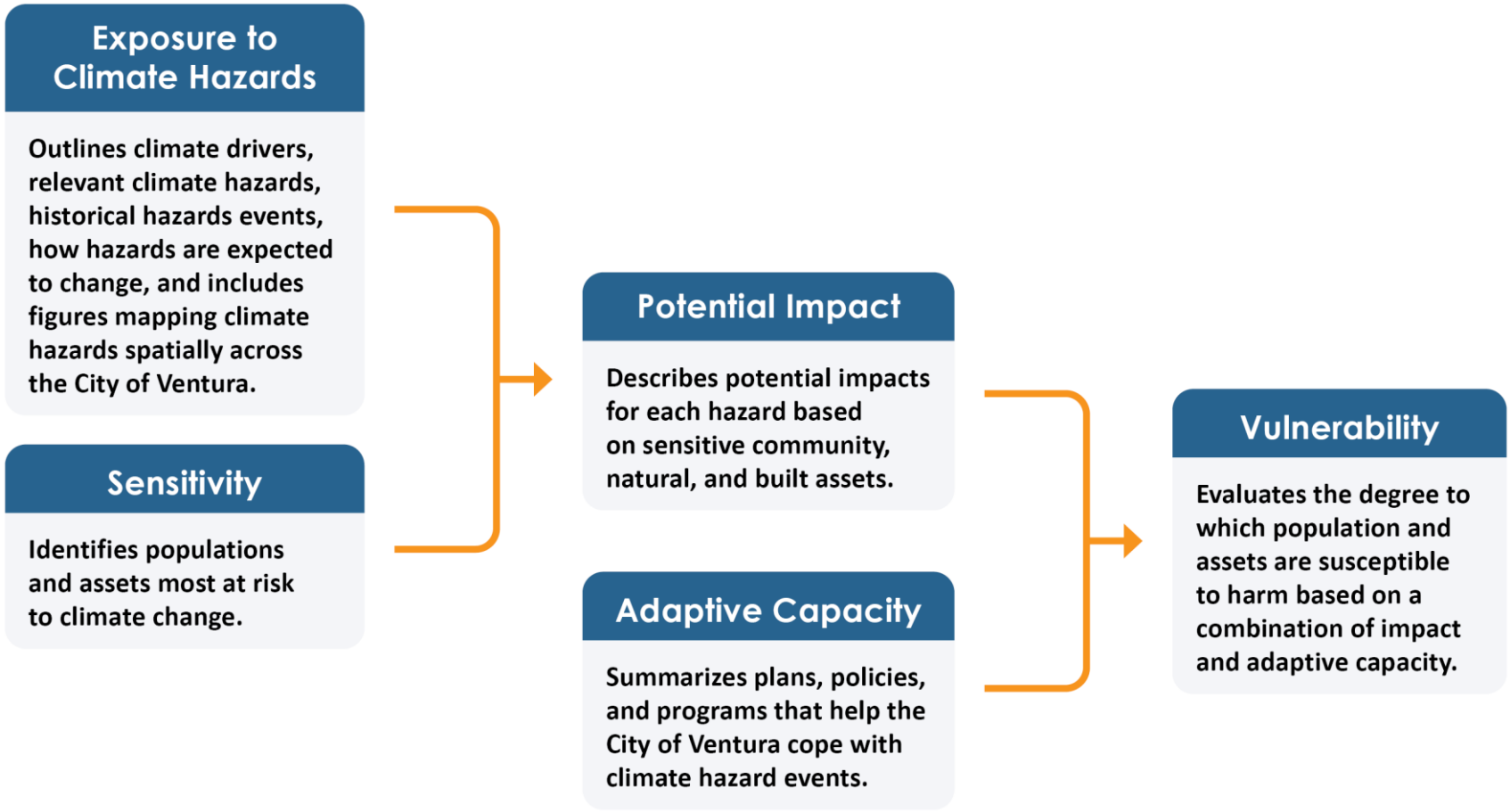
The City of Ventura Climate Change Vulnerability Assessment follows the vulnerability assessment process recommended by the California Governor's Office of Emergency Services (Cal OES), as documented in the 2020 California Adaptation Planning Guide (Cal APG). The adaptation planning process outlined by the Cal APG consists of four phases, illustrated in the graphic below, with Phase 2 detailing the vulnerability assessment process (Cal OES, 2020). The City of Ventura Climate Change Vulnerability Assessment is prepared consistent with Phase 2 of the Cal APG (see Figure 1) and is composed of the following parts found in Figure 2.

Figure 1 California Adaptation Planning Phases to Assessing Vulnerability



Source: 2020 California Adaptation Planning Guide

Figure 2 Vulnerability Assessment Flow Diagram



Key Data Sources

The following data sources and tools, many of which are recommended within the Cal APG, were used in preparation of this report.

- **U.S. Census, 2015-2019 American Community Survey (ACS)** presents demographic data by census tract and was used to supplement the HPI percentile score. U.S. Census data was used to identify the percentage of the City of Ventura population that corresponds to each vulnerable group
- **Cal-Adapt** is an online tool that presents historic and modeled projections based on 10 different global climate models. The tool was developed and is maintained by the University of California with oversight from the California Energy Commission (CEC). This tool is used to present projection data related to minimum and maximum temperature, precipitation, extreme heat, warm nights, drought, and wildfire.
- **California's Fourth Climate Change Assessment** was developed by the CEC and other State of California coordinating agencies to present up-to-date climate science, projections and potential impacts associated with climate change. The CEC and coordinating agencies developed nine regional reports to provide regional-scale climate information to support local planning and action. The Los Angeles Region Summary Report (2018) presents an overview of climate science, regional projections, specific strategies to adapt to climate impacts, and key research gaps needed to safeguard the greater Los Angeles area (including Ventura) from climate change. The Los Angeles Region Summary Report was used to understand regional changes that may affect the City of Ventura both directly and indirectly.
- **The California Healthy Places Index (HPI)** is an online mapping tool that reports on community conditions that are known to predict health outcomes and life expectancy. The tool was prepared by the Public Health Alliance of Southern California, a collaborative of local health departments in Southern California. HPI displays 25 community characteristics at various legislative boundaries, including census tracts and city and county boundaries. The community characteristics relate to the following identified Policy Action Areas: economic, education, housing, health care access, neighborhood, clean environment, transportation, and social factors. HPI applies a relative percentile score across all census tracts in California using statistical modeling techniques based on the relationship of the Policy Action Areas to life expectancy at birth. Low percentile scores reflect unhealthy conditions. HPI was used to prepare the social sensitivity index score as described in more detail below. HPI is a useful in providing both big picture and localized insights into community health. HPI was updated in the Spring of 2022 to include data averages from the U.S. Census 2015-2019 ACS.
- **The Nature Conservancy (TNC) Coastal Resilience Web Tool** is an online mapping tool showing potential impacts from sea level rise and coastal hazards designed to help communities develop and implement solutions that incorporate ecosystem-based adaptation approaches. This tool is available statewide but has detailed modelling for the Ventura area.
- **Ventura County Multi-Jurisdictional Hazard Mitigation Plan** presents information on existing processes and plans in place that address Ventura County and the City's ability to prepare for climate change impacts and informed the adaptive capacity discussion of this report. The Multi-Jurisdictional Hazard Mitigation Plan (2022) was also used to identify recent historical events.

- **Ventura County Resilient Coastal Adaptation Project** The County of Ventura's Resilient Coastal Adaptation Project (VC Resilient) uses best available science to develop a balanced and forward-thinking response to sea level rise. It considers various coastal hazards and has several web tools and story maps to help disseminate SLR information to the affected communities. The website contains many resources including related county ordinances, plans, projects, and tools. The associated **Ventura County Sea Level Rise Assessment** is specific to unincorporated Ventura County, however, information in the assessment pertaining to the broader Ventura region is included in this report.

Data Limitations

- The limitations of this report and analysis stem from gaps in data availability and completeness of data methods. Census data can miss portions of the population (e.g., homeless populations) and general demographic information may not accurately capture populations vulnerable to climate change (Cantwell 2021). Federal Emergency Management Agency (FEMA) 100-year and 500-year flood plains do not account for climate change projections, zones are instead based on historical information. The California Department of Forestry and Fire Protection (CalFire) very high fire hazard severity zones are based on vegetation, fire history, and terrain but also has similar limitations, projections of future fire are not included (OSFM 2022). Extrapolating landslides and air quality hazard exposure data in the context of climate change is difficult and therefore expected exposures are likely to be underestimated.
- The data presented in **Cal-Adapt** tools are projections, or estimates, of the future. The limitation in these projections is that the long-term behavior of the atmosphere is expressed in averages – for example, average annual temperature, average monthly rainfall, or average water equivalent of mountain snowpack at a given time of year. The averages discussed often downplay the extremes by which daily weather events occur and when presented as an average, only show moderate changes within the climate. For example, what is using averages can result in an omission of the frequency of extremes. For example, in the case of like extreme weather events, atmospheric rivers may increase, while low-moderate intensity weather events decrease through the end of the century. In instances of modeled precipitation projections, an average maintains a quantification similar to historic levels which does not account for anticipated fluctuations in extremes (CEC 2021).

Vulnerability Scoring Methodology

Vulnerability scoring is a valuable step in the climate vulnerability assessment process because it identifies which assets and populations face the highest threat to climate hazards. This can aid in the prioritization of adaptation actions. The vulnerability score is a combination of the impact and adaptive capacity score and is discussed in the Vulnerability Analysis section of this report. The impact and adaptive capacity scores are developed using a qualitative methodology outlined in the Cal APG, as seen in Table 1. Impact and adaptive capacity scores are identified for each asset and population for each climate hazard.

Table 1 Impact and Adaptive Capacity Scoring Rubric

Score	Impact	Adaptive Capacity
Low	Impact is unlikely based on projected exposure; would result in minor consequences to public health, safety, and/or other metrics of concern.	The population or asset lacks capacity to manage changes; major changes would be required.
Medium	Impact is somewhat likely based on projected exposure; would result in some consequences to public health, safety, and/or other metrics of concern.	The population or asset has some capacity to manage climate impact; some changes would be required.
High	Impact is highly likely based on projected exposure; consequences to public health, safety, and/or other metrics of concern.	The population or asset has high capacity to manage climate impact; minimal to no changes are required.

Source: Cal OES 2020

The vulnerability score is prepared by combining the two scores as demonstrated in Table 2. The range of potential impacts spans 1 through 5 with 4-5 being at highest threat.

Table 2 Vulnerability Score Matrix

Potential Impacts	**High**	3	4	5
	Medium	2	3	4
	Low	1	2	3
		High	**Medium**	**Low**
		Adaptive Capacity		

Source: Cal OES 2020

2 Exposure to Climate Hazards

Climate change is a global phenomenon that can impact local health, natural resources, infrastructure, emergency response, and many other aspects of society. Projected changes to the climate are dependent on location. The Cal-Adapt tool provides climate data from global scale models that have been localized (downscaled) to 3.7 mile by 3.7-mile grids (CEC 2021). The data in Cal-Adapt is combined with information from the California Fourth Climate Change Assessment to model future changes in specific types of hazards within this report. Projections throughout this section are outlined by two separate Representative Concentration Pathways (RCPs) (CEC 2021).

- RCP 4.5 is a medium emissions scenario where global emissions peak by the year 2040
- RCP 8.5 is a high emissions scenario in which global emissions continue to rise through the end of the 21st century.

Additionally, projections are forecasted to mid-century (2035-2064) and end-century (2070-2099) as 30-year averages to be compared to a modeled historical baseline (1961-1990) (CEC 2021).

This section presents information on temperature and precipitation, which are characterized as climate drivers. The section then provides information on projected changes to natural hazards, including extreme heat and warm nights, drought, wildfire, landslides, riverine and stormwater flooding, air quality, and sea level rise, which result from changes to climate drivers.

2.1 Climate Drivers

In Ventura, the climate drivers of concern include temperature and precipitation. All projections are pulled from the Cal-Adapt Local Climate Change Snapshot tool and supplemented with the Los Angeles regional information found in the California Fourth Climate Change Assessment (CEC 2021, Hall et al. 2018).

Temperature

The average maximum and minimum temperatures are expected to increase in Ventura with mid-century projections showing a 3.5°F (RCP 4.5) to 4.3°F (RCP 8.5) increase in temperature maximum and minimums (CEC 2021). End-Century projections show a 4.5°F (RCP 4.5) to 7.1°F (RCP 8.5) increase in Ventura. Temperature increases affect extreme heat and warm nights, drought, wildfire, and air quality. Global temperature increases cause ocean temperatures to rise which expands ocean waters. Glaciers, ice caps, and ice sheets melt from rising temperatures which further contribute to sea level rise (Hall et al. 2018).

Precipitation

Ventura precipitation projections under RCP 8.5 demonstrate a 0.132-inch increase by mid-century and 0.289-inch increase by end-century in annual precipitation totals (CEC 2021). However, as already observed in recent decades precipitation changes are largely observed as more extreme variability with intensely wet years followed by extreme droughts (Hall et al. 2018). It is projected that the wettest day every year will increase by 25-30% by the end

of the century in some parts of the Los Angeles Region (Hall et al. 2018). There will be more dry periods punctuated by increased precipitation intensities of the largest storms or wet periods, producing little net change in precipitation totals but more extreme conditions (Hall et al. 2018). Precipitation changes are expected to affect wildfire, drought, landslides, riverine and stormwater flooding, and air quality.

2.2 Hazards

This section outlines projected changes for the following climate hazards:


Extreme Heat and Warm Nights


Drought


Wildfire

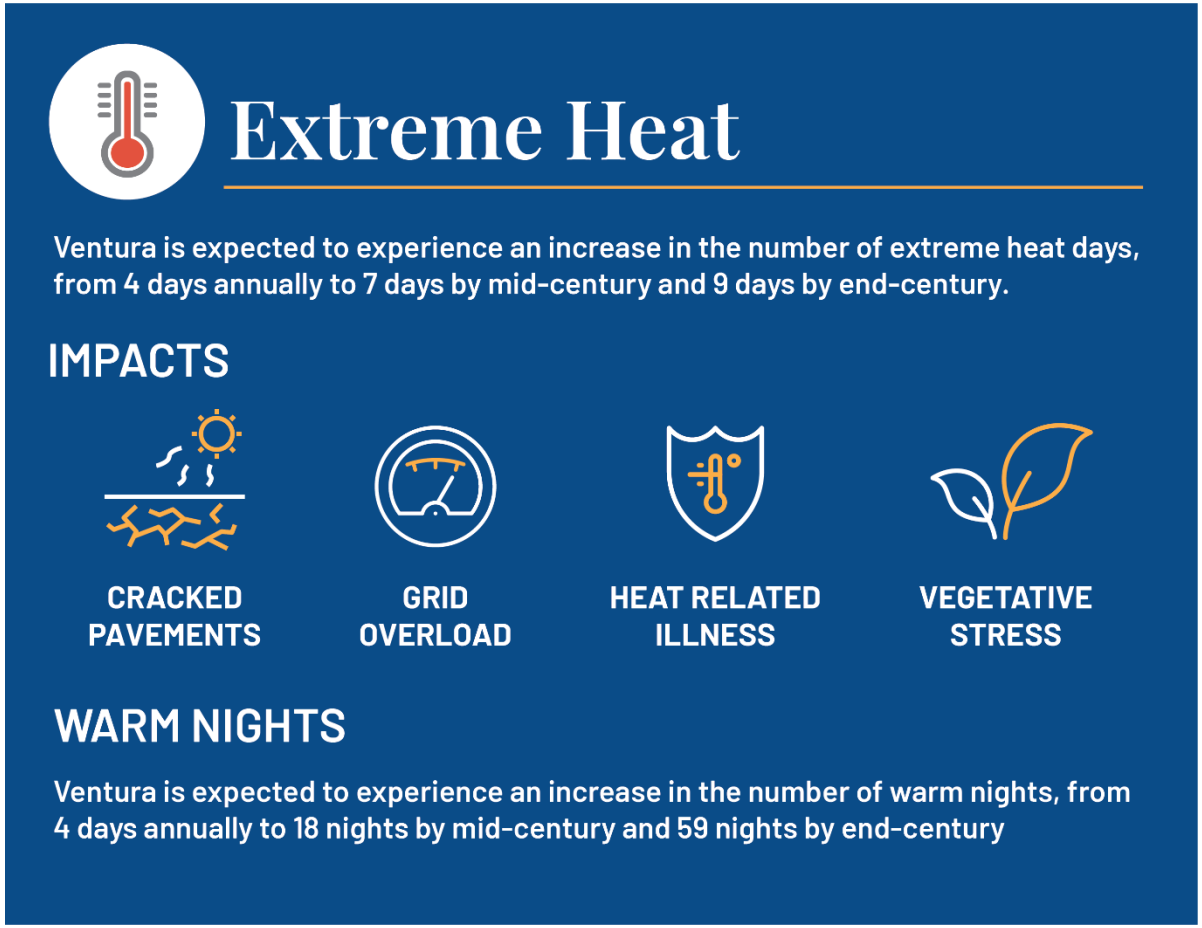

Landslides


Riverine and Stormwater Flooding


Air Quality


Sea Level Rise

Extreme Heat and Warm Nights

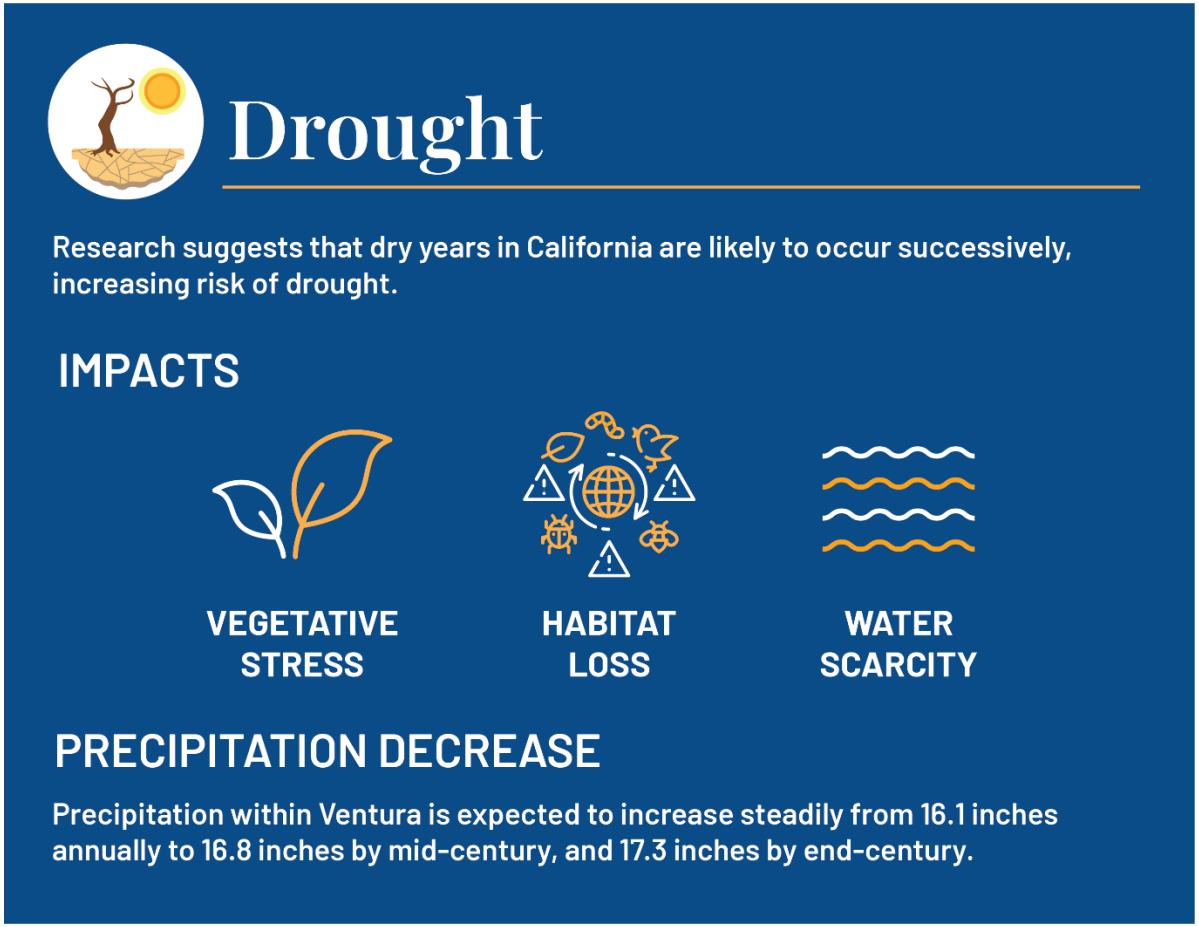


Extreme heat events are defined as days in which the daily maximum temperature exceeds the 98thpercentile value of the historical average (CEC 2021). For Ventura, the threshold temperature is 91.9°F (CEC 2021). Increased frequency of extreme heat days can result in increased public health risks, which tend to be disproportionate for vulnerable populations such as those experiencing homelessness, outdoor workers, older adults, children, and individuals with underlying chronic diseases. These include increased likelihood of heat-related illnesses such as heat stroke, and vector-borne illnesses. Warm nights can further exacerbate the risk of heat illness because they affect the body's ability to cool after a day of heightened temperatures, which may be mitigated with at home cooling systems including fans, air conditioning, and proper insulation. Due to the cost of acquiring and utilizing these systems, disproportionate effects are experienced by those with economic disadvantages. High concentrations of impervious surfaces such as pavements and roofs coupled with minimal tree canopy and green space can increase urban heat effect. This effect can cause temperature increases in urban areas by multiple degrees and is further exacerbated during heatwaves (Hall et al. 2018). Ventura has historically experienced 4 warm nights a year and is projected to experience a mid-century total of 25 nights (RCP 8.5) and an end-century total of 26 (RCP 4.5) to 59 nights (RCP 8.5) (CEC 2021). Extreme heat can also damage roadways, overload electrical grid systems, and result in vegetation die-off or stress.

Drought

Climate change will increase the likelihood that low-precipitation years will coincide with above-average temperature years. Warming temperatures increase seasonal dryness and the likelihood of drought due to decreased supply of moisture and increased atmospheric demand for moisture as evaporation from bare soils and evapotranspiration from plants increases. The increased moisture loss from soils and vegetation amplifies dryness during periods without precipitation. In California's highly variable climate setting, climate models project less frequent but more extreme daily precipitation, with year-to-year precipitation becoming more volatile and the number of dry years increasing (Hall et al. 2018).

The duration of dry spells is projected to vary based on emissions scenario. Like patterns in precipitation some of the annual variability is obscured within 30-year averages. Despite this, the clear trend is for maximum lengths of dry spells to increase through the end of century (CEC 2021).

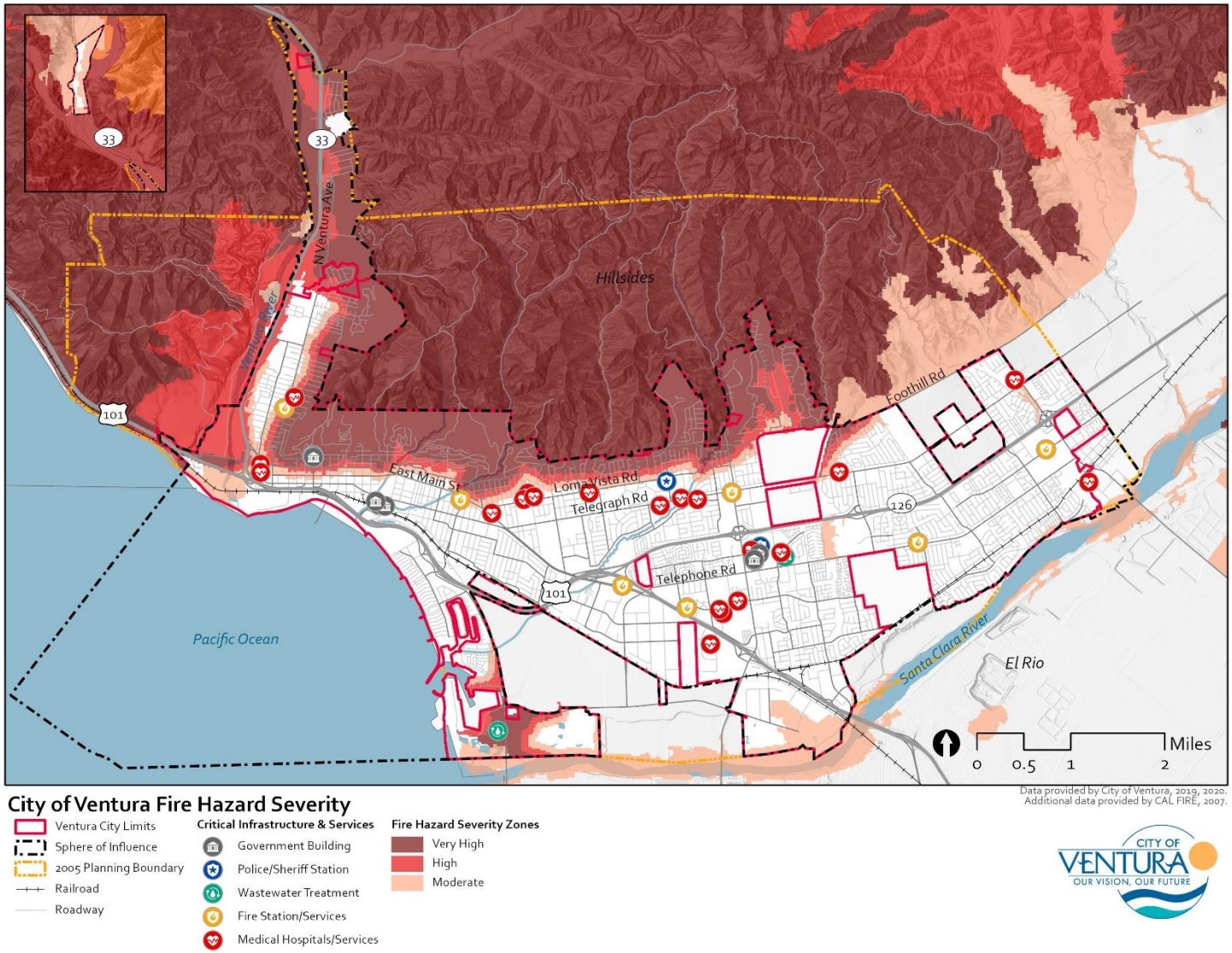


Drought can affect vulnerable populations as can suppress economic productivity throughout the Ventura region. Vulnerabilities for natural resources can include stressed vegetation and habitat depletion and populations may be more vulnerable to heat stress and dehydration (Hall et al. 2018). Additionally, sustained drought conditions can lead to dry, dusty conditions which can impact health, as discussed in the section on air quality below.

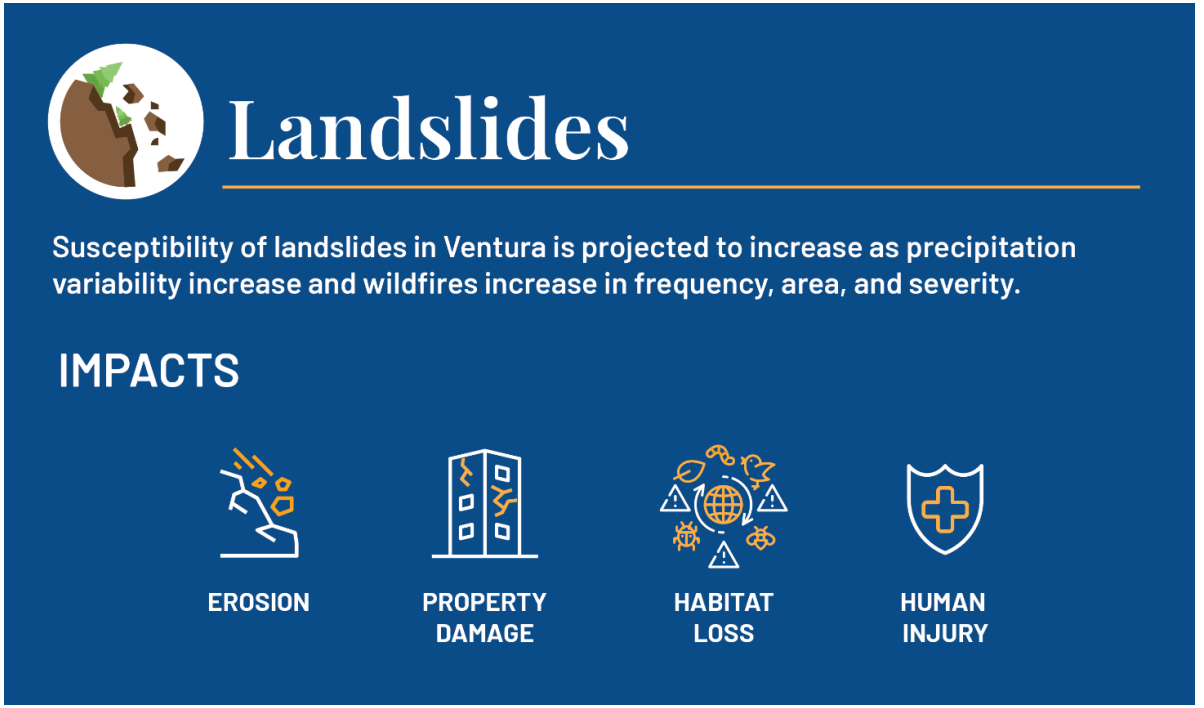
Wildfire

The occurrences of wildfires have increased significantly within California in frequency and intensity over the past two decades (Hall et al. 2018). For Ventura this trend is projected to follow through mid and end-century projections (CEC 2021). Wildfire events are a product of temperature increases compounded with precipitation declines creating wildfire prone conditions. Ventura County's wildfires are influenced by Santa Ana Winds, downed power lines, and fuel availability (Hall et al. 2018). Areas in Ventura that are of significant risk to wildfire are located along the northern portion of the City. These areas are categorized as CAL FIRE very high fire hazard severity zones (VHFHSZ), shown in Figure 3. There are several critical facilities within proximity to the VHFHSZ including medical facilities, government buildings, fire stations, and the police station. Several roads and residential areas are also located within the City's fire zone. Wildfires can create risk of injury, death, or financial hardship if personal property is damaged as well as physical damage to all other assets creating cascading risks for vulnerable populations when infrastructure is damaged or off-line. For example, individuals with chronic health conditions who rely on medical equipment for critical health care could be severely impacted by a wildfire-caused power outage. Since 2005 there have been 14 federal disaster declarations for Wildfire events in Ventura County, including the 2017 Thomas Fire which burned numerous structures and residences in the City of Ventura (County 2022).

Figure 3 Wildfire Hazard Severity Zones in the City of Ventura



Landslides

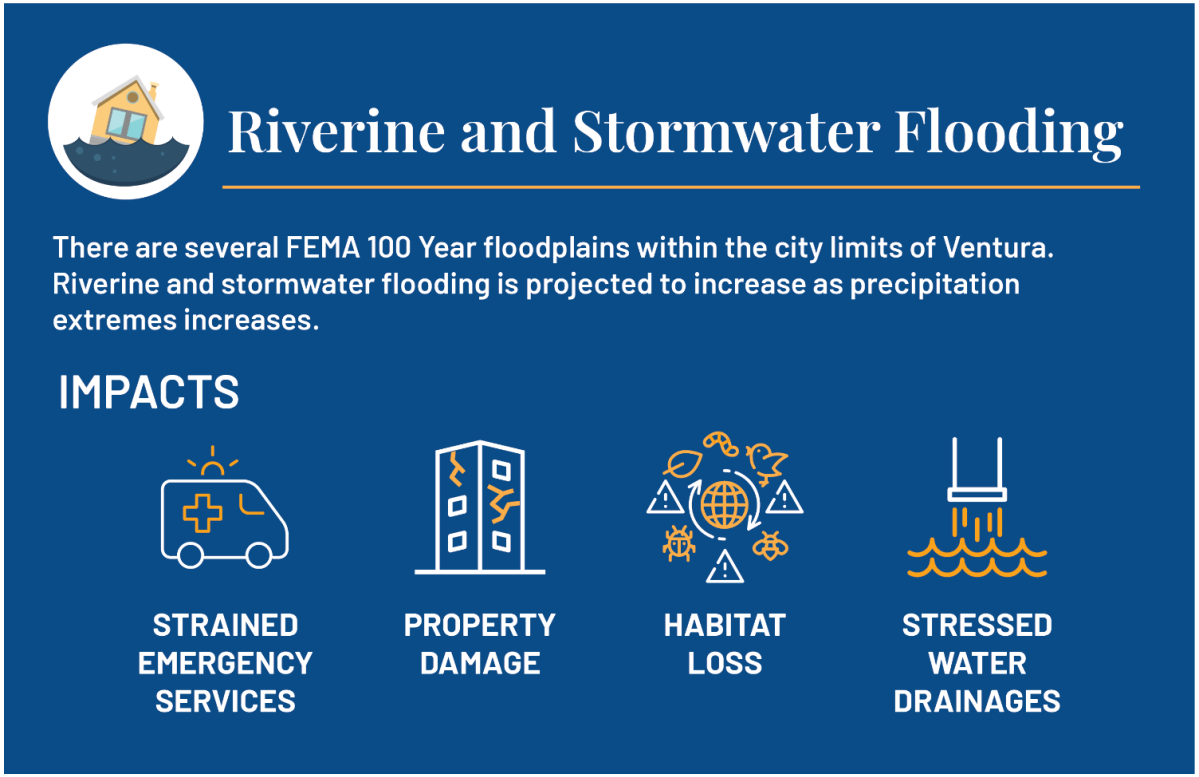


Triggered by extreme bouts of precipitation or wildfires, the susceptibility of the larger Ventura region to landslides is projected to increase as precipitation variability increases and wildfires increase in frequency, area, and severity (Hall et al. 2018). The Ventura Region is projected to experience increases to wildfire and precipitation and subsequently landslide-prone conditions (CEC 2021). Historically, landslides have occurred in the hillsides south of the Santa Clara River, and the east side of the Ventura River. Additional landslide prone regions in the City of Ventura overlap with wildfire zones (CDOC 2021). The Ventura County Multi-Jurisdictional Hazard Mitigation Plan ranks the risk for landslides as the highest of all other climate hazards for the City of Ventura. In 2017, The Thomas Fire burned over 500 homes in the City and left burn scars in the hillsides susceptible to landslides (County 2022). The susceptibility to deep-seated landslides is classified as high along most of the northern border of the City as well as along both sides of Highway 33. Specifically, the hillsides north of Poli Street/Foothill Road, and east of Ventura Avenue and Cedar Street contain several landslide prone areas and are likely to sustain future landslide activity (City 2021). The projected increase in precipitation extremes, alone and in combination with the projected increase in wildfires, creates increased overall potential for floods, mudslides, and debris flows in the City.

Historical Debris Flows

Following heavy rains and winter storms, substantial debris flows have occurred in the Santa Clara River, Ventura River, as well as other local streams and culverts. Debris flows following wildland fires are particularly bad and can require removal of material from streams, streets, culverts, and beaches.

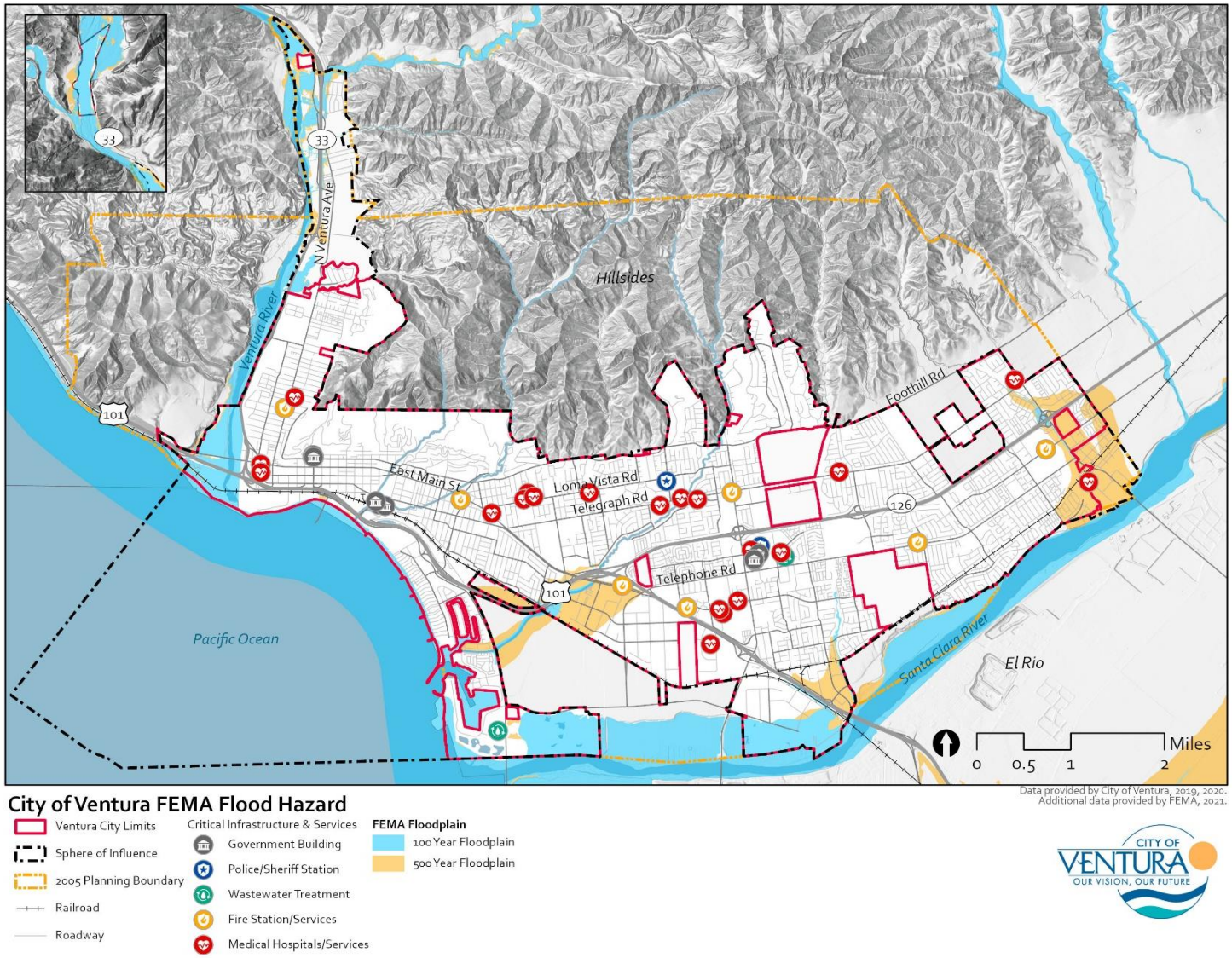
Riverine and Stormwater Flooding



Climate change may cause low-lying areas throughout Ventura to experience more frequent flooding and could increase the extent of 100-year floods, as seen in Figure 4. Stormwater systems may be overwhelmed more frequently as more extreme rain events occur, causing localized flooding which could impact properties and close streets. The Santa Clara and Ventura Rivers run through the City, as well as a series of seasonal watercourses called barrancas. FEMA regulates development along all City watercourses in the case of a 100-year flood event. While 100-year flood hazard zones for Ventura's watercourses are relatively limited, the largest recorded flood event along the Santa Clara and Ventura rivers in 1969 exceeded the 100-year flood zone (Ventura GPU 2005). The Multi-Jurisdictional Hazard Mitigation Plan for Ventura County identifies flooding as a medium risk, and notes that numerous areas of the City are subject to flooding during periods of high rain. The impact of the flooding includes street closures, and damage to property, vehicles, and buildings (County 2022).

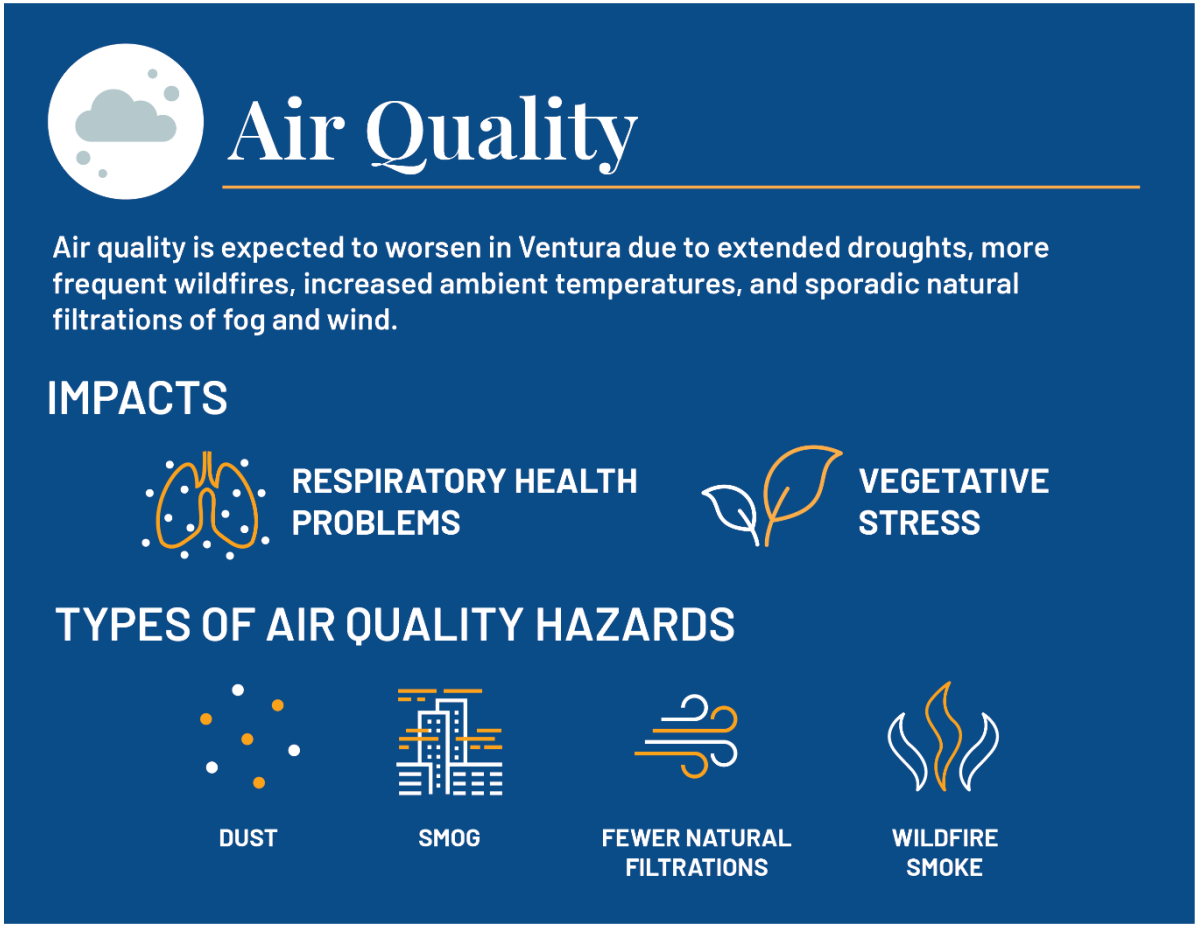
On record, there have been 23 flood events since 1954 that warranted Federal Disaster Declarations in Ventura County. These tend to occur in the winter and early spring following severe storms and/or wildfires and have become more frequent in recent history (County 2022). Flooding impacts cause physical damages from inundation, and can also have cascading effects on power, wastewater, and storm drainage infrastructure, exacerbating public health concerns (Hall et al. 2018).

Figure 4 100 and 500 Year Floodplain in the City of Ventura



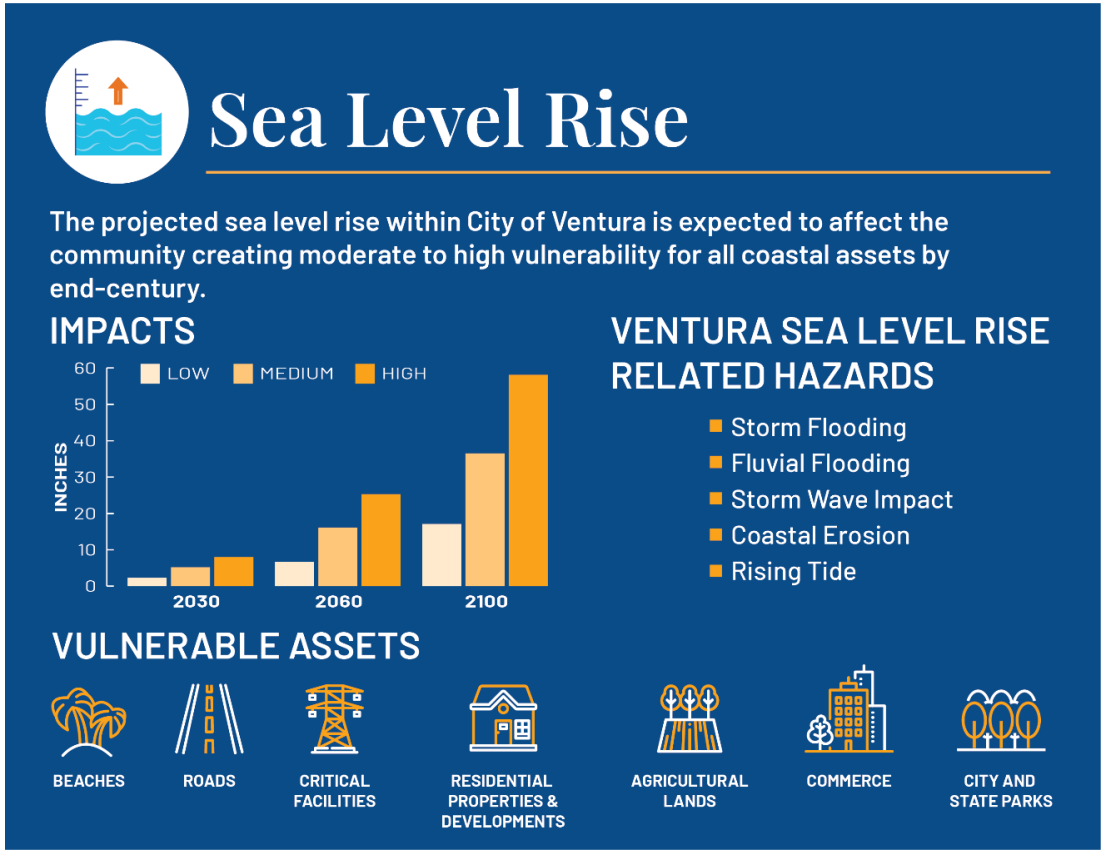
Air Quality

Worsening air quality due to climate change can create respiratory issues for vulnerable populations and impact indoor areas without adequate air filtration systems. There are several types of air quality decline sources found below:



- **Dust.** Increased temperature leads to dry, dusty conditions also associated with drought (Hall et al. 2018).
- **Smog.** Increases in ambient temperature can lead to higher rates of smog also referred to as ozone. Ground-level ozone specifically will be experienced at higher rates leading to raised cardiovascular and respiratory morbidity and mortality rates (CDPH, 2014). Ground-level ozone has also been shown to have particularly disproportionate adverse impacts on populations experiencing homelessness and lower median income (PNAS 2021). The City of Ventura will experience increases in ozone concentrations in parallel to temperature increases.
- **Fewer Natural Filtrations.** Precipitation variability and long periods of dry spells lead to less reliable air quality for the entire region. Moisture in the air can filter pollutants and provide for overall improved conditions.
- **Wildfire Smoke.** Temperature, severe wildfire conditions, and the area burned by wildfires throughout the state has increased and will continue to increase. Higher temperatures accompanied by an increase in the incidence and extent of large wildfires will lead to increased wildfire smoke and associated toxins and air pollution (Hall et al. 2018).

Sea Level Rise



- Sea levels in California are expected to rise in the coming decades as a result of global greenhouse gas emissions. It is anticipated that until mid-century, the most damaging events for the California coast will be dominated by large El-Niño-driven storm events in combination with high tides and large waves. By the end of the century, as sea levels continue to rise, scientists project that even small storms will cause substantial damage and large events will have unprecedented consequences (CCC 2018). The effects of sea level rise in Ventura include regular rising tides, coastal erosion, wave impact, storm flooding, and fluvial flooding. Climate change is expected to increase the rate of sea level rise dependent on the extent of warming temperatures. The Nature Conservancy Coastal Resilience Model provides precise hazard predictions and has been used for all the coastal planning in the Ventura region. This tool is available statewide and has detailed modeling for Ventura County. The following are Coastal Resiliency projections for SLR and related hazards for the Ventura region. They are provided for the years 2030, 2060, and 2100 at low, medium, and high SLR rates (TNC n.d.)
- By 2030, sea level is expected to rise 2.3” (in a low modeling scenario), 5.2” (in a medium outcome scenario), and 8.0” (in a high outcome scenario).
- By 2060, sea level is expected to rise 7.4” (low), 16.1” (medium), and 25.3” (high).
- By 2100, sea level is expected to rise 17.1” (low), 36.5” (medium), and 58.1” (high).

The following sub-sections discuss sea level rise related hazards and their current and projected impacts on the City of Ventura.

Coastal Erosion

Large portions of the California coast are susceptible to coastal erosion. As sea levels rise, the amount of time that beaches are exposed to waves and abnormally high tides increases, furthering beach erosion and substantially altering the width of beaches (CCC n.d.) Figure 6 shows projected coastal erosion in the City of Ventura for 2030, 2060, and 2100 (TNC n.d.) Sandy beaches and dunes are at risk of erosion related to sea level rise, with low-lying beaches, such as those in the City, being at particular risk (TNC 2021). 2030 projections show erosion potential surpassing the beach line and entering the residential community along Ventura Beach. The By 2060 and 2100, estimation of erosion impacts are expected to increase with the greatest change taking place north of Sanjon Road, where erosion will impact Shoreline Drive and the neighboring commerce.

Fluvial Flooding

The City of Ventura is set between two rivers, the Santa Clara and Ventura Rivers, both of which deposit into the Pacific Ocean. Fluvial flooding during storm events is expected to worsen as ocean water levels rise (TNC n.d.) As seen in Figure 4, models project fluvial floodplains along these rivers in the event of 100-year flood. The 100-year floodplain for the Santa Clara River extends from Olivas Park Drive to West Gonzales Road, with a breakout area reaching south of West Gonzales Road between South Victoria Avenue and West 5th Street.

Storm Flooding

Climate change may cause low-lying coastal areas to experience more frequent flooding and an increase in the inland extent of 100-year coastal floods. Drainage systems that discharge close to sea level may also have similar issues and inland areas may become flooded if outfall pipes back up with saltwater (CCC n.d.) Figure 7 shows projected storm flooding in the City of Ventura for 2030, 2060, and 2100 (TNC n.d.) During winter storms, increased temporary short-term flooding in tandem with sea level rise. If coupled with high tides and large waves, significant erosion and property damage is likely to occur. In a moderate SLR scenario of 14 inches or less – likely to occur before 2050—the risk of serious flooding to life and property would increase by orders of magnitude (Hall et al. 2018). The 2030 projections show impacts to nearly all the residences and commercial areas south of East Harbor Blvd. By 2060 and 2100, projections show flooding surpassing the Ventura Freeway at the intersection of Highway 33. This level of flooding could affect roads, residential developments, the wastewater treatment facility, and medical facilities, as well as commercial and industrial areas in the City.

Storm Wave Impact

Rising sea levels will cause waves to force water further inland, especially during coastal storm events (CCC n.d.) If waves become larger and more frequent, they are expected to increase erosion of beaches, possibly damaging properties, and development. Figure 8 shows projected storm wave impact in 2030, 2060, and 2100 in the City of Ventura (TNC n.d.) In 2015, waves of up to 15 feet resulted in the evacuation and closure of the Ventura Pier, and caused 15 pylons to break, causing an extended closure while repairs were made (County 2022). In 2030, storm wave impacts are expected encroach on the communities south of Ventura Beach, and the

Marina Park and Harbor areas. By 2060 and 2100, the impacts are magnified, and are projected to extend beyond the Ventura Highway at the intersection of Highway 33. These impacts could affect residential areas, parks and open space, medical and governmental facilities, as well as commercial and industrial areas in the City.

Rising Tide

Sea level rise will cause areas not currently exposed to the tide to become inundated (CCC n.d.) Unlike flooding, inundation results in permanent wetting, often resulting in the need to either protect or move infrastructure and development. Figure 9 shows projected rising tide impacts in 2030, 2060, and 2100 in the City of Ventura (TNC n.d.) In the City of Ventura, people experiencing homelessness live on or near the beach and are therefore at a greater risk during high tide events (County 2022). Near term impacts (i.e., 2030 and 2060) from projected rising tide in the City is minimal. By 2100, the rising tides are expected to impact Seaside Wilderness Park and residential and commercial structures near Marina Park in the area known as the Ventura Keys.

Figure 5 Sea Level Rise in the City of Ventura

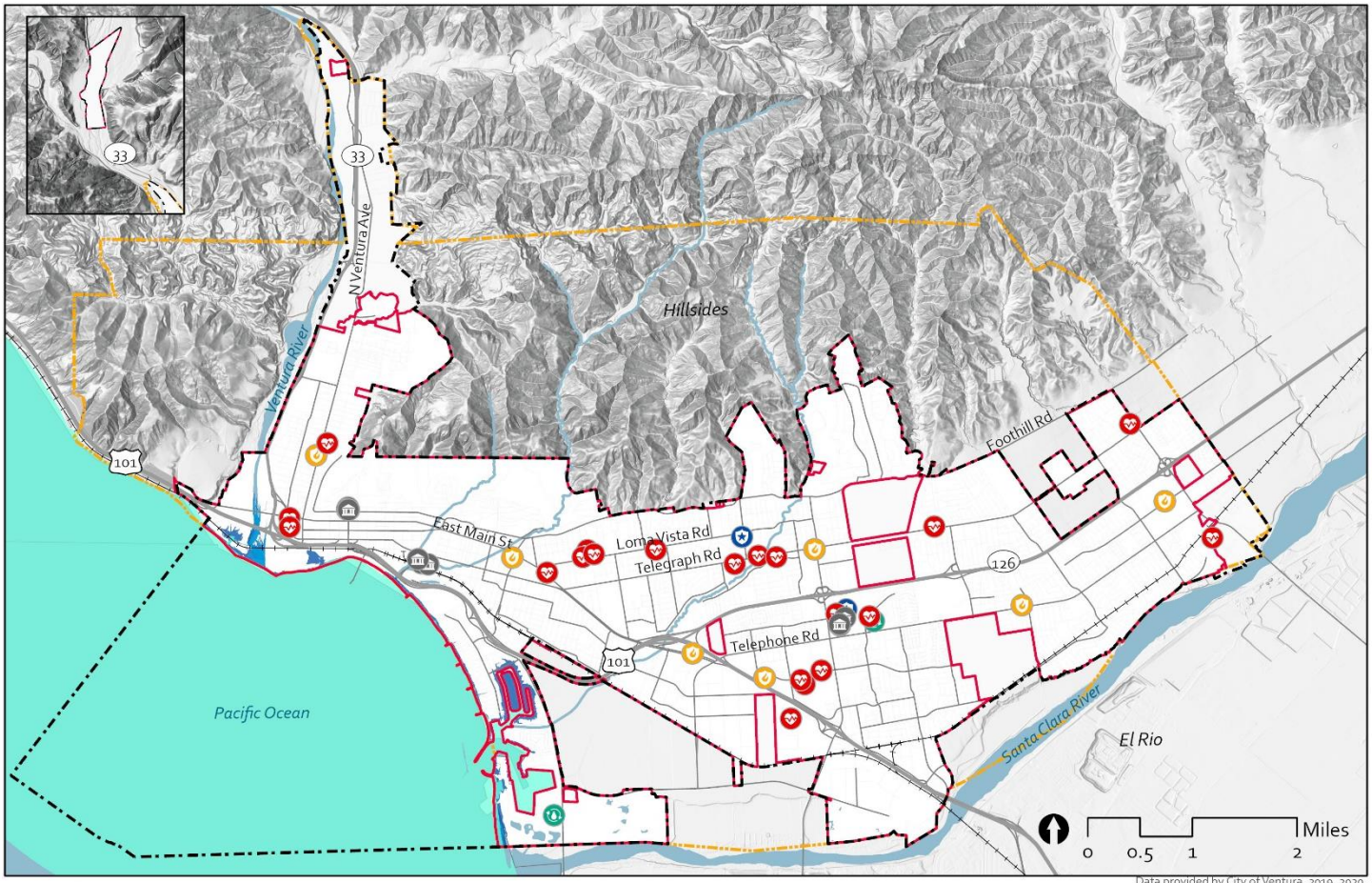


Figure 6 Coastal Erosion in the City of Ventura

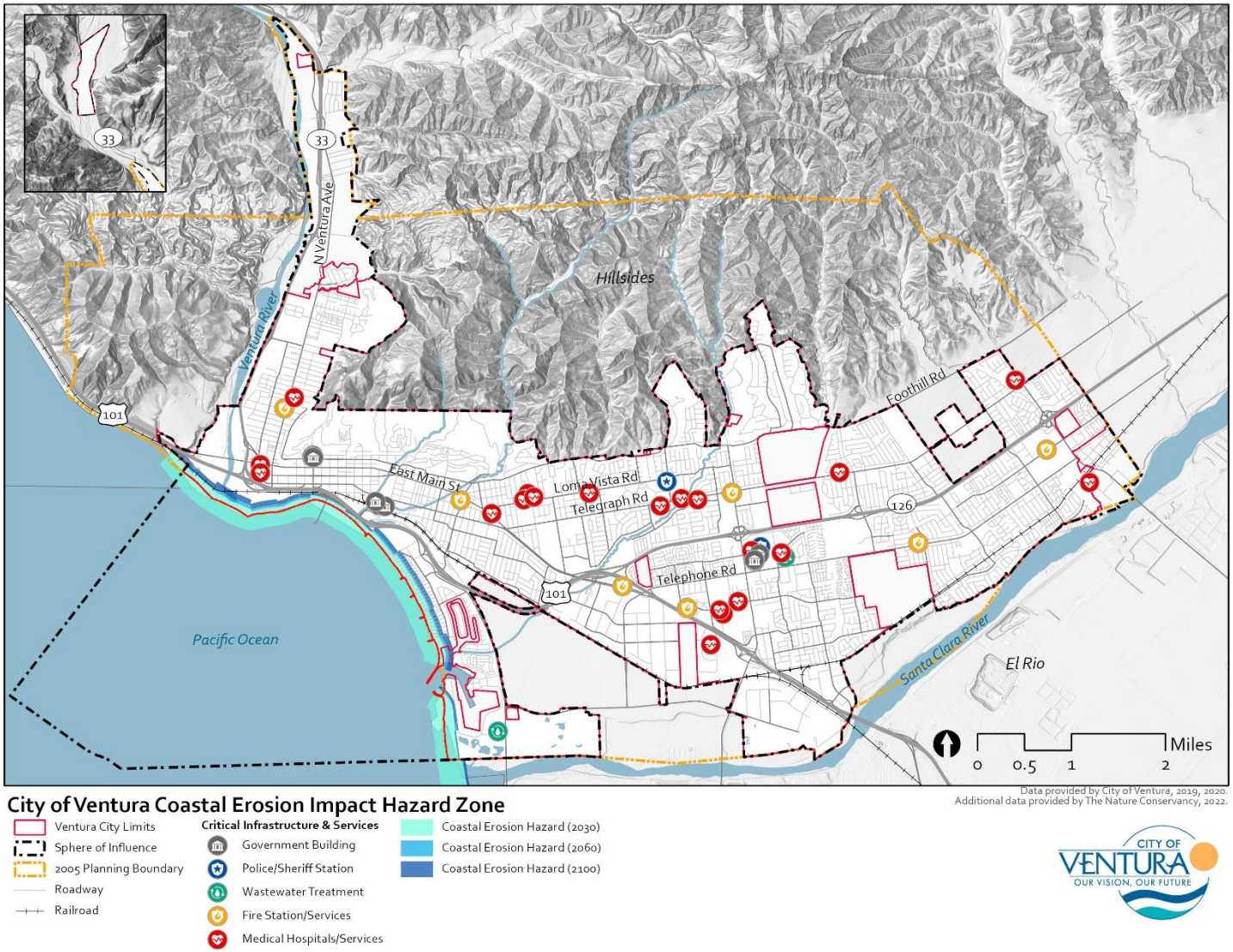


Figure 7 Coastal Storm Flooding in the City of Ventura

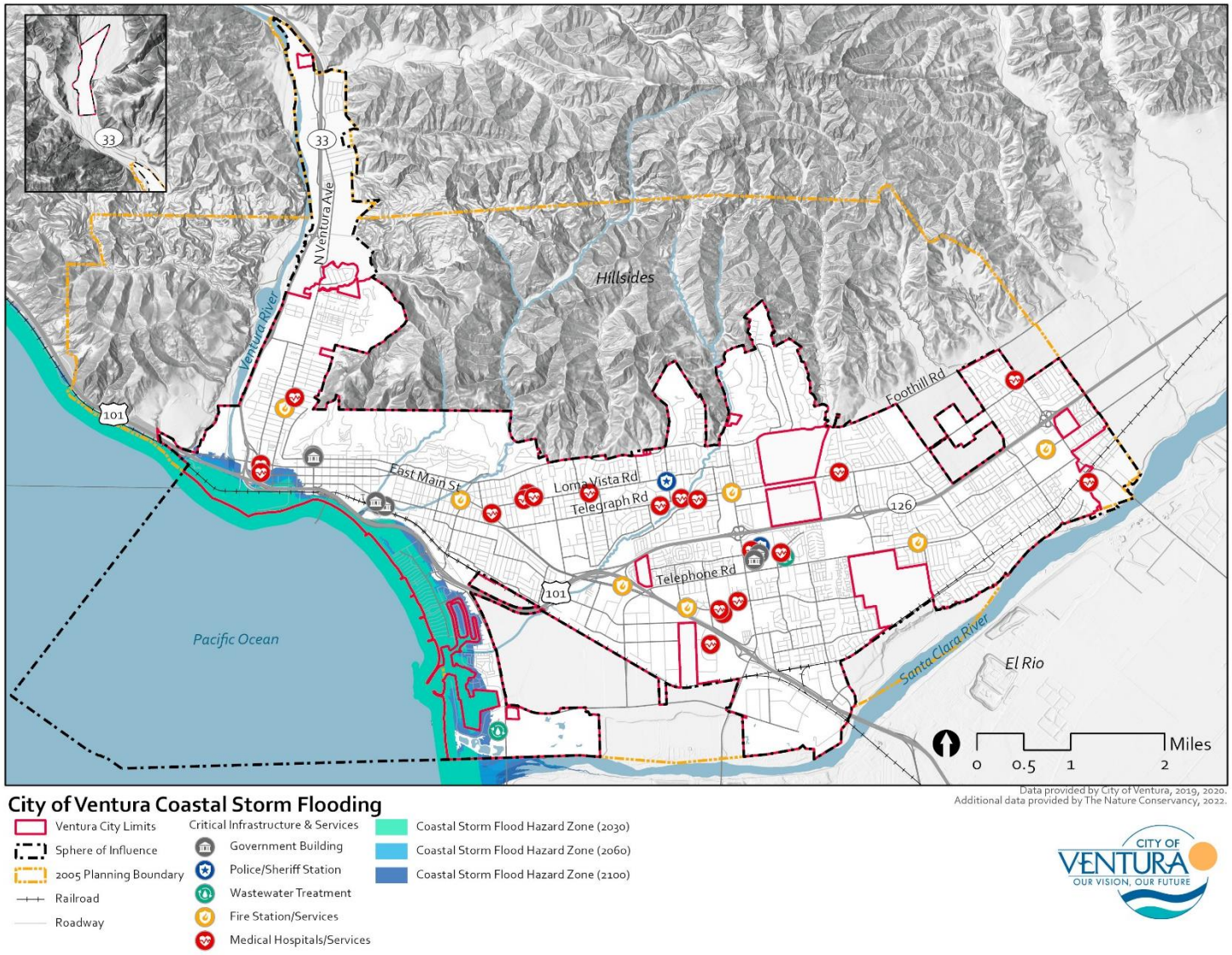


Figure 8 Storm Wave Impact in the City of Ventura

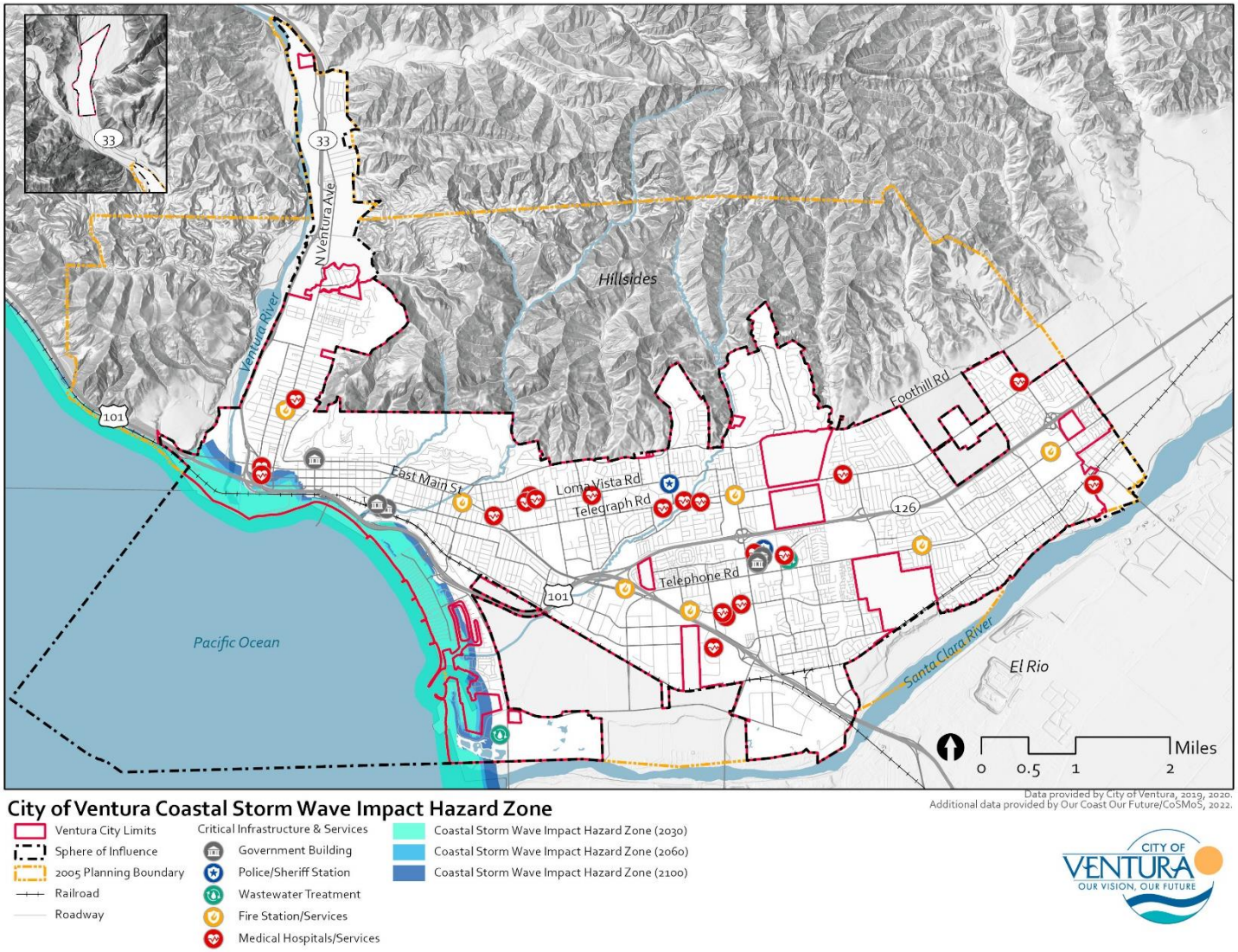
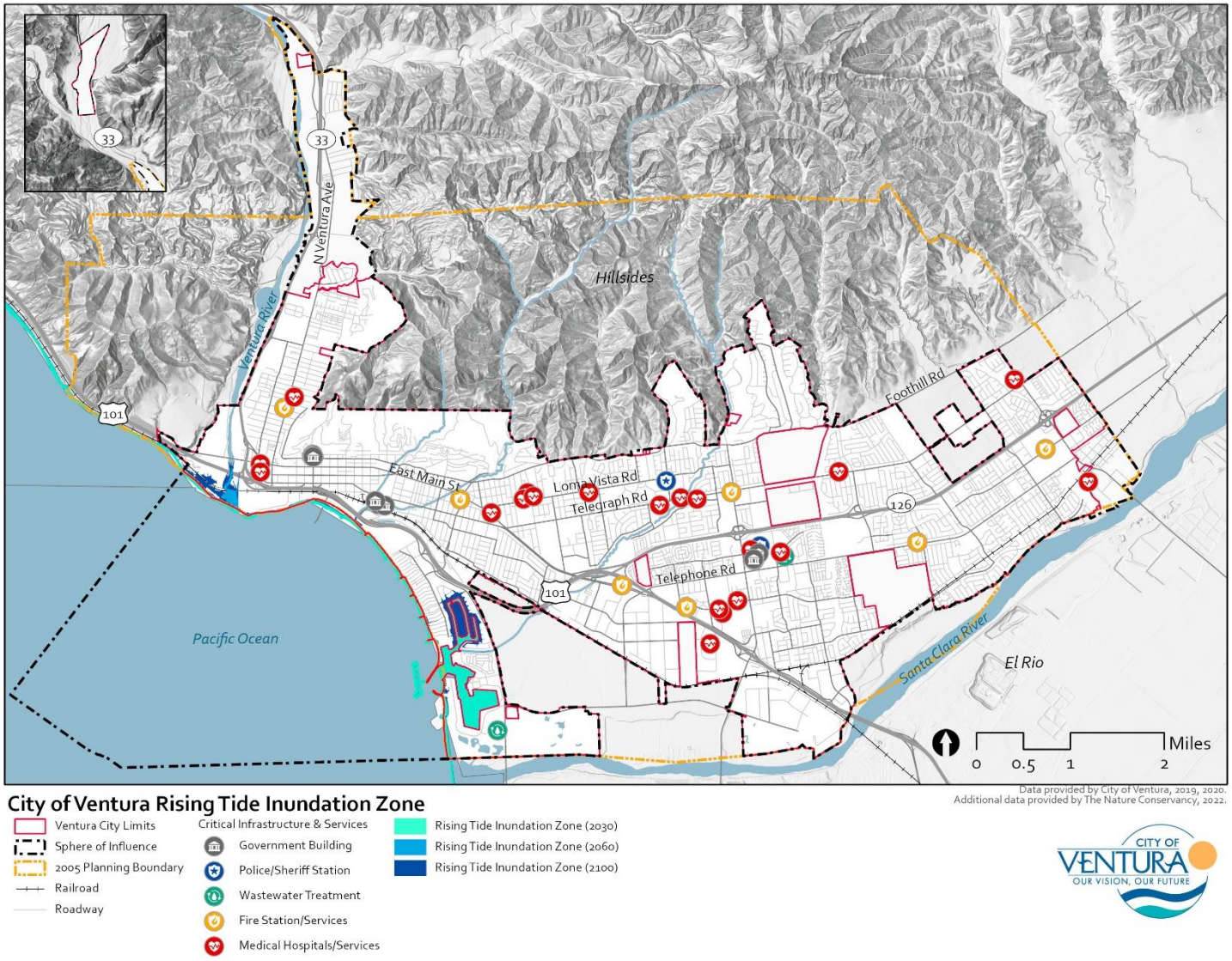


Figure 9 Rising Tide Inundation in the City of Ventura



3 Sensitivity

Populations and assets are affected by climate change depending on their sensitivity to climate hazards. This section identifies sensitive populations and assets within the City of Ventura. Potential impacts from the climate hazards of concern on sensitive populations and assets are presented in the Vulnerability Analysis section. Assets are grouped in the following manner:


Vulnerable Populations


Natural and Managed Resources


Buildings and Facilities


Infrastructure and Critical Services

3.1 Vulnerable Populations


While all people in a community will experience climate change, some may be more affected than others. For example, older adults and young children may be more at-risk to heat illness during an extreme heat event. Several factors influence sensitivity to climate hazards including an individual's health, age, and ability, societal disadvantages, inequities in access to health care, economic opportunity, education and other resources, and inequities found in basic needs and exposure to environmental stressors (Cal OES 2020). Vulnerable populations experience heightened risk to climate change and have fewer resources to adapt and recover from climate change impacts. Following guidance from the Southern California Adaptation Planning Guide, vulnerable population groups were identified for the City (SCAG 2020). Indicators of vulnerable populations were also identified as part of the Social Vulnerability Assessment for the City of Ventura Climate Action and Resilience Plan using data gathered from U.S Census Bureau's 2-15-2019 American Community Survey (ACS). The City of Ventura has several vulnerable populations that will disproportionately experience the impacts of climate change, listed in Table 3 below.

Vulnerable populations were grouped based on potential exposure to climate hazards, access to resources to prepare, cope with, or recover from climate hazards, whether individuals face societal disadvantages, or if individuals have heath conditions or health sensitivities that leave them vulnerable to climate hazards.

Table 3 Vulnerable Populations in the City of Ventura

Population	Population Description	Total Number, Percentage of Population, or Households
Renters*	Percent renter-occupied housing units	45.5%
Population of color*	All individuals that do not identify as white	45%
Seniors*	Percentage 65 years or older	16.6%
Foreign-Born-Non-Citizens	Percent of people born outside of the US that are not US citizens	47.3%
Individuals with no health insurance	Individuals aged 18 to 64 years old currently uninsured	9.7%
Individuals with disabilities*	Individuals with any of the six disability types (hearing, vision, cognitive, ambulatory, self-care, and independent living difficulty)	12.3%
Youth and Children*	Percent age 17 or younger	21.4%
Miliary Veterans	Individuals who have served but are not currently serving in the US Armed Forces	6,656
Linguistically isolated individuals*	Individuals 5 years and older who speak English less than very well	8.8%
Agricultural workers*	Individuals who are employed, 16 and older, and work in agriculture	2.9%
Outdoor construction workers*	Individuals who are employed, 16 and older, and work outdoors in construction	6.4%
Isolated Individuals*	Percent no vehicle households	6.5%
People experiencing homelessness	Individuals who currently lack fixed, regular, and adequate housing	531
Tribal and Indigenous communities	American Indian or Alaska Native	0.427%
Housing cost burdened*	Percent of households with housing cost burden (renter and homeowner)	39.9%
Individuals with education attainment less than 4 years of college*	Percent age 25 or older with less than a Bachelor's degree	64.9%
Mobile Homes*	Percent of mobile homes	5.2%
Pre-1980 Housing*	Percent of pre-1980 housing	70%
Low Income*	Percent of households below 80% of area median income	47.7%
Households without broadband internet*	Households without access to broadband internet	17.7%

Source: The percentages used in this table were acquired from the California Healthy Places Index 3.0 and the U.S. Census American Community Survey (ACS) 2015-2019 5-year estimates acquired from Social Explorer.

Notes:

*These indicators were identified as part of the Social Vulnerability Assessment for the City of Ventura Climate Action and Resilience Plan.

Often individuals have characteristics that make them vulnerable in a variety of ways; however, for the purpose of this report, they were grouped based on the sensitivity that increases their risk the most. Vulnerable populations are grouped below:

- **Individuals with High Outdoor Exposure.** Agricultural workers, outdoor construction workers, and people experiencing homelessness.
- **Under-Resourced Individuals.** Individuals with no health insurance, low income, renters, isolated individuals, housing cost burdened, pre-1980 housing occupants, mobile home occupants, individuals with education attainment less than 4 years of college, and individuals without broadband internet**.**
- **Individuals Facing Systemic Discrimination.** Populations of color, linguistically isolated, Tribal and Indigenous communities, and foreign-born-non-citizens.
- **Individuals with Chronic Health Conditions or Health Related Sensitivities.** Seniors, Youth, Individuals with disabilities, and Military Veterans.

3.2 Natural and Managed Resources

Natural and managed resources within the City of Ventura are detailed in the City's General Plan. Natural resources include coastal resources and beaches, hillsides, rivers (Ventura River, Santa Clara River) and barrancas, riparian and freshwater marshes, and the related biodiversity. Recreational resources include neighborhood, community, citywide, linear parks, and agricultural lands. The City oversees nearly 600 acres of developed park facilities (City 2005). Agriculture has been a dominant industry in Ventura for decades and can be found in various parts of the City including Midtown, the North Bank, and at Taylor's Ranch (City 2005). These various resources provide habitat, sources of community resilience, recreation, and economic productivity to the City. These resources are spread throughout the City and face various levels of exposure to climate hazards.

3.3 Buildings and Facilities

Climate change is expected to amplify extreme weather and climate hazards in the City of Ventura. A jurisdiction's vulnerability increases when buildings and facilities are not designed, operated, and/or maintained to function effectively under extreme weather conditions or can be damaged by extreme weather conditions. The following buildings and facilities would be particularly sensitive to climate change including residential buildings and developments, and educational facilities.

3.4 Critical Infrastructure and Services

Within the City of Ventura there is a wide array of critical infrastructure and services that are vulnerable to the impacts of climate change. Assets within this category include water supply, wastewater treatment, solid and hazardous material waste and recycling, government buildings, fire services, police services, medical services, utilities and major utility corridors, communication facilities, energy services, public transportation, roadways, and active transportation routes. This asset group is sensitive to climate change as the impacts of hazards can affect the service line ability to provide resources and the infrastructure in place may not be adequately prepared to sustain increasing and compounding hazards.

4 Adaptive Capacity

Adaptive capacity is the ability to adjust to the consequences of climate change. This section summarizes the ways in which the City currently manages for the negative impacts of climate change. Types of adaptive capacity include adjustments in behavior, resources, and technologies. The City of Ventura has actively taken steps to increase the City's adaptive capacity. Existing policies, plans, programs, and institutions that increase the City's resilience to climate change impacts are organized by climate hazard and listed in Table 4.

4.1 Programs, Plans, and Policies to Manage Impacts of Climate Hazards

Table 4 lists programs, plans, and policies that help communities become more resilient to an increase in climate hazards.

Table 4 Program, Plans, and Policies to Manage Impacts of Climate Hazards

Existing and Planned Programs, Plans, and Policies	Objectives	Climate Hazard Mitigated
Ventura County Contingency Plan for Heat/Cold Weather Events (County 2020)	This document outlines responses to an extended heat wave or cold weather that could endanger the lives of citizens of Ventura County, especially those who are medically fragile, those living alone, and disabled individuals. Some considerations discussed include community centers as refuges from weather, creation of Voluntary Relief Centers, and proposed establishment of Cooling Centers.	Severe weather
Heatwave Safety (City of Ventura n.d.)	The City of Ventura webpage under emergency preparedness provides information about extreme heat and how to prepare for a heat emergency. The page Includes resources for shelter from extreme heat and signs of heat-related illnesses.	Severe weather
Surfers Point Managed Retreat Project (Surfrider Foundation 2022)	This project focuses on moving infrastructure away from the beach to preserve the beach and surf break. Instead of building coastal armor such as a seawall, this project will move the parking lot, pedestrian path, and bike path away from the tideline. The project also includes planting and maintaining native vegetation within sand dunes and bioswales.	Sea level rise, stormwater runoff

Existing and Planned Programs, Plans, and Policies	Objectives	Climate Hazard Mitigated
2020 Draft Urban Water Management Plan for the City of San Buenaventura (City of Ventura 2020)	The 2020 Urban Water Management Plan for the City of San Buenaventura includes descriptions of the community's water supply sources, projected water demands, and supply reliability during normal water years, single dry years, and five-dry years. The plan includes a discussion of the potential impacts of climate change on the system as well as reliability planning and a water shortage event contingency plan. The Urban Water Management Plan does not include strategies for mitigation and adaptation.	Drought, flooding
Coastal Resilience Ventura Project (TNC n.d.)	This program uses a web-based mapping tool to help identify Ventura County's vulnerability from coastal hazards. Vulnerable populations are identified under various climatic scenarios. Critical infrastructure in coastal zones is identified under various sea level rise and storm surge scenarios as well.	Sea level rise, severe storm
Ventura Land Trust Community Wildfire Protection Plan (Ventura Land Trust 2022)	The Ventura Land Trust's Community Wildfire Protection Plan (CWPP) identifies wildfire risks and clarifies priorities for funding and programs to reduce impacts of wildfire on communities at risk. Some actions include vegetation management, wildfire safety education programs, and establishment and maintenance of evacuation routes.	Wildfire, air quality
Ventura Regional Fire Safe Council Home Hardening Resiliency Program (VRFSC 2020)	The Ventura Regional Fire Safe Council has implemented Wildfire Safety Liaisons to lead in facilitating educational workshops as well as free home hardening assessments in locations designated as high-risk for wildfire.	Wildfire
The 2005 City of Ventura General Plan (City 2005)	The 2005 City of Ventura General Plan includes actions that assess wildfires, flood hazards, air quality, water supply, and emergency response practices. General Plan policies include actions to optimize firefighting and minimize exposure to air pollution associated with point sources, project design review, land use compatibility, and compliance with the Ventura County Air Pollution Control District requirements. The General Plan also describes the water supply and system including the Casitas Municipal Water District, Ventura River surface water intake, subsurface water and wells (Foster Park), Mound groundwater basin, Oxnard Plain groundwater basin (Fox Canyon Aquifer), and Santa Paula groundwater basin. The General Plan includes policies for resource conservation, policies to minimize flood hazards and mitigation for new development within flood hazard zones.	Wildfire, flooding, air quality, drought
Ventura County Multi-Jurisdiction Hazard Mitigation Plan (Ventura County 2022)	The Ventura County Multi-Jurisdiction Hazard Mitigation Plan describes hazard mitigation policies for landslides, flooding, wildfires, sea level rise, and drought. The policies within the plan are regarding FEMA 100-year tide	Landslides, flooding, wildfires, sea level rise, drought, severe weather, severe storm

Existing and Planned Programs, Plans, and Policies	Objectives	Climate Hazard Mitigated
	and sea level rise, compliance with NFIP, flood plain management, and long-term resilience to sea level rise and extreme storms for communities and critical assets adjacent to San Buenaventura Beach, Santa Clara River, Ventura River, and nearby areas of the shoreline. The plan also describes the County's StormReady program, Ventura Water Pure Program, Hall Canyon Channel Drainage Basin Improvement Project, and wildfire awareness program.	
City of Ventura Emergency Response Team (CERT) Program (City of Ventura 2020)	The CERT program trains volunteers in basic first aid, light search and rescue, and small fire suppression, and is closely associated with Ventura's Fire Department. CERT volunteers may assist neighbors and other emergency personnel in times of emergency, and support evacuations along with other responsibilities.	Severe weather, severe storm, landslide, flooding, wildfire
City of Ventura Emergency Operations Plan (City of Ventura 2021)	Ventura's Emergency Operations Plan details protocols to improve emergency preparedness, response, and recovery from natural disasters. The plan provides a system for the effective management of emergency situations and identifies lines of authority and responsibility. The plan reviews the hazards most likely to impact the City, especially those exacerbated by climate change including drought, extreme heat, wildfire, flooding, and severe winter storms.	Drought, extreme weather, wildfire, flooding, severe storm
City of Ventura Tree Master Plan (City 2018)	The City Tree Master Plan is a guide to effective administration and management of a comprehensive Urban Forest program in the City. Tree canopy is low in the City and this Plan discusses the climate adaptation benefits of tree canopy.	Drought, extreme heat, air quality

5 Vulnerability Analysis

This section describes the impacts each climate hazard has on community assets and services described in the Sensitivity section. Existing plans, policies, and programs that contribute to the adaptive capacity is summarized throughout. An impact score and an adaptive capacity score is identified for each asset by climate hazard, along with an overall vulnerability score consistent with the scoring methodology described in Vulnerability Assessment Methodology.


Vulnerable Populations


Natural and Managed Resources


Buildings and Facilities


Critical Infrastructure and Services

5.1 Vulnerable Populations


Individuals with High Outdoor Exposure including agricultural workers, outdoor construction workers, mobile home occupants, and people experiencing homelessness face disproportionate direct exposure to climate hazards, causing them to be extremely vulnerable to the effects of climate change.

Under-resourced individuals often do not have access or the ability to afford resources needed to prepare for, cope with, and recover from climate change impacts. Individuals who are unemployed or are low-income often face financial barriers when preparing for and recovering from climate change hazards. Individuals in these groups often live in homes that are less protected against climate hazards. Low-income individuals may not be able to take time off work to address health concerns either caused by or exacerbated by climate hazards. Individuals with educational attainment of less than 4 years of college usually have lower earning potential than those with a 4-year college degree. As defined by the U.S. Census Bureau, this population group does not include individuals who have attended trade schools, apprentice programs, or who have attained associates degrees. Individuals with 4-year degrees are half as likely to be unemployed than those who only have a high school degree (Association of Public and Land-Grant Universities n.d.). Under-resourced individuals in this group are less likely to have access to transportation, healthcare, and other basic needs. These individuals often lack the financial resources to evacuate from a climate hazard and/or find an affordable place to evacuate to.

Individuals Facing Systemic Discrimination are subject to disproportionate impacts of climate change. People of color are more likely to live in high hazard risk areas and less likely to be homeowners, which leaves them vulnerable to climate hazards. If evacuation and/or advisory notices, hazard preparedness material, or governmental guidance is not provided in languages other than English, linguistically isolated individuals, and foreign-born non-citizens may not be able to prepare for, cope with, or recover from a climate hazard (Gamble et al. 2016). The close relationship some

tribal communities have with their surrounding ecosystems and natural resources leaves these populations particularly at risk to climate change impacts because the natural systems their livelihoods are dependent on are rapidly changing (Baird 2008).

Individuals with chronic health conditions or health related sensitivities are socially and physiologically vulnerable to climate change impacts and hazards. Seniors and individuals with disabilities may have limited or reduced mobility, mental function, or communication abilities, making it difficult to evacuate during or prepare for a climate hazard event (CDPH 2020). They may also have medical needs for electricity which may be impacted during a public safety power shutoff or climate hazard event. Individuals in these groups are more likely to have pre-existing medical conditions and/or chronic illnesses that may exacerbate the risk of illnesses and medical problems from climate hazards. Children are socially and physiologically vulnerable to climate hazards with limited understandings of climate hazards and insufficient resources to independently prepare for and safely respond during a climate hazard event. Children, especially young ones, are reliant on their parental figures to ensure their health, safety, and wellbeing (CDPH 2020). Children also have vulnerable physical characteristics because they have not fully physiologically developed and are therefore more vulnerable to health effects of climate change impacts (Kenny et al. 2014). Military veterans are more likely to be low-income and experience homelessness after their service, which also makes them vulnerable to preparing for and responding to climate hazards (Olenick et al. 2015).

Potential Impacts

Extreme Heat and Warm Nights

Outdoor workers and people experiencing homelessness are at risk to health impacts from extreme heat. Outdoor workers, including construction workers and agricultural workers, are often subject to strenuous work conditions and are vulnerable during extreme heat events. People experiencing homelessness are exposed to health-related impacts associated extreme heat because they have limited access to shelter and air conditioning. The primary health impacts to these populations are heat-related illnesses, such as heat stress, heat stroke, and dehydration, which can be life-threatening (CDPH 2020).

Under-resourced individuals may not be able to pay for adequate air conditioning or fans, increasing their exposure to extreme heat. Isolated individuals don't have access to a vehicle to travel to cooling centers or move to temporary shelters during extreme heat event (Cooley et al. 2012). Under-resourced individuals are less likely to receive medical care for illnesses triggered or exacerbated by extreme heat. Households without a computer or broadband internet may not receive heat advisory warnings or governmental guidance, causing them to experience health impacts from extreme heat exposure (CDPH 2017). Additionally, individuals with no health insurance may not be able to receive care in the case of extreme heat related illness.

People experiencing systemic discrimination, including populations of color, linguistically isolated, foreign-born-non-citizens, and Tribal and Indigenous communities are at risk to impacts of extreme heat. Communities of color and Indigenous communities often live in housing with insufficient protection from extreme heat events and limited or no affordable air conditioning (Gamble et al. 2016). Linguistically isolated individuals may not to be able to read heat

advisory warnings or governmental guidance, potentially causing them to experience greater exposure to extreme heat (Gamble et al. 2016). The primary health impacts to these populations are heat-related illnesses, such as heat stress, heat stroke, and dehydration, which can be life-threatening (CDPH 2020). These populations may not have access to medical services to treat heat-related illnesses.

Individuals with chronic health conditions or health related sensitivities are particularly at risk to heat related illnesses during extreme heat events. Individuals with disabilities, older adults, youth, and children may have difficulty turning on air conditioning or traveling to cooling centers during extreme heat events. Extreme heat conditions can exacerbate asthma, cardiovascular disease, certain disabilities, and other respiratory and cardiovascular conditions, potentially causing heat-related illnesses such as heat stress, heat stroke and dehydrations, which can be-life threatening (CDPH 2020). Children are still physiologically developing which means that they are less able to regulate their bodies during extreme heat events (Kenny et al. 2014).

Drought

Individuals with high outdoor exposure are at risk to drought conditions and associated cascading impacts. During prolonged drought conditions, people experiencing homelessness may have difficulty accessing clean and affordable drinking water (Gamble et al. 2016).

During periods of prolonged drought, under-resourced individuals are more likely to experience the cost burden associated with increased water rates (Feinstein et al. 2017). These individuals may struggle to access clean and affordable drinking water which may cause dehydration and/or exacerbate underlying health conditions and illnesses (Gamble et al. 2016).

Individuals facing systemic barriers may face discrimination and restrictive policies when seeking to access affordable and clean water supplies, which may cause dehydration and/or exacerbate underlying health conditions and illnesses (Gamble et al. 2016). Tribal communities may experience food insecurity if a drought negatively impacts local food sources (Lynn et al. 2011).

Individuals with chronic health conditions or health related sensitivities are at risk to drought conditions and associated cascading impacts. Prolonged drought conditions can lead to water scarcity and individuals may need to rely on poor quality water supplies. Individuals with chronic health conditions or health related sensitives may experience negative health impacts if they become dehydrated. Children, youth, and older adults are especially at risk to dehydration as their bodies are not able to regulate as well (Kenny et al. 2014). Dehydration may exacerbate underlying health conditions and illnesses. (CDPH 2017).

Wildfire

Outdoor workers may be exposed to hazardous work conditions during wildfire events and may become injured from smoke inhalation or burns. People experiencing homelessness are particularly at-risk during wildfire events as they often suffer from respiratory conditions, mental illness, and chronic health conditions that may be exacerbated from physical contact with wildfire or smoke inhalation. People experiencing homeless have limited access to shelter and do not have access to transportation to evacuate from burning areas. They may also have their personal belongings destroyed or damaged during a wildfire event (CDPH 2017).

Under-resourced individuals may experience injuries or death from smoke inhalation or burns and are less likely to receive medical treatment (CDPH 2017). These individuals are more likely to live in

wildfire hazard zones and in housing with insufficient protection and thus may have their belongings, homes, and health damaged by wildfire and/or smoke. If this occurs, under-resourced individuals are likely to suffer from the cost burden associated with losses or damage. Households without a computer or internet may not receive communications and evacuations to safely evacuate from hazard areas. Isolated individuals are vulnerable during wildfires because they no do have access to a vehicle to evacuate. Renters have limited control over home hardening and improvements that may protect against fire and smoke. Subsequently, they may experience economic and health impacts and a greater loss of belongings than homeowners (Gamble et al. 2016).

Populations experiencing system discrimination may experience disproportionate impacts during wildfires. Communities of color and Indigenous people are more likely to be in wildfire hazard zones and in housing with insufficient protection against wildfire. Linguistically isolated individuals and foreign-born-non-citizens may not be able to read wildfire or smoke advisory warnings or governmental guidance, potentially causing them to experience greater exposure to smoke and/or wildfire. Individuals in these groups may face systematic and/or cultural barriers to access resources to safely evacuate hazard areas (Gamble et al. 2016). As a result, individuals in these groups may experience injuries or death from smoke inhalation or burns (CDPH 2017).

Individuals with chronic health conditions or health related sensitivities may experience injuries or death from smoke inhalation or burns (CDPH 2017). Seniors, military veterans, and pollution burdened individuals are vulnerable to health impacts from wildfire smoke pollutants because they are more likely to have underlying respiratory and/or cardiovascular conditions and illnesses. Youth and children may experience respiratory health impacts from wildfire smoke because their respiratory systems are not fully developed and are therefore more sensitive to stressors. Individuals with disabilities, youth and children, and seniors may have difficulty evacuating from wildfires, increasing the risk of health impacts and or death from wildfire, smoke inhalation, or fire burns (EPA 2022).

As seen in Figure 10, the communities along the East side of the Ventura River have a social vulnerability index (SVI) between 0.81-1.0 and are at high and very high risk of wildfires. Along Loma Vista Road, communities at varying social vulnerability levels are in VHFHSZ's, including those along the Northern edge of East Main Street, who have an SVI of 0.91-1.0.

Landslides

Vulnerable populations living in areas with high landslide risk may be subjected to disproportionate negative impacts during landslide and debris flow events. Communities of color and Indigenous people are more likely to be situated in wildfire scar zones or landslide prone areas. Linguistically isolated individuals and foreign-born-non-citizens may not be able to read landslide advisory warnings or governmental guidance, potentially causing missed critical evacuation information or limited ability to safely evacuate hazard areas (Gamble et al. 2016).

Riverine and Stormwater Flooding

Outdoor workers may be exposed to hazardous work conditions during riverine and/or stormwater flooding events and therefore are vulnerable to health impacts (CDPH 2020). People experiencing homelessness are disproportionately at risk to health impacts during flood events because they often live in flood hazard areas and do not have access to transportation to evacuate inundated areas. They may also have their personal belongings destroyed or damaged during a flood event (Ramin & Svoboda 2009).

Under-resourced individuals may experience injuries or death because of high velocity flooding and are less likely to receive medical treatment (CDPH 2017). Individuals in these groups may experience cost burdens if their belongings and homes are damaged from floodwater inundation. Isolated individuals have limited or no access to a vehicle to evacuate flood hazard areas. Households without a computer or internet may not receive communications and emergency alerts to safely evacuate from hazard areas (CDPH 2020). Renters have limited control over home improvements that may protect against flood damage. Subsequently, they may experience economic and health impacts and a greater loss of belongings than homeowners (Gamble et al. 2016).

Populations that experience system discrimination are at greater risk to impacts of extreme heat. Communities of color and Indigenous groups are more likely to live in flood hazard areas and in housing with insufficient protection against riverine and stormwater flooding. Linguistically isolated individuals and foreign-born-non-citizens may not be able have access to flood warning or governmental guidance in their language, potentially causing them to experience greater exposure to flooding. Individuals in these groups may face systematic and/or cultural barriers when seeking to access resources needed to safely evacuate hazard areas (Gamble et al. 2016).

Seniors, youth, and children are particularly at risk to injury and/or death from high velocity flooding (CDPH 2017). Riverine and stormwater flooding may also limit access to transportation systems, healthcare centers, and emergency response to those that are injured or in need or consistent medical care, such as those with chronic health conditions or illnesses. Youth, children, seniors, individuals with disabilities, and individuals with chronic health conditions or illnesses may not be able to safely evacuate floodwater hazard areas.

Many communities along the Western portion of the Santa Clara River are located in the FEMA 100- and 500-year flood plains, including communities with an SVI of 0.81-0.9, visible in Figure 11.

Air Quality

Individuals with high outdoor exposure, such as outdoor workers and people experiencing homelessness, are disproportionally vulnerable to poor air quality because they are outdoors and are therefore directly exposed to air pollutants (CDPH 2017).

Under-resourced individuals may be disproportionally impacted by poor air quality if their housing lacks sufficient air filtration, and they may not be able to afford supplemental air filtration equipment (Gamble et al. 2016). Individuals in these groups may experience the development or exacerbation of respiratory illnesses and are less likely to receive medical treatment (California Department of Public Health 2017).

Individuals experiencing system discrimination are at higher risk of negative health outcomes associated with air quality. Tribal communities and populations of color are vulnerable to health impacts associated with poor air quality because their housing may lack sufficient air filtration and they may not be able to afford supplemental air filtration equipment (Gamble et al. 2016). Linguistically isolated individuals and foreign-born-non-citizens may not have access to air quality advisory warnings or governmental guidance that are in their primary language, potentially causing them to experience greater exposure to extreme heat (CDPH 2017).

Individuals with chronic health conditions or health related sensitivities are at risk of developing or experiencing exacerbated health impacts from poor air quality. Youth and children are extremely vulnerable to health impacts from poor air quality because their respiratory system has not fully developed yet (CDPH

2017). Seniors, military veterans, and individuals with disabilities are vulnerable to health impacts from poor air quality because they are more likely to have underlying health conditions (EPA 2022).

Sea Level Rise

People who live in inundation zones may need to retrofit homes to adapt to sea level rise and associated impacts, such as mold. This activity is particularly difficult for those with limited access to resources including individuals who are unemployed, and low-income individuals. Linguistically isolated individuals may not have access to non-English versions of sea-level-rise preparedness guidance and therefore may not be able to prepare for and cope with sea-level-rise. (Cooley 2012).

The Ventura County Resilient Coastal Adaptation Project (VC Resilient Report) identifies seniors, youth and children, and low-income populations as most affected by flood hazards (County 2018). Seniors may have decreased mobility, and may not have access to emergency warning systems, and in the case of a loss of property or belongings, may lack financial resources to recover. Renters are vulnerable in the mitigation and recovery stages of hazards because they lack the authority over their residence to aptly prepare for flooding. Additionally, they are less likely to have insurance to cover their belongings in the case of a flood event (County 2018).

The figures below show the projections of SLR and related hazards in relation to the City of Ventura's citizens social vulnerability indices. Areas with an SVI of 0.81-1.0 are located along the coast in potential sea level rise and rising tide inundation areas such as along the intersection of highway 1 and highway 33, as well in the areas surrounding the Ventura Harbor, as seen in Figure 12 and Figure 16. Storm flooding has the potential to impact coastal communities, extending beyond Shoreline Drive, and reaching up to West Main Street on the Northern end of the City and up to Outrigger Avenue on the Southern end. The impacted communities have a breadth of SVIs ranging from 0.21-1.0, as seen in Figure 13.

In Figure 14, coastal erosion projections show impacts to all coastal communities in the City, with impacted groups having SVIs ranging from 0.21-1.0. Storm wave impacts will expand beyond highway 101 in many places along the City's coastline, causing impacts to communities beyond those directly on the coast. These communities have SVIs ranging between 0.21-1.0, as shown in Figure 15.

Adaptive Capacity

The City of Ventura has plans, policies and programs in place that protect vulnerable populations from all climate hazards. The level of enforceability, implementation, and efficacy varies based on the hazard type.

Ventura only has 4 percent of land with tree canopy, which is lower than 75 percent of other California cities and towns. Tree canopy is beneficial in many ways but particularly can be essential in mitigating the effects of extreme heat events (HPI 2022). The Ventura County Contingency Plan for Heat/Cold Weather Events plan outlines responses to extended heat waves that could endanger the lives of vulnerable populations in Ventura, including seniors and individuals with disabilities. The Heatwave Safety webpage provides emergency preparedness information for the community to prepare for heat emergencies.

Plans concerning stormwater flooding and drought mainly address infrastructure resilience and water reliability. The Ventura County Sea Level Rise Assessment includes an appendix which discusses stormwater flooding impacts on vulnerable populations. Plans like the Urban Water Management Plan, the General Plan, and the City

of Ventura Emergency Response Plan serve as a baseline of water assurance planning for the general populations in response to drought events, but do not explicitly address vulnerable populations. The City of Ventura has just over 50 percent impervious surface cover and is in the 82.5th percentile in California, implying that there is more impervious cover than most other cities and towns in the states. These materials cover the ground and prevent water from soaking into soil which can exacerbate flooding and reduce groundwater reserves (HPI 2022).

Though air quality is mentioned in the City's General Plan as well as the Wildfire Plan as a health hazard, no specific programs or actions are discussed to mitigate related harm to vulnerable populations.

The Ventura County Muti-Jurisdiction Hazard Mitigation Plan assigns a modest capacity to the City residents' ability to adapt to climate impacts. The plan acknowledges that vulnerable populations within the City may not be able to relocate or protect their home in the case of a flood but provides no guidance on how to address vulnerable populations in the case of SLR or flooding events (County 2022). The Ven-6 action outlined in the plan aims to improve long-term resilience to all population groups in SLR and extreme storms in the areas adjacent to the beach and the rivers (County 2022).

Vulnerability Score for Vulnerable Populations

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat	High	Medium	**4-High**
Drought	Medium	Medium	**3-Medium**
Wildfire	High	Medium	**4-High**
Landslides	Medium	Low	**4-High**
Riverine and Stormwater Flooding	Medium	Medium	**3-Medium**
Air Quality	High	Low	**5-High**
Sea Level Rise	High	Low	**5-High**

Vulnerable populations in the City of Ventura are most vulnerable to extreme heat/warm nights, drought, wildfire, landslides, air quality, and sea level rise.

Figure 10 Wildfire Hazard Severity Zones and Social Vulnerability in the City of Ventura

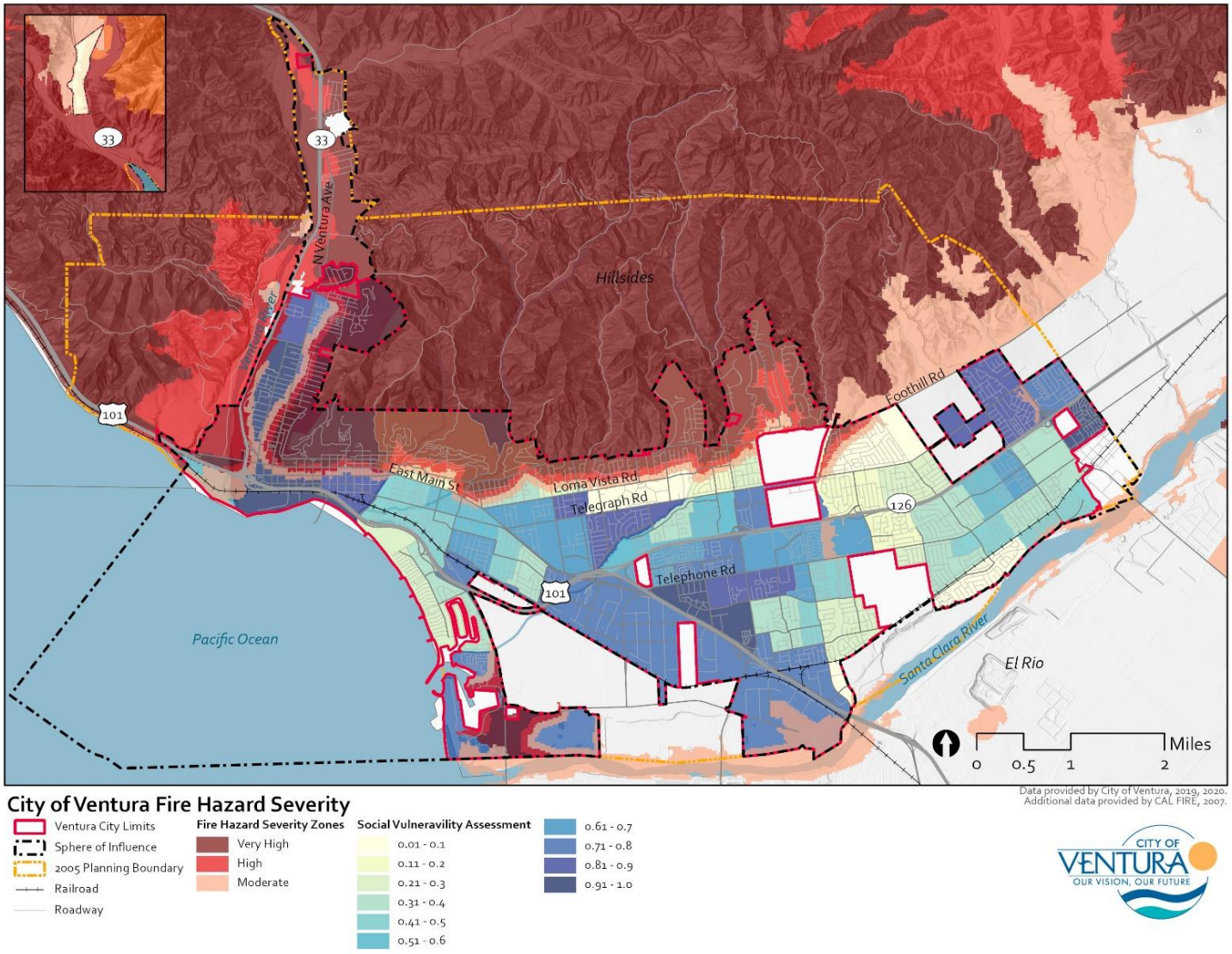


Figure 11 FEMA Flood Hazard Zones and Social Vulnerability in the City of Ventura

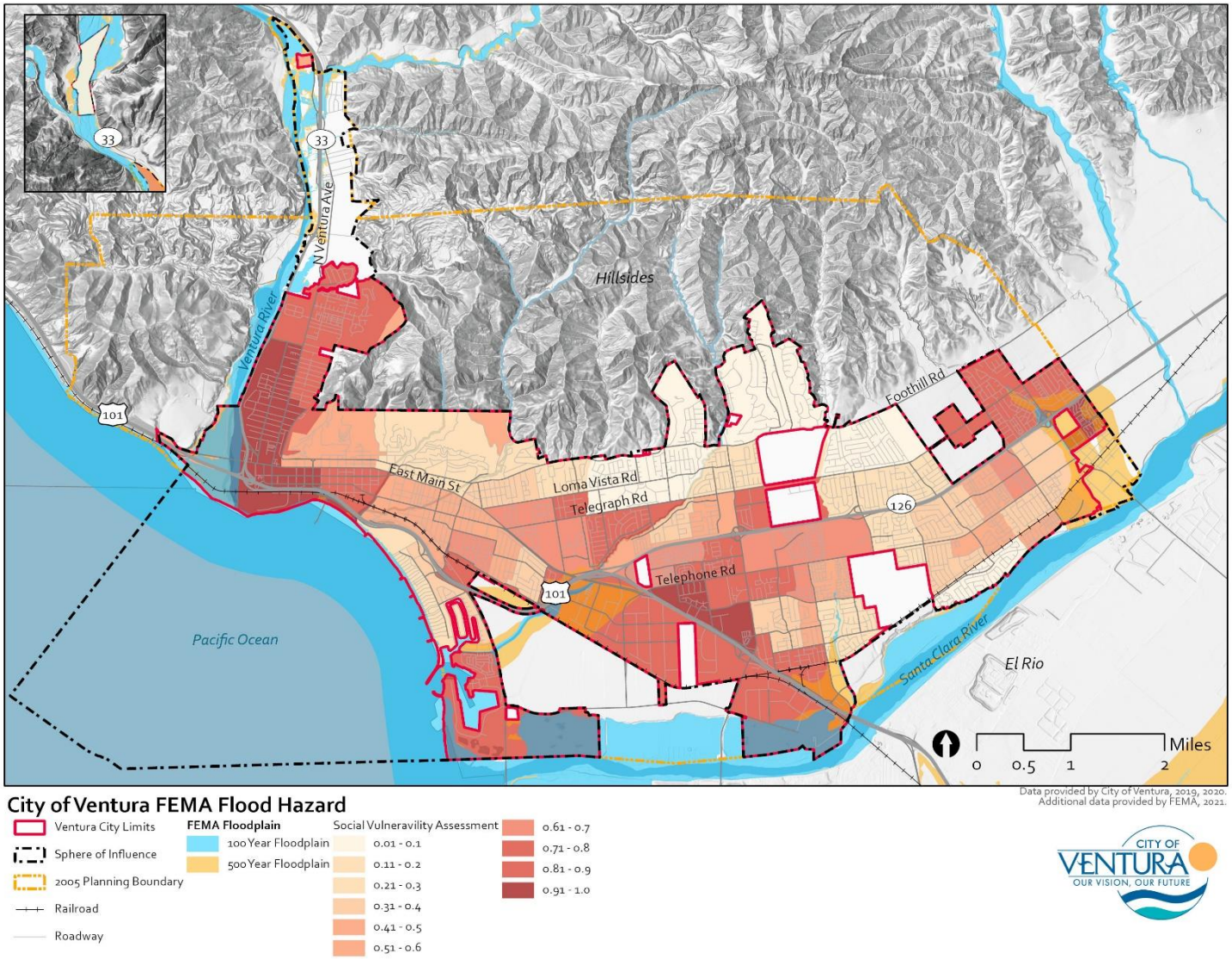


Figure 12 Sea Level Rise and Social Vulnerability in the City of Ventura

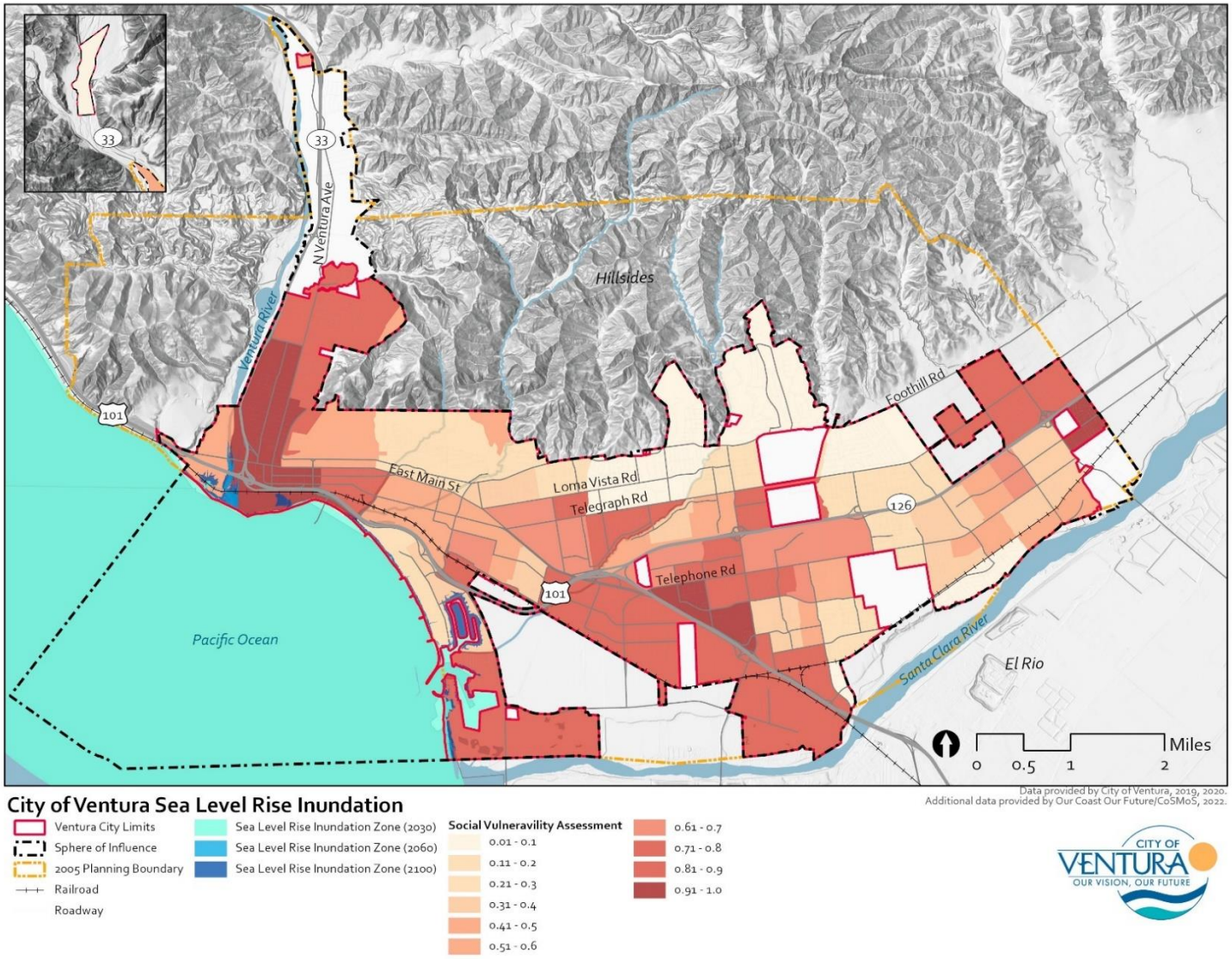


Figure 13 Coastal Storm Flooding and Social Vulnerability in the City of Ventura

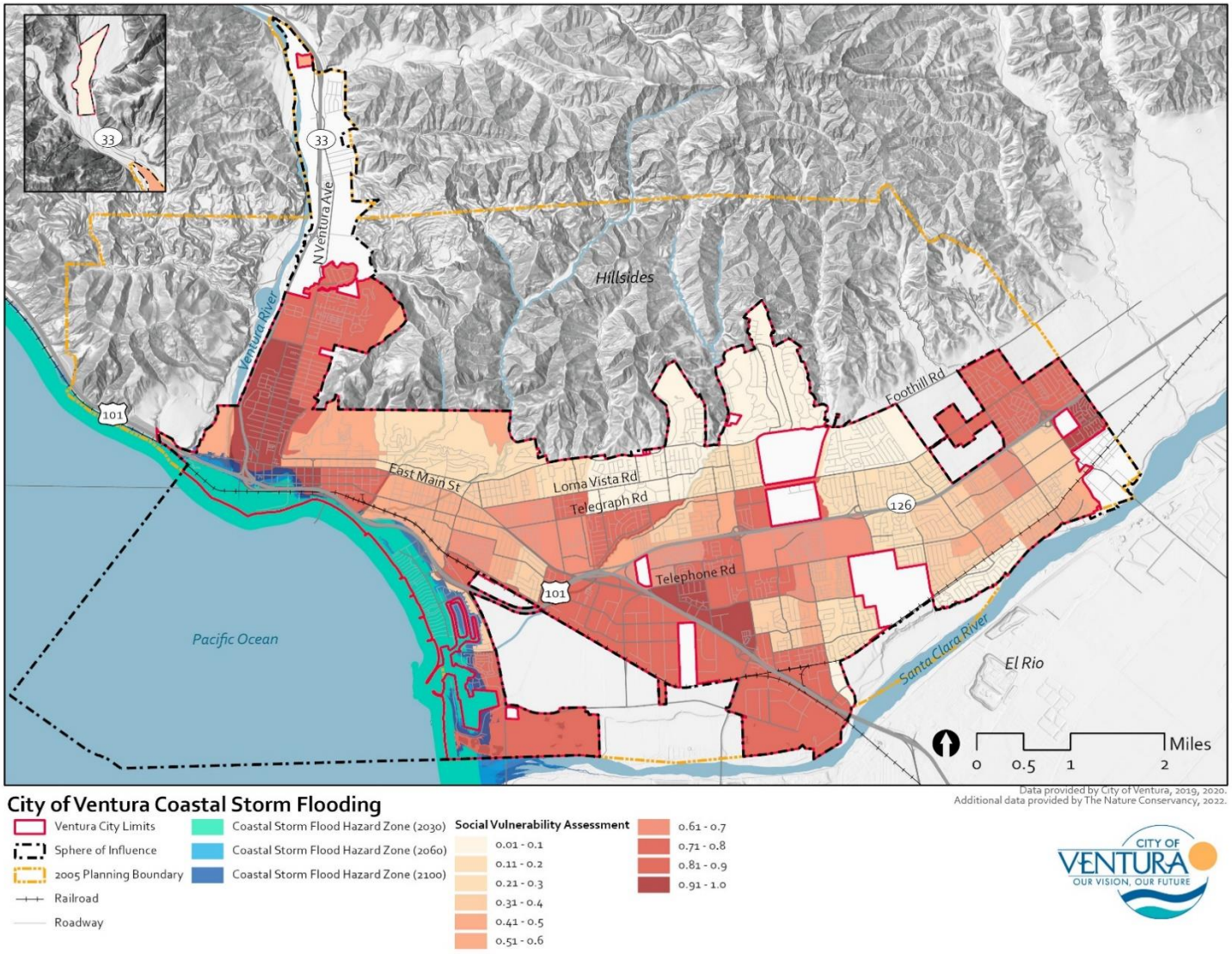


Figure 14 Coastal Erosion and Social Vulnerability in the City of Ventura

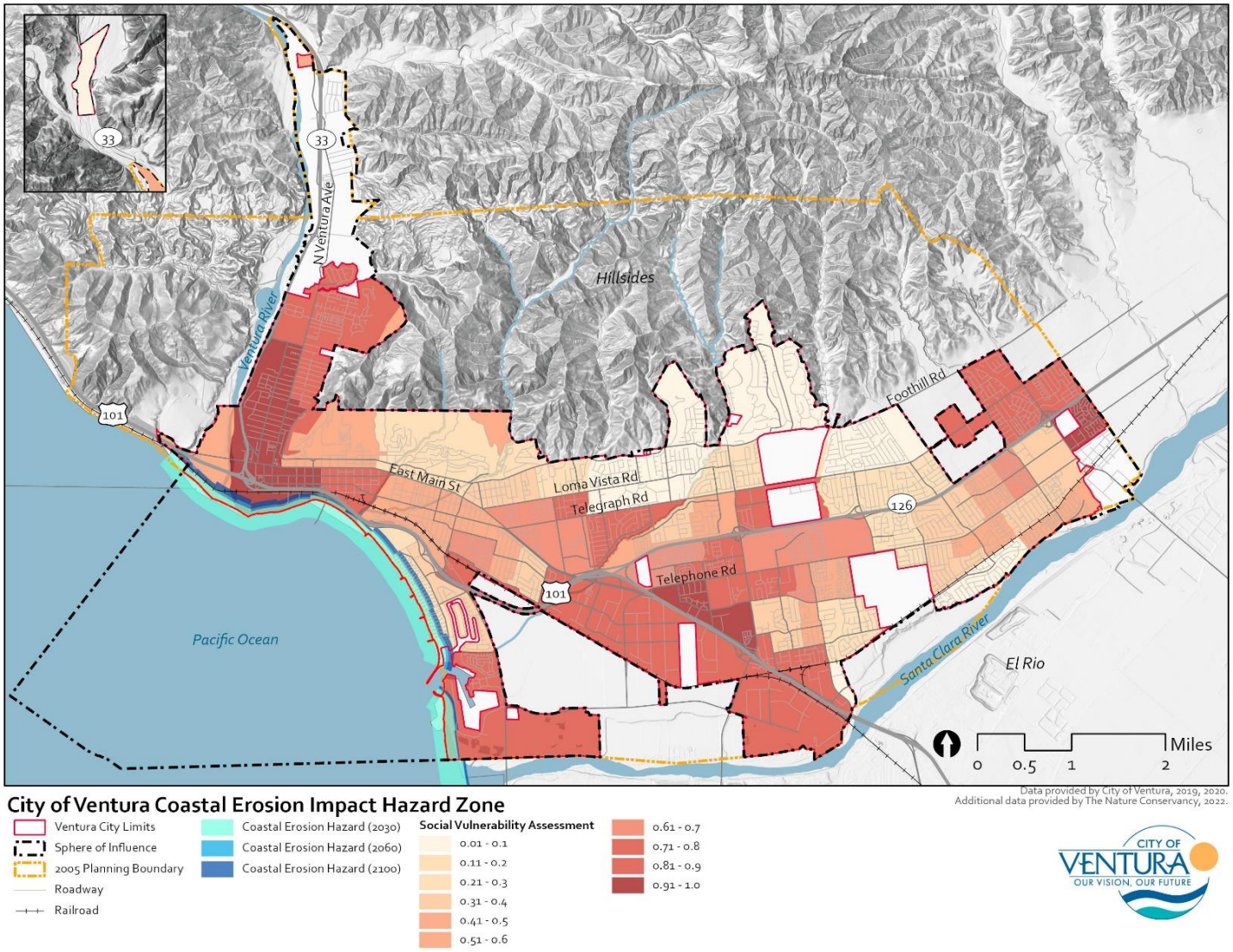


Figure 15 Coastal Storm Wave Impact and Social Vulnerability in the City of Ventura

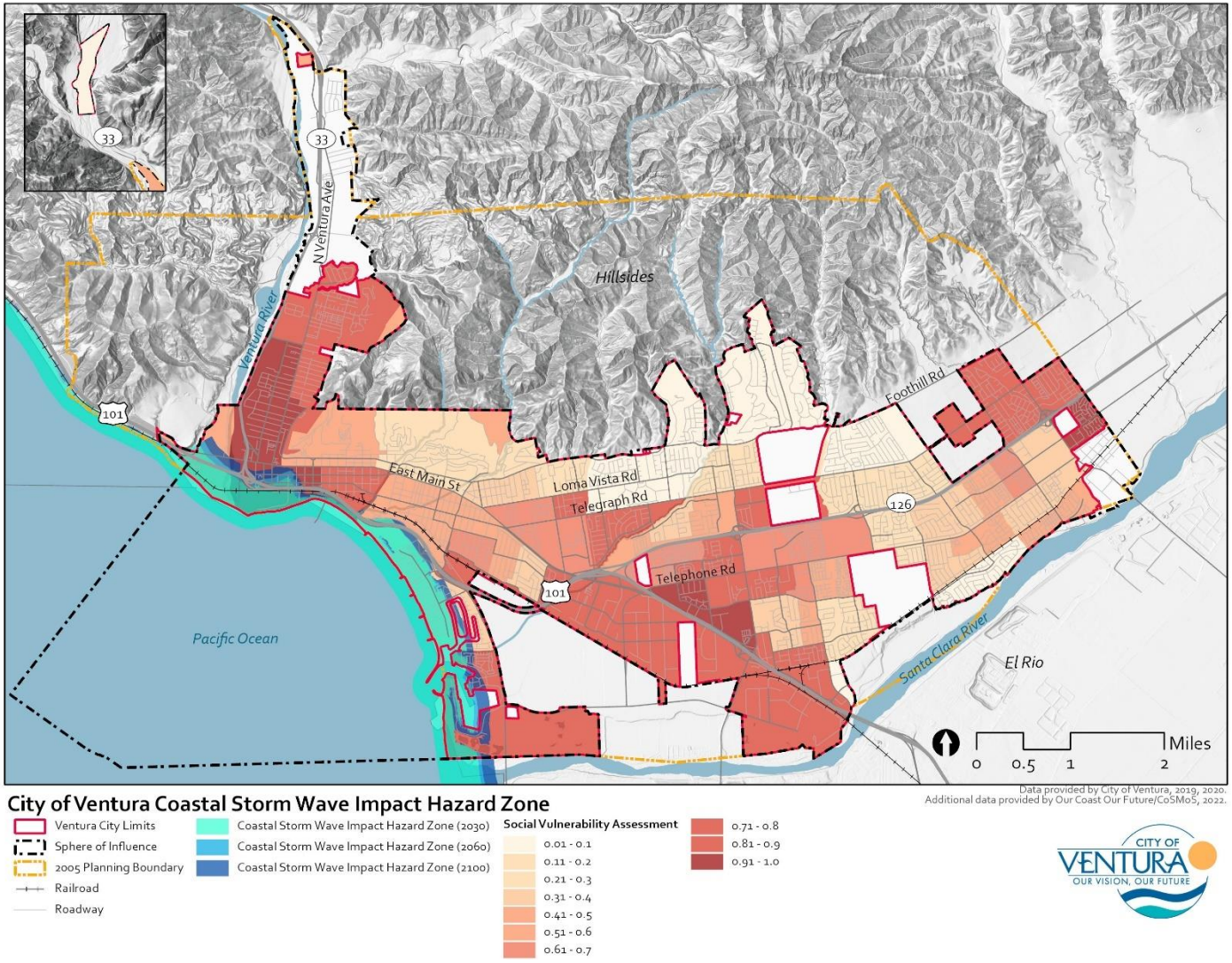
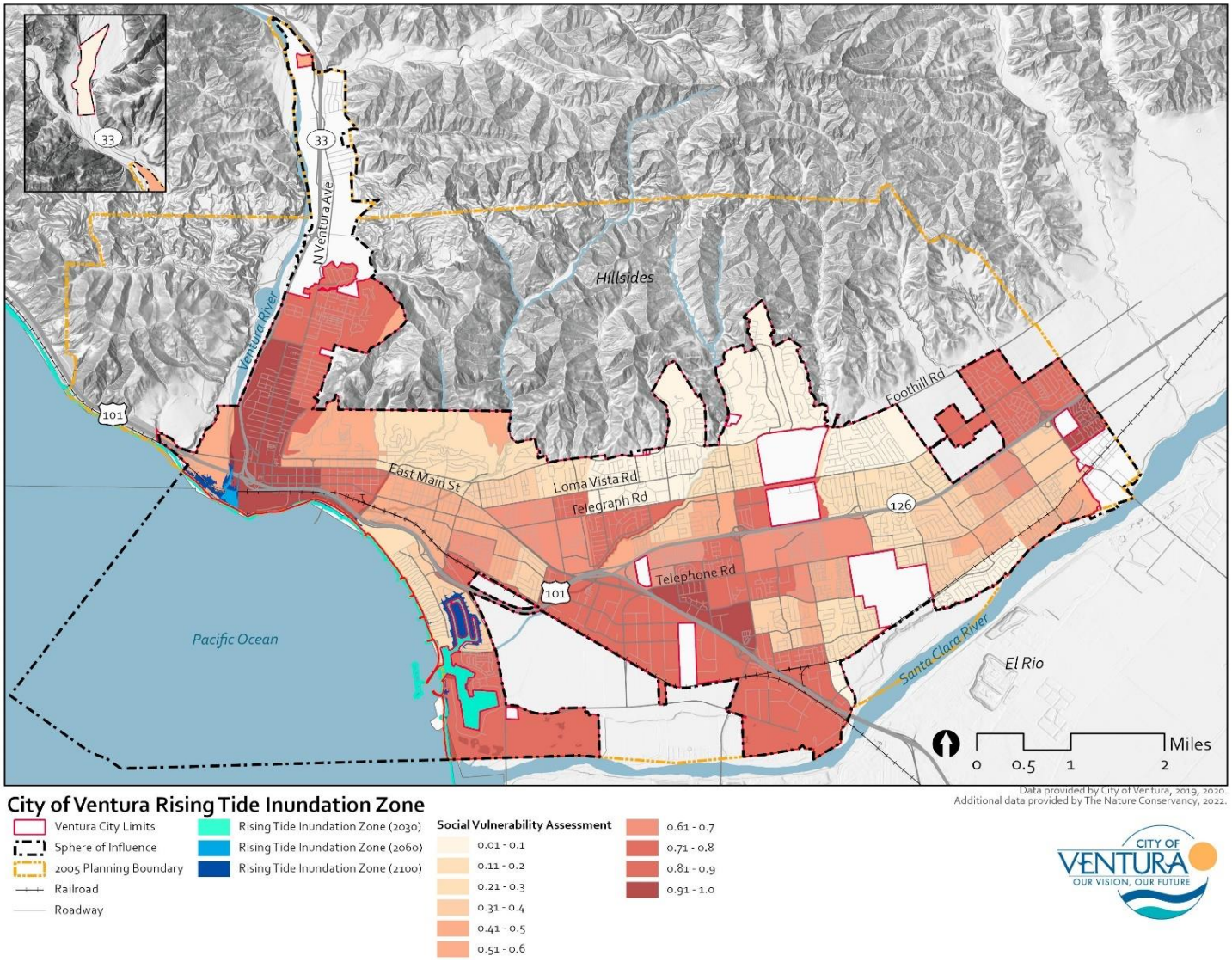


Figure 16 Rising Tide Inundation and Social Vulnerability in the City of Ventura



5.2 Natural and Managed Resources

Primary vulnerabilities for natural resources are associated with climate hazard-caused stress and physical damage to resource types within this asset group. Compounding climate hazards stress natural ecosystems past their ability to absorb individual climate hazards. Wildlife will seek out more conducive habitats during climate hazards such as extreme heat or drought which tend to be where people recreate (USDA 2018). Impacts related to habitat shifts are exacerbated in comparison with rural communities, as densely populated and isolated open space areas have limited opportunities for natural re-seeding or re-habitation from adjacent areas. Both natural resources (beaches, hillsides, rivers and barrancas, riparian and freshwater marshes, biodiversity) and managed resources (parks and agricultural lands) in the City of Ventura, are highly affected by and vulnerable to the effects of climate change.

Potential Impacts

Extreme Heat

The impacts to natural and managed resources in the City of Ventura during extreme heat and warm nights are similar to the impacts experienced by vulnerable populations. Wildlife under these conditions face heat stress and heat related illness as well as disrupted reproductive cycles, and compounding risks associated with early and extended seasonal temperature increases (Backlund 2008). Because it is seasonally warmer earlier in the year species can emerge early with no food source and potentially face an untimely cold front, which increases mortality rates. Timing of seasonal warmth may not overlap with food sources and extreme heat may stress dependent vegetation communities and wildlife (Dale 1997, Hamerlynck 1995, Maclean 2011). Plants are more likely to experience heat stress and drying, habitat ranges may shift, and native species may be outcompeted by invasive species capable of surviving the harsh conditions. Some pests can proliferate more easily with warmer temperatures (Hamerlynck 1995), and some plants and animals ill-suited to the new warmer conditions may suffer increased mortality rates (CA, 2022). Natural resources are highly exposed to extreme heat and warm nights. Both mid- and end- of century projections depict dramatic increases in extreme heat days (CEC 2021).

Higher temperatures will decrease the snowpack in California and raise the snowline, decreasing one of the most important surface water reserves for agriculture in the state (CA 2022). Extreme heat and warm nights can result in declines in crop yields because of heat stress and anomalous warmth during periods that are typically cooler (Parker et al. 2020). Lower crop yields can increase costs and ultimately decrease agriculture profitability. Livestock operations are potentially less viable during extreme heat events as livestock may suffer from heat related illness.

Drought

Impacts from drought involve risks associated with water scarcity and availability for reliant natural resources. Drought will disrupt habitats and will decrease the resiliency of wildlife. Extended or variable drought conditions effect the amount and duration of water available in ephemeral and permanent sources, which impacts plants and wildlife dependent on those aquatic resources (Burkett 2000).

Like extreme heat and warm nights, drought is linked to declines in crop yields, increasing costs, and decreasing crop profitability.

Drought can result in regional losses of crops and can stress the statewide water supply. Crops grown in Ventura, such as fruit, nuts, vegetables, cut flowers, and livestock and poultry are dependent on high depths of water and subsequently higher water intensity needs. In Ventura County in 2020, there were 96,523 acres of irrigated cropland (VCAC 2020).

Wildfire

The largest direct impacts to natural resources are caused by wildfires. The severity and frequency of wildfires can lead to long term habitat conversions, or vegetative communities that no longer support reliant species, and the landscape provides minimal alternative habitats (Bell et al. 1999, Stephenson et al. 1999, Coop et al. 2020). As discussed with the Exposure to Climate Hazards section, extreme wildfire risk days in the City of Ventura are projected to increase through the end of the century (CEC 2021). Figure 3 depicts the delineation of VHFHSZ's which both border and fully encompassing areas with natural resources including many recreational areas and city parks.

Given the projected expansion of wildfire prone areas, larger areas of croplands may be within fire hazard severity zones in the future due to climate change. Wildfires can destroy crops and disrupt rangeland operations while wildfire smoke may stress the health of crops and livestock.

Landslides

Landslide susceptibility is limited and the likelihood of landslides occurring is determined by precipitation and wildfire occurring sequentially (CA, 2022). In the event of a landslide there is potential for loss of lands, habitat, and disruption of waterbodies in areas of debris flow. Wildlife and plants face a compounding risk when presented with landslide events. The hillsides north of Poli Street/Foothill Road, and east of Ventura Avenue and Cedar Street contain several landslide prone areas and are likely to sustain future landslide activity (City 2021).

The majority of the City's cropland is in the foothills, where landslide potential is greatest, and are therefore at high risk of related disruption or destruction (VCAC 2020).

Riverine and Stormwater Flooding

The major impacts of flooding on natural and managed resources are the damage and destruction that occurs because of related erosion, as well as the degradation of water quality, which impacts survival rates of aquatic species and fish (Talbot 2018). One way that stormwater flooding reduces water quality is by causing algae blooms which lead to plant and wildlife health issues within wetlands and waterbodies (EPA 2022). Other impacts include damage from inundation in storm flooded areas including natural habitats and public and private land surrounding waterbodies in the City. Riverine and stormwater flooding will mostly affect sensitive species of plants and wildlife that are based in low-lying areas of the City, specifically those adjacent to the rivers and barrancas in the area. The 100-year flood hazard area for the Ventura River is confined to the area west of the levee, near the River mouth. A 100-year flood along the Santa Clara river would cause a limited area of the City just north of the river, including Olivas Park and Buenaventura Golf Courses to be impacted (City 2021).

Agricultural operations neighboring the Santa Clara river are susceptible to the impacts riverine and stormwater flooding. These operations have the potential to be disrupted during flood events, and inundation is likely to result in crop yield reductions. Agricultural worker's residences could also be damaged by floodwater inundation (VCAC 2020).

Air Quality

The direct effects of air quality declines on natural resources relates to plant and wildlife health as increased air pollutants is correlated to increased stress and mortality rates. Impacts from air quality can further impact natural resources since air quality declines correspond with other hazards (such as wildfire and extreme heat events), which compounds risks.

The direct impacts of air quality on crop yield and livestock health within the City of Ventura are of concern as livestock are dependent on clean air for overall health, and smoke damage may render crops unsaleable.

Sea Level Rise

The extent to which coastal inundation affects habitats, wildlife, and plants is significant in the City of Ventura. The Ventura Sea Level Rise Vulnerability Assessment outlines several coastal resources that will be vulnerable to SLR through the end of the century throughout Ventura County. Coastal sand dunes, beaches estuarine ecosystems, and various coastal recreation areas are the most vulnerable to sea level rise and potentially at risk of flooding and coastal erosion. Ventura's beaches draw many visitors annually and brings a significant economic benefit to the City. Under existing projections, the beaches are subject to coastal erosion and flooding, which will render many unusable at high tide (County 2018)

Though most agricultural land in the City in the foothills, some plots near the Santa Clara river are susceptible to the impacts of SLR related hazards (VCAC 2020).

Adaptive Capacity

There are no explicit plans, programs, or policies directly increasing the adaptive capacity of the City of Ventura's natural resources to the climate hazard of extreme heat, drought, or landslides.

The Coastal Resilience Ventura Project provides data with projections of SLR- related hazards which highlights natural and managed resources that will be impacts in the coming decades.

Related to wildfire, there are existing programs and plans outlined in the Ventura Land Trust Community Wildfire Protection Plan. The plan identifies natural and managed resources that are susceptible to wildfire and plans for vegetation management as a mitigation effort. Indirect planning, such as emergency notification and alert systems, exists within the 2020 Urban Water Management Plan, the 2005 City of Ventura General Plan, the 2022 Ventura County Multi-Jurisdictional Hazard Mitigation Plan, and the 2021 City of Ventura Emergency Response Plan to provide awareness of natural and managed resources impacts around climate hazards.

Phase 1 of the Surfers Point Managed Retreat Project has been completed which is an effort to relocate bike trails, parking lots, and other beach access amenities away from the shoreline in SLR and coastal erosion areas.

Vulnerability Score for Natural and Managed Resources

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat/Warm Nights	High	Low	**4-High**
Drought	High	Low	**4-High**
Wildfire	High	Medium	**4-High**
Landslides	High	Low	**4-High**
Riverine and Stormwater Flooding	High	Medium	**3-Medium**
Air Quality	Medium	Medium	**3-Medium**
Sea Level Rise	High	Medium	**4-High**

Natural and managed resources in the City of Ventura are most vulnerable to extreme heat/warm nights, drought, landslides, wildfire, and sea level rise.

5.3 Buildings and Facilities

Vulnerabilities within this asset category primarily concern physical exposure and damages to residential areas, commercial and industrial buildings, and educational facilities in relation to climate hazards. Impacts associated with operations of critical services are discussed under the Critical Infrastructure and Services section.

Potential Impacts

Extreme Heat and Warm Nights

Extreme heat could impact occupants of buildings and facilities that are not adequately weatherized for increased temperatures.

Drought

Drought will have minimal impact on the physical structures of buildings and facilities across the City of Ventura.

Wildfire

The structures and buildings that occupy wildfire hazard zones are at risk of structural damage from wildfires. There are several residential areas in the City's wildfire hazard zones shown in Figure 3.

Landslides

Landslide susceptibility for the City of Ventura overlaps with sloped wildfire hazard zones (CDOC 2021). Impacts to buildings and facilities as outlined in the multi-jurisdiction hazard mitigation plan encompass many residential neighborhoods as well as some commercial developments.

Riverine and Stormwater Flooding

There is some risk of riverine and stormwater flooding to the physical structures outlined under this asset category. The location of floodplains in Figure 4 show only a slight risk of impact based on current flood conditions, primarily to residences neighboring the Santa Clara and Ventura Rivers.

Air Quality

The impact of reduced air quality will have a similar effect as extreme heat on buildings and facilities. The ability to filter air will greatly affect the subsystems, services, and populations that are reliant on the buildings and facilities, but the direct impact on structures is low.

Sea Level Rise

Physical damages to buildings and facilities brought about by coastal flooding are mainly related to structural damages--residential properties, coastal commercial industry, and some industrial facilities (County 2018).

The Ventura Sea Level Rise Vulnerability Assessment found that losses to residential land made up 95% of all land use vulnerabilities --primarily concentrated in oceanfront neighborhoods comprised primarily of single-family residences (County 2018).

Adaptive Capacity

The City of Ventura has minimal existing adaptive capacity to increase the weatherization of buildings and facilities throughout the City. This means that risks related to climate hazards including wildfire, landslides, riverine and stormwater flooding, and air quality are significant.

The Multi-Jurisdiction Hazard Mitigation Plan provides some actions to retrofit, purchase, or relocate structures located in hazard areas, with priority on those that have experienced repetitive loss or are in high-risk areas (County 2022).

The 2005 Ventura City General Plan acknowledges several concerns in the City's ability to provide swift and successful response in the case of a wildfire that may impact buildings and facilities: lack of fire protection systems in older structures, lengthy response times to far reaching areas in the City, insufficient staffing levels, and a need for a reliable and sustainable source of revenue for fire response (City 2005).

Vulnerability Score for Buildings and Facilities

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat/Warm Nights	Low	Low	**3-Medium**
Drought	Low	Low	**3-Medium**
Wildfire	High	Medium	**4-High**
Landslides	Medium	Medium	**3-Medium**
Riverine and Stormwater Flooding	Medium	Medium	**3-Medium**
Air Quality	Low	Low	**3-Medium**
Sea Level Rise	High	Medium	**4-High**

Buildings and facilities in the City of Ventura are most vulnerable to wildfires and sea level rise.

5.4 Critical Infrastructure and Services

Overall vulnerabilities associated with this asset category involve structural preparedness and service reliability in the face of climate change. This section is mainly concerned with the cascading impacts physical damages to buildings and facilities can have on services and infrastructure.

Potential Impacts

Extreme Heat and Warm Nights

As temperatures increase, roadways, active transportation routes, and railroads are vulnerable to damages through sustained heat such as buckled railroad ties and cracked surfaces (Hall et al. 2018). Additional impacts from extreme heat are associated with increased emergency service calls which could strain medical services. Electrical infrastructure may become overwhelmed by demand and result in blackouts, or energy providers may conduct power safety shutoffs to avoid impacts to electrical facilities. Power outages have significant impacts on communication networks, water conveyance, and vulnerable populations, and are a cascading impact of extreme heat events, which place additional strain on infrastructure and critical services.

Drought

Drought can impact water reliability and water infrastructure. All emergency services depend on water, particularly firefighters, who rely on adequate water supply for fire suppression. Water providers within the City will encounter increased difficulty as drought decreases general service reliability. Drought impacts can create service strain for emergency and medical services. Cracked pavements from drought compounded with extreme heat affects roadways and transportation routes.

Wildfire

There are some critical facilities, such as the police station, several medical facilities, fire stations, and government buildings, located in the high and moderate fire hazard severity zones as shown in Figure 3 that are at risk of damage and destruction caused by wildfires. Additionally, utility lines have the potential to be damaged in high-risk locations, resulting in oil and gas leaks and power outages. Utility lines under certain high wind conditions can also trigger wildfires through downed power lines (Hall et al. 2018). Power safety shut offs in response to wildfire risk can affect service reliability of power. Increased frequency of wildfires can place strain on fire and emergency services. Evacuation routes could be disrupted during a wildfire event limiting emergency responders and ability for people to evacuate as well. Post-wildfire there are additional issues of displacement and needs for temporary shelters for uprooted communities.

Landslides

The Thomas Fire burned over 500 homes in the City and left burn scars in the hillsides susceptible to landslides (County 2022). Landslides risk is high along most of the northern border of the City as well as along both sides of Highway 33, which leaves critical facilities and services, including the police station, several medical facilities, fire stations, and government buildings vulnerable.

Riverine and Stormwater Flooding

Impervious surfaces can impede the absorption of water and increase stormwater flooding in areas of the City. There is risk of

damage from increased extreme precipitation events including erosion, washouts, and sinkholes. Storm drainage and flood protection services for the City may be impacted by these events. In flood events, water quality decreases, which may lead to cascading impacts such as limited availability for fire suppression.

Air Quality

Higher incidence of unsafe air quality caused by increased smog, dust and wildfire smoke can create general strain on existing critical services and infrastructure through increased rates of hospitalization and emergency and medical services (CDPH 2020).

Sea Level Rise

The SLR-related hazards that the City of Ventura is expected to experience are significant. Critical services and infrastructure including critical transportation, coastal highways, and infrastructure corridors are vulnerable to sea level rise and related hazards. The Pacific Coast Highway is the most vulnerable road on the coast (County 2018). SLR will likely impact the City's wastewater treatment facility, located on the northern bank of the Santa Clara River. Additionally, coastal medical facilities and government buildings may be impacted by rising sea level and related hazards.

Adaptive Capacity

The relevant existing plans, policies, and programs for the City of Ventura are mainly multi-hazard based. All multi-hazard plans, programs and systems are designed to address service and infrastructure failings and contingencies. Existing planning cover wildfires, drought, landslides, flooding, severe weather and storms, and sea level rise. Relevant plans and systems in place are found below:

- Ventura County Multi-Jurisdictional Hazard Mitigation Plan
- City of Ventura Emergency Response Plan
- City of Ventura Emergency Response Team (CERT) Program
- City of Ventura 2005 General Plan Public Safety Element

The Multi-Jurisdiction Hazard Mitigation Plan includes action Ven-21 which highlights City fire facilities and develops plans to retrofit fire facilities in accordance with local regulations and industry standards (County 2022).

Cascading risks of services and power dependencies are addressed in relation to the aforementioned hazards throughout these plans and programs.

Vulnerability Score for Critical Services and Infrastructure

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat/Warm Nights	High	Low	**5-High**
Drought	High	Medium	**4-High**
Wildfire	High	High	**3-Medium**
Landslides	Medium	Low	**4- High**
Riverine and Stormwater Flooding	High	Low	**5-High**
Air Quality	Medium	Low	**4-High**
Sea Level Rise	High	Medium	**4-High**

Critical services and infrastructure in the City of Ventura are most vulnerable to extreme heat/warm nights, drought, landslides, riverine and stormwater flooding, air quality, and sea level rise.

6 Conclusion

This report evaluates how climate change may impact vulnerable community members, natural resources, critical facilities, buildings, services, and infrastructure in the City of Ventura. The report provides a list of vulnerable population groups and assets for which adaptation policies and programs should be developed and implemented to increase community resilience. Vulnerability is based on the combination of potential impacts and adaptive capacity, as identified in the Vulnerability Analysis section of the report.

A list of asset categories and related vulnerability scores is provided on the next page. Highly vulnerable assets are discussed below:

- All sensitive population groups identified are highly vulnerable to many climate hazards including extreme heat, air quality, wildfires, flooding, landslides, and sea level rise.
- Natural and managed resources are highly vulnerable to extreme heat, drought, wildfire, flooding, landslides, and sea level rise.
- Buildings and facilities in the City are highly vulnerable to wildfire and sea level rise. Buildings and facilities located in inundation zones are at risk of structural damage from sea level rise.
- Critical infrastructure and services are highly vulnerable to extreme heat, flooding, landslides, air quality, and sea level rise. Several facilities are in the wildfire hazard severity zones of the City. These buildings and facilities are at risk of structural damage from wildfire. Infrastructure and dependent populations experience additional cascading impacts around power outages from downed utility lines, power safety shut offs and grid overload. All forms of power outages can affect how critical services are able to perform their needed functions during a hazard.

This report establishes a foundation for identifying adaptation policies and programs that can increase resilience in the City of Ventura. The City of Ventura Safety Element will include policies and programs to increase the resilience of the population groups and asset categories with the highest vulnerability to climate change.

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Vulnerable Populations			
Extreme Heat	High	Medium	**4-High**
Drought	Medium	Medium	**3-Medium**
Wildfire	High	Medium	**4-High**
Landslides	Medium	Low	**4-High**
Riverine and Stormwater Flooding	Medium	Medium	**3-Medium**
Air Quality	High	Low	**5-High**
Sea Level Rise	High	Low	**5-High**
Natural and Managed Resources			
Extreme Heat/Warm Nights	High	Low	**4-High**
Drought	High	Medium	**4-High**
Wildfire	High	Medium	**4-High**
Landslides	Low	Low	**4-High**
Riverine and Stormwater Flooding	High	Medium	**3-Medium**
Air Quality	Medium	Medium	**3- Medium**
Sea Level Rise	High	Medium	**4-High**
Buildings and Facilities			
Extreme Heat/Warm Nights	Low	Low	**3-Medium**
Drought	Low	Low	**3-Medium**
Wildfire	High	Medium	**4-High**
Landslides	Medium	Medium	**3-Medium**
Riverine and Stormwater Flooding	Medium	Medium	**3-Medium**
Air Quality	Low	Low	**3-Medium**
Sea Level Rise	High	Medium	**4-High**
Critical Services and Infrastructure			
Extreme Heat/Warm Nights	High	Low	**5-High**
Drought	High	Medium	**4-High**
Wildfire	High	High	**3-Medium**
Landslides	Medium	Low	**4- High**
Riverine and Stormwater Flooding	High	Low	**5-High**
Air Quality	Medium	Low	**4-High**
Sea Level Rise	High	Medium	**4-High**

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