8

Safety

The purpose of the Safety Element is to identify the natural and man-made public health and safety hazards that exist within the city, and to establish preventative and responsive policies and programs to mitigate their potential impacts. This Element addresses geologic hazards, flood hazards, hazardous materials, wildfire hazards, climate change, and emergency services. It also includes policies on natural hazards mitigation planning, in alignment with the Federal Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency's implementing regulations and support the County's Multi-Jurisdictional Local Hazard Mitigation Plan. Airport safety is addressed in the Land Use, Circulation, and Noise Elements.

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8.1 SEISMIC AND GEOLOGIC HAZARDS

Geologic and soils hazards include steep slopes and landslides, subsidence, expansive soils, and soils with naturally-occurring asbestos. Additional information on soils and erosion within the Planning Area is in the Open Space & Conservation Element. Seismic hazards related to earthquakes include groundshaking and ground failures, such as liquefaction, lateral spreading, ground lurching, seiches, mudslides, landslides, and soil slumping.

Geology

The Planning Area is in a basin bounded by the Sierra Nevada foothills and mountains to the east and the Coast Ranges to the west, and filled with deep layers of sediment from the Sierra Nevada. The St. Johns River flows through the northeastern portion of the Planning Area, along with smaller streams and canals. The area is basically flat, lying at an elevation of approximately 330 feet above sea level. As described in Chapter 6, surface soils in the Planning Area range from fine sandy loam and loam to alkali soils. Some soils have the potential to present moderate geologic hazards to building, due to their susceptibility to erosion or to expansion and contraction.

Expansive Soils

Expansive soils have the potential to shrink or swell significantly with changes in moisture content, which can limit the development capacity of an area. The type and amount of the silt and clay content in the soil will determine the amount of shrink or swell associated with the various levels of water content. Soils comprised of sand and gravel are not expansive soils.

Expansive soils are most likely to be found in basins and basin rims. Any structure located on expansive soils can be significantly damaged should the soil suddenly shrink or swell. Structural damage may result over a long period of time, usually from inadequate soils and foundation engineering or the placement of structures directly on expansive soils. Construction in areas of expansive soils may require major sub-excavation and replacement of existing materials with more stable soils.

Soil types considered to have a moderate "shrink-swell" potential underlie about 2,480 acres in the Planning Area, and are located near the Highway 99/198 interchange, north of the St. Johns River, and in the northwest near the intersection of Road 80 and Avenue 328. Erosion susceptibility and shrink-swell potential figures can be found in Chapter 6 of the General Plan.

The Safety Element identifies natural and manmade hazard and establishes preventative and responsive policies.

New structures are required to adhere to current California Building Code (CBC) standards. (top)

In the Planning Area, hazards due to ground shaking are considered to be low. Damage is most likely to occur to older masonry buildings. (bottom)

Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. Some areas in Tulare County have subsided up to 16 feet over the past few decades.[1] Subsidence may occur in the Planning Area, particularly in areas with high clay content soils or due to groundwater withdrawal.

Seismic Hazards

There are no known active earthquake faults in the Planning Area as shown in **Figure 8-1**. The closest active faults are Owens Valley fault group and Sierra Nevada Fault Zone, 75 miles to the east of the Planning Area, the San Andreas Fault Zone (60 miles to the west), and an unnamed fault group north of Bakersfield (60 miles to the south).[2] Major earthquakes such as the 1906 San Francisco, 1952 Kern County, and 1983 Coalinga quakes were felt and caused some minor to moderate property damage in Visalia. It is possible, but unlikely, that previously unknown faults could become active in the area. The State Geologist has not delineated any Alquist-Priolo Earthquake Fault Zones within or near the Planning Area.

Groundshaking

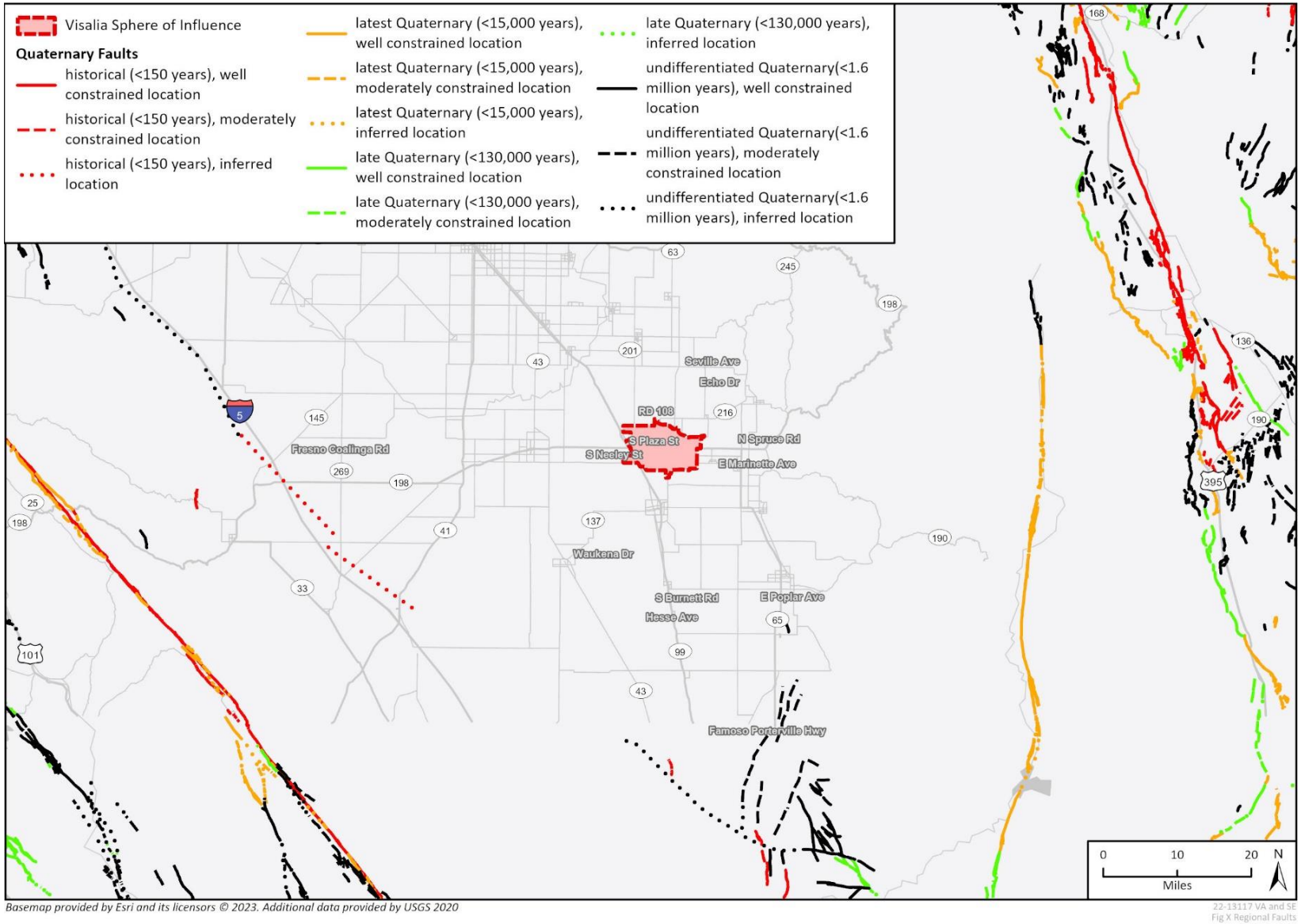
The most significant hazard associated with earthquakes for the Visalia area is ground shaking caused by earthquakes along the San Andreas fault to the west or Owens Valley fault to the east. However, the hazards due to groundshaking are considered to be low, according to the California Geological Survey and US Geological Survey's Probabilistic Seismic Hazard Analysis. The analysis is based on historic earthquakes, slip rates on major faults and deformation throughout the region and the potential for amplification of seismic waves by near-surface geologic materials. The resulting earthquake shaking potential is used in developing building code design values, estimating future earthquake losses and prioritizing earthquake retrofit. In the Planning Area, low levels of shaking, with less frequency, are expected to damage only weaker masonry buildings. However, very infrequent earthquakes could still cause strong shaking.[3]

[1] Tulare County, General Plan 2030 Update, August 2012. Appendix A. http://generalplan.co.tulare.ca.us/

[2] USGS Fault Maps, http://quake.wr.usgs.gov/info/faultmaps

[3] California Geological Survey and US Geological Survey, Earthquake Shaking Potential for California, Map Sheet 48 Revised 2016). 2016. https://www.conservation.ca.gov/cgs/Documents/Publications/Map-Sheets/MS_048.pdf

Figure 8-1: Regional Faults



Ground Failure

Earthquake-induced ground failures, such as ruptures, lateral spreading, ground lurching, seiches, or mudslides, are unlikely to occur in the Planning Area because of its relatively stable geologic formation and lack of active faults.

Seismic Safety

Existing structures in the Planning Area could be affected by the types of earthquake-induced effects listed above, but to varying degrees based on length, intensity, and distance of the earthquake from a given building. New structures are required to adhere to current California Building Code (CBC) standards for Seismic Zone 3, and provide adequate design, construction and maintenance of structures to prevent exposure of people and structures to major geologic hazards. In particular, any critical facilities such as hospitals, fire and police stations, and emergency communications and operations centers must be adequately designed, constructed and maintained with the goal of remaining functional after a large seismic event. The use of flexible utility connections, building anchors, and adequately reinforced concrete can reduce the loss of life and damage to buildings for human occupancy.

8.2 FLOOD HAZARDS

Visalia is subject to extensive flood hazards. With global temperatures continuing to rise, more water evaporates from the oceans, increasing the amount of water vapor in the atmosphere and ultimately altering weather patterns. This results in heavier and longer lasting storm events which can cause significant flooding and damage to communities and infrastructure. These changes can be especially impactful in Visalia, where an arid climate, flat topography, and development increases the amount of impervious surfaces and results in flooding. In 2023, Visalia entered a state of emergency to prepare for localized flooding as a result of multiple atmospheric rivers causing record precipitation across California and bringing Lake Kaweah to capacity.

Although the average annual precipitation in the Visalia area is approximately 11 inches, portions of the Kaweah watershed which contributes to flooding in Visalia have a mean annual precipitation of 40 inches. Most rainfall occurs between October and May. Due to climate change, however, the frequency and severity of anomaly years like 2023 are expected to increase, making stormwater management and flooding response a top priority.

In the Planning Area, waterways and surface runoff generally flow from east to west, terminating in the

Tulare Lake Basin. Channels include the St. John's River, Modoc Ditch, Mill Creek Ditch, Mill Creek, Tulare Irrigation District (TID) Canal, Packwood Creek, Cameron Creek, Deep Creek, Evans Creek, Persian Ditch (See **Figure 8-2**). Most watercourses are intermittent drainages that receive a significant portion of flow from storm water runoff during the rainy season. This intermittent flow is typically supplemented from water released from Terminus Dam on the Kaweah River.

Monthly mean outflows from Lake Kaweah, the reservoir created by Terminus Dam, ranges from no releases to a maximum of 3,821 cubic feet per second (cfs) that occurred during June of 1969. The highest recorded daily outflow of 6,056 cfs from Lake Kaweah took place in March of 2023. In general, outflows are highest in the late spring and early summer and lowest in the fall. The lake is operated by the U.S. Army Corps of Engineers for flood control through the detention of inflows from the watershed and regulation of releases from the lake in an effort of maintaining flows within the channel capacities of the Kaweah River System below the dam. The reservoir's capacity is limited and during times when the volume of inflow rises above the lake's available storage it will necessitate releases that could potentially cause flood damage while preserving the integrity of the dam. Outflow from Lake Kaweah and associated uncontrolled watersheds flows through several different types of conveyances within the Kaweah River System, including the creeks and ditches that meander within the city of Visalia.

The city's municipal storm drainage system consists of drainage channels, 29 detention and retention basins, 37 pump stations and 269 miles of pipe. Historically, runoff was disposed of by directing it to the natural creeks, rivers and irrigation ditches that flow through the city. To mitigate the increased runoff due to urbanization, the City has invested millions of dollars in the purchase of land and the construction of permanent retention basins, including the Modoc Basin acquisition, Burke Street Basin development, and Kiwanis Park Pond improvements. See the Parks, Schools, Public Facilities, and Utilities Element for more information about storm drainage facilities.

Historic Flood Events

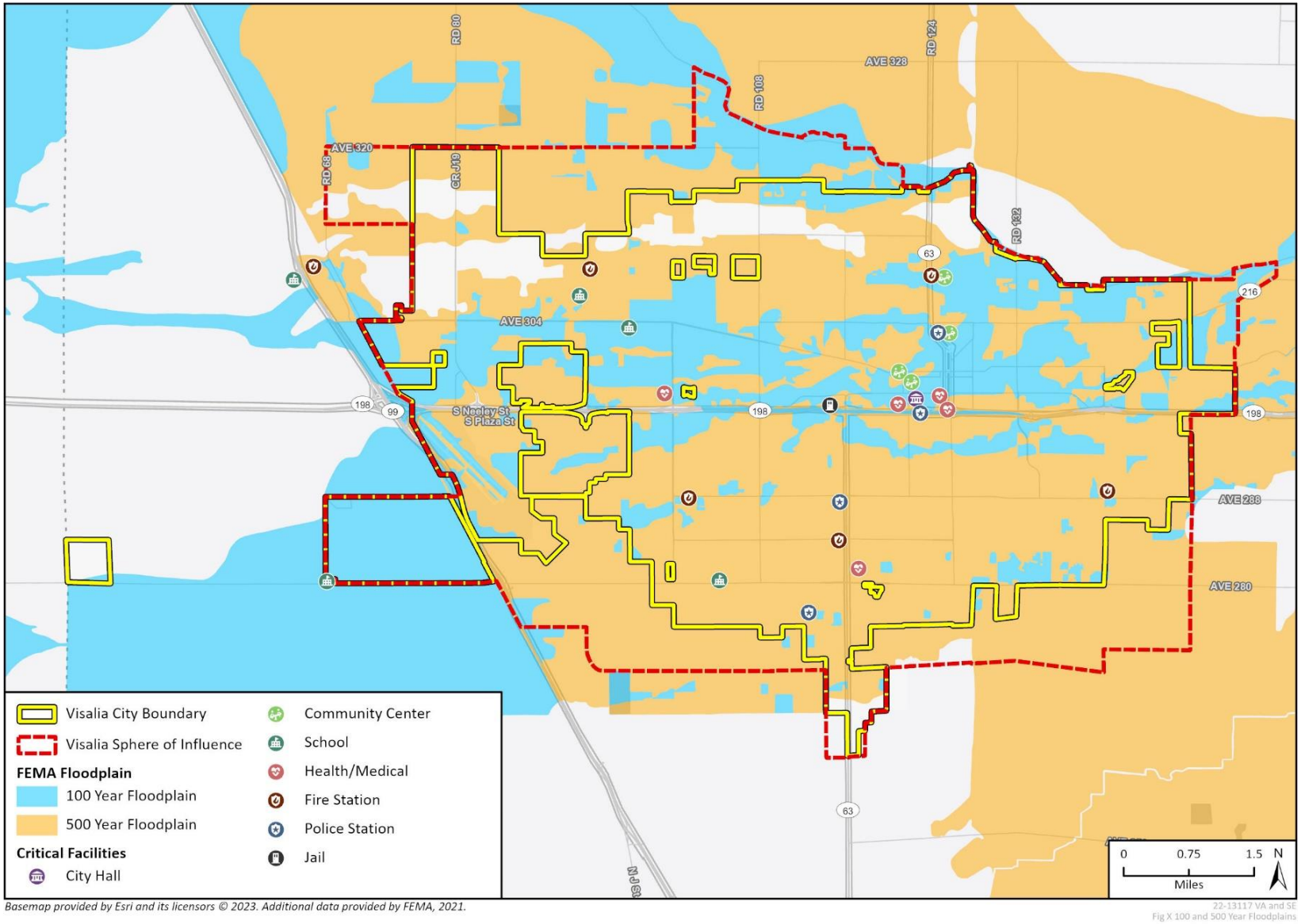
The following historical flood events took place in and adjacent to Visalia:

1955 Severe winter storms causing flooding of the downtown district of Visalia when the Kaweah River overflowed. One of the river's overflow channel was Mill Creek, which flowed under the downtown area via aqueduct.

Historically, runoff was disposed of by directing it to the natural creeks, rivers and irrigation ditches that flow through the city. (top)

Approximately 25 percent of the total Planning Area is located within the 100-year floodplain and another 60 percent is within the 500-year floodplain. (bottom)

Figure 8-2: Flood Zones



1966 Heavy rains causing flooding of Dry Creek, Tule River, Kaweah River, and Tulare Lakebed.

1969 Heavy rains causing flooding of approximately 100,000 acres in Tulare County, resulting in about $16,000,000 worth of damage to farms, homes, businesses, and publicly-owned facilities.

2010 Severe winter storms causing minor flooding of portions of Visalia and the development of a sinkhole on the intersection of Ferguson and Shrink. Damages estimated to be about $900,000.

2023 Multiple atmospheric rivers resulting in heavy rains, localized flooding, and a state of emergency for Visalia due to Lake Kaweah reaching capacity and dangerous flows in St. John's River, Dry Creek, and Mill Creek.

Flood Zones

Flood zone mapping by the Federal Emergency Management Authority (FEMA) indicates that approximately 27 percent of the city's Urban Growth Boundary is located within high risk areas within the 100-year floodplain and another 67 percent is in moderate risk areas within the 500-year floodplain (see **Table 8-1**). FEMA updated the Flood Insurance Rate Map panels for Visalia in June 2009 to reflect the infrastructure improvements made to capture and convey storm water within the city[4]. As shown in **Figure 8-2**, some areas of the city, in particular the central northeast and west, are at risk of flooding from a 100-year storm event. Most of the rest of the city is within the 500-year floodplain.

Table 8-1: Floodplains in Urban Growth Boundary

Type	Acres	Percent of Planning Area
100 Year Floodplain	9,044	27%
500 Year Floodplain	22,232	67%
Area Outside Floodplain	2,144	6%
Farmland of Local Importance	1,606	5%

Source: FEMA National Flood Hazard Layer, 2021.

[4] FEMA Flood Map Service Center.
https://msc.fema.gov/portal/advanceSearch#searchresultsanchor

Many contaminated sites are associated with leaking underground storage tanks which have caused groundwater infiltration by gasoline and related compounds. (top)

State and federal legislation requires every business that handles hazardous materials report their inventories to the local fire department. This helps the city handle emergency incidents more effectively. (bottom)

8.3 HAZARDOUS MATERIALS

The California Code of Regulations defines a hazardous material as a substance that, because of physical or chemical properties, quantity, concentration, or other characteristics, may either (1) cause an increase in mortality or an increase in serious, irreversible, or incapacitating, illness or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of, or otherwise managed.[5] Hazardous wastes are hazardous materials that no longer have practical use, such as substances that have been discarded, discharged, spilled, contaminated, or are being stored prior to proper disposal. A hazardous materials incident involves the uncontrolled release of a hazardous substance during storage, use or Laws and Regulations

Federal and State laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, transported and disposed of, and in the event that such materials are accidentally released, to prevent or mitigate injury to health or the environment. Laws and regulations require hazardous materials users to train employees to manage them safely. The primary Federal agencies with responsibility for hazardous materials management include the U.S. Environmental Protection Agency (EPA), U.S. Department of Labor Occupational Safety and Health Administration (OSHA), and the U.S. Department of Transportation (DOT). In many cases, California State law mirrors or is more restrictive than federal law, and enforcement of these laws has been delegated to the State or a local agency.

The State Water Resources Control Board (SWRCB) administers the aboveground storage tank (AST) program and the underground storage tank (UST) program. The AST program covers facilities that store petroleum in a single tank, or multiple tanks with an aggregate capacity in excess of 1,320 gallons, and requires that tank owners or operators file a storage statement, pay a facility fee, and prepare and implement a Federal Soil Prevention, Control and Countermeasure (SPCC) Plan. The SPCC Plan must identify procedures, methods, and equipment in place at the facility to prevent discharges of petroleum from reaching navigable waters. State laws governing UST's specify requirements for permitting, construction, installation, leak detection monitoring, repairs, release reporting requirements, corrective actions, cleanup, and closure.

[5] California Code of Regulations, Title 22, Division 4.5, Chapter 10, Article 2, Section 66260.10

In Visalia, the Tulare County Environmental Health Division (TCEHD) is the local agency responsible for the implementation of the state-mandated Unified Hazardous Waste and Hazardous Materials Management Regulatory Program. Tulare County has prepared a Hazardous Materials Business Plan and a Multi-Jurisdictional Local Hazard Mitigation Plan (LHMP) which serves as the county's emergency response plan for hazardous materials emergency incidents. In addition, the TCEHD acts as lead agency to ensure proper remediation of leaking underground petroleum storage tank sites and certain other contaminated sites. TCEHD provides three permanent Household Hazardous Waste (HHW) drop-off facilities in the county including one in Visalia, and operates mobile collection events throughout the year. These services are available free of charge to any Tulare County resident.

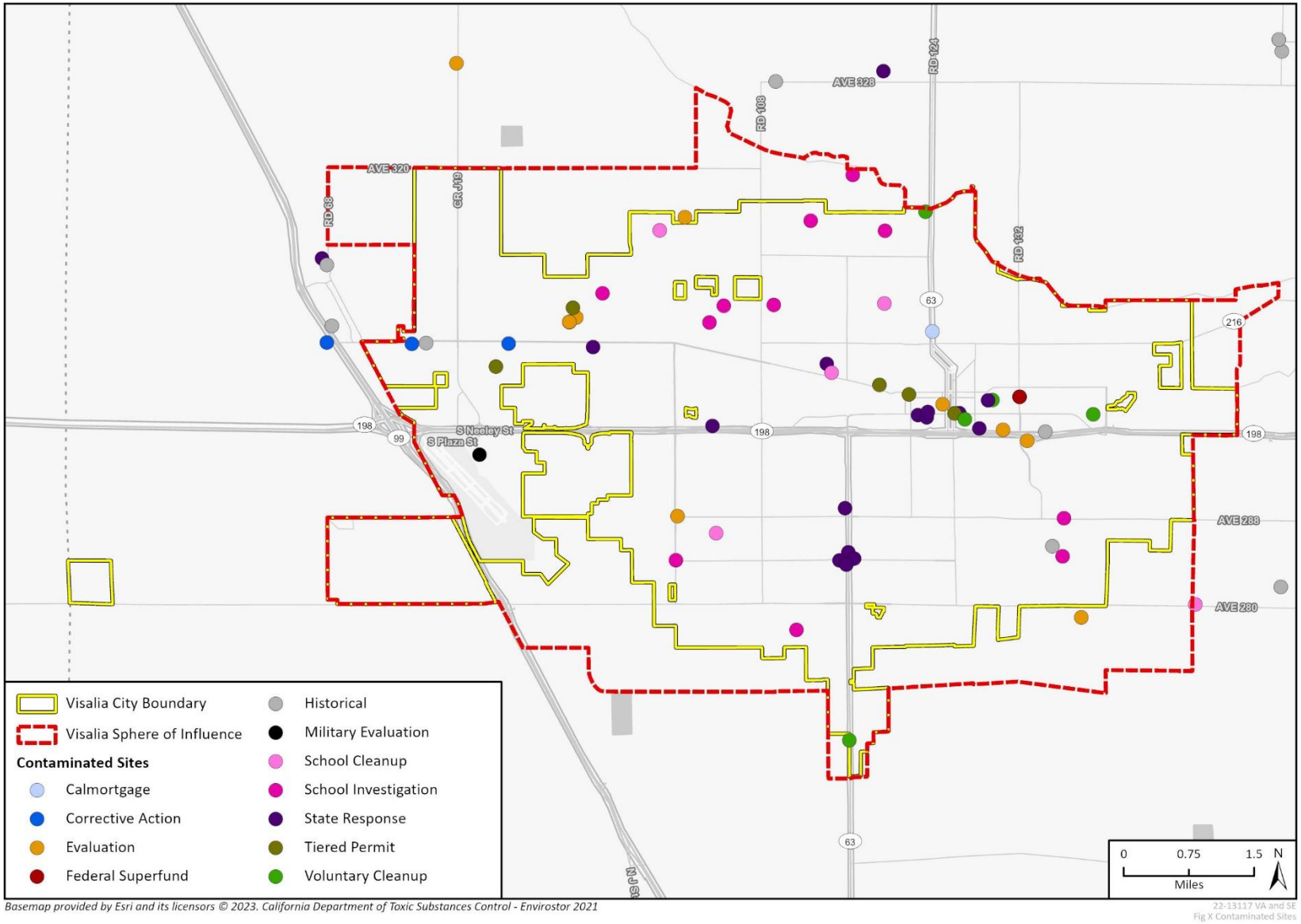
The City of Visalia Fire Department provides some oversight of hazardous materials. The Fire Department is responsible for conducting inspections for code compliance and fire-safe practices and for investigation of fire and hazardous materials incidents. The Fire Department regulates explosive and hazardous materials under the Uniform Fire Code, and permits the handling, storage and use of any explosive or other hazardous material.

Hazardous Materials Sites

Areas where historic or on-going activities have resulted in the known or suspected release of hazardous materials into the soil and groundwater are identified by the Department of Toxic Substances Control and State Water Resources Control Board. Many contaminated sites are associated with leaking underground storage tanks which have caused groundwater infiltration by gasoline and related compounds, or operations which have resulted in groundwater contamination by tetrachloroethylene, or PCE. Sites with ongoing or active cleanup programs are shown on **Figure 8-3**. Most sites are associated with retail and commercial uses (e.g., gas stations, convenience stores, car washes, etc.) or dry cleaners, and some are associated with local industrial uses.

The Planning Area contains one Superfund site, where electrical poles were treated between the 1920s and the 1980s. The Regional Water Quality Control Board (RWQCB) initiated cleanup in 1976, and the site was placed on the National Priorities List (NPL) in 1987, with the Department of Toxic Substances Control as lead agency. Work was completed in 2006, and achievement of water and soil standards was certified in 2009.

Figure 8-3: Contaminated Sites



Land use restrictions on the site prevent residential use, hospitals, schools, daycare facilities, or any use which disturbs the soil below a depth of ten feet.

Not including cleanup sites at current or former dry cleaners, the Department of Toxic Substances Control has led state efforts at three other contaminated sites in Visalia. Agricultural chemicals were detected on the 20-acre former site of Green Acres Airport on West Goshen Avenue. Site remediation involving soil excavation and removal and extensive water sampling was certified complete in 2009. Future residential use, day care centers, hospitals, schools, agriculture, or any soil excavation are not permitted without agency approval.

At the Southern California Gas Company/Visalia MGP site on North Tipton Street, site investigations in 1988 found petroleum-based soil contamination and groundwater contamination with heavy metals and Volatile Organic Compounds (VOCs). The site was remediated and capped with asphalt, and was certified in 1998. A deed restriction requires that the present commercial/ industrial use designation remain.

Wastes containing VOCs were found to be contaminating groundwater from two adjacent parcels at Goshen Avenue and Shirk Road where various industrial activities had taken place. Deep exploratory borings at eight locations were drilled and sixteen deep monitoring wells at six cluster locations were constructed; these onsite monitoring wells are regularly sampled alongside downgradient domestic and agricultural wells which are periodically sampled. These wells indicate that the extent of offsite groundwater contamination is about one-quarter mile wide and about one mile long. An operation and maintenance plan is ongoing.

8.4 FIRE HAZARDS

Wildland and Urban Fires

Fire hazard potential is largely dependent on the extent and type of vegetation, known as surface fuels, that exists within a region. In general, the threat of wildland fires in Visalia is very small because of the area's flat topography and relative absence of grassland, forest, and brush. There are no Fire Hazard Zones in the City of Visalia. Even though Visalia is not considered to be a fire-prone city, structural fires pose a greater risk to life and property than wildland fires. The City of Visalia requires all new development and subdivisions to meet or exceed California Fire Code provisions, and reviews all development applications during the plan check process. Fire services are discussed further in the following section.

Police Department substations on the city's north and south sides are intended to facilitate contact with the community and support robust incident response. (top)

The ability of the Police Department to provide acceptable levels of service are contingent on growing staffing levels consistent with population growth. (bottom)

8.5 SAFETY SERVICES AND EMERGENCY RESPONSE

Police Services

Law enforcement services in Visalia are provided by the Visalia Police Department (VPD). The Department currently has 167 sworn officers, 96 professional staff, and 31 Volunteers in Policing (VIPS). Operations personnel are supported by dispatch, records, crime analysis, and other essential law enforcement units. Police headquarters is located at 303 South Johnson Street in downtown Visalia.

VPD does not adhere to service standards in terms of officers per thousand residents or incident response time. The Department's response times were under 20 minutes for 71 percent of all calls in 2022, and the average response time for Priority 1 calls was 7 minutes.[6] Response times and the ability of the Police Department to provide acceptable levels of service are contingent on growing staffing levels, sworn and civilian, consistent with resident population and the population of visitors, merchants, schools, and shoppers in the service area. The Police Department has successfully developed a new headquarters as part of the Civic Center Master Plan. Future growth will impact service delivery over time, and there may be the need for additional sub- stations within the 20-year planning period, located to serve growth areas.

The Police Department collaborates with other law enforcement agencies and the District Attorney's office on crime prevention. VPD works with city and county agencies and education and social service providers on a variety of outreach and youth programs. The Department is engaged in gang prevention efforts ranging from school presentations to intensive management of high-risk probation cases to injunctions against two gangs and the establishment of a "safe zone" in north Visalia.

The Tulare County Sheriff's Department provides police protection services and investigates crimes in unincorporated areas of the county, including rural and semi-rural areas within the Planning Area. The Department is headquartered on the county administrative campus in Visalia. As Visalia grows, the Police Department will need to work closely with the Sheriff's Office to monitor and respond to any increases in crime within rural and semi-rural areas of the Planning Area.

[6] Visalia Police Department

Fire Services

Visalia Fire Department

The Visalia Fire Department (VFD) provides fire and life safety services for residents located within the city limits while the Tulare County Fire Department provides additional services for unincorporated areas within the Planning Area. Minimum VFD staffing includes two truck companies and five paramedic engines with three suppression staff on each unit, for a total of 21 suppression staff. Additionally, there are two squad units with two paramedics on various shifts, and a Battalion Chief is on staff daily. Minimum daily staffing is 22, with most days providing 26.

Fire Response Standard and ISO Rating

Awarded through the Insurance Service Office (ISO)—a private organization that surveys fire departments in cities and towns across the United States—the Visalia Fire Department currently holds a Class 3 rating (1 being highest and 10 being lowest). This rating considers a community's fire defense capacity versus fire potential, and then uses the score to set property insurance premiums for homeowners and commercial property owners.

VFD follows the National Fire Protection Association (NFPA) response time standard, aiming to respond to 95 percent of calls within 5 minutes, including one minute of "turnout" and four minutes of driving. As of 2023, the Department has an average response time of 6 minutes 8 seconds. Areas of southwest Visalia and smaller areas in the northwest and northeast cannot reasonably be served within the Department's target response time. These needs would become more acute if growth were to occur in the northwest, northeast, and southwest. The Department notes that increases in population have historically been accompanied by an increased number of service calls, and there will be a need to increase staffing.

Fire Prevention

Fire prevention is an important part of the Fire Department's work. The Department conducts property maintenance, does public education programs in schools and other venues, and checks all development plans during the review process. The Fire Department's focus is on making sure that proposed projects will be adequately served by water, and accessible to emergency vehicles.

The Department enforces the city's Hydrant Ordinance, which determines minimum spacing for fire hydrants. Street dimensions are scrutinized to ensure that space will be preserved for ladder trucks to be stabilized, and for emergency vehicles to turn around. Basic requirements in the city's subdivision ordinance include 52-foot minimum

VFD follows the National Fire Protection Association (NFPA) response time standard, aiming to respond to 95 percent of calls within 5 minutes. (top)

VFD staffs five paramedic engine companies, one truck company and a Battalion Chief daily, from five fire station locations. Additional stations are likely to be required to serve the growing city. (bottom)

Visalia will continue to upgrade preparedness strategies and techniques in all departments so as to be prepared when disaster, either natural or man- made, occurs.

right-of-way widths and a 53-foot turning radius for cul-de-sacs.

Emergency Response

In 2023, the department responded to 9,064 calls for service attributed to emergency medical or rescue services.

Mutual And Automatic Aid

The City of Visalia actively participates in the California Master Mutual Aid Plan. Formal mutual aid agreements have been written between the city and surrounding jurisdictions. A broad automatic aid agreement encompassing 48.5 square miles surrounding Visalia exists between Tulare County and the city.

Tulare County Fire Department

The Tulare County Fire Department (TCFD) provides fire and emergency medical services in unincorporated areas. The Department's Emergency Fire Communications Center, or Fire Com, provides dispatch services for the county fire department along with five other rural fire districts. The county fire department is also engaged in fire prevention work. This includes inspecting buildings and enforcing fire safety codes, conducting plan review for new buildings and fire protection systems, and interpreting fire safety codes during the design phase of new buildings. It also includes ongoing public education programs.

Emergency Planning

The California Emergency Services Act (Government Code Section 8550-8668) provides a framework for local jurisdictions to prepare and maintain an Emergency Plan for natural, manmade, or war-caused emergencies that result in conditions of disaster or in extreme peril to life. The Tulare County Emergency Operations Plan (EOP) includes planning and response scenarios for seismic hazards, extreme weather conditions, landslides, dam failure and other flooding, wildland fires, hazardous materials incidents, transportation emergencies, civil disturbance, and terrorist attacks. It is meant to work in conjunction with the State Emergency Plan.

The Fire Department is represented on the county's emergency council, which meets for regional coordination purposes at least four times per year. The Fire Department also houses the city's Emergency Operations Center and leads emergency preparedness and planning for the city. In addition, the City Fire Department has specific procedures for hazardous materials emergency response.

Disaster Preparedness

Alongside the EOP, California Government Code Section 65302.6 indicates that Visalia may adopt a Hazard Mitigation Plan into its Safety Element as long as it meets applicable state requirements. As the City's General Plan is an overarching long-term plan for community growth and development, incorporating its Hazard Mitigation Plan into its Safety Element also creates a stronger mechanism for implementing it. The Hazard Mitigation Plan identifies ongoing programs to mitigate hazards as well as new programs to be implemented in the coming years.

Visalia has adopted its annex of the Tulare County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP), which allows for federal grant funding eligibility to mitigate many of the natural hazards identified in the city. The MJHMP Annex complies with all requirements set forth under the federal Disaster Mitigation Act of 2000. The MJHMP Annex is incorporated by reference in this element, as allowed by California Government Code Section 65302(g).

To access the City's MJHMP Annex, visit the following website: https://oes.tularecounty.ca.gov/oes/mitigation/tulare-county-mjlhmp/

Evacuation Routes and Shelter Sites

Tulare County's Evacuation Plan, adopted in 2011 and incorporated in the EOP, establishes responsibilities, threat levels and triggers for evacuation, evacuation areas, and evacuation routes to be used in case of catastrophic emergencies. The extent and the severity of a disaster will determine which routes and which direction people must take in order to escape or avoid the afflicted areas. The Evacuation Plan places Visalia in Zone 5, and identifies SR 198, SR 99, and SR 63 as evacuation routes. The Agriculture Center in Tulare is identified as a county shelter.

Visalia and other cities within the county are responsible for preparedness activities including identifying equipment, vehicles, and critical supplies; identifying locations outside of potential impact areas to move resources, and to keep contact information updated for the county and state database.

In the event of a natural or manmade disaster, the City will coordinate with the Red Cross, Salvation Army, and state and federal agencies responsible for providing emergency shelter for displaced residents. The sites most commonly used are schools, senior centers, community centers, public buildings, and churches. Kaweah Delta Health

Care District provides emergency health care services.

Consistent with Government Code Section 65302[7], as amended by Senate Bill 747, the city also conducted an emergency evacuation analysis to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios, included as Appendix A of this Safety Element. Using dynamic GIS modeling, the city evaluated three unique scenarios prompting partial and near citywide evacuation: train derailment carrying hazardous materials, a 100-year flood event, and a 500-year flood event. Based on results from the analyses, designated city evacuation routes for each scenario are expected to remain adequate pathways for safely and quickly exiting the city, with alternative routes available if necessary.

8.6 CLIMATE CHANGE

In the last century, human activities such as burning fossil fuels and deforestation have caused a rapid increase in the concentration of greenhouse gases (GHGs) in the atmosphere. These gases, such as carbon dioxide, methane, and nitrous oxide, absorb and re-emit heat that has been discharged from the Earth's surface. This works to ultimately trap heat near the Earth's surface and increase global temperatures. Anthropogenic (human-caused) global warming is well-understood and widely accepted by the scientific community, with over 97% of climate scientists agreeing that the planet is warming at an accelerated rate and that human activities are the root cause. This rise in average temperatures across the globe affects precipitation patterns, temperature, and ocean water levels. Visalia is expected to experience increases in temperatures, more severe storms, increases in extreme heat events, changes in precipitation patterns, extended drought conditions, and increases in flood risk because of climate change.

[7] Also included in Government Code Section 65302, as amended by Senate Bill 99, is the requirement to identify residential developments in hazard areas that do not have at least 2 emergency evacuation routes. As discussed in the Fire Hazards section of this Safety Element, there are no single-access residential neighborhoods within areas designated in the city as high or very high FHSZs.

Climate Change Vulnerability Assessment

The Visalia Climate Change Vulnerability Assessment, located in Appendix B of this Safety Element, includes an evaluation of how climate change may impact vulnerable community members as well as services, critical facilities, natural and managed resources, and infrastructure in the city. Key findings from the assessment are summarized below.

The Intergovernmental Panel on Climate Change (IPCC), a United Nations subgroup responsible with global advancement and communication of Climate Change understandings, has established several scenarios used to describe possible future GHG emissions and associated warming. Two of these are commonly used to compare possible futures and have been selected for this assessment, consistent with guidance from the California Government Office of Emergency Services (Cal OES) California Adaptation Planning Guide.

- The Representative Concentration Pathway (RCP) 4.5 represents a "medium-emissions" scenario in which emissions peak around 2040 and then decline at the end of the century. This scenario assumes global agreement and implementation of GHG reduction strategies.
- The Representative Concentration Pathway (RCP) 8.5 represents a "high emissions" scenario in which emissions continue to rise throughout the 21st century.

Temperature

Visalia's average maximum temperature during the years 1961-1990 was 75.9°F, while the average minimum temperature was 49.6°F. However, mid-century projections according to the California Energy Commission's (CEC) Cal-Adapt data tool indicate that there will be an increase in average maximum temperatures by 3.8°F (RCP 4.5) to 4.8°F (RCP 8.5) and an increase in average minimum temperatures by 3.2°F (RCP 4.5) to 4.1°F (RCP 8.5). By the end of the century, it is expected that the average maximum temperatures will increase by approximately 5.0°F (RCP 4.5) to 8.6°F (RCP 8.5) and the average minimum temperatures will increase by approximately 4.2°F (RCP 4.5) to 7.7°F (RCP 8.5)..

Precipitation

As per Cal-Adapt, the city's modeled historical (1961-1990) annual precipitation is a 30-year average of approximately 9.5 inches. While average annual precipitation is not expected to change significantly, according to Cal-Adapt, precipitation will likely fall in more intense storms within a shorter wet season. For much of the state, and

especially the San Joaquin region, research suggests that wet years will become wetter and dry years will become drier and will extend for longer stretches of time, increasing the risk of extended drought.[8]

Flooding

Due to its location in the heart of the Kaweah River's delta system, many rivers and creeks flow directly through the city. As more heavy precipitation events occur, river and stormwater systems may be overwhelmed more frequently causing localized flooding. Low-lying areas throughout Visalia are especially at risk, with the majority of the city within the 500-year floodplain and a large swath of the central portion of the city in the 100-year floodplain. Alongside structural damage, flooding can also cascade into power, wastewater, and storm drainage infrastructure, leading to interruptions in services relied upon by the community. In worst cases, flooding can also create risk of injury—directly though floodwaters or indirectly as physical assets, such as medical equipment, are damaged or go off-line.

Extreme Heat

As previously discussed, temperatures in Visalia are expected to increase under all RCP scenarios. Extreme heat days are defined as days in which the daily maximum temperature exceeds the 98thpercentile value of the historical average. For Visalia, the threshold temperature is 103.4°F according to the CEC. During this century, the number of extreme heat days per year is expected to increase from the annual average of four days to between 22 (RCP 4.5) and 30 (RCP 8.5) by mid-century and between 32 (RCP 4.5) 63 (RCP 8.5) by end-century (CEC 2022) Exposure to extreme heat can lead to heat-related illnesses such as heat cramps, heat exhaustion, and heat stroke, and even fatalities. Moreover, it can worsen pre-existing medical conditions. A rise in the number of extreme heat days can escalate public health risks, especially for vulnerable groups such as older adults, young children, and people with underlying chronic diseases, by increasing the occurrence of heat-related illnesses and vector-borne diseases.

Wildfire

The risk of wildfires is on the rise in California and the Tulare County region. While the possibility of fire within the limits of Visalia city is relatively low, the neighboring areas, especially those situated to the east of the city, are expected to experience an increase in risk as climate change exacerbates conditions like prolonged drought and extreme

[8] NASA. Goddard Space Flight Center. Accessed at: https://climate.nasa.gov/news/2891/a-drier-future-sets-the-stage-for-more-wildfires/.

temperatures. The consequences of neighboring wildfires can lead to poor air quality, and negatively impact public health in Visalia.

Vulnerability

Communities will be affected by climate change to varying degrees depending on their sensitivity to its impacts. Social vulnerabilities can greatly inhibit the adaptive capacity of a community. On a larger scale, communities may be more vulnerable because of limited access to financial capital and resources, various institutional barriers, social network limitations, and compromised access to critical infrastructure.

Certain population groups may be disproportionately harmed by the impacts of climate change in Visalia. Vulnerable populations identified in Visalia include but are not limited to:

- Individuals with high outdoor exposure
- Under-resourced individuals
- Individuals with chronic health conditions or health related sensitivities
- Individuals facing societal barriers

The City relies on infrastructure for mobility, water, power, and communications. These systems are vulnerable to climate change, which in turn can reduce the ability of people to adapt. Health risks may arise or be exacerbated as a result of damaged infrastructure, such as from the loss of access to electricity, or impacts to sanitation, safe food, water supplies, health care, communication, and transportation.

Additional factors present in Visalia that may exacerbate climate change vulnerability include exposure to poor air quality and drinking water contaminants as well as other environmental conditions. Because climate change impacts are closely intertwined with vulnerable populations and inequities, addressing underlying inequities can help increase resilience for all residents of Visalia.

8.7 OBJECTIVES AND POLICIES

Objective S-O-1: Seismic and Geologic Hazards

To minimize risks of property damage and personal injury posed by geologic and seismic hazards.

Policies

S-P-1 Work with Caltrans to seismically retrofit or replace local ramps and freeway overpass bridges that are categorized as structurally deficient by Caltrans, are located in high ground shaking areas, and/or are necessary for first responders to use during and/ or immediately after a disaster or emergency.

S-P-2 Seismically retrofit or replace public works and/or emergency response facilities that are necessary during and/or immediately after a disaster or emergency.

S-P-3 Continue to administer a public relations and education program to increase community awareness for emergency preparedness.

S-P-4 Update subdivision and zoning ordinance review criteria to include seismic design considerations.

S-P-5 Require all new development to be constructed in accordance with current California Building Code seismic safety design standards.

S-P-6 Continue to inspect sub-standard housing conditions to evaluate when a structure is unsafe to occupy.

S-P-7 Consult with a qualified engineering geologist to periodically review the Safety Element and building code for compliance with best practices.

Objective S-O-2: Flood Hazards

To protect the community from risks to life and property posed by flooding and stormwater runoff.

Policies

S-P-8 Reinforce the City's transportation infrastructure for protection from flooding through activities such as elevating roads, installing culverts beneath roads, or constructing higher bridges across an area that experiences regular flooding.

S-P-9 Continue to implement recommendations contained in the County Flood Control Master Plan that are within the City's jurisdiction.

S-P-10 Increase participation in the National Flood Insurance Program by enhanced floodplain management activities that may allow property owners to receive a discount on their flood insurance.

S-P-11 Work with FEMA Region IX to address any floodplain management issues that may have arisen/arise from the countywide Digital Flood Insurance Rate Map, Community Assessment Visits, and/or the California Department of Water Resources oversight.

S-P-12 Prohibit development which impairs the ability of the regulatory floodway to convey flood waters.

S-P-13 Maintain flood hazard policies in accordance with the City's MJHMP Annex.

S-P-14 Implement nature-based solutions projects, such as community rain gardens, parking lot bioswales, permeable pavement development, and floodplain restoration, to enhance stormwater management and increase flood protection.

S-P-15 Ensure adequate flood early warning systems by updating and maintaining rain and creek level gauges.

S-P-16 Implement drought-tolerant green infrastructure projects including street trees and landscaped areas, and encourage installation of green roof systems in public and private spaces to reduce stormwater runoff.

Objective S-O-3: Hazardous Material

To protect soils, surface water, and groundwater from contamination of hazardous materials.

Policies

S-P-17 Require remediation and cleanup of sites contaminated with hazardous substances.

Note: *The level of remediation and cleanup will be determined based on the intended use and health risk to the public. At the minimum, remediation will follow federal and State standards. Clean up shall be required in conjunction with new development, reconstruction, property transfer of ownership, and/ or continued operation after the discovery of contamination.*

S-P-18 Promote the reduction, recycling, and safe disposal of household hazardous wastes through public education and awareness and maintain adequate collection programs. Coordinate with hazardous waste recyclers to increase the frequency of hazardous waste collection events.

S-P-19 Coordinate with the Tulare County Environmental Health Division and other appropriate regulatory agencies during the review process of all proposals for the use of hazardous materials or those involving properties that may have toxic contamination, such as petroleum hydrocarbons, CAM 17 metals, asbestos, and lead.

S-P-20 Only permit development of facilities that produce, handle, store or transport hazardous materials in areas and in a manner that protects public health, safety, and the environment.

Note: *New policy.*

S-P-21 Where feasible, create open space buffers between hazardous materials routes and residential neighborhoods to prevent hazardous material transportation incidents from affecting residential areas.

Objective S-O-4: Fire Hazards

Protect Visalia's residents and businesses from potential fire hazards.

Policies

S-P-22 Manage vegetation in areas within and adjacent to public rights-of-way and in close proximity to critical facilities in order to reduce the risk of tree failure and property damage and avoid creation of wind acceleration corridors within vegetated areas.

S-P-23 Continue to improve law enforcement and investigation equipment by adapting equipment available and purchasing new equipment where needed.

S-P-24 Require that all buildings and suites/units have visible street addressing and signage in accordance with City of Visalia's Addressing Policy.

S-P-25 Working with city water provider, ensure availability of adequate water supplies to meet public health and safety needs, and for resource protection, by maintaining the following order of priority for water use:

- Potable water supply, fire protection, and domestic use
- Resource protection and preservation
- Industrial, irrigation, and commercial uses
- Water-oriented or water-enhanced recreation
- Air conditioning

Objective S-O-5: Safety Services and Emergency Response

Provide comprehensive emergency response, disaster preparedness, and evacuation routes for Visalia area residents.

Policies

S-P-26 Integrate the Tulare County Hazard Mitigation Plan, in particular the hazard analysis and mitigation strategy sections, into the development review process, the emergency operations plan, and capital improvement program, as appropriate.

S-P-27 Continue to administer GIS-based pre-application review for new construction and major remodels of residential and/or non-residential structures in hazard areas by integrating maps from the General Plan Update and the county's Hazard Mitigation Plan into the city's GIS system.

S-P-28 Continue a program designed to eliminate unfit, unhealthy, dangerous, structurally unsafe, and fire hazardous housing units by rehabilitation or removal.

S-P-29 Continue the use of an "inspection team" to inspect all deteriorated and dilapidated housing units in the city. The team will carry out appropriate actions such as giving instructions, red tagging, posting and removal of housing units when necessary.

Note: *The team approach incorporates staff from departments having expertise in the area of inspection for safety, sanitation, and structural adequacy.*

S-P-30 Where feasible, locate all new critical care facility development, such as nursing homes, housing for the elderly, and other housing for the mentally and physically infirm, within a reasonable distance (3 miles or 3 minutes) from fire stations.

S-P-31 Continue to work with weather forecasting and public safety agencies to provide warning and protective information to residents, travelers, and visitors about severe valley fog conditions.

S-P-32 Continue to rely on the Tulare County Office of Emergency Services to maintain inventories of available resources to be used during disasters.

S-P-33 Continue to upgrade preparedness strategies and techniques in all departments so as to be prepared when disaster, either natural or manmade, occurs.

S-P-34 Continue to coordinate a public education program to foster public awareness of hazards and disaster response with the intention of reducing injury and loss of life, damage to property, and degradation of the natural environment, particularly in conjunction with the public school system and "critical facility." Programs should seek to reach all age groups, socio- economic classes, both urban and rural residents, and vulnerable populations. Education programs should be offered in both Spanish and English, as appropriate.

Note: *Education programs can be carried out through public and private schools, the libraries, police and fire department, the news media, civic organizations and on the city website.*

S-P-35 Periodically conduct joint training exercises with the County, State and federal agencies and others with the goal of developing the best possible coordinated action in fire suppression and crowd control.

S-P-36 Maintain compliance with state and federal standards for disaster preparedness and emergency response plans.

Objective S-O-6: Climate Change – Community Resilience

To provide additional services and infrastructure that promote community resilience for Visalia residents, enabling them to cope with hazards associated with climate change.

Policies

S-P-37 Establish resilience hubs, or augmented community facilities, that would serve as focal points for coordinating and distributing resources and services before, during, and after a natural disaster

event. Resilience hubs are public-serving facilities that provide information and services to build resilient communities, and provide essential resources to the most vulnerable populations, including under-resourced and health-sensitive individuals.

S-P-38 Develop and maintain backup power sources that will ensure the reliability of critical facilities such as communications towers, electrical substations, water services, and first-response buildings during periods of high demand such as extreme heat events or possible outages because of safety power shut offs and extreme weather. Work to implement on-site power generation through solar photovoltaic systems and battery storage.

Objective S-O-7: Climate Change – Extreme Heat

To protect the community against risks to life and property arising from extreme heat events and urban heat island effects.

Policies

S-P-39 Implement drought-tolerant green infrastructure projects including street trees and landscaped areas and encourage installation of green roof systems in public and private spaces to provide natural cooling and offset energy demand during extreme heat events.

S-P-40 Develop a program to increase the reflectivity, or decrease the albedo, of City-owned roofs, walls, and other building envelope features to reduce localized temperatures during extreme heat days.

S-P-41 Encourage energy efficiency in buildings through upgrading appliances and building infrastructure retrofits to best prepare for fluctuating prices and electrical grid overload during peak demand periods of extreme heat events.

S-P-42 Evaluate the need for new or additional cooling centers to ensure adequate geographical distribution and access. Identify partners and funding sources to design and construct new cooling centers to serve as a refuge during extreme heat days.

S-P-43 Identify and map cooling centers in locations accessible to vulnerable populations and establish standardized temperature triggers for when they will be opened.

S-P-44 Work with county and state agencies, including Housing Authority of Tulare County (HATC) and Community Services Employment Training (CSET), to review the adequacy of programs designed to help vulnerable populations stay cool during heat waves, with attention to promote ways to offset the economic impacts on seniors and low-income groups.

S-P-45 Protect large, continuous greenspaces wherever possible for greater cooling magnitude and extent. Include a mix of grass and trees for greatest cooling benefits.

S-P-46 Create new park designs that offer a variety of land cover including trees and lawn to provide recreation opportunities and shading.

S-P-47 Collaborate with dry utility providers, including Southern California Edison and Southern California Gas Company, to evaluate utility capacity during surge periods and identify actions to minimize outages and establish back-up power supplies.

Objective S-O-8: Climate Change – Regional Collaboration

To stay up to date on climate change information and participate in regional climate change planning efforts.

Policies

S-P-48 Engage surrounding jurisdictions in climate adaptation planning to prioritize efforts that address regional climate change vulnerabilities of community members, infrastructure and services, natural resources and ecosystems, and critical facilities and buildings.

S-P-49 Integrate and regularly update best available climate science, projections, and potential impacts into relevant city plans, codes, and planning documents including the MJHMP Annex, Municipal Code, and Comprehensive Emergency Operations Plan.

S-P-50 Prepare for and adapt to the effects of climate change by considering climate change vulnerability in planning decisions, including those involving new public facilities and private development. Re-evaluate the city's Climate Change Vulnerability Assessment over time and update as appropriate.

S-P-51 Pursue adaptation planning and implementation grant funding to successfully implement climate change mitigation and adaptation strategies. Consider collaborating at the regional level with organizations such as the Tulare County Resource Conservation District and Flood Control District, local fire safe councils, or other community-based organizations.

Objective S-O-9: Climate Change – Community Outreach and Engagement

To implement community outreach and engagement strategies to educate and collaborate with Visalia residents, especially vulnerable populations, on climate change-related hazards and emergency evacuation preparedness.

Policies

S-P-52 Support and partner with local agencies and organizations to conduct multi-lingual workshops and trainings that highlight best practices on emergency preparedness, energy efficiency, water conservation, and sustainable transportation. Develop specific training for emergency preparedness as it relates to heat related illness and flooding events.

S-P-53 Conduct public information campaigns using various media channels such as social media, local newspapers, flyers, and billboards, to disseminate information about Visalia's most significant climate hazards (e.g., extreme heat, flooding) and what residents can do to prepare

Appendix A

City of Visalia Emergency Evacuation Analysis

Rincon Consultants, Inc.
7080 North Whitney Avenue, Suite 101
Fresno, California 93720
559-228-9925

June 6, 2024
Project No: 22-13117

Brandon Smith, AICP, Principal Planner
Community Development Department
City of Visalia
Email: brandon.smith@visalia.city

Subject: City of Visalia Emergency Evacuation Analysis

Dear Brandon:

This supplemental evacuation analysis was prepared in support of the Visalia Safety Element Update. This study is intended to provide the City of Visalia (the City) with a broad planning level assessment of the capacity of the transportation system during a citywide evacuation event. It identifies residential developments with a single entrance and exit road and evaluates the efficacy of existing evacuation routes under various hazard scenarios in compliance with the following two statutes:

Senate Bill 99 requires that the Safety Element of the General Plan identify any residential developments in any hazard area that does not have at least two evacuation routes. This is a requirement for all safety element updates included upon the revision of the housing element on or after January 1, 2020.

Assembly Bill 747 requires that the Safety Element be reviewed and updated to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. This will be a requirement for all safety elements or updates to a hazard mitigation plan completed after January of 2022. Since this requirement has recently gone into effect, there is no established standard methodology.

These scenarios are intended to model a potential range of different evacuation scenarios, but not all possible scenarios. Emergency evacuations can occur due to any number of events and at any location, beyond those specifically identified in this report. In addition, emergency movement is unpredictable, and the specific conditions of an emergency evacuation could result in evacuation behavior that diverges from the assumptions used in this analysis. This analysis serves only to represent informed estimates of likely potential evacuation scenario footprints and capacity constraints based on available data and does not guarantee that evacuations will follow modeling that is used for analysis purposes. Emergency evacuation assessments are an emerging field and, as noted above, there is no established standard methodology. The methodology used in this evaluation is based upon best practices consistent with the Governor's Office of Planning and Research's Draft Evacuation Planning Technical Advisory[1] and the professional experience and knowledge of Rincon staff. Rincon is not responsible for any damage to life or property that might occur following the City's emergency evacuation management techniques based on the results of the evacuation analyses herein, and any accompanying recommendations.

[1] https://opr.ca.gov/docs/20231004-Evacuation_TA_for_Public_Comment.pdf

SB 99 Analysis – Single Entrance/Exit Neighborhoods

Per SB 99, the Safety Element of the General Plan is required to identify neighborhoods in any hazard area that does not have at least two evacuation routes that would be accessible by car. For this analysis, a neighborhood is defined as 31 or more dwelling units that only have a single route to access a collector or arterial road, based on California Fire Code Appendix D107[2]. There were 35 neighborhoods identified in the city that have a single entry or exit point, as shown in Figure 1. About half of the single entry/exit neighborhoods are located in the northern half of the city (north of California State Route (SR) 198), while the remaining neighborhoods are spread across the southern half of the city (south of SR 198). Single entry/exit neighborhoods in the northern half of the city are predominately located within the vicinity of Akers and Demaree Streets and Golden West High School, while single entry/exit neighborhoods in the southern half of the city are spread evenly across. In the case of an evacuation event, these single entry/exit neighborhoods would likely use the easternmost and westernmost roads of the city to evacuate. Neighborhoods located in the southernmost area of the city, near Perry Family Park, may also use roads to the south.

AB 747 Analysis – Evacuation Scenarios

In accordance with AB 747, the following analyses and results outline the potential outcomes of a variety of hazard events requiring emergency evacuation.

Evacuation Assessment Methodology

Hazards Scenarios

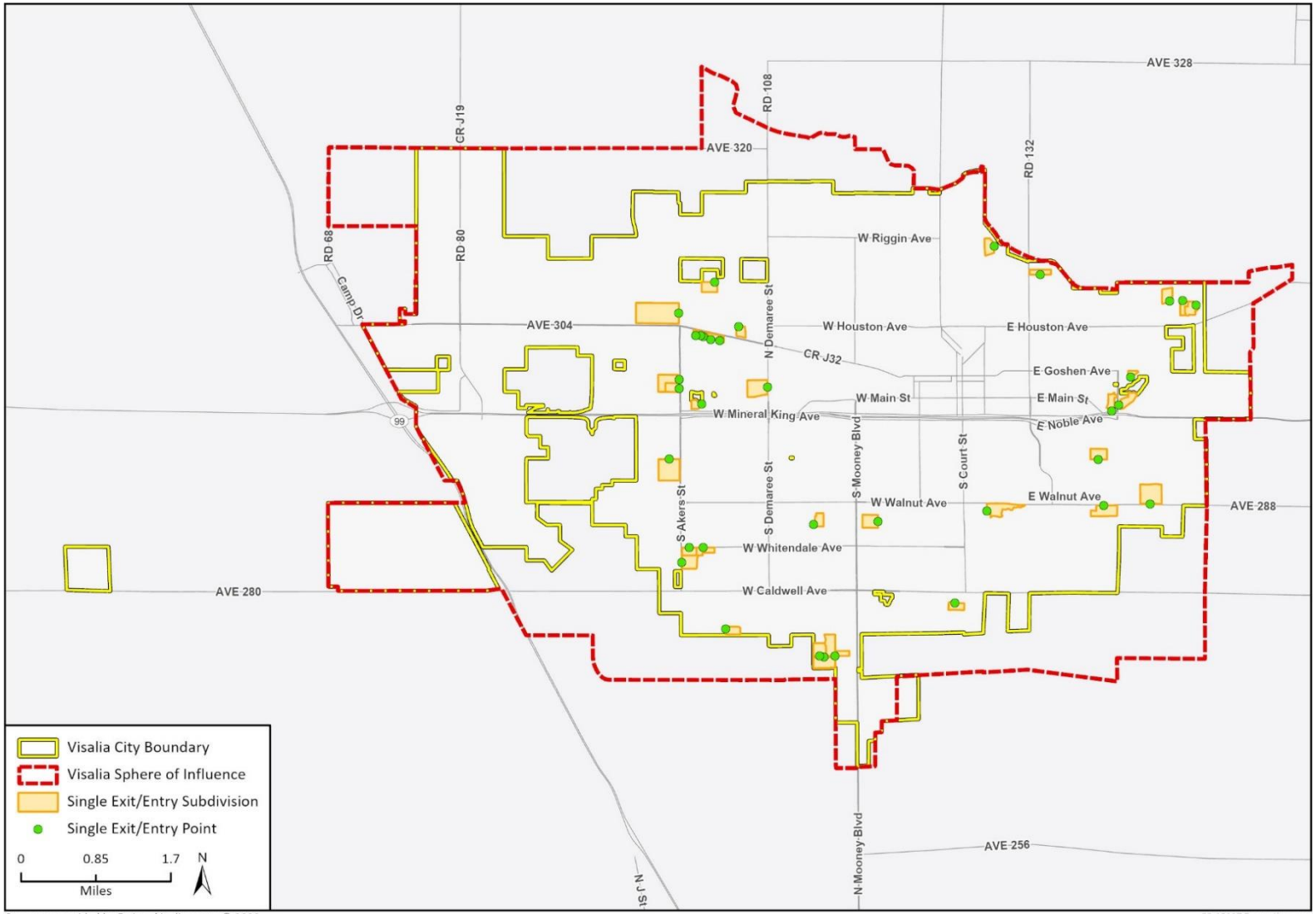
In accordance with AB 747, a range of potential hazard scenarios have been presented in this evacuation analysis. The spatial extent and magnitude of a potential hazard highly affects how evacuation would occur within a city. With a near 100 percent probability in future years due to heavy rain events, inadequate drainage, and the flat geography of Visalia, evacuation scenarios included in this analysis evaluate the potential evacuation effects of widespread flooding across Visalia's 100- and 500-year floodplains. Also contained within the Visalia's borders and sphere of influence (SOI) are a few miles of the San Joaquin Valley Railroad (SJVR). The short-line SJVR periodically carries hazardous material through Visalia, and a derailment scenario would have an impact on the portions of Visalia's transportation system since there are no grade-separated crossings between the railroad other than one freeway underpass. Therefore, this analysis evaluates the potential evacuation effects of a train derailment carrying hazardous material near downtown Visalia. A total of five hazard scenarios, in addition to a baseline scenario, are considered in this analysis:

- Baseline – Typical traffic conditions within Visalia on Monday at 5:00 PM
- 100-Year Flood Event
- 500-Year Flood Event
- Hazardous Train Derailment Event (1)
- Hazardous Train Derailment Event (2)
- Hazardous Train Derailment Event (3)

Each of these hazard scenarios are described below in detail in the Evacuation Assessment Results section.

[2] 2019 California Fire Code, Title 24, Part 9 with July 2021 Supplement. Accessed at: https://codes.iccsafe.org/content/CFC2019P4/appendix-d-fire-apparatus-access-roads

Figure 1 Single Entry/Exit Neighborhoods



Data Sources and Data Processing

Transportation Network

The transportation network was created using ESRI's StreetMap Premium. StreetMap Premium is a comprehensive dataset that provides enriched network data based on commercial street reference data from leading global and local street data suppliers: HERE and GeoTechnologies, Inc. The dataset includes detailed basemap data and a network dataset for routing, both of which were used in the evacuation analyses. This dataset is well-suited for emergency evacuation analysis because it includes a robust road network, baseline traffic data, and is regularly updated to ensure that it remains accurate and current.

Parcel Data

The parcel layer used in the model include residential, commercial/industrial, and public/institutional land uses from Visalia's zoning code and General Plan Land Use (GPLU) data. The parcel polygons were joined to GPLU data, then converted into point features that retained the attributes of the original parcel polygon for use in the evacuation models.

Population Modeling

Population data from the American Community Survey (ACS) and the U.S. Bureau of Labor Statistics were modeled to determine how many Visalia residents would be at risk during an emergency evacuation scenario. Using parcel data, residential land uses were identified and the estimates of people driving to work within each census tract were taken from ACS 5-year estimates data. The number of individuals driving to work was distributed among parcel data with residential land uses. According to the ACS 5-year estimates, there are an estimated 59,569 individuals that drive to work in Visalia. Individuals driving to work was established as a population parameter because it is most likely that individuals leaving the city in an evacuation would do so by car. There are an estimated 5,797 people over the age of 16 that do not drive to work in Visalia.

In addition to the population living in Visalia, there are individuals that travel into the city regularly for work. These individuals would most likely be concentrated in non-residential land uses during a daytime emergency evacuation scenario. According to the 2019 Occupational Employment Statistics from the Bureau of Labor Statistics, there are approximately 155,660 employees that work in Visalia. Agricultural, educational instruction and library occupations, as well as police and sheriff's patrol officers, were removed from the total number numbers of employees as they are assumed to be already captured in the residential population. The remaining 90,740 employees were divided by the total area of commercial/industrial land use parcel acreage for an average of 21.21 employees per acre. The average numbers of employees in educational instruction and library occupations were calculated using the same methodology, for an average of 14.14 employees per acre.

Evacuation Modeling

Evacuation routes and traffic congestion during an emergency evacuation event were modeled using ArcGIS's Closest Facility tool included in the Network Analyst extension. The Closest Facility tool enables finding the closest facility (e.g., hospital, fire station, or gas station) to a given location or set of locations. The Closest Facility tool can also be customized to include other factors that affect travel time, such as speed limits and road closures. For this evacuation analysis, the "facilities" analyzed were points outside of Visalia city boundaries located on roads along three County-designated

evacuation routes: SR 198[3], SR 99, and SR 63. After distributing the modeled population throughout the city, the evacuation model was run to simulate the level of traffic congestion on roads and major highways during each hazard scenario assuming simultaneous departure of all populations from the evacuation origin to the nearest, available evacuation points along the transportation network.

The traffic congestion was shown by assigning average daily traffic (ADT) Level of Service (LOS) B capacities from Table 4-2 of the Visalia Circulation Element to each modeled evacuation route/trip. The count of modeled evacuation routes/trips that intersected the segments of the road network were divided by the road segment's ADT LOS B capacity to create a ratio (i.e., the percentage of ADT each portion of the road network would experience at the time of evacuation).

The total number of starting locations for evacuation trips were created by taking 75 percent of the population living in the city and driving to work, and 75 percent of the employees distributed across the city. This created a distribution of individuals across the city where evacuations would originate from.

Assumptions and Limitations

The 75 percent taken from each category of the modeled population is meant to account for the limitations of the data sources that were used to model the population, and where they would be within Visalia on a typical weekday.

These limitations include margin of error within the data, individuals that work an atypical work shift, individuals that may have been off from work at the time of the evacuation, and individuals that live within the city but drive outside the city for work.

Evacuation Assessment Results

Baseline

The baseline scenario evaluates the typical traffic congestion in the city at 5:00 PM on a Monday. Baseline traffic data was derived from ESRI's StreetMap Premium database and is used as the basis of comparison for each modeled evacuation scenario. As shown in Figure 2, most traffic congestion typically occurs near the downtown city-center and at intersections along major roads within the city, including Caldwell Avenue, Walnut Avenue, Goshen Avenue (Ave 304), and Riggin Avenue. All County-designated evacuation routes are available to residents for evacuation, with onramps for each evacuation route showing Free Flow to Moderate traffic congestion.

100-Year Flood Event

This scenario assumes a flood event across FEMA-designated 100-year floodplains within the city. As noted in the *Evacuation Modeling* section, SR 198 is not viable during a 100-year flood event due to the possibility that flooding could occur on SR 198, or that SR 198 could be used as an emergency flood basin during a flooding event. Although most outbound roads leading to County-designated evacuation routes are viable, it is assumed that eastbound evacuation would not be practical due to the high likelihood that flood flows would originate from areas east of the city, within the Kaweah River Basin and/or Southern Sierra watershed, during heavy storm events, resulting in northwest-, west-, and southbound evacuation.

[3] In both flooding scenarios, evacuation route SR 198 is not viable, and therefore "closed" in the analyses, due to the possibility that flooding could occur on SR 198, and/or that SR 198 could be used as an emergency flood basin during a heavy flood event, per discussions with City personnel.

Figure 3 shows traffic congestion originating along S. Court Street as impacted individuals near and within downtown Visalia travel southbound onto W. Caldwell Avenue, eventually exiting the city using SR 63, or S. Mooney Boulevard. Traffic congestion along S. Court Street and portions of southbound SR 63 (within City limits) exhibit 25-50 percent of ADT, while traffic congestion along W. Caldwell Avenue and one and a half miles of SR 63 (outside of City limits) exhibit 50-100 percent of ADT. Other areas of moderate traffic congestion include W. Riggin Avenue, Road 80 or N. Plaza Drive, and northwest bound SR 99, all of which exhibit 25-50 percent, and small portions of 50-100 percent, of ADT. The most severe traffic congestion, starting as 50-100 percent of ADT then transitioning to greater than 100 percent of ADT, occurs along Betty Drive as evacuees turn onto SR 99. Evacuation responders could consider activating evacuation traffic management at this junction to ensure evacuees can safely and quickly exit the city using SR 99. Alongside the roads listed above, other roads to consider monitoring in this scenario include S. Bridge Street, S. Conyer Street, N. Santa Fe Street, and other roads located within downtown Visalia floodplain evacuation areas, as these may become congested during simultaneous evacuation out of the floodplain areas.

500-Year Flood Event

This scenario assumes a flood event across FEMA-designated 500-year floodplains within the city. As noted in the Evacuation Modeling section, SR 198 is not viable during a 500-year flood event due to the possibility that flooding could occur on SR 198, or that SR 198 could be used as an emergency flood basin during a flooding event. Like the 100-year flood event scenario, it is assumed that eastbound evacuation would not be practical due to the high likelihood that flood flows would originate from areas east of the city, within the Kaweah River Basin and/or Southern Sierra watershed, during heavy storm events, resulting in northwest-, west-, and southbound evacuation.

With a much greater flooding area than the 100-year flood event scenario—covering nearly all of the city—this scenario is expected to cause moderate to severe traffic congestion along all available County-designated evacuation routes. Figure 4 shows the most severe traffic congestion, greater than 100 percent of ADT, along westbound W. Riggin Avenue, N. Plaza Drive, and SR 99 as individuals travel towards and evacuate using northwest bound SR 99; and portions of W. Caldwell Avenue and SR 63 as individuals travel towards and evacuate using southbound SR 99 and SR 63. Areas of traffic congestion exhibiting 50-100 percent of ADT include portions of S. Court Street, S. Ben Maddox Way, and all roads previously listed. Moderate traffic congestion, exhibiting 25-50 percent of ADT, include all roads previously listed, in addition to portions of W. Goshen Avenue, N. Akers Street, S. Roeben Street, S. Shirk Road, S. Mooney Boulevard, W. Main Street, Burke Street, and South Lovers Lane. Evacuation responders could consider activating evacuation traffic management at the most impacted westbound evacuation route feeder roads (W. Riggin Avenue and W. Caldwell Avenue) and contra-flow lane reversal on south SR 63 to allow both lanes to be used for evacuation if necessary. Evacuation responders could also consider re-routing evacuees towards additional evacuation routes, such as Avenue 280, Road 80, and Road 140 if traffic congestion along the available County-designated evacuation routes becomes too severe.

Hazardous Train Derailment Event (1)

This scenario assumes a train carrying hazardous materials derails near downtown Visalia. The train derailment area is a half mile stretch along the SJVR tracks, with the evacuation area being a one-mile buffer around the crash site. As shown in Figure 5, the most severe traffic congestion, 50-100% percent of ADT, occurs within the evacuation area along E. Murray Avenue, as individuals proceed towards eastbound SR 198, and along the E. Noble Avenue onramp for eastbound SR 198. Less severe traffic congestion, exhibiting 25-50 percent of ADT, occurs along a small portion of E. Goshen Avenue, S. Ben Maddox Way, and parts of SR 198. Although traffic congestion during this hazardous

train derailment event is not expected to be severe, emergency responders could consider activating evacuation traffic management at impacted roadways/intersections within and around the evacuation area and ensure evacuees can rapidly exit the evacuation area while no bystanders can enter.

Hazardous Train Derailment Event (2)

This scenario assumes a train carrying hazardous materials derails in the southeastern vicinity of Visalia where a derailment is relatively more likely due to the curvature of the tracks in this area. This is primarily because curves pose additional challenges to train stability and require careful management. Like the previous derailment scenario, the train derailment area is a half mile stretch along the SJVR tracks, with the evacuation area being a one-mile buffer around the crash site. As shown in Figure 6, little to no traffic congestion occurs within and around the evacuation area, with only small portions of E. Noble Avenue, E. Mineral King Avenue, and E. Main Street exhibiting 25-50 percent of ADT. Although traffic congestion during this hazardous train derailment event is not expected to be severe, emergency responders could consider activating evacuation traffic management at impacted roadways/ intersections within and around the evacuation area and ensure evacuees can rapidly exit the evacuation area while no bystanders can enter.

Hazardous Train Derailment Event (3)

This scenario assumes a train carrying hazardous materials derails in the northwestern vicinity of Visalia near a railroad junction. Although train derailments can occur at various locations along a railway, switches and junctions are potential points of vulnerability due to the complexity of rail layouts and the need for precise alignment. The train derailment area is a half mile stretch along the SJVR tracks, with the evacuation area being a one-mile buffer around the crash site. As shown in Figure 7, due to the location of the train derailment evacuation area, evacuating using westbound SR 198 or northbound SR 99 is not viable. The most severe traffic congestion, 50-100 percent of ADT, occurs along S. Shirk Road and W. Caldwell Avenue, as evacuees use these roads to move away from the evacuation away onto southbound SR 99. Other areas with less severe congestion, 25-50 percent of ADT, occur along Plaza Drive and small parts of eastbound SR 198. Like the previous scenarios, although traffic congestion during this hazardous train derailment event is not expected to be severe, emergency responders could consider activating evacuation traffic management at impacted roadways/intersections (notably, S. Shirk Road and W. Caldwell Avenue) within and around the evacuation area and ensure evacuees can rapidly exit the evacuation area while no bystanders can enter.

Evacuation Strategies

The following lists evacuation strategies that the City may consider to improve future evacuation events.

Traffic Management

- Reverse one or more lanes of a highway to accommodate an increased flow of traffic in one direction.
- Redirect all lanes of a designated evacuation route to accommodate rapid evacuation from a city or region.
- Temporarily close inbound travel lanes on selected unlimited access arterials (such as parkways and boulevards) to allow outbound traffic to utilize these lanes during evacuation.

- Close inbound lanes on highways used for evacuation routes to prevent drivers on these routes from entering the city while evacuation is underway.
- Minimize left-turn movements along evacuation routes and on roads leading to evacuation routes.
- Signage: Use variable message board equipment and targeted installation of permanent dynamic message signs on evacuation routes to improve communication and reduce public confusion.
- Consider how to stage tow trucks at key bottleneck locations along evacuation routes to help detect and clear minor crashes and maintain traffic flow.
- Increase the green time and/or progression band for through movements leading out of an evacuation zone.
- Install signal battery backups in case signal operations need to be maintained during a power outage. Consider using channeling devices, static signs, and coning strategies to manage intersection flow during power outage if the signals lack power.
- Identify and communicate with communities that have at least two access points. Prioritize adding additional access to communities which are currently served by only one or two access points.
- Develop transportation solutions such as the use of a bus system for evacuating individuals with special needs (such as those with mobility limitations).
- Establish traffic control points (i.e., locations along designated evacuation routes with emergency management personnel) to maintain a greater degree of evacuation management. These locations could enhance the efficiency of an evacuation, reduce public confusion, and allow increased operational flexibility during an evacuation.

Communications

- Strengthen and maintain communication among coordinating emergency event agencies. This could be achieved through systems such as the Public Information Emergency System and Emergency Satellite Communications.
- Implement a traffic control center to coordinate all evacuation activities. This center would have up to the minute reports on traffic patterns and can communicate directly with the broadcast media to let drivers know about roadway congestion and conditions and direct them to alternate routes.
- Install counters and/or CCTV cameras to assess traffic flow, volume of vehicles evacuating, and monitor incidents.
- Develop a communication plan to provide information regarding primary and secondary evacuation routes and incidents to the public.

Vulnerable Populations

- Understand if there are areas in the city with a greater percentage of senior adults, disabled people, mobility impaired, visually impaired, people with medical conditions, and people without vehicles with of objective of identifying areas that should be prioritized by first responders during an evacuation.
- Develop system to ensure hearing impaired receive evacuation warnings.
- Provide special assistance to mobility impaired, visually impaired, people with medical conditions, and people without vehicles such as paratransit.

- Translated materials should be prepared to support communication to non-English speaking populations including during evacuation.
- Evacuation centers should provide dialysis machines or other life-sustaining equipment.
- Provide resources for free to unhoused populations during evacuation.

Conclusion

The City's transportation network allows for a streamlined evacuation north, west, south, and east of the city during a disaster[4]. However, due to the growing population density and potential hazard risks, an evacuation event could still put a burden on the transportation network. In compliance with SB 99, we have identified 35 neighborhoods that have a single entry or exit point throughout the city. The emergency evacuation analysis, according to AB 747, shows that in the case of a 100- or 500-year flood event, some portions of the City's evacuation network could become unviable, namely SR 198. Depending on the severity of the flooding, evacuation routes could become significantly impacted thus prompting emergency traffic management and the use of alternative evacuation routes. In the case of a hazardous train derailment, the analysis of three different derailment scenarios depicts only moderate impact on the evacuation network, however emergency traffic management during these derailment events should still be considered.

Implementing traffic management strategies will aid in efficient and expeditious flow of evacuation traffic, which is the most critical and challenging element in a successful evacuation. Communication during an evacuation event is found to be an extreme challenge due to the coordination between agencies responsible for communication. Improved training, procedures, platforms, and public education are all strategies that can occur pre-emptively to improve communication among entities involved in the management of response, and communication between the City and the general public. Vulnerability of residents should also be considered in determining which areas may need to be prioritized by first responders during an evacuation. Areas within the city with a greater percentage of elderly people, disabled people, households that do not own vehicles (i.e., transit dependent populations), and institutionalized populations require a greater amount of support during an evacuation. Other vulnerable groups should be evaluated relative to evacuation route vulnerability.

It is recommended that the results of these analyses be considered to frame supportive policies for the Safety Element Update. These policies can be used to identify potential evacuation capacity and resiliency improvements throughout the city.

[4] Excluding flood disasters, in which case eastbound evacuation would most likely become unviable.

Figure 2 Baseline Traffic Conditions

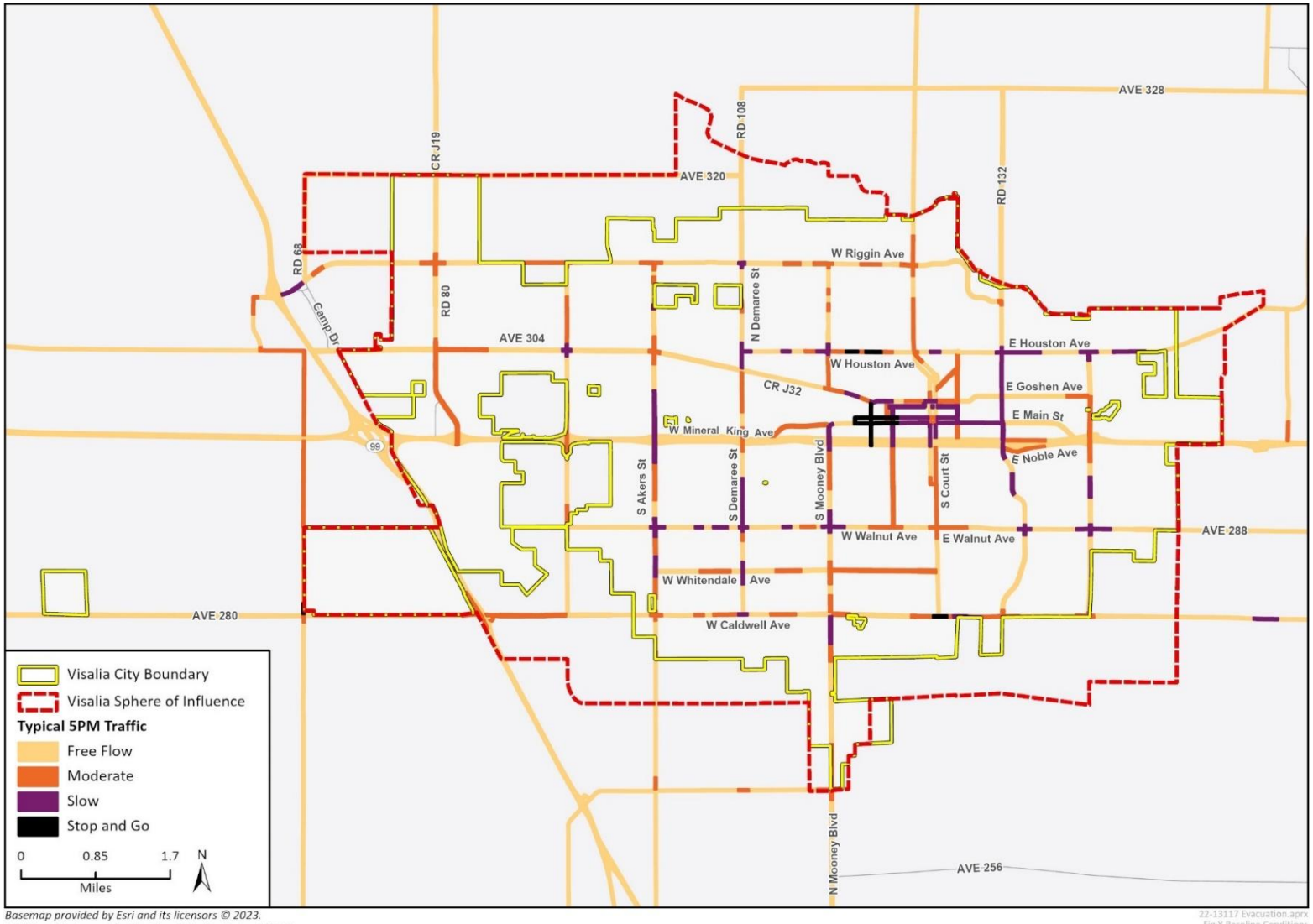
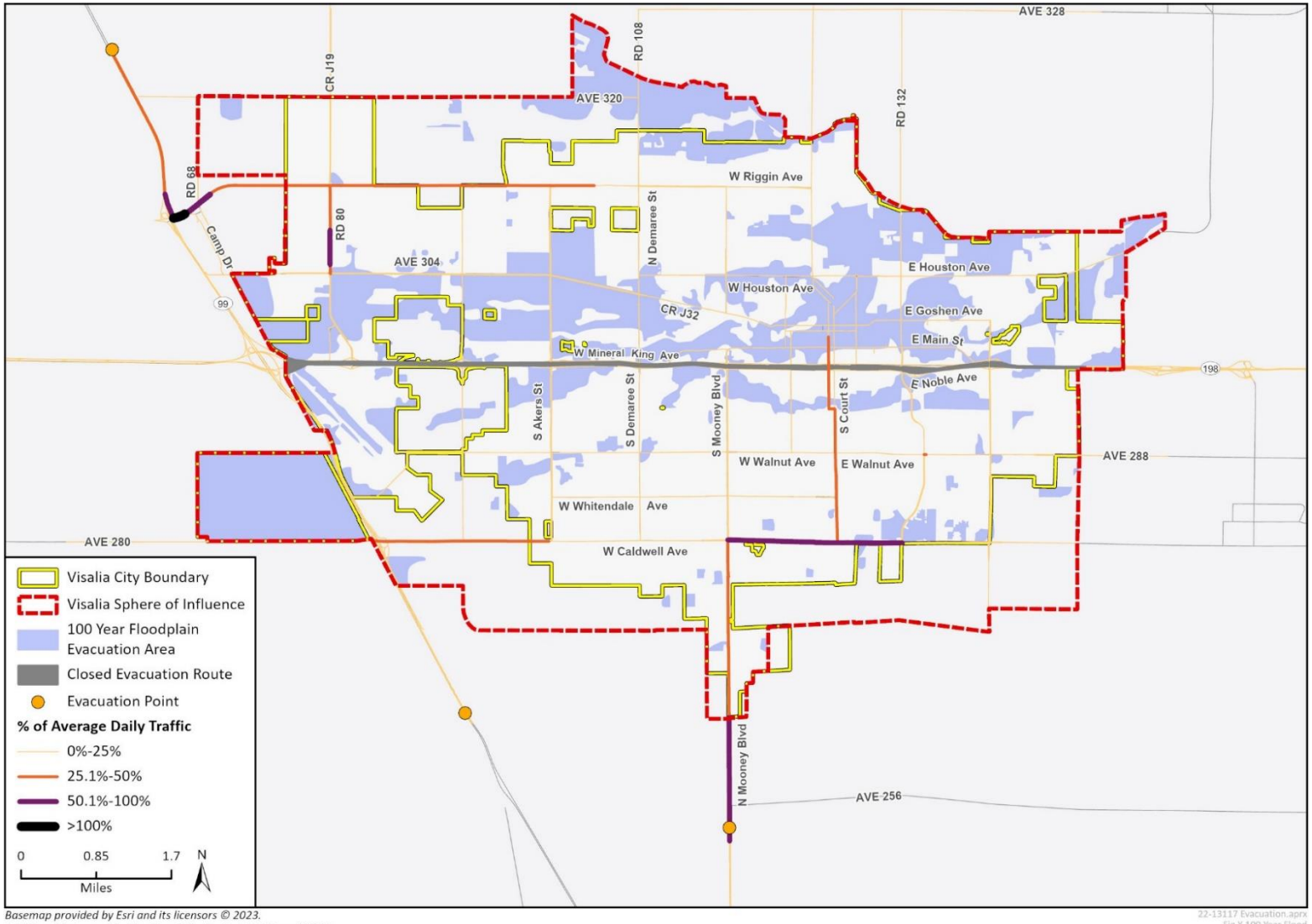


Figure 3 100-Year Flood Event



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Additional data provided by City of Visalia, Esri, FEMA, and HERE

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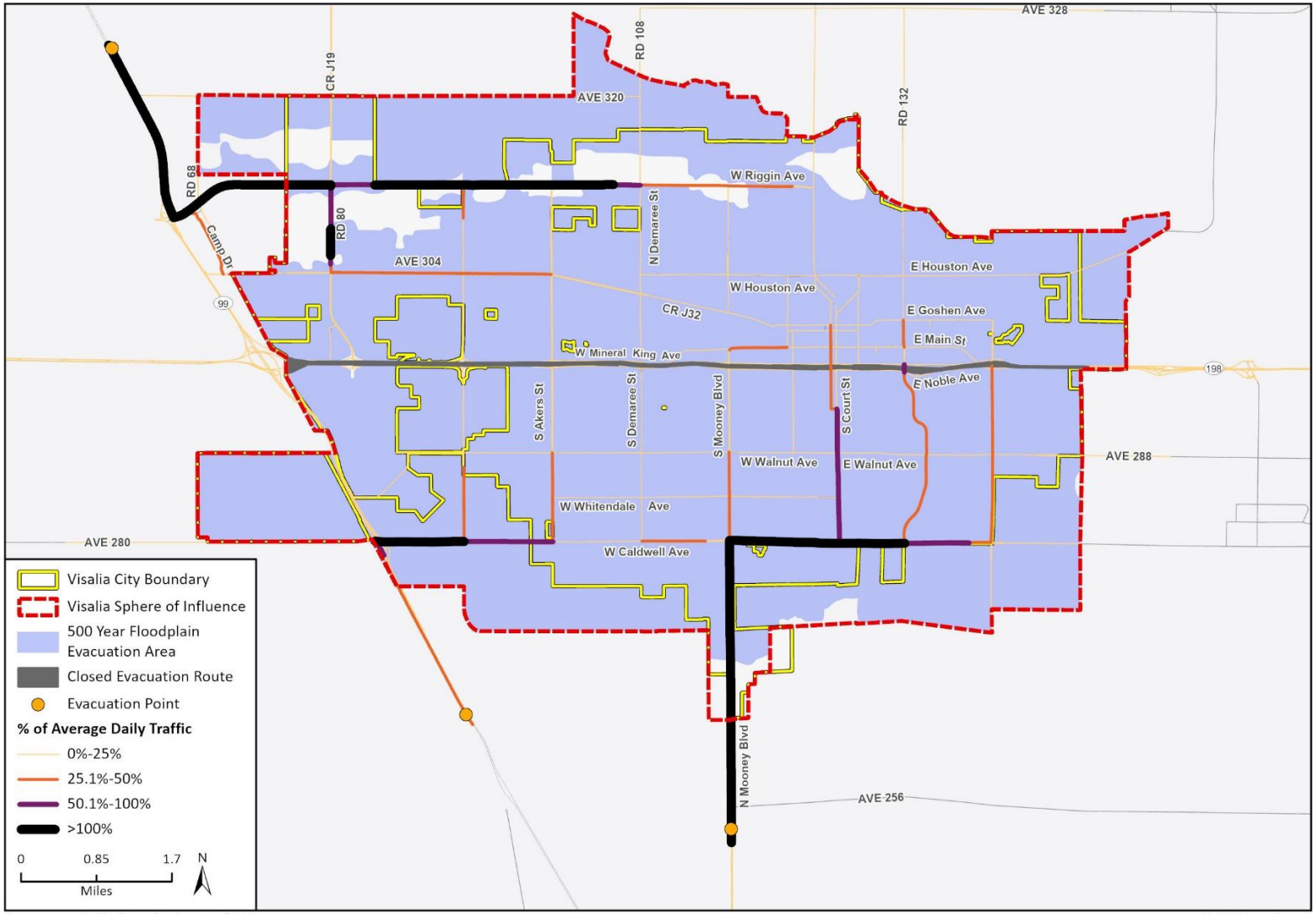
Fig X 100 Year Flood

Figure 4 500-Year Flood Event



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Additional data provided by City of Visalia, Esri, FEMA, and HERE

22-13117 Evacuation.aprx
Fig X 500 Year Flood

Figure 5 Hazardous Material Train Derailment (1)

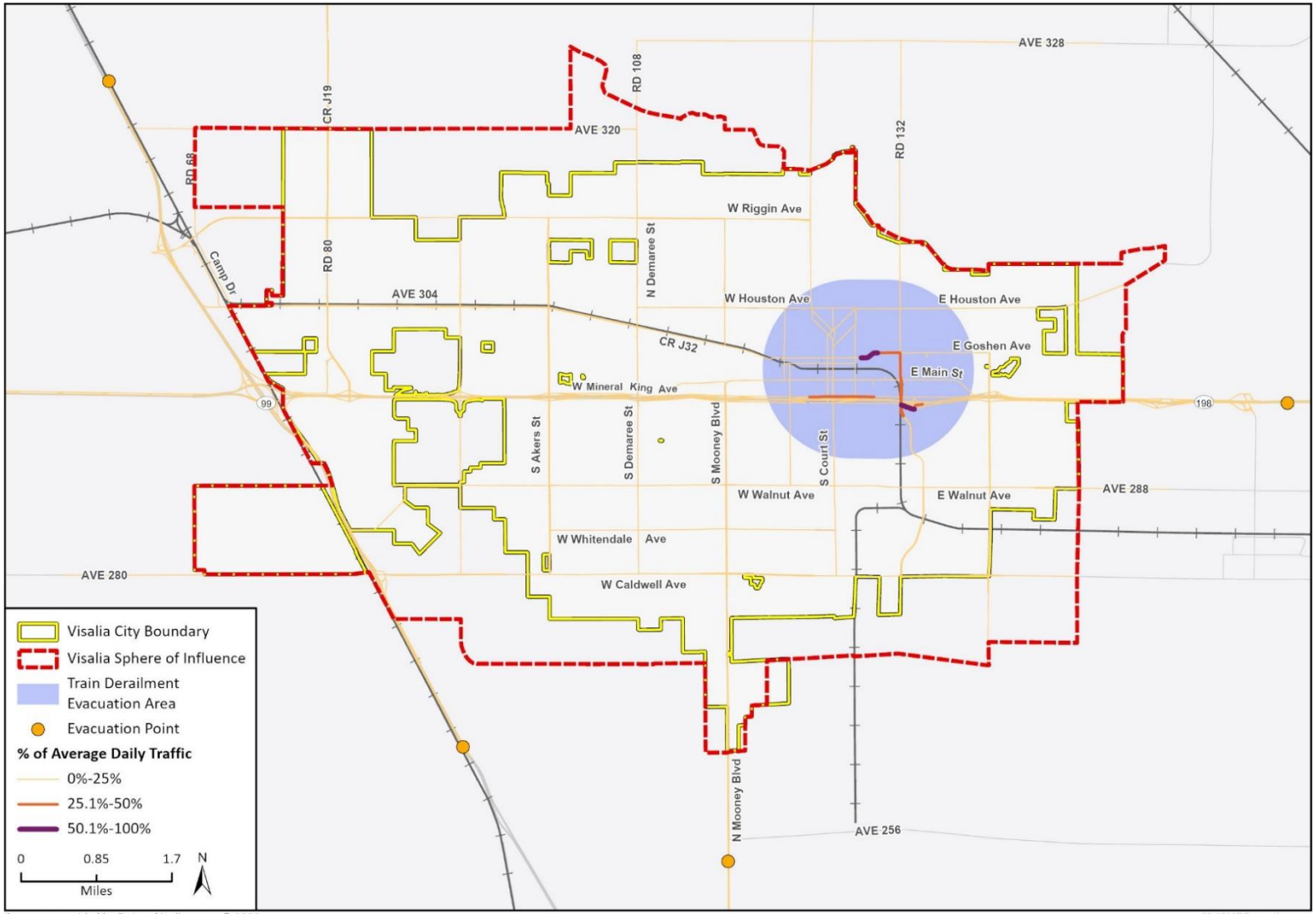


Figure 6 Hazardous Material Train Derailment (2)

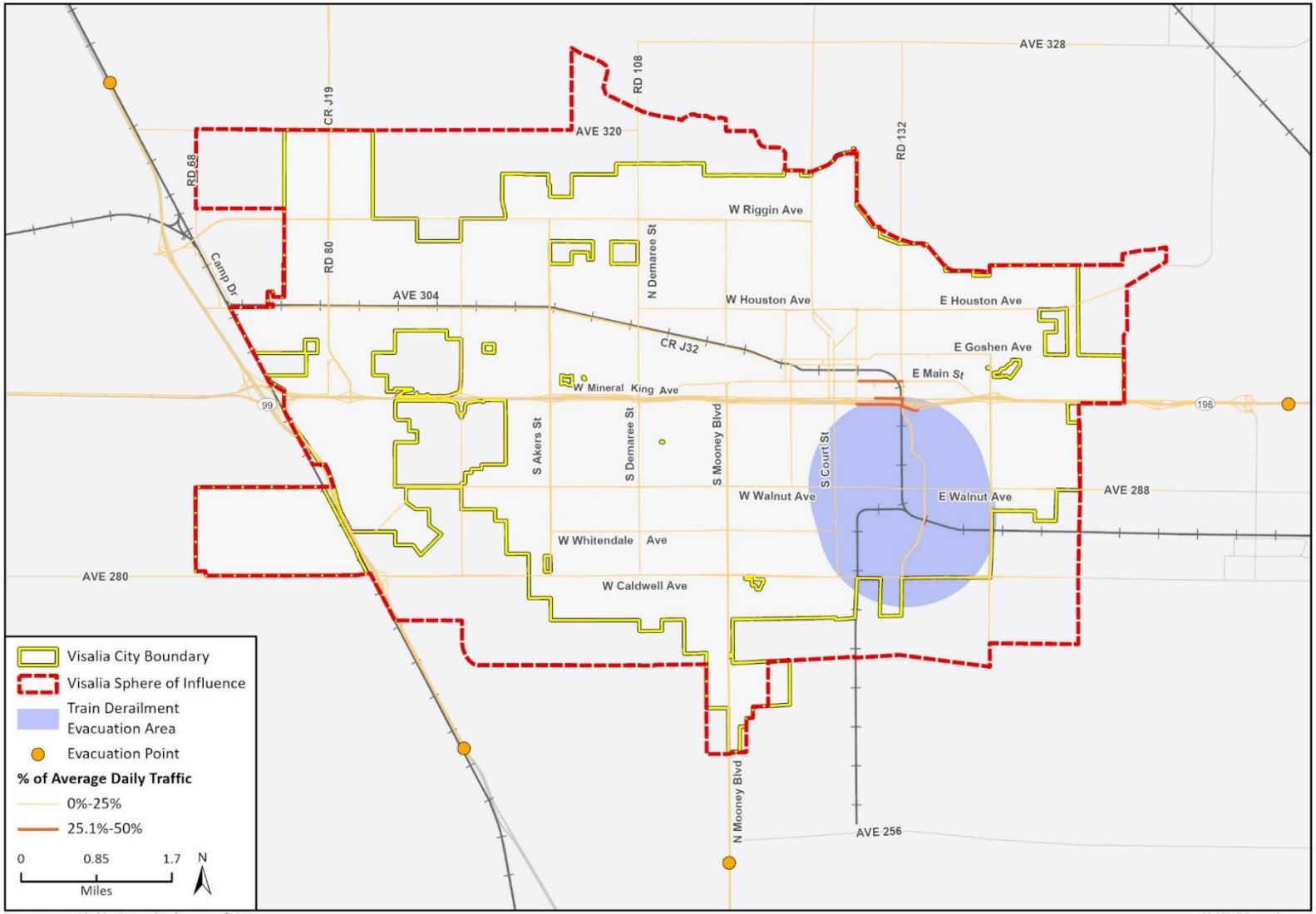
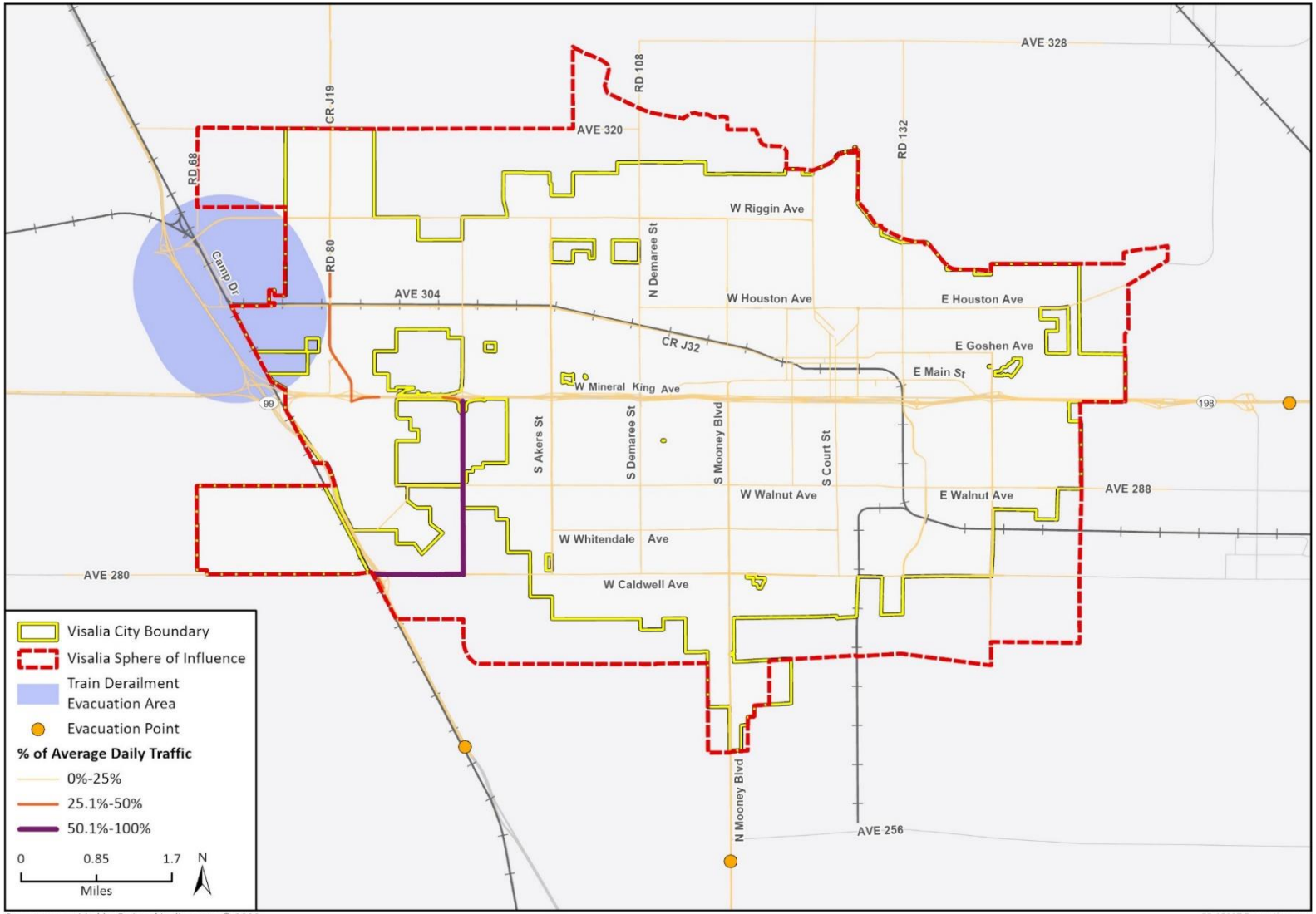


Figure 7 Hazardous Material Train Derailment (3)



Appendix B

City of Visalia Climate Change Vulnerability Assessment

City of Visalia

Safety Element Update

Climate Change Vulnerability Assessment

February 2023

Prepared by

Rincon Consultants, Inc.

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1 Introduction

1.1 Report Overview

This report evaluates how climate change may impact vulnerable populations, natural and managed resources, buildings and critical facilities, and infrastructure and services in Visalia. This report is consistent with Government Code § 65302 (as amended by Senate Bill (SB) 379) which requires California's local jurisdictions to prepare a Climate Change Vulnerability Assessment to inform updates to the Safety Element of the General Plan. Understanding Visalia's vulnerabilities to climate change provides a foundation to develop required climate adaptation goals, policies, and implementation programs for the Safety Element. The report is organized as follows:

1. **Introduction** provides background on climate change, Visalia snapshot, a glossary of terms used throughout the report, and describes the methodology and key data sources used to prepare the Climate Change Vulnerability Assessment.
2. **Climate Hazards** outlines climate drivers, relevant climate hazards, historical hazards events, how hazards are expected to change, and includes figures mapping climate hazards across Visalia.
3. **Sensitivity** identifies populations and assets most at risk to climate change.
4. **Adaptive Capacity** summarizes plans, policies, and programs that may help Visalia adapt to climate hazard events.
5. **Vulnerability Analysis** describes potential impacts for each hazard based on sensitive community, natural, managed, 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.

1.2 Background on Climate Change

This report evaluates how climate change may impact vulnerable community members, natural resources, agriculture, buildings, community facilities and infrastructure in Visalia. Government Code §65302, as amended by SB 379, requires cities, and counties across California to prepare a Climate Change Vulnerability Assessment to inform updates to the Safety Element of the General Plan.

1.3 Visalia Snapshot

The land that Visalia occupies today was traditionally the territory of the Yokuts Native American tribes (Gorelick 2020). Founded in 1852, the City of Visalia is situated in the southern San Joaquin Valley and is the County seat of Tulare County. The City is approximately 190 miles north of Los Angeles and 230 miles southeast of San Francisco. Visalia is flat, with a dry Mediterranean climate, characterized by hot and dry summers and moderate winters. The St Johns River runs along the city's northeast edge. Visalia serves as the county's economic center and is recognized as one of the most productive agricultural regions in the nation, with major crops including grapes, olives, cotton, citrus, and nursery products. The population in 2021 was 140,109, with the largest employers including Tulare County, Kaweah Delta Healthcare, College of the Sequoias, and CIGNA HealthCare (MHLHMP 2017).

Causes of Climate Change

Climate change is caused by the addition of excess greenhouse gases (GHGs) into the atmosphere, which traps heat near the earth's surface, raising global average temperatures and creating the greenhouse effect. This increase in average temperatures across the globe affects 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), GHG levels are higher now than they have been in the past 400,000 years, with carbon dioxide levels increasing 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 during 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).

1.4 Glossary

Several words and phrases are used throughout the report to illustrate climate vulnerabilities within the city.

- **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.** The ability for a community 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).
- **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 Visalia are extreme heat, warm nights, chill hours, drought, tule fog, riverine and stormwater flooding, wildfire and secondary climate/wildfire impacts such as air quality.
- **Compounding Risk.** When two or more extreme events or 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 due to the interaction of climate hazards and the vulnerabilities of the system or asset 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)
- **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).

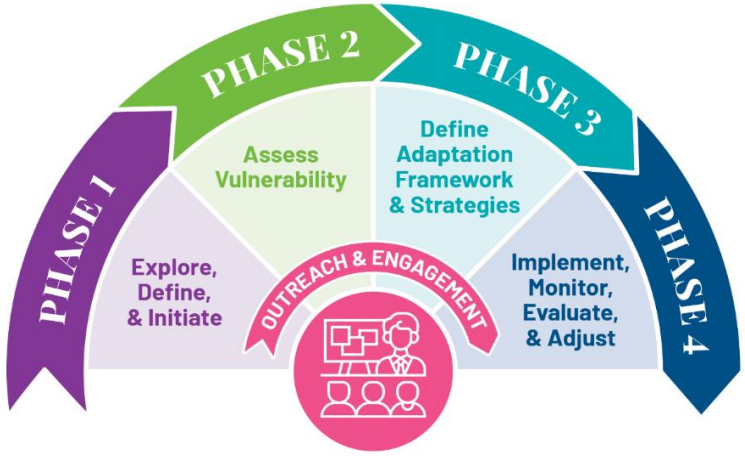
1.5 Vulnerability Assessment Methodology

The following section details state guidance, methods, and sources used to produce this report.

California Adaptation Planning Guide Phases

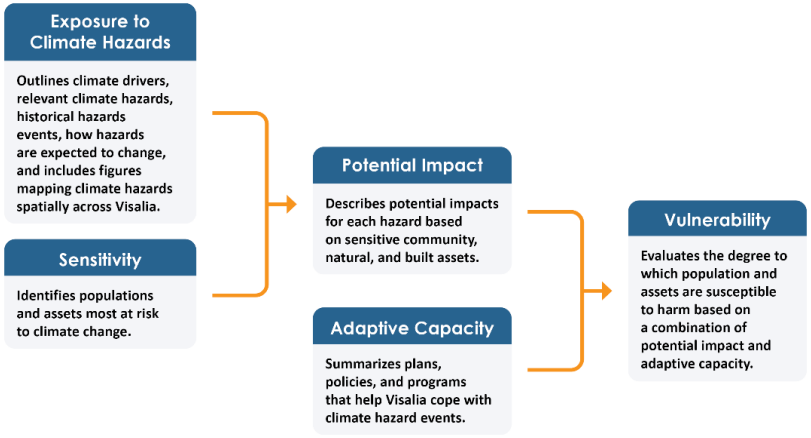
The City of Visalia Climate Change Vulnerability Assessment follows the vulnerability assessment process recommended by the California Governor's Office of Emergency Services (Cal OES), as documented in the 2020 California Adaptation Planning Guide (Cal APG). The adaptation planning process outlines by the Cal APG consists of four phases, illustrated in Figure 1, with Phase 2 detailing the vulnerability assessment process (Cal OES, 2020). The City of Visalia Climate Change Vulnerability Assessment is prepared consistent with Phase 2 of the Cal APG and is composed of the components described 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 by the Cal APG, were used in preparation of this report.

- **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). Cal-Adapt 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 San Joaquin Valley Region Summary Report (Santiago et. al 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 the San Joaquin Valley Region (including Visalia) from climate change. The San Joaquin Valley Region Summary Report was used to understand regional changes that may affect Visalia both directly and indirectly.
- **Tulare County Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP)** presents information on existing processes and plans that address Visalia's ability to prepare for climate change impacts and informed the adaptive capacity discussion of this report. The MJLHMP (2017) was also used to identify recent historical events. The MJLHMP includes information on past hazard events and resulting damage in and around Visalia.
- **The California Healthy Places Index (HPI)** is an online mapping tool that reports on community conditions 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 useful in providing both big picture and localized insights into community health. HPI was used to prepare the social sensitivity index score as described in more detail below. HPI is 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.
- **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 Visalia population that corresponds to each vulnerable group.

Data Limitations

The limitations of this report and its analysis stem from gaps in the existing available data. Census data can miss portions of the population (e.g., unhoused, or undocumented 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; flood zones are instead based on historical information.

Extrapolating air quality hazard exposure data in the context of climate change is difficult for many reasons including compounding effects 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. Using averages can result in an omission of the frequency of extremes. In the case of extreme weather events, atmospheric rivers may increase, while low-to-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).

Vulnerable Communities Identification

Significant vulnerable communities are included in the report according to the following methodology. The list of vulnerable populations considered in this assessment originates from the Cal APG. Each population statistic from the Cal APG list is identified for the City from Healthy Places Index (HPI). If the data was not available for the population, the U.S. Census American Community Survey (ACS) was used (more information can be found in the Key Data Sources section). A vulnerable population statistic is considered significant if the U.S. Census statistic is larger than the state average for that same population group. If the statistic originates from the HPI, it is considered significant between the 0-50 percentile for unhealthy conditions (in comparison to other jurisdictions in the state). Some vulnerable communities, such as people experiencing homelessness and low income, were included regardless of the city having a population considered significant by this methodology, in order to account for the disproportionate burden of climate impacts on those communities.

Vulnerability Scoring Methodology

Vulnerability scoring is a valuable step in the climate change vulnerability assessment process because it identifies which assets and populations face the greatest threat from climate hazards. This scoring methodology can aid in the prioritization of adaptation actions and measurement development. The vulnerability score is a combination of impact and adaptive capacity scores. 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 every asset and population for each climate hazard. These impact and adaptive capacity scores were combined in a matrix, as seen in Table 2, to develop a vulnerability score. The range of vulnerability scores spans between 1 through 5 with 4 and 5 representing the greatest vulnerability.

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

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 Climate Hazards

Climate change is a global phenomenon that can impact many aspects of society including public health, natural and managed resources, critical facilities, buildings infrastructure, and services. Projected changes to the climate are dependent on geographic 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 assessment. Projections throughout this section are outlined by two separate Representative Concentration Pathways[1] (RCP) (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 twenty-first century.

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).

The exposure section of this assessment presents information on temperature and precipitation, which are characterized as climate drivers. Subsequently, this section provides information on projected changes to natural hazards, including extreme heat, drought, wildfire, air quality, and riverine and stormwater flooding, which result from changes to climate drivers.

[1] Representative Concentration Pathways (RCP) is a greenhouse gas concentration (not emissions) trajectory adopted by the Intergovernmental Panel on Climate Change (IPCC). A greenhouse gas concentration trajectory describes possible future scenarios based on the volume of greenhouse gases emitted globally in years to come.

2.1 Climate Drivers

In Visalia, the climate drivers of concern include temperature and precipitation. All projections are taken from the Cal-Adapt Local Climate Change Snapshot tool and supplemented with the regional information found in the California Fourth Climate Change Assessment San Joaquin Regional Report (CEC 2021, Santiago et. al 2021).

Temperature

Visalia's historical (1961-1990) average maximum temperature is 75.9°F and average minimum temperature is 49.6°F. Visalia's mid-century projections for average maximum temperatures show a 3.8°F (RCP 4.5) to 4.8°F (RCP 8.5) increase. Mid-century projections for average minimum temperatures show a 3.2°F (RCP 4.5) to 4.1°F (RCP 8.5) increase. End of the century projections for average maximum temperatures are expected to increase in Visalia by approximately 5.0°F (RCP 4.5) to 8.6°F (RCP 8.5). End of the century projections for average minimum temperatures are expected to increase by approximately 4.2°F (RCP 4.5) to 7.7°F (RCP 8.5) (CEC 2021). Temperature increases affect extreme heat and warm nights, drought, wildfire, and air quality (Santiago et. al 2021).

Precipitation

California's San Joaquin Valley region experiences highly variable annual rainfall, ranging from 8 to 20 inches per year. The observed 30-year average annual precipitation in Visalia is 9.5 inches. Annual precipitation projections for the city shows minimal change. Under RCP 4.5, Visalia is projected to experience a slight change, 0.4-inch decrease by mid-century and a 0.3-inch decrease by end-century. Under RCP 8.5 projections show a 0.2-inch decrease by mid-century and a 0.3-inch decrease by end-century. (CEC 2021).

Despite minimal projected changes in average precipitation, dry and wet extremes are both expected to increase in the future. In the San Joaquin region, 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. Atmospheric rivers bring between 20-50% of the state's precipitation annually. These vary in in intensity, with some benefitting water supply and replenishing snowpack, while others are responsible for destructive and floods (Santiago et. al 2021).

Maximum 1-day precipitation values are projected to increase between 0.001-inch (RCP 4.5) and 0.034 inch (RCP 8.5) by mid-century and between 0.017-inch (RCP 4.5) and 0.050-inch (RCP 8.5) by end-century. Precipitation changes are expected to affect incidence of wildfire, drought, riverine and stormwater flooding, and air quality.

Hazards

This section outlines projected changes for the following climate hazards:

Extreme Heat and Warm Nights

Drought

Wildfire

Riverine and Stormwater Flooding

Air Quality

Tule Fog

Chill Hours

Extreme Heat and Warm Nights

Extreme heat days are defined as days in which the daily maximum temperature exceeds the 98thpercentile value of the historical average. For Visalia, the threshold temperature is 103.4°F (CEC 2022). Climate change is causing a severe increase in temperatures throughout the San Joaquin Valley region. Annual average maximum temperatures have increased by about 1°F and are expected to increase 4 °F (RCP 4.5) to 5 °F (RCP 8.5) by mid-century and by 5 °F (RCP 4.5) to 8 °F (RCP 8.5) by the end of the century (Santiago et. al 2021). The Cal-Adapt Climate Change Snapshot Tool projects that extreme heat days in Visalia will increase from the annual average of 4 days to between 22 (RCP 4.5) and 30 (RCP 8.5) by mid-century and between 32 (RCP 4.5) 63 (RCP 8.5) by end-century (CEC 2022).

Exposure to extreme heat can cause direct heat-related illness (heat cramps, heat exhaustion, and heat stroke) and death, and can also exacerbate certain existing medical conditions (Santiago et. al 2021). Increased frequency of extreme heat days can result in increased public health risks, particularly to vulnerable populations like older adults, young children, and individuals with underlying chronic diseases, through heat-related illnesses and increased 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. According to Cal-Adapt, a warm night is defined as a day in April through October when the daily minimum temperature exceeds the 98th historical percentile of daily minimum temperatures based on observed data from 1961–1990. In Visalia, a warm night occurs when the minimum temperature is higher than 71.1°F. The 30-year observed average of warm nights in the city between 1961-1990 was 4. Warm nights in Visalia are projected to increase between 16 nights (RCP 4.5) and 24 nights (RCP 8.5) by mid-century and between 24 nights (RCP 4.5) 59 nights (RCP 8.5) by end-century.

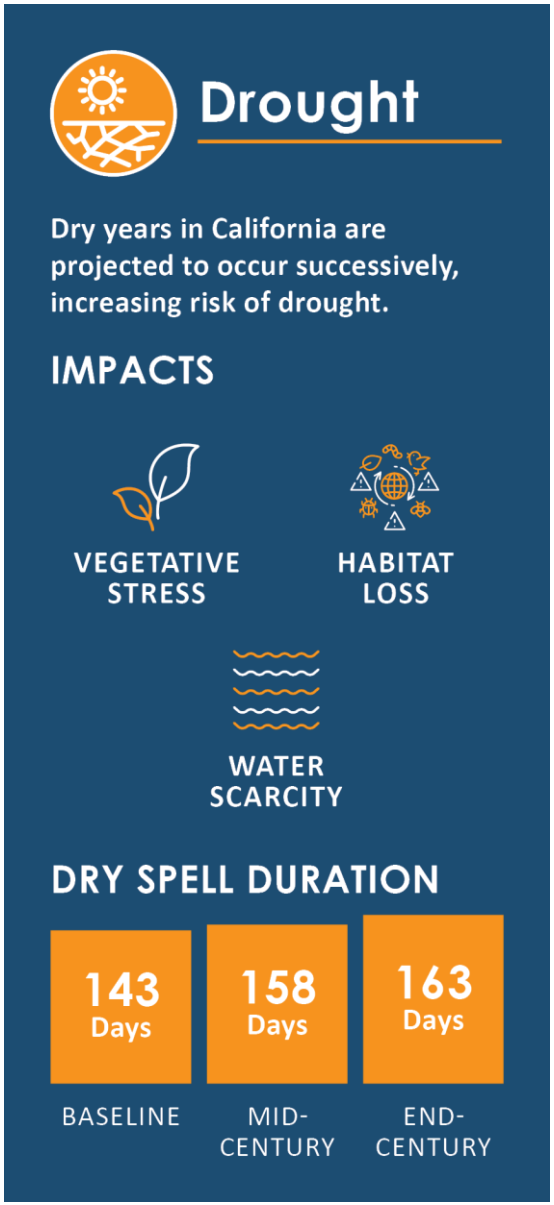
Prolonged extreme heat events can exacerbate drought conditions. Vulnerabilities for natural resources can include stressed vegetation and habitat depletion, while populations may be more vulnerable to heat stress and dehydration (CEC 2018).

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 annual precipitation will be characterized by more extremes and increasing variability with the number of dry years increasing (Santiago et. al 2021). The duration of dry spells is projected to vary depending on which emissions scenario is used. Like precipitation patterns, 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).

Extreme droughts can diminish the natural recharge of groundwater aquifers, which can lead to increased risk of over-pumping. The city is dependent on groundwater supply for the majority of its needs, so prolonged drought conditions may lead to a need for importing water and/or water rationing. Drought can disproportionately affect vulnerable populations and agriculture and can impact economic productivity throughout Visalia. Vulnerabilities for natural and managed resources can include reduced crop productivity and increased livestock and wildlife mortality (City 2017).



Wildfire

In the past two decades, wildfires in California have occurred more frequently and with greater intensity (Santiago et. al 2021). This trend is projected in the Tulare region through mid and end-century (CEC 2021). Though the cause of most wildfires relates to human-activities or lightning, wildfire behavior is based on three primary factors: fuel, topography, and weather.

The City of Visalia has not experienced wildfire within its city limits. Neighboring wildfires have tended to occur east of the city, including the 2020 Castle Fire, which burned more than 129,000 acres in the Sequoia National Forest.

Current wildfire risk is projected using CAL FIRE's Fire Hazard Severity Zone maps which designate moderate, high, and very high Fire Hazard Severity Zones based on a set of factors that influence fire likelihood and fire behavior. Within Visalia's city limits, there are no areas designated as Very High or High Fire Hazard Severity Zones

Wildfire risk is increasing, both in the state of California and in the Tulare County region. Though fire risk within Visalia city limits is limited, risk in neighboring areas, specifically those to the east of the city, is expected to increase as climate change conditions, such as prolonged drought and extreme temperatures continue to worsen (Santiago et. al 2021). Cascading risks of neighboring wildfires can cause poor air quality and have additional impacts on public health.

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 goes 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.

Riverine and Stormwater Flooding

Climate change may cause low-lying areas throughout Visalia to experience more frequent flooding and could increase the extent of 100-year or 500-year flood-affected areas. Riverine flooding is projected to increase as precipitation extremes increase (CEC 2021). The City of Visalia Annex to the Tulare County MJLHMP sites flooding as highly likely. During heavy rain events, stormwater systems may be overwhelmed more frequently as more extreme rain events occur, causing localized flooding which could impact properties and close streets. Structures and infrastructure damages can lead to extreme financial losses to both the City and its residents. Flooding can also cascade into power, wastewater, and storm drainage infrastructure, leading to interruptions in services relied upon by the community.

Visalia is located in the heart of the Kaweah River's delta system, so many rivers and creeks flow through the city. Surface runoff generally flows from east to west and terminates in the Tulare Lake Basin. The major water resources in the city include the St. Johns River, Mill Creek, Packwood Creek, Cameron Creek, Deep Creek, Evans Creek, Modoc Ditch, Mill Creek Ditch, Persian Ditch, Tulare Irrigation District (TID) Canal, and some other local ditches (City 2014).

The majority of Visalia is within the 500-year floodplain, with a large swath of the central portion of the city within the 100-year floodplain. Several critical facilities including health care facilities, schools, and City facilities are located within the flood pain, as shown in Figure 3.

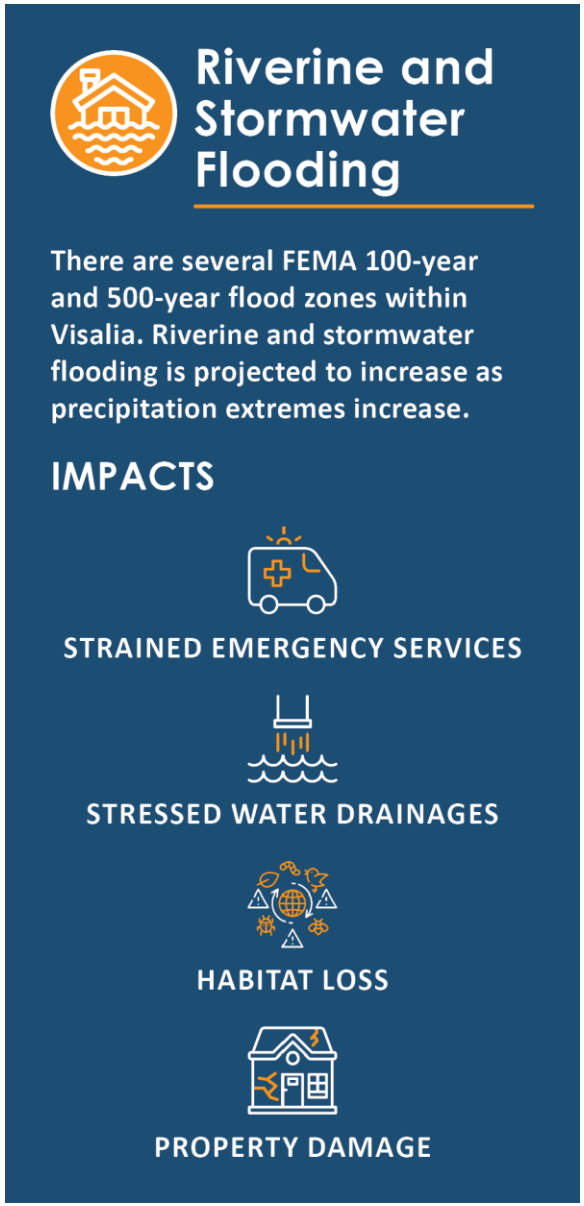
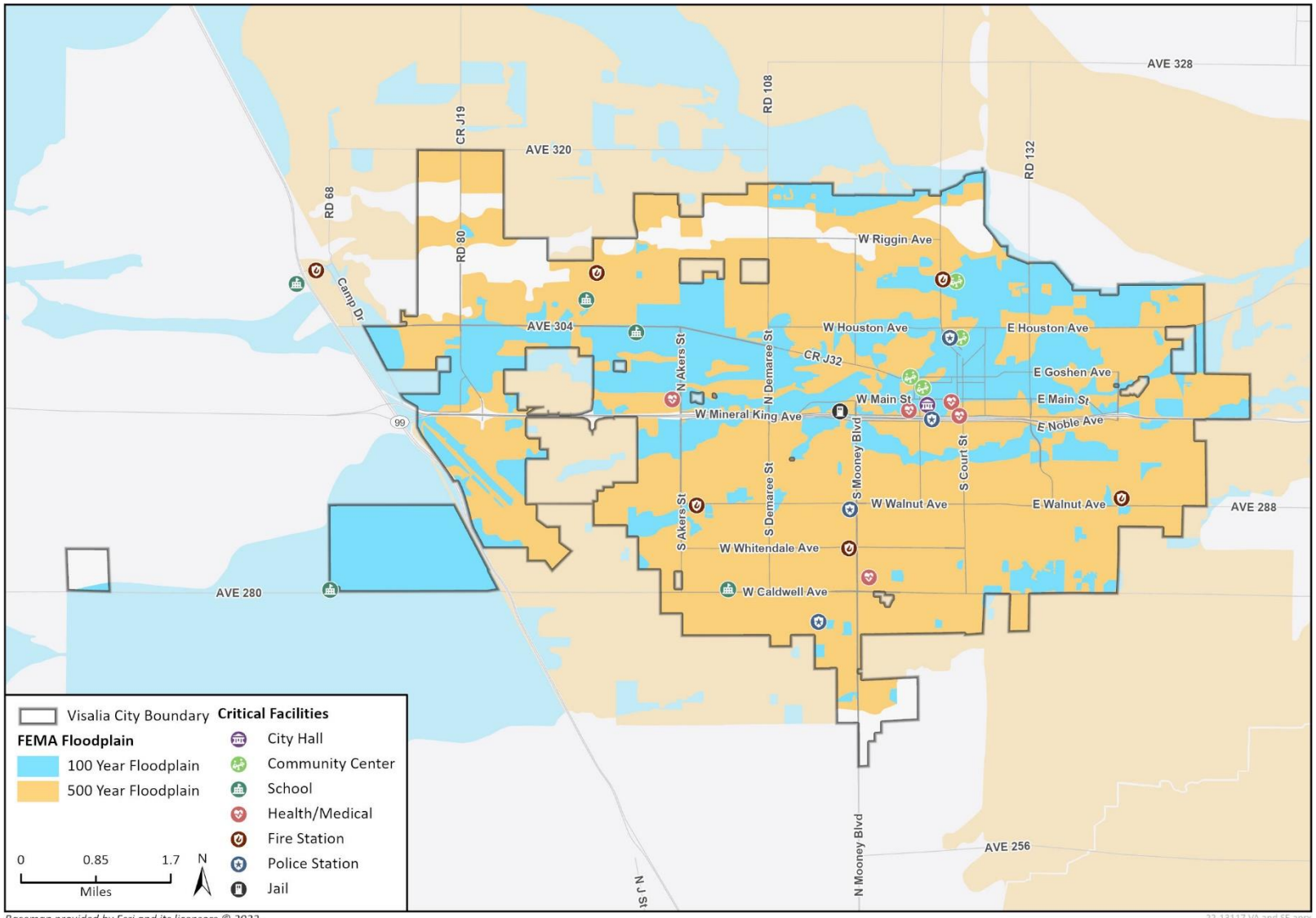


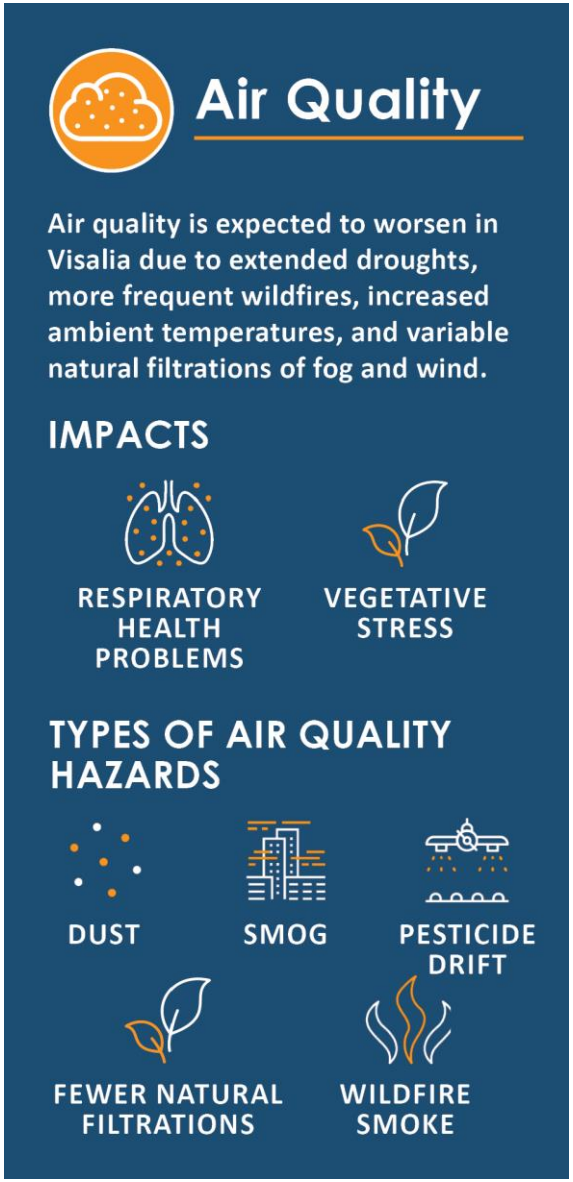
Figure 3 100 and 500 Year Floodplain in Visalia



Air Quality

In Visalia, worsening air quality is likely as climate change intensifies. Poor air quality, due to increasing temperatures and wildfires, can create respiratory issues for vulnerable populations and impact indoor areas without adequate air filtration systems. There are several sources of poor air quality:

- **Dust.** Increased temperature leads to a lack of soil moisture and increased dry, dusty conditions also associated with drought and increased evaporation (Santiago et. al 2021).
- **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). Visalia is expected to experience increases in ozone concentrations in tandem with temperature increases.
- **Pesticide Drift.** Air quality in Visalia may be impacted by pesticide drift, or the airborne movement of pesticides from an area of application to any unidentified site, from neighboring conventional agriculture operations.
- **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 (Santiago et. al 2021).
- **Wildfire Smoke.** Temperature, severe wildfire conditions, and the area burned by wildfires throughout the state have increased and will continue to increase in the future. Higher temperatures accompanied by an increase in the incidence and extent of large wildfires will lead to increased wildfire smoke exposure and associated toxins, air pollution, and particulate matter (Santiago et. al 2021).



Tule Fog

Tule Fog, characteristic to the San Joaquin Valley, forms after intense precipitation through a combination of radiant heat and cool nights. This fog layer helps fruit and nut trees attain dormancy requirements, a component of the crop cycle that requires moisture and cool temperatures. Since 1980 the frequency of Tule Fog has dropped by 75%. With projected increases in average temperature as well as decreases in precipitation frequency, Tule Fog occurrences are projected to further decline (Angel et al. 2021).

Chill Hours

The City of Visalia and the surrounding Tulare County contain large portions of agricultural land, making the hazard of chill hours decline an acute concern (Angel et al. 2021). Chill hours are defined as hours below 45°F which help in facilitating synchronized blooming, pollination, and standardize production of quality and quantity of crops within the San Joaquin Valley (Angel et al. 2021). Chill hours are a necessary component of agricultural productivity, and a proxy measure of minimum temperature shows a steady decrease in time spent below the 45°F threshold (Angel et al. 2021). Chill hour declines impact the City of Visalia's agricultural industry by negatively impacting crop yields.

Relevant Chill Hour Hazards

Tulare's neighboring county, Fresno County, has experienced a decline in chill hours that is linked to significant county-wide agricultural damages. In 2014 the USDA declared a chill hours disaster which amounted to $53 million in damages for the county (Fresno County 2018).

Based on a survey of Fresno County asset managers, the McMullin Area Groundwater Sustainability Agency observed a loss of crops, plants, and trees because of the 2014 Chill Hours disaster (Hurley 2022).

This neighboring disaster has implications for Tulare County and the City of Visalia, as both contain similar topography to Fresno County, and have economies similarly reliant on tree crops and agricultural success.

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 Visalia. Potential impacts from the climate hazards of concern on sensitive populations and assets are presented in the Vulnerability Analysis section.

Sensitive Populations

Natural and Managed Resources

Buildings and Critical Facilities

Infrastructure and Services

3.1 Sensitive 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 of heat illness during an extreme heat event. Several factors can influence sensitivity to climate hazards including an individual's health, age, and ability, societal disadvantages, access to health care, economic opportunity, education and other resources, and inequities found in basic needs and exposure to environmental stressors (Cal OES 2020). Sensitive populations experience heightened risk to climate change and have fewer resources to adapt and recover from climate change impacts. Visalia has several vulnerable populations that will be disproportionately impacted by climate change that are grouped below and listed in Table 3 below.

- **Individuals with high outdoor exposure**. People experiencing homelessness and outdoor workers.
- **Under-resourced individuals.** Low income, renters, and households without access to a vehicle.
- **Individuals facing societal barriers.** Communities of color, undocumented immigrants, Native Americans, and linguistically isolated individuals.
- **Individuals with chronic health conditions or health related sensitivities.** Older adults, young children, and individuals with a disability.

Table 3 Sensitive Populations in Visalia

Population	Population Description	Percentage of Population or Households
People experiencing homelessness	Individuals who currently lack fixed, regular, and adequate housing	0.3 - 0.7%*
Low-income	Households below 80% of area median income	30.9%
Undocumented immigrants	People born outside of the US that are not US citizens	50.2%
Older adults	Individuals 65 years or older	11.7%
Young children	Individuals 5 years and younger	8.5%
Communities of color	Individuals that do not identify as white	61.1%
Outdoor workers	Individuals who are employed, 16 and older, and work outdoors	6.46%
Renters	Housing units that are renter occupied	54.9%
Linguistically isolated	Households with individuals who are non or limited English-speaking	35.8%
Individuals with a disability	Individuals with access and functional needs (physical and mental)	13.2%
Native Americans	Individuals who identify as American Native and Alaskan Native	9.4%
Households without vehicle access	Households without access to a vehicle	5.2%

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

* Assumes 500 – 1,000 people experiencing homelessness (Personal communication with City of Visalia) and City of population of 143,966 (U.S. Census Bureau, 2022). Census data can miss portions of the population (e.g., unhoused, or undocumented populations) and general demographic information may not accurately capture populations vulnerable to climate change (Cantwell 2021).

3.2 Natural and Managed Resources

Natural and managed resources within Visalia are detailed in the Parks, Schools, Community Facilities and Utilities chapter of the City's General Plan. There are a total of 640 acres of City-owned and operated park land located in within the city, including the following:

- Neighborhood Parks (greater than 2 acres): 23
- Community Parks (5-12 acres): 4
- Large City Parks (greater than 40 acres): 3

Plaza Park, Mooney Grove Park, Riverway Sports Park, and St. Johns Riverway are some of the largest managed spaces in the city. The Open Space Element of the General Plan identifies natural priorities including biological resources, cultural resources, soil and minerals, water resources, air quality, and open space (City 2014).

The City of Visalia is surrounded by agricultural land, with some portions falling within city boundaries, primarily in the north and southwest. Key crops include but are not limited to grapes, olives, cotton, citrus, and nursery products.

Natural and managed resources provide habitat and improve air and water quality, and are sources of community resilience, recreation, and economic productivity to the city. They are spread throughout the city and face various levels of exposure to climate hazards.

3.3 Buildings and Critical Facilities

Climate change is expected to amplify extreme weather and climate hazards in Visalia. A jurisdiction's vulnerability increases when buildings and critical facilities are not designed, operated, and/or maintained to function effectively under extreme weather conditions or can be damaged by extreme weather conditions. Critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery, such as:

- Fire Stations
- Police Stations
- Hospital/Healthcare Facilities
- Emergency Shelters
- Schools
- Jails

Additional buildings mentioned in this section include residential and commercial developments.

3.4 Infrastructure and Services

There are various types of infrastructure and services within Visalia that are vulnerable to climate change. Assets within this category include water services, wastewater, emergency services, medical services, utilities and major utility corridors, public transportation, roadways, and active transportation routes.

4 Adaptive Capacity

Adaptive capacity is the ability to adjust to the effects of climate change. This section summarizes the ways in which the City currently plans for and manages the negative impacts of climate change. Types of adaptive capacity include adjustments in behavior, resources, and technologies. 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. The adaptive capacity findings are overlayed with impacts of each climate hazard on different asset categories to produce a vulnerability score for each asset in the Vulnerability Analysis section.

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

Table 4 lists programs, plans, and policies that help increase the community's resilience to extreme heat and warm nights, drought, wildfire, riverine and stormwater flooding, air quality, and tule fog.

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

Existing and Planned Programs, Plans, and Policies	Objectives	Hazards Addressed
City of Visalia General Plan (City 2014)	The City's General Plan provides a set of policies and programs that form a blueprint for long-term development of the community. It consists of written text and diagrams that express how a community should develop and is a key tool for influencing the quality of life. The plan is a basis for decision-making on land use, city services, and public works used by policymakers such as the Planning Commission and the City Council. The General Plan includes the following elements that pertain to climate change and resiliency: Land Use, Open Space and Conservation, Air Quality and Greenhouse Gases, and Safety. These include policies for land planning, resource conservation, and to minimize impacts from hazards including wildfire, flooding, and air quality.	All
City of Visalia Active Transportation Plan (ATP) (City 2017)	Active transportation refers to non-motorized, human-powered transportation, and refers mostly to walking, biking, wheeling, or rolling. The primary goal of the City's ATP is to provide the means to support active transportation, specifically biking and walking, as an alternative mode of transportation. This provides opportunities for improving community health, and reducing impacts of transportation on air quality, noise, traffic congestion, and energy resources consumption.	Air Quality

Existing and Planned Programs, Plans, and Policies	Objectives	Hazards Addressed
Tulare County Multi-Jurisdictional Local Hazard Mitigation Plan (MJLHMP 2017)	The Tulare County Multi-Jurisdiction Hazard Mitigation Plan describes hazard mitigation policies for flooding, wildfires, drought.	All
City of Visalia Climate Action Plan (CAP 2013)	The City of Visalia's Climate Action Plan was created to guide the development and enhancement of actions designed to reduce Visalia's greenhouse gas (GHG) emissions. It includes GHG emissions inventory for the year 2005, which was used as a baseline, and includes emissions from all sectors within the city.	All
Visalia Urban Water Management Plan (District 2021)	The purpose of this document is to be a baseline document and source of information for the Department of Water Resources (DWR) and to serve as: ▪ A short-and long-range planning document for water supply; ▪ A data source for developing a regional water supply plan; ▪ A resource for the City in preparing and updating the General Plan; ▪ A key component of an Integrated Regional Water Management Plan.	Drought
Southern California Edison (SCE) Medical Baseline Allowance Program (SCE 2022)	SCE provides eligible customers with a medical need for electricity (for oxygen, dialysis, etc.) with extra notifications (i.e., calls, texts, or doorbell rings) in advance of a public safety power shutoff. Public safety power shutoffs may occur during an extreme heat event.	Wildfire
Southern California Edison (SCE) Self-Generation Incentive Program (SCE 2022)	The SCE Self-Generation Incentive Program pays for all costs associated with procuring battery storage for eligible customers. Medical Baseline Program customers qualify for full benefits of the Self-Generation Incentive Program.	All
Southern California Edison (SCE) Wildfire Safety Program (SCE 2022)	SCE regularly communicates with customers in the county during power outages and notifies customers when power will be restored. SCE provides translation assistance to non-English speaking individuals and the option to update language preference for PSPS alerts.	All
City of Visalia Agricultural Mitigation Program & Feasibility Study (City 2020)	The Agricultural Mitigation program is intended to prevent urban development of agricultural land and address the conversion of Prime Farmland and Farmland of Statewide Importance by requiring a 1:1 ratio of preserved and converted agricultural land. While the City's General Plan Policy does not specify the need to preserve like-for-like agricultural land, all land conserved through the program must have adequate water supply and the appropriate agricultural zoning.	Drought

Existing and Planned Programs, Plans, and Policies	Objectives	Hazards Addressed
City of Visalia Municipal Service Review (MSR) (County 2013)	This report contains information about the municipal services provided by the City of Visalia. Information has been gathered about the capacity of services, the ability to provide services, the accountability for service needs, and the efficiency of service provision The MSR considers and makes recommendations based on the following information: ▪ Present and planned land uses in the area. ▪ Present and probable need for services in the area. ▪ Present ability of each service provider to provide necessary services. ▪ The fiscal, management, and structural health of each service provider.	All
Visalia Municipal Code Title 8 Health and Safety	The purpose of this code is to establish the minimum requirements to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation, and safety to life and property from fire and other hazards attributed to the built environment; to regulate and control the demolition of all buildings and structures, and for related purposes.	Wildfire, Flooding
Emergency Operations Plan (EOP 2003)	The EOP describes what actions the local jurisdiction will take in response to an emergency. It discusses the role of the Emergency Operation Center (EOC) and the coordination between the EOC and the City's departments and response agencies.	All
Local Energy Assurance Plan (LEAP 2012)	The Energy Assurance Plan (EAP) specifies the policies, procedures, actions and departmental responsibilities and assignments necessary to maintain critical facilities and services in the City of Visalia during the disruption of electricity, natural gas and petroleum supplies. This energy assurance plan is an extension of the Visalia Emergency Operations Plan (EOP).	All

5 Vulnerability Analysis

The following section outlines the impacts that each climate hazard has on vulnerable population groups and assets as described in the Sensitivity section. Existing plans, policies, and programs that contribute to the adaptive capacity of the assets, as outlined in the Adaptive Capacity section, are summarized throughout. An impact score and an adaptive capacity score is identified for each asset and climate hazard type producing the overall vulnerability score, consistent with the scoring methodology described in Vulnerability Assessment Methodology.

5.1 Sensitive Populations

Individuals with high outdoor exposure, including people experiencing homelessness and outdoor workers, face high outdoor exposure, which may cause them to be more vulnerable to the effects of climate change than the general population. Individuals in this group often live in homes that are less protected against climate hazards, lack a permanent residence, or don't have shelter altogether. People experiencing may not have access to healthcare coverage or financial resources to address health concerns either caused by or exacerbated by climate hazards.

Under-resourced individuals are those who lack certain resources (i.e., income, vehicles, or sufficient housing) and therefore may not have the ability to effectively prepare for, cope with, and recover from climate change impacts. People in this group often face financial barriers and limited access to resources when preparing for and recovering from climate change hazards. For example, low-income individuals may not be able to take time off work to address health concerns either caused by or exacerbated by climate hazards, and individuals without access to a vehicle may face hardship because they may not have the ability to evacuate, or access to critical services and medical assistance. Individuals who rent housing have limited ability to weatherize their homes for hazard events. They also may not have temperature control in their housing units and generally experience a higher water and energy utilities cost burden than homeowners (Cooley et al. 2012).

Individuals facing systemic discrimination are those that may be directly impacted by the social and economic challenges that are ubiquitous in society. These challenges can create educational, resource, economic, and health disparities that leave communities of color extremely vulnerable to and disproportionately impacted by climate change (Baird 2008). Communities of color and undocumented immigrants are more likely to live in high hazard risk areas and less likely to be homeowners, which leaves them vulnerable to climate hazards. Undocumented immigrants often lack access to medical services, quality housing, and basic needs. Because these individuals are not citizens, they lack access to social and economic services that would allow them to prepare for, respond to, and cope with climate hazards. Individuals who are linguistically isolated have minimal or no English-speaking ability. If evacuation and/or advisory notices, hazard preparedness material, or governmental guidance is not provided in language appropriate versions, these individuals may not be able to properly prepare for, cope with, or recover from a climate hazard (Gamble et al. 2016).

Visalia is located on the ancestral lands of the Yokuts tribes (Gorelick 2020). The city has a rich human history that continues to this day with several tribal groups having ties to the land. Not all city residents who identify as Native American have ties to tribal communities within Visalia. Most Native Americans experience some degree of the implications of colonial violence, cultural erasure, and social marginalization, and as a result, they are more likely to be under-resourced and low-income (Lynn et al. 2011). In 2020, one in three Native Americans across the United States were living in poverty (Northwestern Institute for Policy Research 2020). Native Americans have lower health status and life expectancies compared to other populations due to a variety of factors including inadequate education, disproportionate poverty, cultural differences, and discrimination in the delivery or accessibility of health services. Native Americans are also less likely to have health insurance, which may limit their ability to seek medical care for injuries or illnesses caused or exacerbated by climate change impacts (Indian Health Services 2019). Native Americans are more likely to live in high-hazard risk areas and less likely to be homeowners, which leaves them vulnerable to climate impacts (Gamble et al. 2016). Within the vulnerability analysis, potential impacts to Native American populations are discussed in the context of people of color.

Individuals with chronic health conditions or health related sensitivities may be socially and physiologically vulnerable to climate change impacts and hazards. Older adults and young children 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). Individuals in this group are more likely to have pre-existing medical conditions or chronic illnesses that may exacerbate the risk of illnesses and medical problems from climate hazards. Treatment provided by medical equipment that requires electricity may be disrupted during a public safety power shutoff or climate hazard event. Children are socially and physiologically vulnerable to climate hazards due to limited understandings of climate hazards and insufficient resources to independently prepare for and safely respond during a climate hazard event. Children, especially those 5 years and younger, 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 may be more vulnerable to health effects of climate change impacts (Kenney et al. 2014).

Potential Impacts[2]

Extreme Heat and Warm Nights

People with high outdoor exposure, such as those experiencing homelessness and outdoor workers, are more likely to be at risk of health impacts from extreme heat than the general population. People experiencing homelessness and outdoor workers are exposed to health-related impacts associated with extreme heat because they are more likely to have limited access to shelter and air conditioning. The primary health impacts to these populations can be 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 afford adequate air conditioning or fans, which increases their exposure to extreme heat. Individuals in this group are less likely to receive medical care for illnesses triggered or exacerbated by extreme heat. Isolated individuals who do not have access to a vehicle may not be able to

[2] Tule fog and chill hours are not discussed as potential impacts to sensitive populations as they are beneficial to the local agricultural system.

travel to cooling centers or move to temporary shelters during extreme heat events (Cooley et al. 2012).

Communities of color and undocumented immigrants are more likely to live in housing with insufficient protection from extreme heat events and limited or no affordable air conditioning. The primary health impacts to these populations can be heat-related illnesses, such as heat stress, heat stroke, and dehydration, which can be life-threatening (CDPH 2020). Undocumented immigrants may not have access to medical services to treat heat-related illnesses. 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).

Older adults and young children may have difficulty turning on air conditioning or traveling to cooling centers during extreme heat events. Children are still physiologically developing which means that they are less able to regulate their bodies during extreme heat events (Kenney et al. 2014). Individuals in this group can be more prone to chronic medical conditions. 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 dehydration, which can be-life threatening (CDPH 2020).

Drought

People experiencing homelessness are not likely to face disproportionate risk to drought conditions and associated cascading impacts unless there are major water shortages, which may increase water costs.

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 and Balbuls 2016). Droughts often trigger cascading economic impacts through the agricultural sector, decreasing job availability and leaving under-resourced individuals particularly vulnerable to financial hardships (Howitt et al. 2015).

Communities of color may be at risk to prolonged drought conditions and associated cascading impacts and may face systemic and/or cultural barriers when seeking to access affordable and clean drinking water, which may cause dehydration and/or exacerbate underlying health conditions and illnesses (Gamble and Balbuls 2016).

Prolonged drought conditions can lead to water scarcity and individuals may need to rely on poor quality water supplies. Young children and older adults are especially at risk of dehydration as their bodies are not able to regulate as well (Kenney et al. 2014). Dehydration may exacerbate underlying health conditions and illnesses.

Wildfire

Individuals with high outdoor exposure are vulnerable to wildfires and the associated cascading effects. People experiencing homelessness may be 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 homelessness may 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). After wildfires, there are additional issues of displacement and the need for temporary shelters to serve

uprooted communities. Some outdoor workers, including firefighters and emergency personnel, may be exposed to hazardous work conditions during wildfire events and may become injured from smoke inhalation or burns.

). Linguistically isolated individuals may not be able to read smoke advisory warnings or governmental guidance, potentially causing them to experience greater exposure to smoke. Undocumented immigrants may not have access to medical services to treat injuries (Gamble and Balbuls 2016).

Older adults may be vulnerable to health impacts from wildfire smoke and pollutants because they are more likely to have underlying respiratory and/or cardiovascular conditions and illnesses. Children may experience respiratory health impacts from wildfire smoke because their respiratory systems are not fully developed and are sensitive to stressors. Children and older adults may rely on others to safely evacuate from wildfires, increasing the risk of health impacts from wildfire smoke inhalation (EPA 2022).

Riverine and Stormwater Flooding

People experiencing homelessness are more likely to experience health impacts during flood events because they may 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 and Svoboda 2009).

Under-resourced individuals may experience injuries or death from 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 with limited or no access to a vehicle may face difficulty evacuating flood hazard areas. Renters may 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 and Balbuls 2016).

Communities of color and undocumented immigrants are more likely to live in flood hazard areas and in housing with insufficient protection against riverine and stormwater flooding. Linguistically isolated individuals may not be able to read flood warning or governmental guidance, potentially causing them to experience greater exposure to flooding. Individuals in this vulnerability group may face systematic and/or cultural barriers when seeking access to the resources needed to safely evacuate hazard areas (Gamble and Balbuls 2016).

Older people and young children may be 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. Children and older adults may rely on others to safely evacuate floodwater hazard areas.

Air Quality

People experiencing homelessness and outdoor workers may be more vulnerable to poor air quality because they spend significant amounts of time outdoors and are directly exposed to pollutants (CDPH 2017). Prolonged exposure to poor air quality may cause exacerbation or development of respiratory diseases and conditions, such as asthma and chronic obstructive pulmonary disease, and respiratory infections, which in some cases may be life-threatening (Ramin and Svoboda 2009).

Under-resourced individuals may be disproportionally impacted by poor air quality because their housing may lack sufficient air filtration and they may not be able to afford supplemental air filtration equipment (Gamble and Balbuls 2016). Individuals in these groups may experience the development or exacerbation of respiratory illnesses and are less likely to receive quality medical treatment (CDPH 2017).

Communities of color and undocumented immigrants may be 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 and Balbuls 2016). They may experience respiratory or cardiovascular health impacts and are less likely to have access to sufficient medical services for treatment (CDPH 2020). Undocumented immigrants are less likely to receive medical treatment for health impacts from poor air quality exposure (Mendez et al. 2020). Linguistically isolated individuals may not be able to read air quality advisory warnings or governmental guidance that are in English, potentially causing them to experience greater exposure to extreme heat (CDPH 2017).

Young children may be extremely vulnerable to health impacts from poor air quality because their respiratory system has not fully developed yet (CDPH 2017). Older adults are more likely to experience health impacts from poor air quality because they are more likely to have underlying respiratory and/or cardiovascular conditions.

Adaptive Capacity for Vulnerable Populations

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

- Extreme Heat and Warm Nights
  - The City provides the following operational cooling centers for community members to access during extreme heat events:
    - Visalia Public Library: 200 West Oak Ave, Visalia, CA 93291
    - Visalia Transit Center: 425 East Oak Ave., Visalia, CA 93291
    - Visalia Rescue Mission:322 NE 1st Ave., Visalia, CA 93291
    - Visalia Transit Buses: Provide a mobile cooling station for all days 105 degrees or higher.
  - SCE has several programs that provide low-income customers, non-English speaking customers, and those with medical needs for electricity with resources to mitigate the impacts and prepare for public safety power shutoffs, which may occur during an extreme heat event.

- Wildfire
  - The SCE Wildfire Safety Program provides customer support during public safety power shutoffs and increasing resistance to wildfire salience. The program provides specific support for non-English speaking individuals, individuals with disabilities, low-income individuals, the older adults, and those with chronic illnesses or health conditions.
  - The City Code of Ordinance, Fire Code includes provisions for preventing hazard to life due to fires.
- Flooding
  - The City of Visalia Municipal Code provisions for protecting public health and safety in the case of flood conditions.
- Air Quality
  - The City of Visalia Active Transportation plan provides opportunities to improve community health by reducing the reliance on transportation that increases pollution and worsens air quality in the city.
  - The Visalia Climate Action Plan details actions to reduce GHG emissions and limit pollution, leading to positive impacts on community health.
- All Hazards
  - The City Code of Ordinances include requirements to safeguard public health in light of climate hazards and makes specific mention of maintaining access of services to persons with disabilities.

Vulnerability Scoring for Sensitive Populations

As described in the Vulnerability Assessment Methodology section, vulnerability scoring is based on the combination of potential impacts to sensitive populations and existing adaptive capacity. The result of which produced a vulnerability score for this group. As summarized in Table 5, sensitive populations in Visalia are most vulnerable to extreme heat/warm nights, flooding, and air quality.

Table 5 Sensitive Populations Vulnerability Score

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

5.2 Natural and Managed Resources

Primary vulnerabilities for natural and managed resources are associated with climate hazard-caused stress and physical damage to resource types within this asset group. Compounding climate hazards stress natural ecosystems beyond their capacity to offset individual climate hazards. Wildlife will seek out more conducive habitats during climate events such as extreme heat or drought, which can tend to be where people recreate (USDA 2018). Recreational areas are also placed under increased risk as climate change creates additional stressors and competing needs for safe habitats.

Agriculture is seen as the heart of Visalia's industry. The agriculture industry was valued at nearly $8 billion in Tulare County in 2021, and Tulare County remains in the top 3 agricultural counties in the country (County 2021). Impacts of climate change to the region's agricultural sector will be far reaching. Some of the top economically profitable crop or rangeland types that can be found in Tulare County include fruit and nut crops, livestock and poultry, field crops, and nursery products (County 2021). The City of Visalia is surrounded by agricultural land, with some portions falling within city boundaries, primarily in the north and southwest. Key crops include but are not limited to grapes, olives, cotton, citrus, and nursery products. Both natural and managed resources are highly vulnerable to the effects of climate change in Visalia.

Potential Impacts

Extreme Heat and Warm Nights

Natural and managed resources are potentially impacted by the same climate hazards as sensitive populations. Wildlife under extreme heat 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). The 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 et al. 2011). Plants are more likely to experience heat stress and dehydration, habitat ranges may shift, and native species may be outcompeted by invasive species capable of surviving the harsh conditions. 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, indicating that heat exposure and related impacts will continue to increase (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 (Santiago et. al 2021). 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 and increased pest pressure are correlated with warmer temperatures (Hamerlynck 1995), both of which can result in increased costs and decreased agricultural profitability.

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 affect the amount and duration of water available in ephemeral and permanent sources, which

impacts plants and wildlife dependent on those aquatic resources (Burkett and Kusler 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.

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, Coop et al. 2020).

No applicable designated wildfire hazard areas currently exist in Visalia. However, the projected expansion of wildfire prone areas, larger areas of croplands may be within fire hazard severity zones in the future. Wildfires in the region tend to occur in the late fall, which aligns with the harvest season of many crops. Wildfires and wildfire smoke can destroy and/or damage crops, such as wine grapes, which have high economic value to the City.

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 freshwater quality (Talbot et al. 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 river and any other water bodies in the area. Agricultural operations situated within the FEMA flood zones in Visalia are susceptible to the impacts of 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.

Air Quality

The direct effects of poor air quality on natural resources relate to plant and wildlife health as increased air pollutants are correlated with 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 compound risks. One direct impact of concern related to air quality and agricultural production is that smoke damage may render crops unsaleable, or poor air quality may impact a grower's ability to harvest on time.

Tule Fog

Fog plays a critical role to achieve the necessary dormancy that some fruit and nut trees require to improve their quality and total crop yield. Tule Fog frequency is decreasing due to climate change which may impact the profitability of orchards in Visalia. Tule Fog can also have impacts on moisture presence of the air affecting air quality.

Chill Hours

Orchards depend on chill hours to break dormancy during the winter, to synchronize blooming, facilitate pollination, and produce standard quality and quantity of crops. Climate change is decreasing the number of chill hours for crops, resulting in reduced tree yield, particularly for pistachios and walnuts, and decreasing suitable locations for these trees.

Adaptive Capacity for Natural and Managed Resources

- Extreme Heat & Warm Nights
  - There are minimal relevant plans programs or policies directly increasing the adaptive capacity of Visalia's natural and managed resources to the climate hazard of extreme heat.
- All Hazards
  - The Tulare County MJLHMP, and specifically the Visalia Annex in the MHLHMP outlines climate change hazard related vulnerabilities to natural and managed resources.
- Riverine and Stormwater Flooding and Drought
  - Visalia's Urban Water Management Plan and Groundwater Management impacts describe strategies to manage the city's water supply and groundwater resources.
  - The Waterways and Trails Master Plan discusses maintenance of the waterways and channels for flood control purposes. It proposes opportunities for creating flood control basins.

Vulnerability Scoring for Natural and Managed Resources

As described in the Vulnerability Assessment Methodology section, vulnerability scoring is based on the combination of potential impacts to natural and managed resources and existing adaptive capacity. The result of which produced a vulnerability score for this group. As summarized in Table 6, natural and managed resources in Visalia are most vulnerable to most climate hazards, including extreme heat/warm nights, drought, flooding, air quality, Tule Fog, and chill hours.

Table 6 Natural and Managed Resources Vulnerability Scores

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat/Warm Nights	Medium	Low	**4-High**
Drought	High	Medium	**4-High**
Wildfire	Medium	Medium	**3-Medium**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	Medium	Low	**4-High**
Tule Fog	Medium	Low	**4-High**
Chill Hours	Medium	Low	**4-High**

5.3 Buildings and Critical Facilities

Vulnerabilities within this category are primarily related to physical exposure and damage due to impacts to climate hazards. Impacts associated with operations of critical services are discussed in the Infrastructure and Services section. Within the City of Visalia, there is a complex network of facilities and infrastructure vulnerable to climate change. Assets within this category are considered critical facilities and include:

- Fire Stations
- Police Stations
- Hospitals/Healthcare Facilities
- Emergency Shelters
- Schools
- Public Libraries
- Jails
- Public Safety and Emergency Communications Facilities

Potential Impacts

Extreme Heat and Warm Nights

Extreme heat could impact occupants of buildings and critical facilities that are not adequately weatherized for increased temperatures. Increased frequency and severity of extreme heat events may lead to long-term impacts on the equipment located within the facilities and buildings in the city. High ambient operation temperatures may lead to a reduction of the lifespan for various electrical equipment (Water Utility Climate Alliance 2020).

Drought

Drought will have minimal impact on the physical structures of buildings and critical facilities in Visalia.

Wildfire

Potential impacts of wildfire to structures and buildings within Visalia is low. However, fire hazard severity zones may expand by end of century which could lead to more buildings and critical facilities at risk of structural damage.

Riverine and Stormwater Flooding

There is significant risk of riverine and stormwater flooding to the physical structures outlined under this asset category. Figure 3 (page 14) shows impact risks throughout the central portions of the city within the 100-year floodplain. The 500-year floodplains extend throughout the majority of the city, and include several medical/health care facilities, schools, fire stations, city buildings, police stations, the Tulare County Jail, and the Visalia Emergency Communications Center. Impervious surfaces can impede the absorption of water and lead to increased stormwater flooding in Visalia.

Air Quality

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

Adaptive Capacity for Buildings and Critical Facilities

- Multiple Hazards
  - The Visalia Annex to the Tulare County MJLHMP assesses the potential impacts of riverine and stormwater flooding and wildfire on critical facilities and buildings. The Plan outlines mitigation strategies to minimize riverine and stormwater flooding and wildfire impacts to buildings and critical facilities.
  - The Emergency Operations Plan (EOP) outlines structural resilience strategies and identifies emergency response strategies to reduce property loss.
  - The Local Energy Assurance Plan (LEAP) specifies the necessary policies, procedures, and actions to maintain critical facilities in Visalia during emergencies.

Vulnerability Scoring for Buildings and Critical Facilities

As described in the Vulnerability Assessment Methodology section, vulnerability scoring is based on the combination of potential impacts to buildings and critical facilities and existing adaptive capacity. The result of which produced a vulnerability score for this group. As summarized in Table 7, buildings and critical facilities in Visalia are most vulnerable to riverine and stormwater flooding.

Table 7 Building and Critical Facilities Vulnerability Scores

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Extreme Heat/Warm Nights	Low	Low	**3-Medium**
Drought	Low	Medium	**2-Low**
Wildfire	Low	Medium	**2-Low**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	Low	Medium	**2-Low**

5.4 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 damage to buildings and critical facilities can have on services and infrastructure.

Potential Impacts

Extreme Heat and Warm Nights

Extreme heat could impact occupants of buildings and facilities that are not adequately weatherized for increased temperatures. As temperatures increase, roadways, active transportation routes, and railroads are vulnerable to heat-related damages such as buckled highways, railroad tracks and premature deterioration of infrastructure (Santiago et. al 2021). Additional impacts from extreme heat are associated with increased emergency service calls which could strain health and medical services. Electrical infrastructure could be overwhelmed by demand and result in blackouts or energy providers could conduct power safety shutoffs to avoid impacts to electrical facilities. Power outages have significant impacts on communication networks, water conveyance, and vulnerable populations. The ability for emergency services to fully function is a cascading impact of power outages which can place additional strain on services during extreme heat events.

Drought

Drought can impact water reliability and water infrastructure. Groundwater is the sole source of water supply for the Visalia District of the California Water Service Company (District 2021). All emergency services depend on water, particularly firefighters who require adequate water supply for fire suppression. Water providers within the city will encounter increased difficulty as drought impacts general service reliability. Drought impacts can create service strain on emergency and medical services. Cracked pavements from drought, compounded with extreme heat, affects roadways and transportation routes.

Wildfire

Infrastructure and services are at a high risk of wildfire. Dependent populations may experience cascading impacts due to power outages from downed utility lines, power safety shut offs and grid overload during wildfire conditions or events. All forms of power outages can affect how critical services are able to perform their needed functions during a hazard.

Utility lines have the potential to be damaged in high-risk locations, resulting in power outages. Certain high wind conditions can often trigger wildfires, especially when power lines are downed or damaged (Santiago et. al 2021). 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 the ability for people to evacuate.

Riverine and Stormwater Flooding

Impervious surfaces can impede the absorption of water and augment stormwater flooding in areas of Visalia. 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.

Water supply for fire suppression as well as wildfire-caused declines in water quality are additional cascading impacts.

Air Quality

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

Adaptive Capacity for Services and Infrastructure

- Multiple Hazards
  - The City of Visalia Urban Water Management Plan includes a discussion of the impacts of climate change on the water system, with minimal strategies for adaptation and mitigation.
  - The Visalia Annex to the Tulare County MJLHMP outlines strategies to reduce riverine and stormwater flooding and wildfire impacts on services and infrastructure.
  - The Visalia Comprehensive Emergency Operations Plan outlines strategies to streamline emergency response and evacuation protocols and reduce interruption to key utilities and services.
  - The City of Visalia Municipal Service Review contains information about the capacity of service providers to provide efficient, uninterrupted service to the community in the case of an emergency.

Vulnerability Scoring for Infrastructure and Services

As described in the Vulnerability Assessment Methodology section, vulnerability scoring is based on the combination of potential impacts to infrastructure and services and existing adaptive capacity. The result of which produced a vulnerability score for this group. As summarized in Table 8, infrastructure and services in Visalia are vulnerable to wildfires and riverine and stormwater flooding.

Table 8 Infrastructure and Services Vulnerability Scores

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

6 Conclusion

This report evaluates how climate change may impact vulnerable community members, natural and managed resources, critical facilities, buildings, services, and infrastructure in Visalia. 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 in Visalia are listed below:

- Individuals with high outdoor exposure, under-resourced individuals, individuals facing societal barriers, and individuals with chronic health conditions or health-related sensitivities are vulnerable to extreme heat & warm nights, stormwater and riverine flooding, and air quality.
- Natural and managed resources are most vulnerable to extreme heat/warm nights, drought, flooding, air quality, Tule Fog, and chill hours.
- Buildings and critical facilities are most vulnerable to wildfire.
- Infrastructure and services are most vulnerable to wildfire and riverine and stormwater flooding.

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

Table 9 Vulnerability Score for Population Groups and Assets

Climate Hazard	Impact Score	Adaptive Capacity Score	Vulnerability Score
Sensitive Populations			
Extreme Heat and Warm Nights	High	Medium	**4-High**
Drought	Medium	Medium	**3-Medium**
Wildfire	Medium	Medium	**3-Medium**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	High	Medium	**4-High**
Natural and Managed Resources			
Extreme Heat/Warm Nights	Medium	Low	**4-High**
Drought	High	Medium	**4-High**
Wildfire	Medium	Medium	**2-Medium**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	Medium	Low	**4-High**
Tule Fog	Medium	Low	**4-High**
Chill Hours	Medium	Low	**4-High**
Buildings and Critical Facilities			
Extreme Heat/Warm Nights	Low	Low	**3-Medium**
Drought	Low	Medium	**2-Low**
Wildfire	Medium	Medium	**2-Low**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	Low	Medium	**2-Low**
Infrastructure and Services			
Extreme Heat	Medium	Medium	**3-Medium**
Drought	Medium	Medium	**3-Medium**
Wildfire	High	Medium	**4-High**
Riverine and Stormwater Flooding	High	Medium	**4-High**
Air Quality	Low	Low	**3-Medium**

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