



Safety Element Update

Climate Vulnerability Assessment

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1 Introduction

This City of Arroyo Grande (City) Climate Change Vulnerability Assessment (CCVA) evaluates how climate change is projected to impact vulnerable populations, the built environment, and natural resources and agriculture within Arroyo Grande. Government Code §65302, as amended by Senate Bill (SB) 379, requires cities and counties across California to prepare a Climate Change Vulnerability Assessment that informs updates to the Safety Element of the General Plan. Understanding Arroyo Grande's vulnerabilities to climate change provides a foundation upon which climate adaptation goals, policies, and implementation programs can be developed for the Safety Element.

1.1 Causes of Climate Change

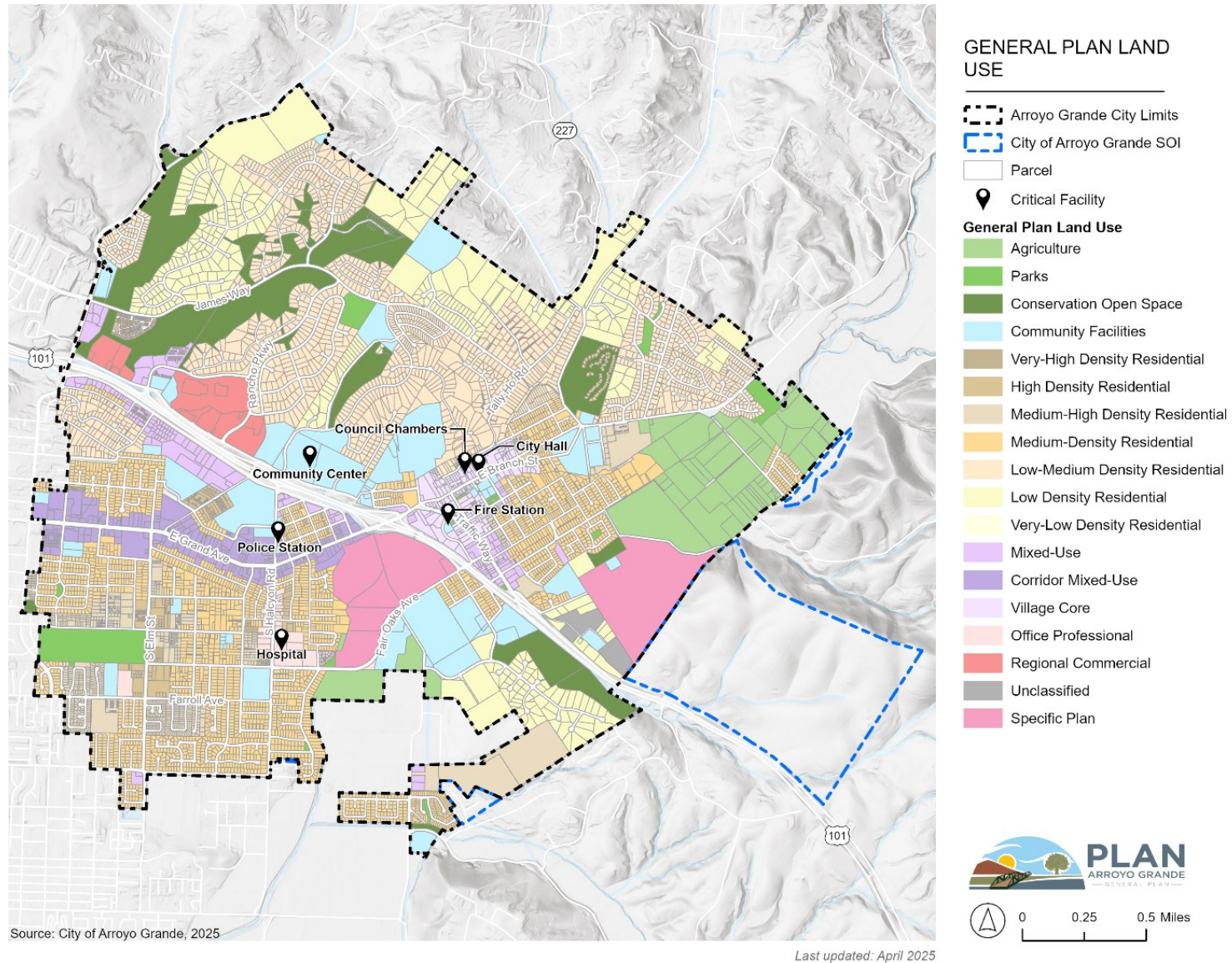
Climate change is caused by the addition of excess greenhouse gases (GHGs) to the atmosphere, which traps heat near the earth's surface, raising global average temperatures in what is referred to as the greenhouse effect. This increase in average temperatures across the globe affects sea level rise, 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 Arroyo Grande Snapshot

Arroyo Grande is a community within San Luis Obispo County with a population of approximately 18,243 people (U.S. Census 2023). Arroyo Grande covers roughly six square miles in southern San Luis Obispo County, 14 miles northwest of Santa Maria and 16 miles south of the City of San Luis Obispo. United States Highway (US) 101 traverses Arroyo Grande in a north-south direction, while State Route (SR) 227 intersects the area in an eastward direction. Surrounded by agricultural lands, Arroyo Grande is primarily an area with truck crops.¹ Critical facilities and General Plan land use designations for Arroyo Grande are displayed in Figure 1. Arroyo Grande's predominant land use is Residential followed by Agriculture, Public, Industrial and Commercial uses.

¹ Truck Crops refer to the products of large scale crop cultivation, which are transported to distant markets.

Figure 1 Arroyo Grande Critical Facilities and General Plan Land Use Designations



2 Methodology

2.1 Background

Government Code §65302, as amended by Senate Bill (SB) 1035 (2018) requires Arroyo Grande and all California cities and counties to update their Safety Element with new information on flood hazards, fire hazard, and climate adaptation and resilience in conjunction with the housing element or local hazard mitigation plan update cycle, which occur every eight years and five years, respectively. In accordance with California Government Code Section 65302(g) (as updated by SB 379), Arroyo Grande is required to complete a climate change vulnerability assessment in conjunction with the update to its Safety Element. The update to the Safety Element must consist of the following components:

1. A vulnerability assessment that identifies the risks climate change poses to the local jurisdiction and the geographic areas at risk from climate change.
2. A set of adaptation and resilience goals, policies, and objectives based on the information specified in the vulnerability assessment.
3. A set of feasible implementation measures designed to carry out the goals, policies, and objectives identified in the adaptation objectives.

2.2 California Adaptation Planning Guide Phases

This report follows the vulnerability assessment process recommended by the California Governor's Office of Emergency Services, 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 Figure 2 below, with Phase two focused on the vulnerability assessment process (Cal OES 2018). The City CCVA is prepared using methods consistent with Phase two of the Cal APG and is composed of the sections outlined in Figure 3.

2.3 Key Data Sources

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

- **Cal-Adapt (Version 2.0) Local Climate Change Snapshot** is an online tool that presents historic and modeled projections based on ten different global climate models. The tool was developed and is maintained by the University of California, Berkeley Geospatial Innovation Facility with funding and oversight by the California Energy Commission (CEC). This tool was used to present projection data related to minimum and maximum temperature, precipitation, extreme heat, warm nights, and wildfire (CEC 2025). The Cal-Adapt Analytics Engine houses downscaled climate projections in support of California's Fifth Climate Change Assessment. At this time, the [Analytics Engine JupyterHub](#) service is currently only open to a select group of users to alpha test the Analytics Engine.

Figure 2 California Adaptation Planning Guide Phases

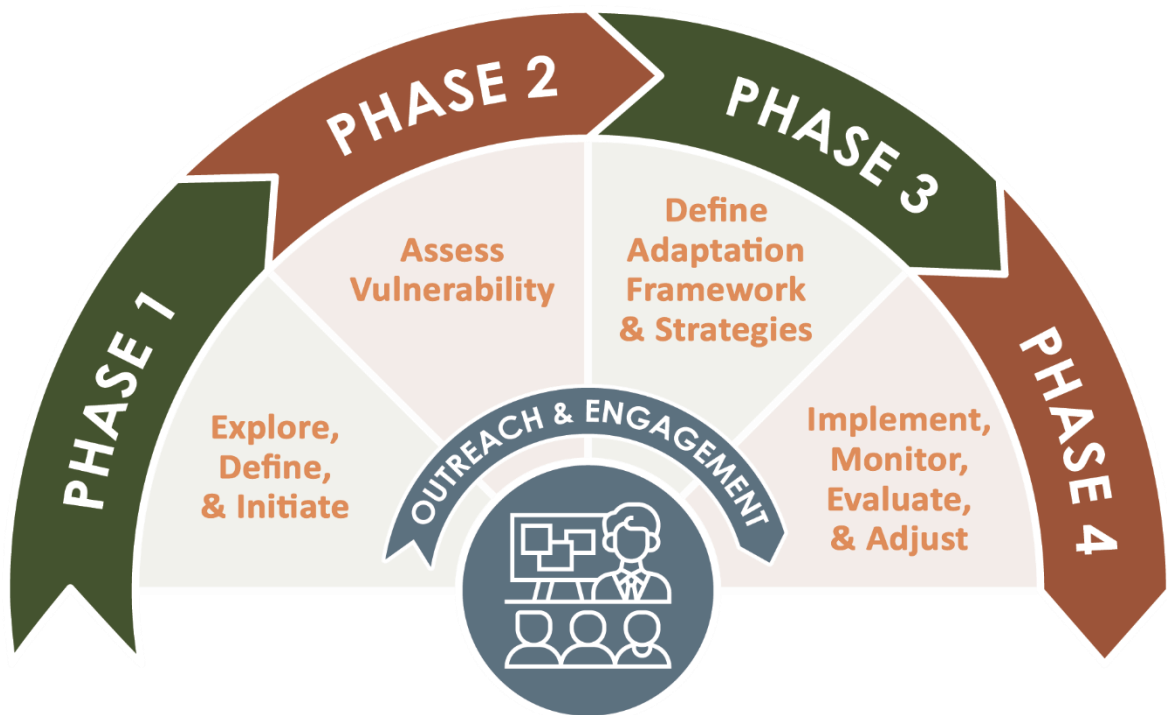
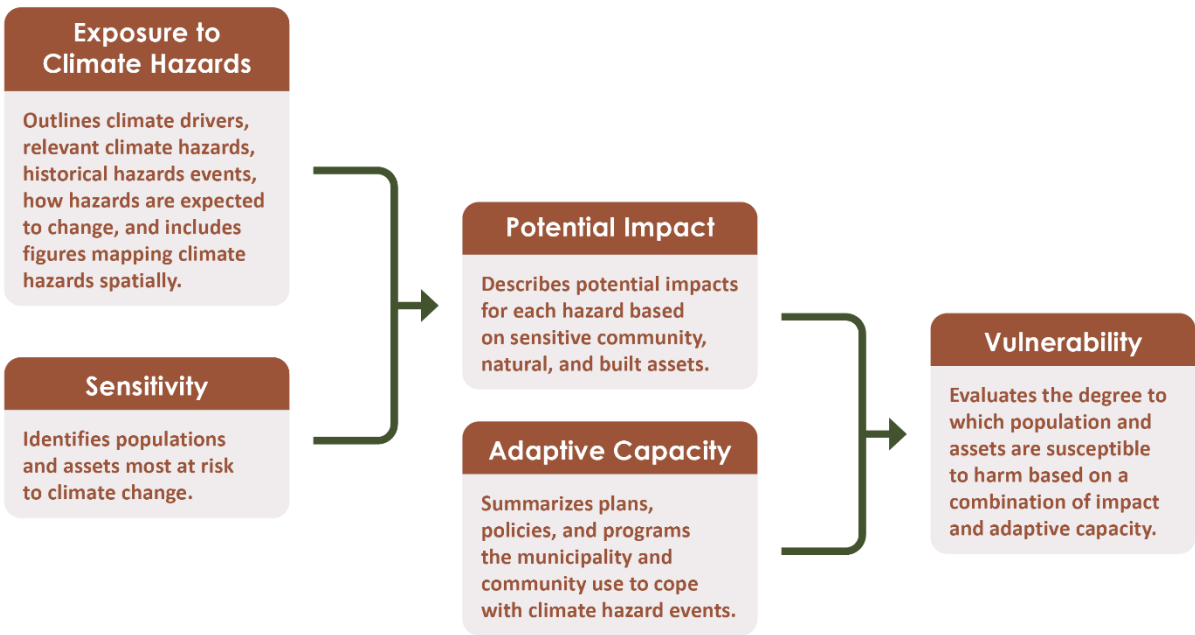


Figure 3 Climate Vulnerability Assessment Workflow



- **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 Central Coast Region Summary Report (2021) presents an overview of climate science, regional projections, specific strategies to adapt to climate impacts, and key research gaps needed to spur additional progress on safeguarding California's Central Coast from the impacts of climate change. The Central Coast Region Summary Report was used to understand regional changes that may affect Arroyo Grande both directly and indirectly. The Fifth Climate Change Assessment is currently being developed. Regional reports are not yet available; therefore the Fourth Climate Change Assessment is the most current version at the time of writing this report.
- **Multi-Jurisdictional Local Hazard Mitigation Plan** presents information on existing processes and plans in place that address Arroyo Grande's ability to prepare for climate change impacts and informed the adaptive capacity discussion of this report. The Hazard Mitigation Plan (2015) was also used to identify recent historical events. A 2025 Update to the Multi-Jurisdictional Hazard Mitigation Plan is in progress at the time of the writing of this report (San Luis Obispo County 2025).

2.4 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, undocumented immigrants), which results in general demographic information not fully identifying the extent of populations vulnerable to the impacts of 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. Extrapolating air quality hazard exposure data in the context of climate change is difficult and the estimates of exposure to these hazards are likely to be underestimated (Fernandez-Bou et al. 2021).

The data presented in Cal-Adapt tools are projections, or estimates, of future climate conditions. 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. What is often lost in averages is that the frequency of extremes, like atmospheric rivers, may increase while low-moderate intensity weather events decrease through the end of the century.

3 Climate Hazards

Climate change is a global phenomenon that can impact local health, natural resources and agriculture, parks, 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 roughly four-mile square grids (CEC 2025). The data in Cal-Adapt specific to Arroyo Grande is combined with information from the California Fourth Climate Change Assessment Central Coast regional report to describe projected future changes for specific types of hazards. Projections throughout this section are presented in a method consistent with the Governor’s Office of Planning and Research (OPR) using Representative Concentration Pathway (RCP) 8.5 as a conservative approach to assessing and adapting to climate change (CEC 2025). RCP 8.5 is a high greenhouse gas emissions scenario in which global emissions continue to rise through the end of the 21st century. Projections are forecasted to mid-century (2035-2064) and end-of-century (2070-2099) as 30-year averages and are compared to a modeled historical baseline (1961-1990) (CEC 2021).

This section presents information on temperature and precipitation, which are characterized as climate drivers. Hazards created by these climate drivers that are discussed in this report include extreme heat, landslide, wildfire, and flooding. Water is supplied by the City of Arroyo Grande’s Public Works Department, Utilities Division, which also leads water planning through water conservation initiatives such as the Water Supply Alternatives Study Update and the Urban Water Management Plan (City of Arroyo Grande 2021). Therefore, although drought is of concern in Arroyo Grande, it is not included as a hazard in this report.

3.1 Climate Drivers

In Arroyo Grande, the climate drivers of concern include Temperature and Precipitation.

Temperature

Arroyo Grande has an average baseline maximum temperature of 68.9°F and an average baseline minimum temperature of 46.2°F (CEC 2025). The average maximum and minimum temperatures are expected to increase, which will shift the temperature range by up to 3.9°F by mid-century and 6.7°F (RCP 8.5) through the end of the century (CEC 2025). Temperature increases influence extreme heat and wildfire (discussed under Section 3.2 Climate Hazards below).

Precipitation

The average annual precipitation in much of the Central Coast region is projected to increase by the end of the century. However, the average annual precipitation specific to Arroyo Grande under high-emissions scenarios (RCP 8.5) is projected to remain similar to current precipitation rates (CEC 2025). The 30-year average for maximum one-day precipitation in Arroyo Grande is modeled at one inch (CEC 2025). While the average annual rates do not change drastically, the intensity of precipitation events for Arroyo Grande is expected to increase. By end-century, annual variability in precipitation is projected to increase substantially (CCCA 2019), pointing to “boom and bust” periods of precipitation, rather than a significant increase in the average precipitation. The maximum one-day precipitation is projected to increase 8 percent by mid-century and 14 percent by

end-century under RCP 8.5 (CEC 2025). This translates into longer dry seasons with less precipitation on average that may lead to increased strain on the Arroyo Grande's water supply from Lopez Reservoir and surrounding watersheds. Coupled with projected longer average dry periods, increasing by 13 days (RCP 8.5) by the end of the century, Arroyo Grande can expect more extreme wet and dry periods. These changes in precipitation and temperature are expected to affect the occurrence of hazard events such as flooding and wildfire and have significant impacts on agricultural production (CEC 2025).

3.2 Hazards

Changes in temperature and precipitation are expected to influence the frequency, duration, and magnitude of the following climate hazards:

- Extreme Heat
- Landslide
- Wildfire
- Flooding

Extreme Heat

The baseline 30-year average for annual average maximum and minimum temperatures are 69°F and 47°F, respectively (CEC 2025). The past 30 years have seen an average of 2 extreme heat days per year and ten warm nights per year (CEC 2025). Extreme heat days refer to the number of days in a year when the daily maximum temperature in Arroyo Grande is above a threshold temperature of 87.7°F (CEC 2025). Warm nights refer to the number of days in a year when the daily minimum temperature in Arroyo Grande is above a threshold temperature of 57.5°F (CEC 2025). For both extreme heat days and warm nights, threshold temperatures are location-specific and defined as the 98th percentile value of historical daily maximum or minimum temperatures (from 1961-1990, between April and October) observed in Arroyo Grande (CEC 2025).

Under RCP 8.5, Arroyo Grande is expected to see higher maximum and minimum temperatures, increasing to 73°F maximum and 51°F minimum by mid-century and 76°F maximum and 54°F minimum by end-century (CEC 2025). Incidences of extreme heat days are expected to increase to 7 days by mid-century and 15 days by end-century. Similarly, incidences of warm nights are expected to increase to 46 nights by mid-century and 86 nights by end-century.

Extreme heat events attributed to increasing temperatures are made worse through compounding built and natural environment factors such as the Urban Heat Island Effect (UHI). UHI refers to developed areas that are hotter than the surrounding landscape primarily due to the use of building materials and surfaces that absorb and re-radiate heat (like roofs and pavements), as well as a lack of vegetation, particularly trees. The UHI effect causes people in cities to have higher heat exposure than residents in less densely developed areas. Within urban landscapes, neighborhoods with more impermeable and dark colored surfaces, and fewer trees, parks, and water features, have greater heat exposure and heat related risk than urban communities with more green space and reflective surfaces. These differences in development patterns typically correspond with income and demographic disparities across the urban environment. UHI will likely compound the impact and risk of extreme heat days and higher average temperatures resulting from climate change. In some locations, the effect could be twice as strong as the impact of climate change alone (Huang et al. 2019). The Tree Equity Score evaluates how effectively the essential advantages of urban tree

canopy coverage are distributed to those who need them most, such as the vulnerable populations described in Section 4 of this report, and provides a score between 0 and 100. A lower score indicates a higher need for investment. A score of 100 indicates that a neighborhood has adequate tree cover, while any score below 100 indicates a tree canopy need (Tree Equity Score 2025). Arroyo Grande's Tree Equity Score ranges from 62 to 100, with lower scores south of Highway 101 and higher scores north of Highway 101 (Tree Equity Score 2025). While no value under 100 is considered minimally acceptable to mitigate risk, the Tree Equity Score can be utilized to prioritize investment; scores of 0-69 indicate highest priority, scores 70-79 indicate high priority, scores of 80-89 indicate moderate priority, and scores of 90-99 indicate low priority.

Landslide

Seismic hazards can further displace already unstable soils, causing landslides, which can pose significant public safety risks, damage to built infrastructure, and harm to natural resources. The nearest fault zones to Arroyo Grande are the Wilmar Avenue fault and the inactive Pismo fault, with the active San Andreas fault zone located further east (City of Arroyo Grande 2024). The Wilmar Avenue fault, which is potentially active, is adjacent to Arroyo Grande and exposed in a sea cliff near Pismo beach, running parallel to Highway 101. This fault presents a moderate potential for fault rupture hazards to Arroyo Grande (City of Arroyo Grande 2024). The inactive Pismo fault, which lies beneath parts of Arroyo Grande, poses a very low potential for rupture hazards (City of Arroyo Grande 2024).

With projected increases in wildfire, as well as projected increases in precipitation variability, landslide is a significant hazard in areas with medium to high landslide potential. Figure 4 below assesses the seismic hazard variability seen across Arroyo Grande, which is highest (>60-80%/g earthquake shaking potential) along Arroyo Grande Creek. Landslide susceptibility in Arroyo Grande can be seen in Figure 5 below, illustrating high landslide susceptibility in the northwestern quadrant of Arroyo Grande, along Tally Ho Road and Highway 101.

Figure 4 City of Arroyo Grande Seismic Hazard Assessment

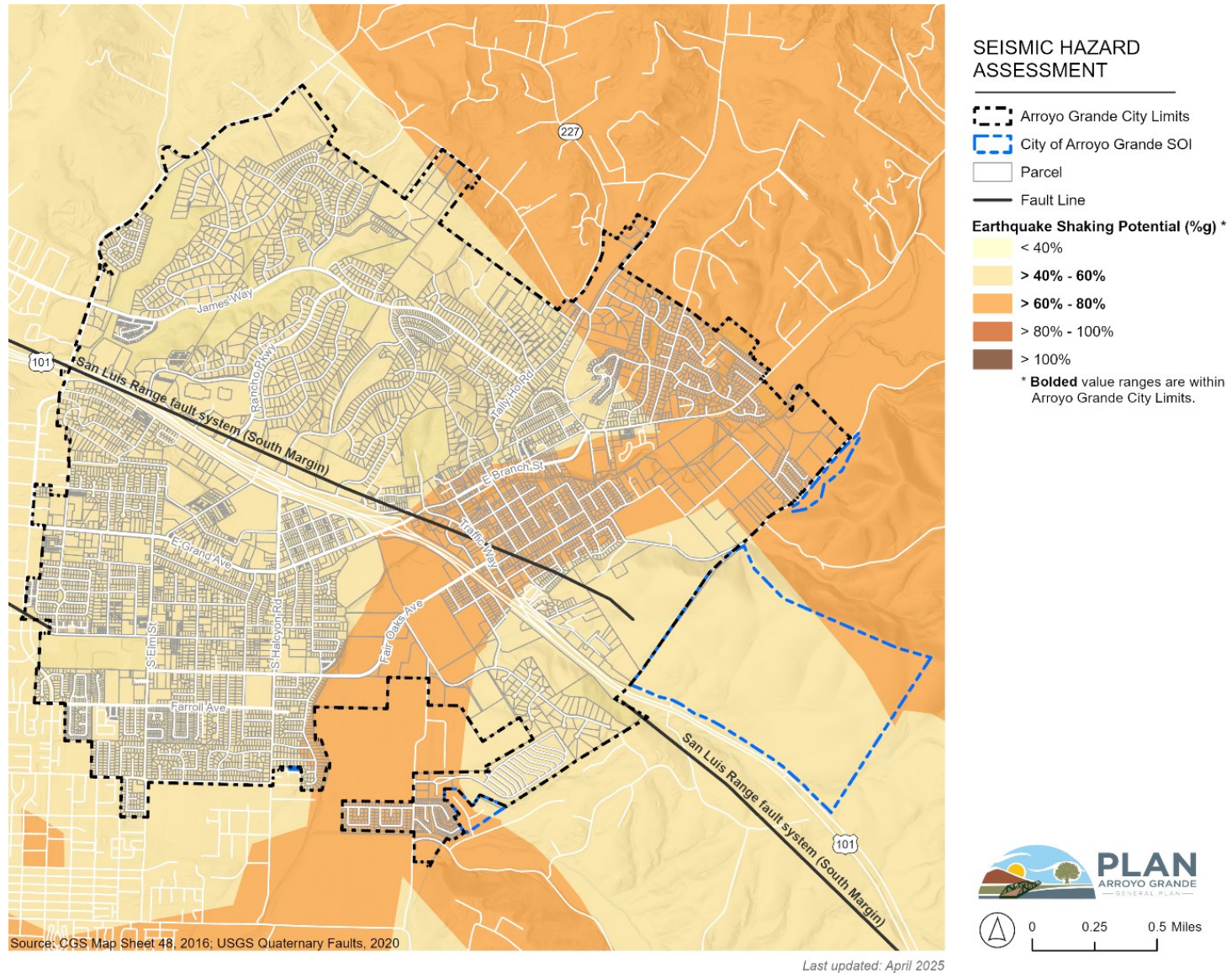
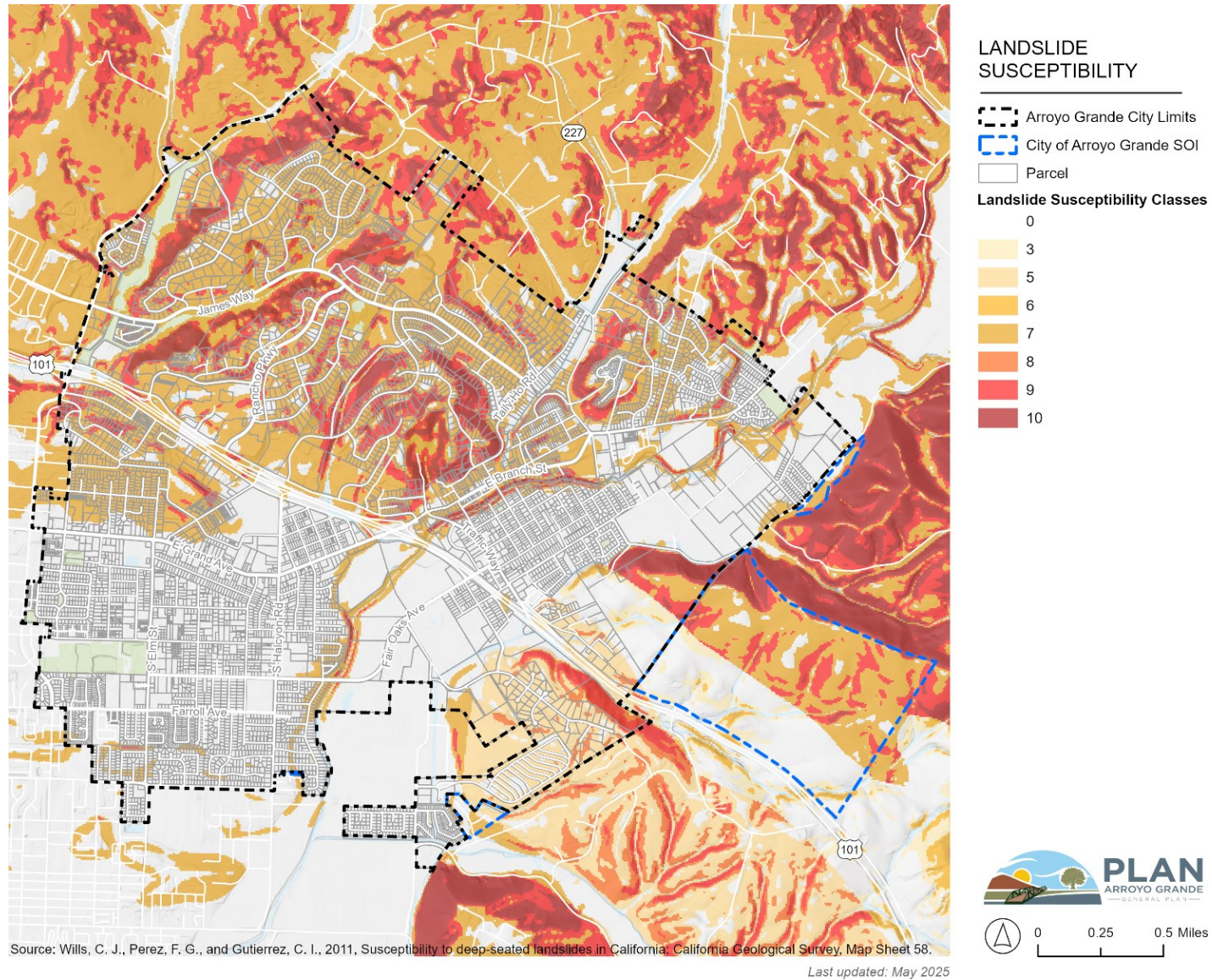


Figure 5 City of Arroyo Grande Landslide Susceptibility



Wildfire

Arroyo Grande features diverse land uses and topography that can help to reduce fire risk (City of Arroyo Grande 2024). Its coastal location on the Santa Lucia Mountain Range provides cool temperatures and coastal fog, which helps to reduce the likelihood of ignition (City of Arroyo Grande 2024). Historically, Arroyo Grande has not experienced a fire within city limits since the 1985 Las Pilitas Fire, which burned over 84,000 acres in the coastal mountains north of Arroyo Grande and destroyed ten homes in San Luis Obispo County (The Tribune 2015). The 30-year average for annual acres burned in Arroyo Grande is 333 acres (CEC 2025). Sections of Arroyo Grande fall within high fire severity zones, including an area northwest of Highway 101 and a section of the city east of Branch Street, which falls in both moderate and high fire hazard severity zones. Fire Hazard Severity Zone mapping can be found in Figure 6 below. Due to Arroyo Grande's geography and the presence of wildland-urban interface (WUI), the risk of wildfires could increase as climate change exacerbates fire conditions in and around Arroyo Grande.

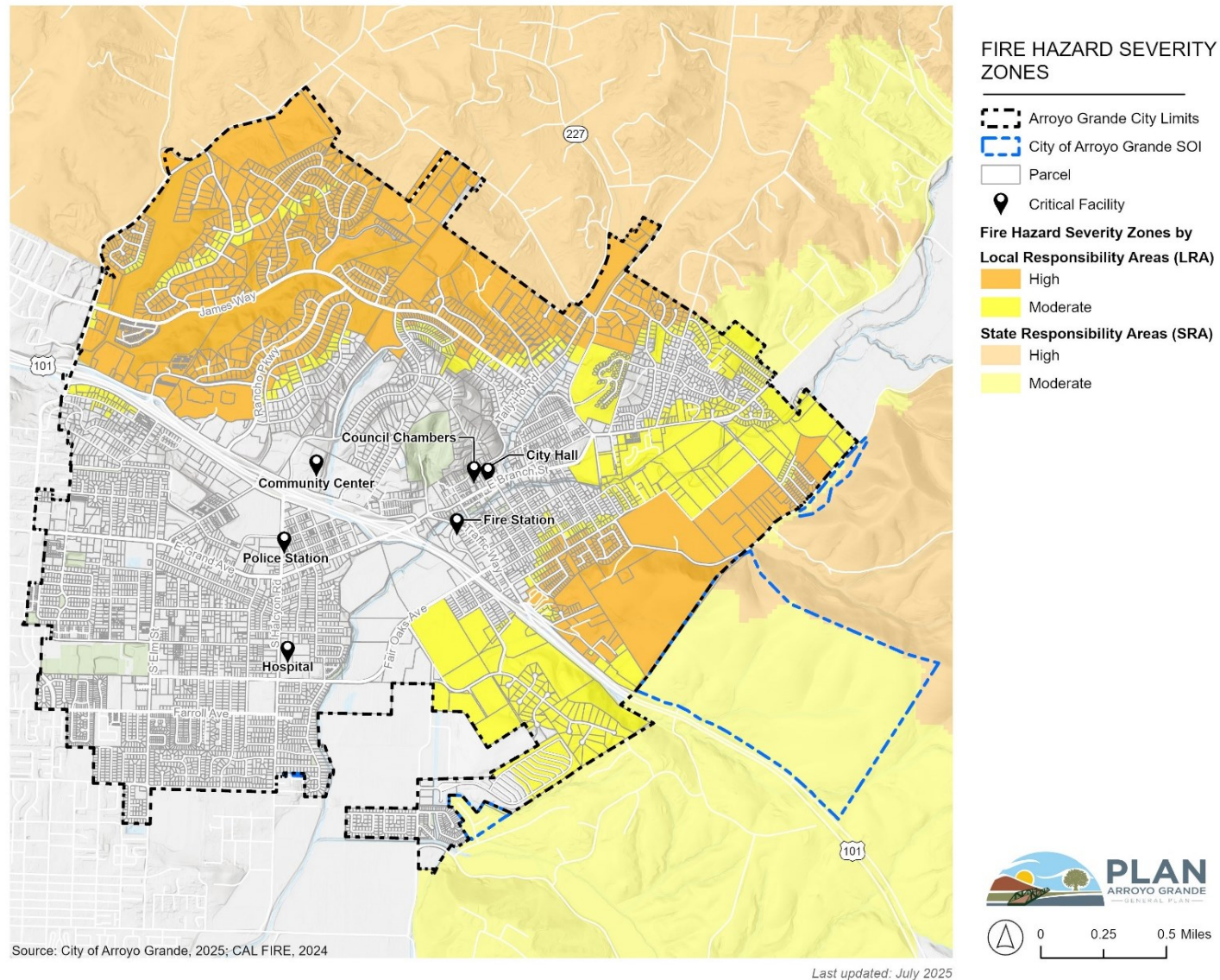
Arroyo Grande is located in an area of low rolling topography, surrounded by agriculture uses and steep hillsides, which helps to minimize the risk of wildfire within Arroyo Grande (MJLHMP). However, as climate change causes an increase in the minimum and maximum daily average temperatures, the coastal fog along the California coast, which helps to maintain high moisture levels in Arroyo Grande and mitigate wildfire risk, could decrease. This decrease in coastal fog could result in higher risk for wildfires and increase risks for air pollution along the Central Coast Region (Torregrosa et al. 2014).

Winds can be strong and will affect fire behavior. The 2020 Avila Fire in nearby Shell Beach is an example of a wind driven fire right on the coast. The summertime ocean influence includes summer fog but also strong afternoon onshore winds. Santa Lucia winds in late Spring and Fall result in high temperatures, low humidity, and strong offshore winds. Systems flowing from over the Great Basin and across the Central Valley bring hot, dry air to the East Arroyo Grande area. This Santa Lucia wind phenomenon has been previously responsible for driving coastal valley temperatures over 115 degrees Fahrenheit, such as those experienced in September 2020 (Lindsey 2021). With these winds accelerating down the Santa Lucia Mountains and into the landscape of the East Arroyo Grande Fireshed, a rural wildfire ignition would spread toward town and could quickly become very problematic and difficult to control. During wind driven wildfires, the fireshed has a high potential for ember cast which can ignite spot fires ahead of the main fire (Voosen 2021).

At its southwestern border, the East Arroyo Grande Fireshed is approximately one-third mile from the Pacific Ocean. This proximity to the moderating maritime influence maintains mild weather patterns within most of the fireshed. Annual average temperatures in Arroyo Grande hover around 68.4°F and humidity levels remain relatively high year-round (CAL ADAPT 2024). Although the East Arroyo Grande Fireshed in the past has not often experienced extreme fire weather conditions, this is changing due to climate change.

The statewide and broader regional wildfire probabilities are expected to increase through 2100. Under RCP 8.5, annual acres burned Arroyo Grande is expected to increase to 466 acres by mid-century and 484 acres by end-century (CEC 2025). Average temperatures, severe wildfire conditions, and acres consumed by wildfires have shown an annual increase statewide and are expected to continue to increase. Higher temperatures accompanied by an increase in the incidence and extent of large wildfires can lead to increased wildfire smoke and associated toxins and air pollution (Hall et al. 2018). Figure 6 below details Fire Hazard Severity Zones in Arroyo Grande, which are high in the northern areas of Arroyo Grande and moderate to high in the eastern region.

Figure 6 Fire Hazard Severity Zones in Arroyo Grande



Flooding

Arroyo Grande is at risk from flooding along creeks and streams (FEMA 2025). There have been several flooding events within Arroyo Grande typically during winter months when rainfall and weather events are most significant. Significant flooding events have occurred as recently as January and March 2023.

Arroyo Grande is at risk from flooding from several watersheds throughout the area, as illustrated in Figure 7 below. Canyon/Meadow creek on the west side of Arroyo Grande, Corbett Canyon, Tally Ho and Arroyo Grande Creeks on the east side of Arroyo Grande, and Los Berros Creek on the southeastern side could all affect large portions of Arroyo Grande under 100-year flood scenarios. The Arroyo Grande Creek Levee drains a 157 square mile watershed directly through and is at risk for flooding under extreme rain events. Flooding in these watersheds would primarily impact adjacent residential areas. Although unlikely, if the Lopez Dam were to experience a total failure, this would produce significant impact on residential properties in Arroyo Grande. Dam inundation zones can be seen in Figure 8 below, illustrating three critical facilities that are located in the extremely high dam inundation boundary class: City Hall, the Council Chambers, and the Fire Station. Climate change may increase the extent and frequency of watershed flooding in Arroyo Grande due to increases in precipitation extremes. Storm water systems, creeks, and the Lopez Dam may be overwhelmed during extreme precipitation events should the storm event exceed the capacity of storm water and floodplain infrastructure (City of Arroyo Grande 2024).

Figure 7 One-Hundred and Five-Hundred Year Floodplains in Arroyo Grande

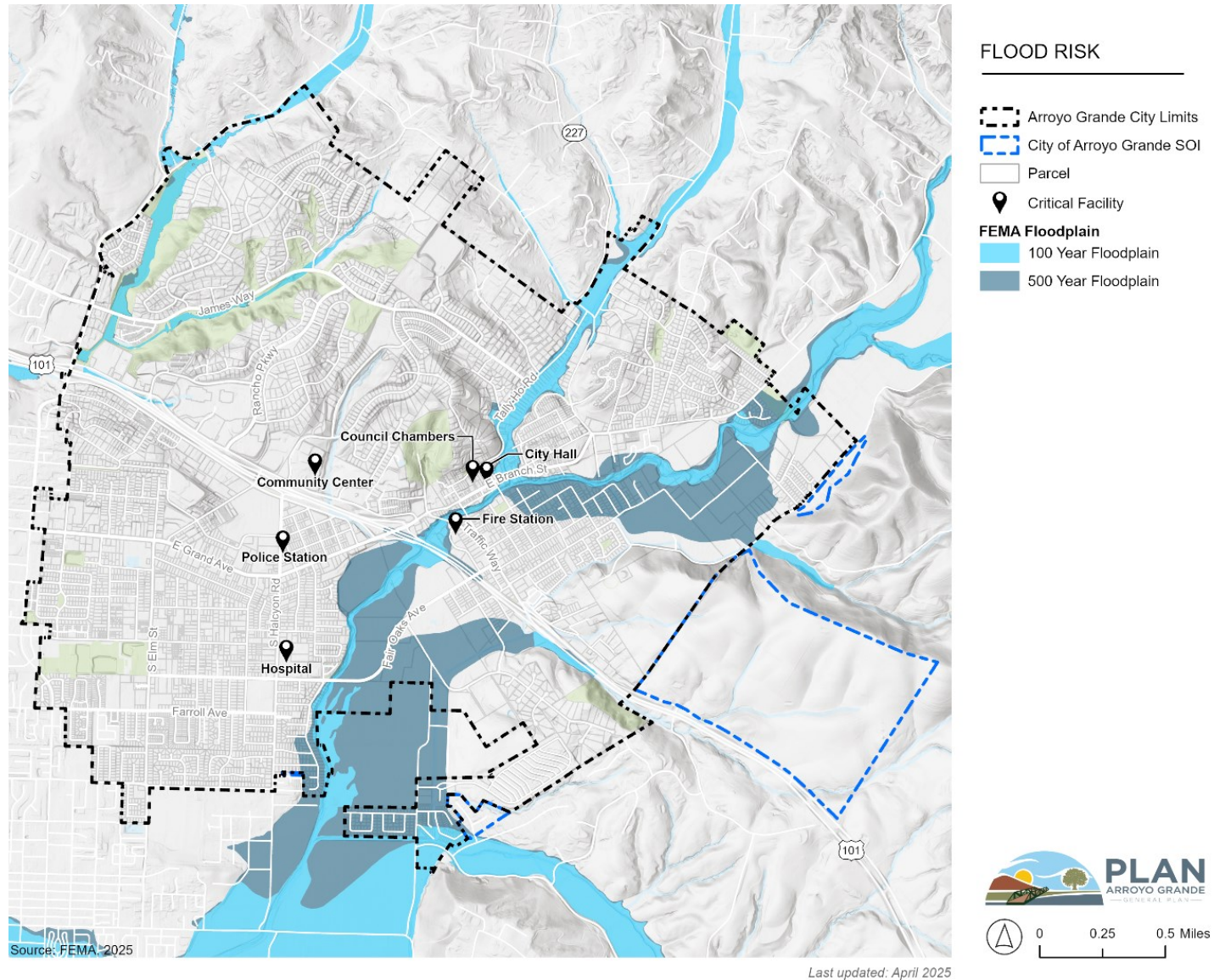
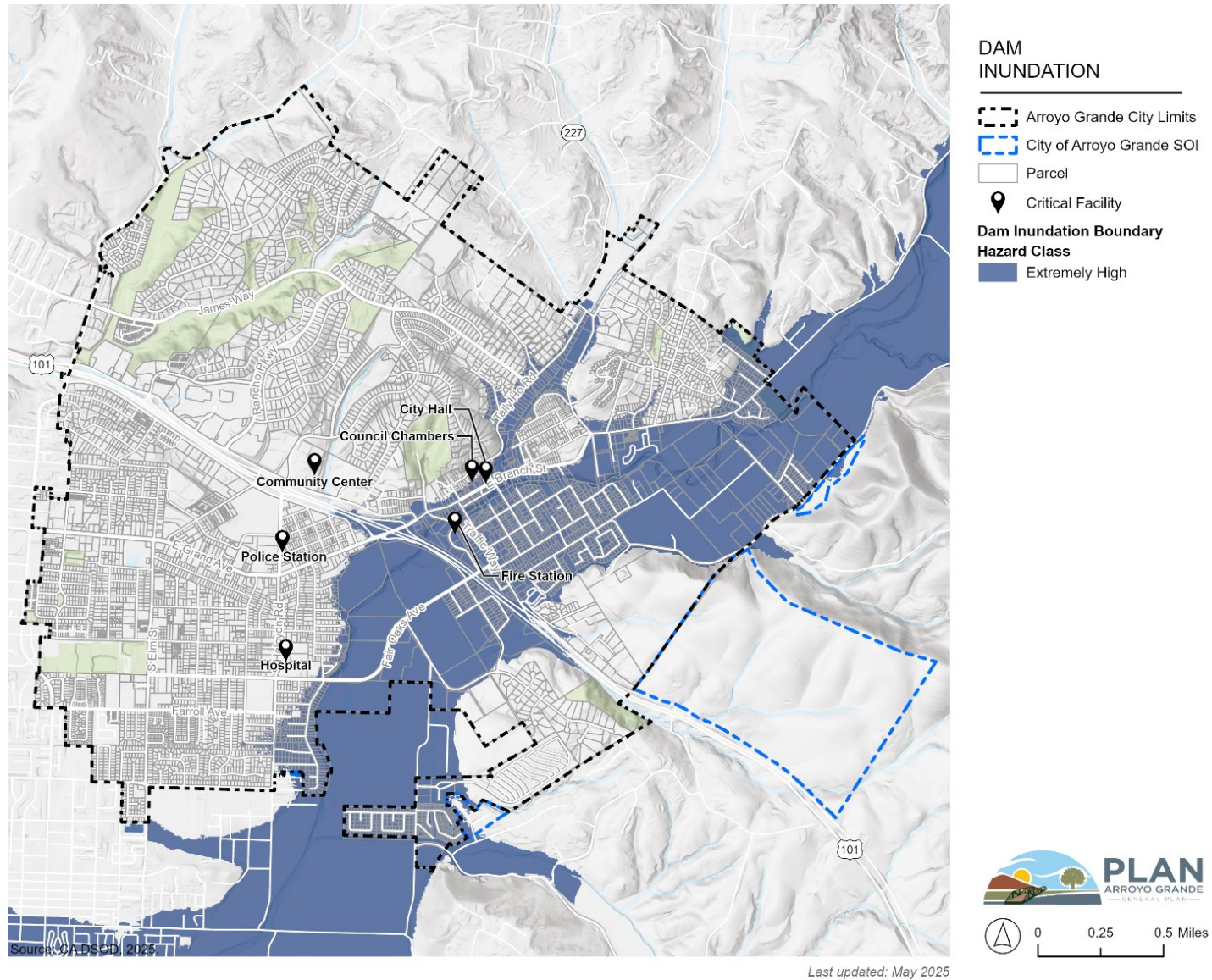


Figure 8 Arroyo Grande Dam Inundation Boundary Hazard Classification



4 Vulnerable Populations

While everyone in a community will face the effects of climate change, some individuals may be more impacted than others. For instance, older adults and young children are more susceptible to heat-related illnesses during extreme heat events. Various factors can influence sensitivity to climate hazards such as age, individual health, institutional biases or exclusion from political and decision-making processes, economic opportunities, and inequalities in environmental and living conditions. These vulnerabilities can limit a community's ability to adapt to and cope with the impacts of climate change.

Climate change will disproportionately impact certain populations in Arroyo Grande. Arroyo Grande does not have any Disadvantaged Communities (DACs) utilizing the 75 percent threshold from CalEnviroScreen and EJSCREEN. However, the following communities are present in Arroyo Grande and are increasingly vulnerable to the impacts of extreme weather and climate change:

- **Young Children.** Children are particularly at risk to climate hazards because they are dependent on others for care, are vulnerable to injury or sickness, and may not understand or are not capable of taking the measures needed to protect against or evacuate from climate hazards. Young children are socially and physiologically vulnerable to climate hazards. They are not fully physiologically developed and are therefore more vulnerable to health effects of climate change impacts (Kenney et.al. 2014). Individuals under five years old make up five percent of Arroyo Grande's population, and individuals under 18 years old make up 20 percent of Arroyo Grande's population (U.S. Census 2024).
- **Older Adults.** 26 percent of Arroyo Grande's population is comprised of adults 65 years and older (U.S. Census 2024). Older adults may have limited or reduced mobility and communication abilities, making it difficult to evacuate or prepare for a climate hazard event. Additionally, older adults may have medical needs for electricity which can be impacted during a public safety power shutoff or climate hazard event. Individuals in this group are more likely to have pre-existing medical conditions or chronic illnesses; climate hazards and their impacts may exacerbate these conditions.
- **Individuals with Chronic Health Conditions or Disabilities.** Individuals that are under 65 years of age with a disability make up 8 percent of Arroyo Grande's population (U.S. Census 2024). Individuals with chronic health conditions or disabilities may be dependent on healthcare workers, medical or communication devices, and medication, which may be impacted in the case of a climate hazard event.
- **Outdoor Workers.** Individuals who work outdoors are exposed to extreme weather conditions and climate change to a significant extent. The Construction industry makes up nine percent of the workforce (762 individuals), and the Agriculture, Forestry, Fishing, and Hunting industry makes up one percent of the workforce (126 individuals) (U.S. Census 2023).
- **Individuals Facing Societal Barriers.** Individuals facing societal barriers include Black, Indigenous, and People of Color (BIPOC) individuals, individuals facing economic barriers, and individuals who are undocumented. Individuals facing societal barriers are disproportionately impacted by climate change due to economic, educational, and health disparities, as well as limited access to essential services. These challenges are exacerbated by linguistic isolation and income barriers, making it difficult for these groups to prepare for, respond to, and recover from climate hazards. The BIPOC population in Arroyo Grande makes up 25 percent of the total

population (U.S. Census 2024). Arroyo Grande sits on the ancestral homelands of the ‘Amuwu, Salinan, and Chumash tribes. The traditional lands of the Salinan people include area from Big Sur to south San Luis County (Salinan Tribe 2025). Similarly, traditional Chumash lands spanned from current-day Malibu to Paso Robles (Santa Ynez Band of Chumash Indians 2025). The displacement, systemic discrimination, geographic isolation, and cultural disruption faced by indigenous people can limit access to essential services, economic opportunities, and political participation. Although not all residents who identify as Native American have ties to tribal communities within Arroyo Grande, most Native Americans experience some degree of the implications of colonial violence, cultural erasure, and social marginalization, and as a result, are more likely to be under-resourced and low-income (Northwestern Institute for Policy Research 2020).

- **Visitors.** Tourism contributes to Arroyo Grande’s economy; in 2022, accommodation and food service sales made up \$103,325,000 of revenue (U.S. Census 2024). Visitors can be particularly vulnerable to climate impacts due to their unfamiliarity with local emergency protocols and resources. Without knowledge of evacuation routes, shelter locations, or emergency contact information, they may struggle to respond effectively during extreme weather events. Following an emergency, Arroyo Grande’s tourism-related revenue may experience negative impacts.

4.1 Potential Impacts to Vulnerable Populations

This section summarizes the potential impacts to vulnerable populations and the services these communities rely on.

Young Children

Young children are especially susceptible to the effects of climate change due to their developmental stages and dependence on caregivers. Children experience more severe physical effects due to their higher air intake per pound, thinner skin, greater risk of fluid loss, and difficulty retaining body heat (Society for Research in Child Development 2025). Additionally, disasters disrupt the care, protection, and support systems provided by adults. **Extreme heat** can result in heat stress, dehydration, and heat-related illnesses, as young children struggle to regulate their body temperature as efficiently as adults (UNICEF 2025). **Landslides** can cause physical injuries and trauma, disrupt their living conditions, and hinder access to essential services (Society for Research in Child Development 2025). Individuals who live or attend school in seismic hazard zones are particularly vulnerable. These areas can be found in Figure 4 above. **Wildfires** expose children to harmful smoke, worsening respiratory issues like asthma and potentially leading to long-term health problems. Wildfire smoke is comprised of a mixture of gaseous pollutants, hazardous air pollutants, water vapor, and particle pollution (fine airborne particulate matter – PM_{2.5}) with particle pollution being the main component and the principal threat to public health (USEPA 2021). Smoke from wildfires is known to contain a large abundance of PM_{2.5} and are estimated to contribute to approximately 18 percent of the total PM_{2.5} atmospheric emissions in the US (Liu et al. 2016). Short-term exposures to PM_{2.5} (up to 24-hours duration) have been associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. These adverse health effects have been reported in infants and children (CARB 2022). Populations that live and/or work in the high fire hazard severity zones, which can be seen above in Figure 6, are particularly vulnerable to these impacts. **Flooding** presents immediate risks such as drowning and

can devastate homes and schools, disrupting children's education and access to clean water and sanitation. Structures located in the 100- and 500-year floodplain can be seen in Figure 7 above.

Older Adults

Older adults often face challenges regarding **extreme heat** or temperature changes due to medications or underlying conditions related to age. Older adults struggle with recognizing overheating or dehydration, which can be worsened by cognitive decline (Harvard Medicine 2021). **Landslides** can disrupt essential services and healthcare, which can be critical for older adults in need of medicine and necessary support. **Wildfires** pose significant respiratory risks due to the inhalation of smoke, which can worsen chronic respiratory diseases and create long-term health issues. Adverse health effects have been reported in older adults, particularly those with preexisting heart or lung disease (CARB 2022). **Flooding** can create immediate dangers such as drowning and home destruction, leading to displacement and/or loss of access to critical resources. The social isolation and mobility challenges faced by many older adults can compound these impacts and hinder the ability to seek help and evacuate.

Individuals with Chronic Health Conditions or Disabilities

Individuals with chronic health conditions or disabilities are particularly at risk to heat related illnesses during **extreme heat** events. **Landslides** can cause evacuation barriers and destroy necessary infrastructure that those with chronic health conditions or disabilities rely on. Climate hazards such as **wildfire** and extreme heat can trigger power outages which are particularly dangerous for individuals who are electricity-dependent, either for their mobility, communication, or medical devices. Hazards such as **flooding** can limit access to transportation systems, healthcare centers, and emergency response to those that are in need of medical care, such as those with chronic health conditions or disabilities. These individuals also experience higher barriers to evacuation in the case of wildfire or flooding.

Outdoor Workers

Outdoor workers face high risk in the face of climate hazards both directly from exposure to hazards and indirectly due to loss of crop yield (agricultural workers) or interrupted work days due to hazard events impacting their economic livelihood. Outdoor workers are often subject to strenuous work conditions and are vulnerable during **extreme heat events** and cases of lowered air quality, such as during **wildfire**. Outdoor workers and other groups that have high outdoor exposure (like visitors) are more vulnerable to hazards related to **landslide** and **flooding**.

Individuals Facing Societal Barriers

Individuals facing societal barriers, such as BIPOC, income-disadvantaged, and undocumented individuals, are disproportionately affected by the climate impacts of extreme heat, landslides, wildfires, and flooding. **Extreme heat** can exacerbate existing health disparities, as these communities may lack access to air conditioning and healthcare (EPA 2021). **Landslides** can displace families, disrupt livelihoods, and limit access to essential services. **Wildfires** pose significant health risks due to smoke inhalation, and economically disadvantaged communities often lack resources for adequate fire prevention and recovery (Stanford 2025). **Flooding** can devastate low-income communities, who are generally more likely to reside in high flood risk areas. (Carbon Brief 2022). These events compound existing vulnerabilities, making it more difficult for these communities to recover and thrive.

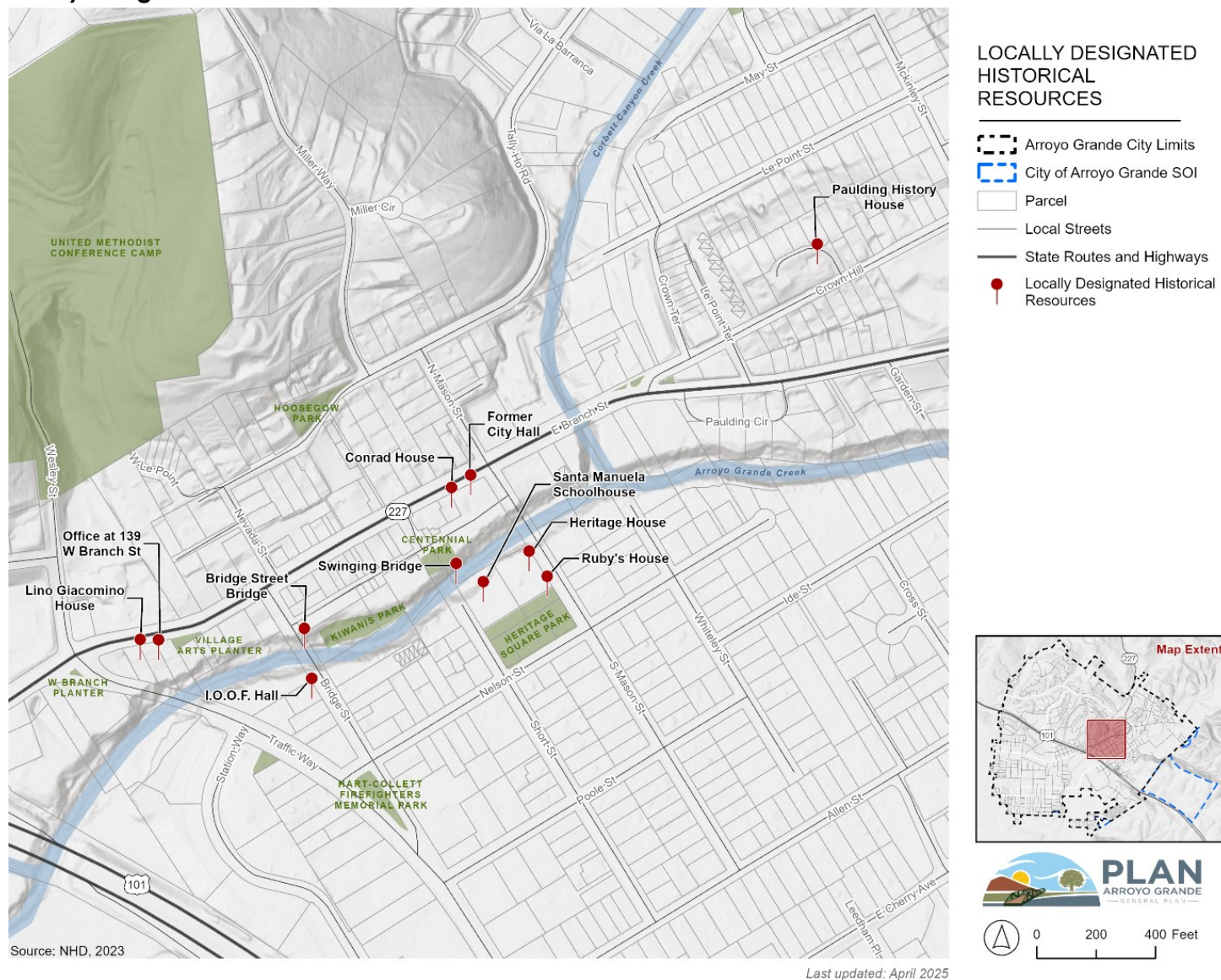
Visitors

Visitors have limited to no control over the weatherization or “home hardening” techniques taken to protect their accommodations from climate hazards, increasing vulnerability to **extreme heat, landslide, wildfire, and flooding**. In addition, visitors may have fewer communication and transportation resources with which to evacuate from emergency situations. Without knowledge of the resources available, visitors are more vulnerable to climate impacts.

5 Built Infrastructure

Arroyo Grande features roadways, bridges, utilities, and critical facilities, detailed in Figure 1 above. Critical facilities include the Community Center, City Council Chambers, City Hall, Police Station, Arroyo Grande Community Hospital, and Five Cities Fire Authority Station 1. These locations are critical to the proper functioning of the City and can be utilized as resilience centers in the case of extreme weather or climate hazards. Built infrastructure in Arroyo Grande also includes historical resources, detailed in Figure 9 below. Historical resources include Lino Giacomino House, Office at 139 W Branch Street, Bridge Street Bridge, Independent Order of Odd Fellows (I.O.O.F.) Hall, Swinging Bridge, Conrad House, Former City Hall, Santa Manuela Schoolhouse, Heritage House, and Ruby's House. Homes are located throughout Arroyo Grande, ranging from Very High-Density Residential Areas south of Highway 101 to Very Low-Density Residential Areas north of Highway 101. Large regional commercial areas can be found in the northwestern section of Arroyo Grande, while community facilities (including critical facilities) are spread throughout Arroyo Grande. Climate hazards such as extreme heat, landslide, wildfire, and flooding can have significant and lasting impacts on built infrastructure in Arroyo Grande.

Figure 9 Locally Designated Historical Resources



5.1 Potential Impacts to Built Infrastructure

Extreme heat is unlikely to impact built infrastructure. For impacts to occupants of buildings that are not adequately weatherized for increased temperatures, refer to Section 4.1 Potential Impacts to Vulnerable Populations.

Landslides pose a significant direct threat to infrastructure, particularly in the more landslide-vulnerable areas in Arroyo Grande, particularly areas along Arroyo Grande Creek as shown in Figure 4 above. Landslides can cause structural collapse or bury roads, bridges, and buildings. Damage can be unpredictable and can disrupt transportation and require costly repairs and mitigation measures. The potential for earthquake shaking significantly increases landslide susceptibility, as the intense ground vibrations can destabilize slopes and trigger mass movements. The area with the highest earthquake shaking potential in Arroyo Grande (>60 percent) is located along E Branch St, where City Hall and the Council Chambers are located. The Fire Station is also located in this section of Arroyo Grande. Medium-Density and Medium-High Density Residential Areas are also located within >60 percent earthquake shaking potential areas. In the case of landslide, these dense residential areas and critical facilities are at risk of significant structural damage.

Wildfires can devastate infrastructure directly by burning buildings, power lines, and other structures. The intense heat can damage materials and cause structural failures. Wildfires also lead to secondary effects like landslide, which can further damage infrastructure. High Fire Hazard Severity Zones, as seen in Figure 6 above, can be found in Medium-Density and Low-Density Residential Areas. These homes may not be properly hardened against wildfire and are vulnerable to structural failure and damage from smoke and landslides.

Impervious surfaces can impede the absorption of water and increase **flooding** in areas of Arroyo Grande. Additionally, per the MJLHMP, Arroyo Grande is likely to face repeated flood incidents annually, resulting in nearly \$2 million in residential damages per year. Dams may erode from extreme precipitation as well, which could increase the risk of catastrophic dam failure. Critical facilities in Arroyo Grande are located within the Lopez Dam inundation zone, including as City Hall, City Council Chambers, and Fire Station 1. Although the risk of total dam failure is low, with new safety work conducted as recently as 2004, the risk of emergency failure brought on by increased atmospheric rivers and prolonged periods of rainfall due to climate change impacts could increase this risk. There is risk of damage from increased extreme precipitation events including erosion, washouts, dam infrastructure erosion, and sinkholes. Increased precipitation can lead to riverine flooding, impacting critical facilities such as the Fire Station and City Hall, which are located along Arroyo Grande Creek. Storm drainage and flood protection services for Arroyo Grande may be impacted by these events; potential areas of impact can be found in Figure 7. The Arroyo Grande Creek Levee poses a significant threat to buildings and residential areas located near the floodplain. These primarily residential areas could see financial damages of approximately \$1.8 million per year (MJLHMP 2015). Although the Arroyo Grande Creek runs through the City, the levee flooding threat is primarily located south of the City in unincorporated area. As represented in Figure 7, storm drainage and flood protection services for Arroyo Grande may be impacted by these events, and flooded roadways may be temporarily impassable, disrupt or delay emergency services, or increase risk to road users. However, the commercial impacts would be minimal, as the 100 and 500-year flood zones are outside the central business district (MJLHMP 2015).

6 Natural Resources and Agriculture

Arroyo Grande features a variety of natural resources that contribute to its ecological and agricultural value. Agriculture, Open Space, and Park/Recreation account for 23 percent of the acreage in Arroyo Grande. Open Space in Arroyo Grande includes the James Way Oak Habitat and Wildlife Preserve, and parks such as the Elm Street Park, Rancho Grande Park, Strother Park, and Heritage Square Park support natural resources in the area. The Arroyo Grande Creek Watershed and Los Berros Creek support riparian habitats and multiple wetland types, including forested/scrub wetlands, freshwater ponds, and freshwater emergent (City of Arroyo Grande 2024). Riparian vegetation includes willow woodlands, freshwater marsh, and riverine wetlands (City of Arroyo Grande 2024). Special Status and Endangered Species are present throughout Arroyo Grande, including the Tidewater Goby, Steelhead Trout, marsh sandwort, Nipomo Mesa lupine, La Graciosa thistle, and the Pismo Clarkia (Arroyo Grande 2024).

Agriculture has played a significant role in the history of Arroyo Grande, as well as the local economy. The agricultural zoning districts (both active agricultural areas and agricultural preserves) account for roughly ten percent of the land in Arroyo Grande (City of Arroyo Grande 2024). The agricultural history of Arroyo Grande has contributed to soil erosion in the past, which has been mitigated by erosion-control check dams, tree planting, cover crops, and terrace planting on slopes (Living New Deal n.d.). This history of farming also impacted the watershed, replacing native vegetation with cultivars and impacting the South Central California Steelhead Trout population in Arroyo Grande Creek (State of California Department of Fish and Game 2009). Agriculture has strengthened Arroyo Grande's economy, contributing to the local wine industry and tourism, as well as providing employment for Arroyo Grande's residents. Impacts caused by extreme heat, landslide, wildfire, and flooding can create significant and lasting damage to natural resources and agriculture in Arroyo Grande.

6.1 Potential Impacts to Natural Resources and Agriculture

Under **extreme heat** and warm nights, wildlife 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 a delayed cold front which increases mortality rates (Dale 1997, Hamerlynck 1995, Maclean 2011). Plants are more likely to experience heat stress and drying and species' habitat ranges may shift. 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 (Fernandez-Bou et al. 2021). Parks and natural resources are highly exposed to extreme heat and warm nights. The exposure to extreme heat and warm nights exacerbates the impacts of climate change on parks and natural resources, as well as agricultural production in Arroyo Grande.

In areas with steep slopes and loose soil, **landslide** can drastically reshape the landscape, destroying habitats and altering watercourses. Landslides can also lead to sedimentation in Arroyo Grande Watershed and Los Berros Creek, impacting water quality and aquatic life. The disruption of soil and vegetation can hinder the recovery of ecosystems and reduce biodiversity. Agricultural land can be

found in areas of Arroyo Grande susceptible to landslides, as can be seen in Figure 1 and Figure 4 above. The increased exposure to landslide increases vulnerability of agricultural land in Arroyo Grande.

Although **wildfires** have become increasingly frequent and intense in California, Arroyo Grande's coastal proximity and prevalent fog have protected the area from intense wildfire. However, a decrease in coastal fog due to extreme heat and drying can worsen future wildfires in Arroyo Grande. Much of the California central coast native vegetation in Arroyo Grande has evolved to be fire adapted or in some cases require occasional wildfires as part of their reproductive process. However, over the past 100 years, fire suppression has led to an accumulation of fuel that can overwhelm the natural function of systems resulting in significant disruption from wildfire events. These intense wildfires, fueled by excessive buildup, can overpower the fire-adapted traits developed by native plants. The prolonged high temperatures generated by these fires raise soil temperatures to levels that plant roots cannot endure, sometimes leading to extensive loss of soil organisms and resulting in lifeless soil (Snow 2022). The consequences of these fires can be devastating and reach beyond the fire event itself. Air quality, water quality, and soil stability can all be negatively affected by wildfires well after the event.

The various creeks that run throughout Arroyo Grande such as Canyon/Meadow creek, Tally Ho creek, Arroyo Grande Creek Levee and the Lopez Dam are the main potential sources of **flooding** that could be exacerbated by changing climate conditions. Although identified FEMA flood zones (found in Figure 7 above) are primarily concentrated along the Arroyo Grande Levee, parks outside of these zones are expected to be impacted by riverine and stormwater flooding due to climate change. Flooding impacts to natural resources and agriculture are mainly caused by associated erosion and the detrimental effects flooding can have on water quality, especially to aquatic and fish species dependent on water quality for survival (Talbot 2018). Other impacts include damage from inundation within storm flooded areas such as agricultural lands, habitats, parks, and communities around the Arroyo Grande Creek Levee and other watersheds in Arroyo Grande.

7 Existing City Plans and Programs

Climate hazards can damage infrastructure and habitats, disrupt services, endanger individuals, and limit evacuation and emergency response. Plans and programs can increase resilience of vulnerable populations, built infrastructure, and natural resources and agriculture in the face of extreme weather and climate hazards in Arroyo Grande. Developing and implementing programs and projects that enhance the community's adaptive capacity, including addressing underlying contributing factors, can help mitigate the negative effects of climate change on vulnerable populations.

Vulnerable Populations

Arroyo Grande's Land Use Element (City of Arroyo Grande LUE) speaks to requirements that can mitigate the impacts of **extreme heat** on residents through roofing and anti-glare mandates.

The Arroyo Grande Housing Element (City of Arroyo Grande 2021) identifies passive solar heating and cooling and energy efficiency requirements that can increase resiliency and decrease financial impact to the resident in the case of **extreme heat**.

The LUE also highlights maintenance of current information regarding protection from **wildfire**, as well as collaboration with other jurisdictions in San Luis Obispo County regarding fire and response time for emergencies, which may include **flood**ing and **landslide** (City of Arroyo Grande LUE).

The Active Transportation Plan recommends incorporating green infrastructure along bicycle paths and other multi-use paths where necessary to mitigate the effects of climate change. (City of Arroyo Grande 2025).

The Safety Element highlights emergency preparedness response goals and coordination policies in the case of **fire**, **flood**ing, or **landslide**, as well as critical facility needs in the case of **extreme heat** (City of Arroyo Grande SE). The Safety Element also provides policies regarding dam maintenance failure evacuation in the case of extreme **flood**ing (City of Arroyo Grande SE).

Built Infrastructure

Extreme heat does not have a significant impact on Built Infrastructure.

Arroyo Grande's Land Use Element highlights the importance of new development review in regard to **wildfire** risk (City of Arroyo Grande LUE).

The Local Hazard Mitigation Plan identifies the possibility of a special **flood** zoning district to reduce long-term risk to infrastructure build in floodplains in Arroyo Grande (Mathe 2015).

The Arroyo Grande Safety Element discourages development in areas of high risk of **flood**, **fire**, or geological hazards such as **landslide** in order to protect future infrastructure from these climate hazards (City of Arroyo Grande SE). The Safety Element also provides policies related to property damage and maintenance with regard to dam inundation and extreme flooding, as well as defensible space requirements to protect property from **wildfire** (City of Arroyo Grande SE). Slope stability must be addressed by owners of existing development, and must be avoided for new development to decrease risk of **landslide** impacts to built infrastructure (City of Arroyo Grande SE).

Natural Resources and Agriculture

The Arroyo Grande Conservation and Open Space Element is intended to preserve open space and natural resources, including areas that require special management and regulation because of hazards such as **flood** plains, unstable soils leading to **landslide**, and high **fire** risk (City of Arroyo Grande 2007). Protection of wildlife corridors and unique or sensitive habitat areas under the Open Space Element make natural resources in Arroyo Grande more resilient to all climate hazards, and riparian habitat corridors protect scenic resources, water quality, and habitat, thereby reducing the UHI effect (City of Arroyo Grande 2007).

The Active Transportation Plan suggests installing active transportation facilities that integrate green infrastructure include bicycle lanes protected by stormwater planter boxes and curb extensions designed with vegetated bioswales, both of which provide safety benefits while retaining and filtering stormwater runoff. (City of Arroyo Grande 2025).

The Arroyo Grande Safety Element includes policies to identify high value and high-risk areas to **wildfire**, including WUI areas and sensitive wildlife areas (City of Arroyo Grande SE).

8 Key Findings

Key vulnerabilities in Arroyo Grande include:

Vulnerable Populations

- Young children and older adults are particularly vulnerable to heat stress and dehydration in the case of **extreme heat**. These health disparities are exacerbated for those facing societal barriers. Societal disparities of climate change-induced extreme heat impacts to vulnerable populations are not directly considered in existing City plans. However, the Housing Element (City of Arroyo Grande 2021) and Land Use Element (City of Arroyo Grande LUE) both include policies aimed at reducing extreme heat impacts to residents by improving energy efficiency.
- **Landslides** cause injuries, displace families, and disrupt services for children, older adults, individuals with chronic health conditions or disabilities, and those facing societal barriers. Existing policies in the Safety Element (City of Arroyo Grande SE) reviewed considered evacuation and building concerns around landslide, but did not consider the impact of societal disparities on landslide impacts.
- **Wildfires** lower air quality and disproportionately impact those facing evacuation challenges. The Arroyo Grande Safety Element (City of Arroyo Grande SE) highlights lower air quality and evacuation challenges around wildfire but does not consider the disproportionate impacts of those facing evacuation challenges.
- **Flooding** limits access to transportation and healthcare for those with chronic conditions or disabilities. The Arroyo Grande Safety Element (City of Arroyo Grande SE) considers evacuation from events such as flooding but does not directly consider impacts to vulnerable populations.

Built Infrastructure

- **Landslides** threaten infrastructure, causing collapse and structural damage. The Arroyo Grande Safety Element (City of Arroyo Grande SE) identifies slope stability requirements and new development standards to avoid landslide damage to built infrastructure.
- **Wildfires** burn buildings and power lines, leading to structural failures and secondary landslides. These impacts are mitigated by policies in the Land Use Element (City of Arroyo Grande LUE) and Safety Element (City of Arroyo Grande SE).
- **Flooding** causes home and critical facility destruction. Policies that consider home and critical facility destruction in the case of flooding can be found in the Safety Element (City of Arroyo Grande SE).

Natural Resources and Agriculture

- Heat stress, illness, and disrupted reproductive cycles can be seen in wildlife and vegetation as a result of **extreme heat**. Policies that reduce impacts of the Urban Heat Effect on wildlife and vegetation can be found in the Open Space Element (City of Arroyo Grande 2007). However, there are no other existing policies or plans that consider climate change-induced extreme heat impacts to natural resources or agriculture.
- **Landslides** impact water quality and reshape natural landscapes, potentially destroying habitats. The Open Space Element includes policies that consider unstable soils and landslide risks (City of Arroyo Grande 2007).

- **Wildfires** devastate vegetation and lead to soil erosion. The Conservation and Open Space Element (City of Arroyo Grande 2007) and Safety Element (City of Arroyo Grande SE) both include policies relating to wildfire risk to natural resources.
- **Flooding** causes erosion and water quality issues, particularly for aquatic species. Policies in both the Active Transportation Plan (City of Arroyo Grande 2025) and Open Space Element (City of Arroyo Grande 2007) consider impacts of flooding to natural resources.

The Climate Change Vulnerability Assessment provides a summary of the climate change hazards projected to occur in Arroyo Grande and the populations, built infrastructure, and natural resources most vulnerable to climate change impacts. The assessment provides a foundation for the City to begin to understand vulnerabilities to climate change in the community and to take actions that serve to increase community resilience. This assessment, in accordance with Government Code §65302 and SB 379, will inform adaptation policies that will be included in the update to the Safety Element of the General Plan.

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