Stanislaus County
2022 Multi-Jurisdictional Hazard Mitigation Plan

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EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. The County of Stanislaus (County) developed this Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) update to make the County, its 10 participating jurisdictions, and its residents less vulnerable and more resilient to future hazard events. This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 so that Stanislaus County would be eligible for the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation and Hazard Mitigation Grant programs.

The County followed a planning process prescribed by FEMA, which began with the formation of a hazard mitigation planning committee (HMPC) comprised of key County representatives, 10 participating jurisdictions from the cities of Hughson, Modesto, Newman, Oakdale, Riverbank, Waterford, Patterson, Turlock, and Ceres, the Stanislaus County Office of Education (SCOE), and other regional stakeholders. The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to the County of Stanislaus, assessed the County's vulnerability to these hazards, and examined the capabilities in place to mitigate them. The County is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Earthquakes, dam incidents, drought, floods, severe weather (dense fog; heavy rain, thunderstorm, hail, and lightning; and high wind and tornado), and wildfires are among the hazards that can have a significant impact on the County.

Based on the risk assessment review and goal setting process, the HMPC identified and modified the following five goals from their previous HMP, which provide the direction for reducing future hazard-related losses within the County's Planning Area:

- **Goal 1:** Minimize the loss of life and reduce property damage as a result of natural, human-health, and human-caused hazards to support the health and safety of the whole community.
- **Goal 2:** Reduce economic impacts and promote a sustainable economy.
- **Goal 3:** Improve community resilience to disasters through increased outreach and awareness and better resources.
- **Goal 4:** Protect climate and socially vulnerable communities in the County, including individuals with access and functional needs and those that may suffer from economic, health, and environmental burdens.
- **Goal 5:** Build resilient infrastructure and communities that withstand climate-related impacts.

The HMPC also developed and updated 71 objectives. To meet identified goals and objectives, the plan recommends 125 mitigation actions, which are summarized in the table that follows. Once formally approved by the California Office of Emergency Services (Cal OES) and FEMA Region IX and adopted by the County and their participating jurisdictions, this plan will be updated every five years.

Table ES-1 Mitigation Actions Summarized by Jurisdictions and Hazards Mitigated

Hazard	Jurisdiction										
	Stanislaus County	Ceres	Hughson	Modesto	Newman	Oakdale	Patterson	Riverbank	Turlock	Waterford	Office of Education
Multi-Hazard	5	-	-	1	3	-	-	3	-	1	8
Agriculture Pest and Disease	-	-	-	-	-	-	-	-	-	-	-
Aquatic Invasive Species	-	-	-	-	-	-	-	-	-	-	-
Cyber Attack	1	-	-	-	-	-	-	-	-	-	-
Dam Incidents	5	2	3	-	-	1	1	1	1	1	1
Drought	1	2	1	-	1	1	2	-	7	-	-
Earthquake	6	-	-	-	2	-	2	-	-	-	3
Extreme Temperature	1	-	1	-	1	-	1	-	1	-	-
Flood	12	-	1	2	2	1	3	1	-	-	-
Landslide	6	-	-	-	-	-	-	1	-	-	-
Public Health Hazards: Pandemic/Epidemic	1	-	1	-	-	-	-	1	-	-	4
Severe Weather	3	-	-	-	-	-	-	-	-	-	2
Wildfire	9	-	-	-	-	1	3	-	-	-	-
Total	**50**	**4**	**7**	**3**	**9**	**4**	**12**	**7**	**9**	**2**	**18**

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1 INTRODUCTION

1.1 Purpose of Plan

Stanislaus County including the participating jurisdictions have prepared this multi-jurisdictional hazard mitigation plan (MJHMP) to guide hazard mitigation planning to better protect the people and property of the County from the effects of hazard events. The purpose of this MJHMP is to identify policies, actions, and strategies that will help to reduce risk and prevent future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damage. Hazard mitigation is most effective when it is based on a comprehensive long-term plan that is developed prior to a disaster occurring.

This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to make Stanislaus County and the participating jurisdictions eligible for certain federal disaster assistance, specifically, the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Building Resilient Infrastructure and Communities (BRIC) program, as well as to make the County and jurisdictions more disaster resistant. This plan demonstrates the County's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

1.2 Hazard Mitigation Planning

FEMA has determined that there is a critical link between hazard mitigation planning and sustainability. This means if Stanislaus County has the foresight to plan ahead to reduce the impacts of hazards, the County will be better able to prevent injury, loss of life and damage to our homes, businesses, and neighborhoods. The County can use the threat of disaster as a catalyst to act and develop a plan so we can recover more quickly following a disaster.

Stanislaus County and their 10 participating jurisdictions have committed to reducing long-term risk to our citizens and damage to property from the effects of natural hazards. By planning, preparing, and adopting a MJHMP, the County and each jurisdiction is taking a proactive approach to reduce or eliminate the impacts of hazards before they occur.

FEMA defines "hazard mitigation" as any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. The County's plan will serve as a tool for learning from disasters that have already occurred, so we can deal with them more effectively and efficiently with less expenditure than in the past.

Direct benefits include:

- Reduced loss of life;
- Reduced loss of property and essential services;
- Reduced economic hardship;
- Reduced reconstruction costs;
- Increased cooperation and communication within the community through the planning process; and
- Expedited post-disaster funding.

Indirect benefits include:

- Disaster resilience;
- Environmental quality;
- Economic vitality; and
- Improved quality of life.

1.3 Federal Regulatory Framework

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act ("the Stafford Act"), enacted by Section 104 of the Disaster Mitigation Act of 2000 ("DMA 2000"), provides revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance and establishes a new requirement for LHMPs. In order to apply for federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with DMA 2000 and its implementing regulations (44 Code of Federal Regulations (CFR) Part 201.6).

Under the 2008 44 CFR update, requirements have changed governing mitigation planning provisions for LHMPs published under 44 CFR §201.6. LHMPs qualify communities for the federal mitigation grant programs including:

- HMA Grants
- HMGP
- BRIC
- FMA
- Severe Repetitive Loss (SRL)
- Repetitive Flood Claim (RFC)

1.4 State and Local Regulatory Framework

The MJHMP was prepared consistent with the Safety Element of the Stanislaus County General Plan, as the planning effort covers common overlapping natural hazard issues and mutually-reinforcing policies and implementation programs. The MJHMP and Safety Element are considered complimentary documents that address natural hazards, and both planning documents contain goals, policies, and project actions or implementation programs to enhance the County's mitigation efforts related to public safety.

California Government Code Section 65302.10, also referred to as Assembly Bill (AB) 2140 encourages California counties and cities to adopt their current, FEMA-approved Local Hazard Mitigation Plans (LHMPs) into the Safety Element of their General Plan. This adoption by reference or incorporation of the MJHMP into the Safety Element of the General Plan follows plan approval and makes Stanislaus County and each participating jurisdiction eligible to be considered for part or all of its local-share costs on eligible public assistance funding to be provided by the State through the California Disaster Assistance Act (CDAA). The CDAA allows the State to pay up to 18.75 percent (%) of the non-federal share that would otherwise fall upon a county or city to pay for public assistance projects. The legislature passed AB 2140 to provide additional funding after a disaster occurs. The local share is 25% of the total project cost; therefore, the legislation allows city and counties that comply to be eligible for only the remaining local share (6.25%).

AB 2140 is an optional state incentive to help counties and cities become more resilient to natural hazards. Compliance with AB 2140 also expires when the MJHMP expires, and the County must re-adopt the plan into the Safety Element during update cycles to ensure continued compliance and funding eligibility. Additionally, each participating jurisdiction in Stanislaus County must adopt their annex into their own General Plan Safety Element, as the annex jurisdictions are not covered under the County's General Plan Safety Element adoption.

1.5 Emergency Management Accreditation Process (EMAP) Standards

The Emergency Management Accreditation Program (EMAP) is a voluntary standards, assessment, and accreditation process for disaster preparedness programs throughout the country. It provides emergency management programs the opportunity to be recognized for compliance with industry standards, to demonstrate accountability, and to focus attention on areas and issues where resources are needed. The EMAP program consists of 66 standards, last updated in 2019 that evaluate all aspects of a jurisdiction's comprehensive emergency management program. The standards cover program management, hazard identification: risk assessment and consequence analysis, hazard mitigation, prevention, operation planning and procedures, incident management, resource management, communications, training and exercises, and emergency public education. Two of the EMAP Standards specifically address hazard assessment and mitigation planning: Standard: 4.1 Hazard Identification, Risk Assessment and Consequence Analysis and Standard: 4.2 Hazard Mitigation. The Stanislaus County MJHMP update was prepared pursuant to the EMAP standards and included an updated risk assessment and consequence analysis in Subsection 4.1 of this plan. The Emergency Management Program consequence analysis considered the impact on the public; responders; continuity of operations; property, facilities, and infrastructure; environment; economic conditions; and public confidence in the jurisdiction's governance. Additional information on the EMAP standards and how the MJHMP update complies with the program is provided in Section 3.4.6.

1.6 Background and Scope

In the State of California and around the world, natural disasters occur frequently. Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. The time and money needed to recover from these events can strain or deplete local resources. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries (Natural Hazard Mitigation Saves: 2017 Interim Report).

Hazard mitigation planning is the process through which hazards that threaten communities are identified; likely impacts are determined, prioritized, and implemented. This MJHMP update continues the hazard mitigation planning process for Stanislaus County, the unincorporated county; the participating cities of Modesto, Turlock, Oakdale, Ceres, Patterson, Riverbank, Newman, Hughson, and Waterford; and the County Office of Education. The plan identifies natural and human-caused hazards and risks within Stanislaus County and identifies the hazard mitigation strategy to reduce vulnerability and make the communities of Stanislaus County more disaster resistant and sustainable. Information in this plan can be used to help guide and coordinate mitigation activities and local land use decisions. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The Stanislaus County planning area has been affected by hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.7 Plan Update

This plan underwent a comprehensive update in 2021-2022 in fulfillment of the five-year update requirement. Several factors underscore the need for this planning effort:

- Stanislaus County is exposed to hazards that have caused past damage.
- Limited local resources make it difficult to be pre-emptive in reducing risk. Eligibility for federal financial assistance is paramount to promote successful hazard mitigation in the area.
- Stanislaus County and its partners participating in this plan want to be proactive in preparing for the probable impacts of natural hazards.

This MJHMP was originally prepared in 2006, pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6). Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act, or DMA. While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that LHMPs must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster

Relief and Emergency Act (Public Law 93-288). Because the Stanislaus County planning and response area is subject to many kinds of hazards, access to these programs is vital. As a result, the County and their participating jurisdictions must complete a comprehensive plan update every five years. For the current plan update, Stanislaus County completed the update as part of a multi-jurisdictional planning process in 2021-2022 to bring the MJHMP into compliance with recent legislation related to climate change and to address new human-health and natural hazards and emerging concerns. The Stanislaus County 2017 LHMP was initially approved by FEMA on January 12, 2006, updated, and approved by FEMA on July 20, 2011, updated again on July 13, 2017.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The Stanislaus County planning area has been affected by hazards in the past and is thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

This hazard mitigation plan identifies resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of the planning partners and their citizens. One of the benefits of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. FEMA encourages multi-jurisdictional planning under its guidance for the DMA. This plan will help guide and coordinate mitigation activities throughout the planning area. The plan was developed to meet the following objectives:

- Meet or exceed requirements of the DMA.
- Enable all planning partners to use federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment that focuses on Stanislaus County hazards of concern.
- Integrate a consequence analysis to meet Emergency Management Accreditation Program (EMAP) standards (ANSI/EMAP EMS 5-2019).
- Update the risk assessment with a consequence analysis that assesses the risk and vulnerability of people, property, the environment, and its own operations form these hazards.
- Conduct a consequence analysis for natural and non-natural hazards to consider the impacts on the public; responders; continuity of operations (including the delivery of services); property, facilities, and infrastructure; environment, economic conditions of the jurisdiction; and public confidence in the jurisdiction’s governance.
- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the County and puts all partners on the same planning cycle for future updates.
- Meet the planning requirements of FEMA’s Community Rating System (CRS), allowing planning partners that may choose to participate in the CRS program to enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

1.8 Multi-Jurisdictional Planning

All citizens and businesses of Stanislaus County are the ultimate beneficiaries of this MJHMP. The plan reduces risk for those who live in, work in, and visit the County. It also provides a viable planning framework for all foreseeable natural hazards that may impact the County. Participation in development of the plan by key stakeholders in the County helps ensure that outcomes will be mutually beneficial. The resources and background information in the plan are applicable countywide, and the plan’s goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

The Stanislaus County MJHMP is a multi-jurisdictional plan that geographically covers everything within Stanislaus County’s jurisdictional boundaries (hereinafter referred to as the planning area). Unincorporated Stanislaus County and the following jurisdictions participated in the 2021 update planning process:

- Stanislaus County
- City of Ceres

- City of Hughson
- City of Modesto
- City of Newman
- City of Oakdale
- City of Patterson
- City of Riverbank
- City of Turlock
- City of Waterford
- County Office of Education

The nine cities and County Office of Education are new participating jurisdictions as part of the 2021-2022 MJHMP update process. While this is the first HMP for some of the jurisdictions, all of the jurisdictions were invited to participate in the 2006, 2010, and 2017 planning processes; however not all jurisdictions formally participated and developed annexes to the County’s MJHMP at the time. For example, only some of the jurisdictions adopted an Annex to the 2010 MJHMP (i.e., City of Riverbank). Further, the 2017 LHMP only covered Stanislaus County. This 2021-2022 MJHMP update process covers each participating jurisdiction and includes 10 annexes.

1.9 Plan Organization

The sections that comprise the County’s MJHMP include:

Executive Summary and Prerequisite – This section includes the executive summary of the MJHMP and addresses the formal adoption of the plan by each governing body to demonstrate the commitment of the community and elected officials to the County's goal of becoming disaster resistant.

Section 1: Introduction – This section describes the purposes of the MJHMP update, benefits of hazard mitigation planning, the federal and state regulatory requirements, and the background of the County’s hazard mitigation planning process.

Section 2: Community Profile and Capability Assessment – This section provides the history and background of the County, including population trends and the demographic and economic conditions that have shaped the area. This section also includes the County’s capability assessment.

Section 3: Planning Process – This section identifies the planning process, the Planning Committee members, the meetings held as part of the planning process, documents the outreach efforts, and the review and incorporation of existing plans, reports, and other appropriate information.

Section 4: Hazard Identification, Risk Assessment (HIRA), and Consequence Analysis –This section describes the process through which the Planning Committee and our local partners identified, screened, and selected the hazards to be profiled. The hazard analysis includes the description, location, extent, and probability of future events for each hazard. This section also includes a Consequence Analysis to align with EMAP standards. The Consequence Analysis covers all hazards and considers the impact on the following assets: public; responders; continuity of operations including continued delivery of services; property, facilities, and infrastructure; environment; economic condition of the jurisdiction; and public confidence in the jurisdiction’s governance.

Section 5: Mitigation Strategy – The mitigation strategy section provides a plan for reducing the potential losses identified in the vulnerability analysis. Mitigation goals and potential actions to minimize the risks and losses associated with each hazard will be described along with a strategy for implementation.

Section 6: Implementation and Maintenance – This section describes the method and schedule for monitoring, evaluating, and updating the plan to ensure it remains an active and applicable document.

Section 7: Plan Adoption – This section includes the plan adoption documentation and process for integrating the plan by reference into the County’s General Plan Safety Element.

Section 8: References – This section lists the sources cited in the plan.

1.10 Appendices

- Appendix A: Hazard Mitigation Planning Committee
- Appendix B: Planning Process Documentation
- Appendix C: Approval and Adoption Documentation
- Appendix D: Mitigation Categories and Alternatives
- Appendix E: Annual Progress Meeting Agenda and Report Template
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1.11 Annexes

- Annex A: City of Ceres
- Annex B: City of Hughson
- Annex C: City of Modesto
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- Annex E: City of Oakdale
- Annex F: City of Patterson
- Annex G: City of Riverbank
- Annex H: City of Turlock
- Annex I: City of Waterford
- Annex J: County Office of Education

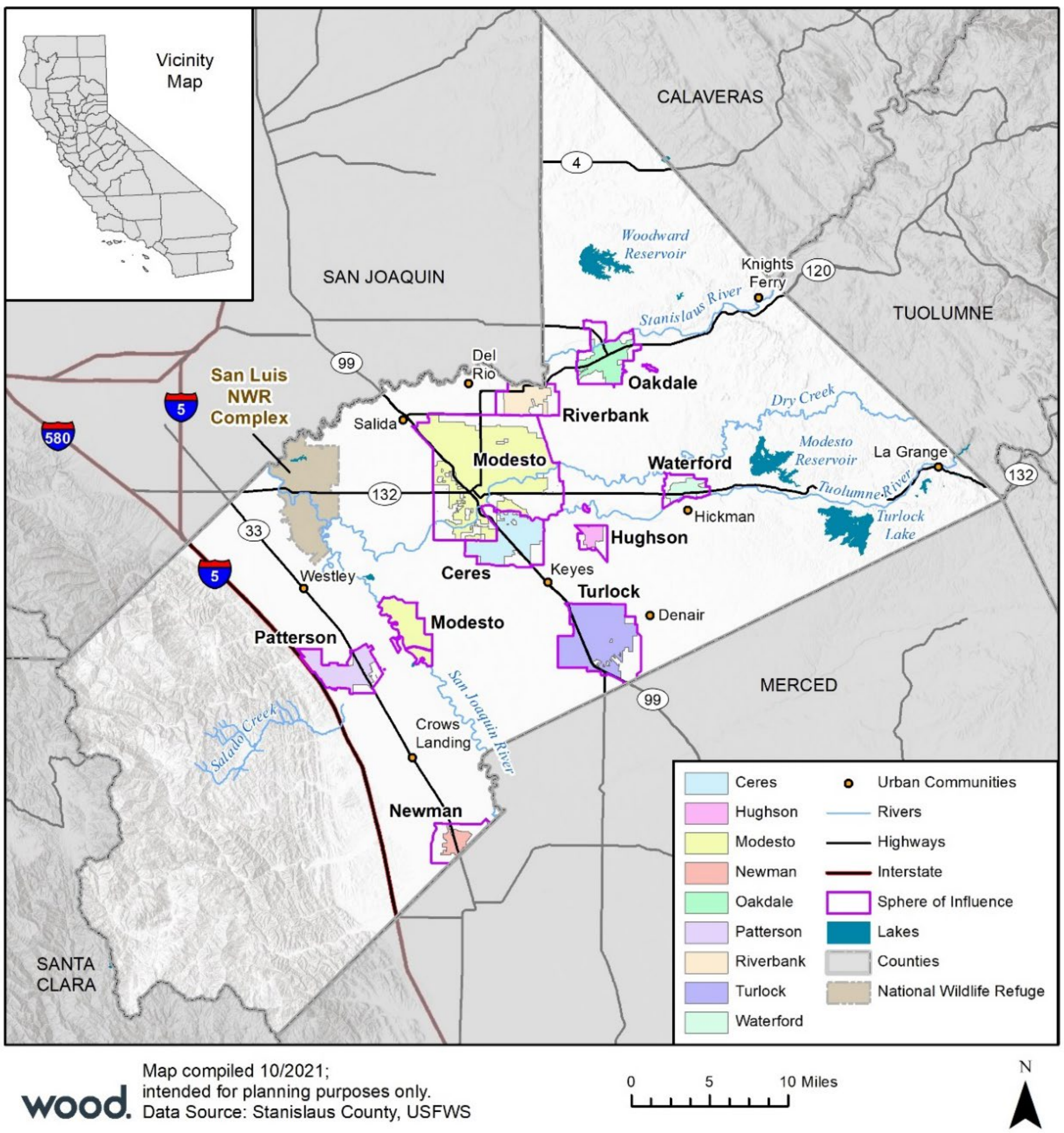
2 Community Profile and Capability Assessment

2.1 History

Stanislaus County is located in the heart of California's Central Valley, (see Figure 2-1) within 90 minutes of the San Francisco Bay Area, the Silicon Valley, Sacramento, the Sierra Nevada Mountains, including Yosemite National Park, and California's Central Coast. It is also within a five-hour drive of Los Angeles. Two of California's major north-south routes (Interstate 5 and Highway 99) intersect the area making the County one of the dominant logistics center locations on the west coast.

The County is bordered on the north by San Joaquin County, the east by Mariposa, Tuolumne, and Calaveras counties, the south by Merced County, and the west by Alameda and Santa Clara counties. Established in 1854, Stanislaus County's total land area is 1,494 square miles. The County seat is the City of Modesto, located near the center of the County.

Figure 2-1 Stanislaus County Planning Area



2.2 Geography and Climate

The mild Mediterranean climate makes Stanislaus County one of the best agricultural areas in the world, positioning it as a global center for agribusiness. The County averages approximately twelve inches of rainfall each year and experiences a full spectrum of the seasons. Temperatures range from an average low of 38 degrees Fahrenheit in the winter, to an average high of 85 degrees Fahrenheit during the spring and fall, and to average highs in the 90's during the summer months. Table 2-1 lists the average high and low temperatures by month and associated average rainfall.

Table 2-1 Temperature and Rainfall Averages for Stanislaus County

Average High/Low Temperature	Average Rainfall
January 55°/40° F (13°/4.5° C)	January 2.6 inches
August 94°/62° F (34.2°/16.8°C)	August.05 inches
Annual 76°/52.2° F (24.4°/10.6° C)	Annual 13.2 inches

Source: U.S. Climate Data 2021

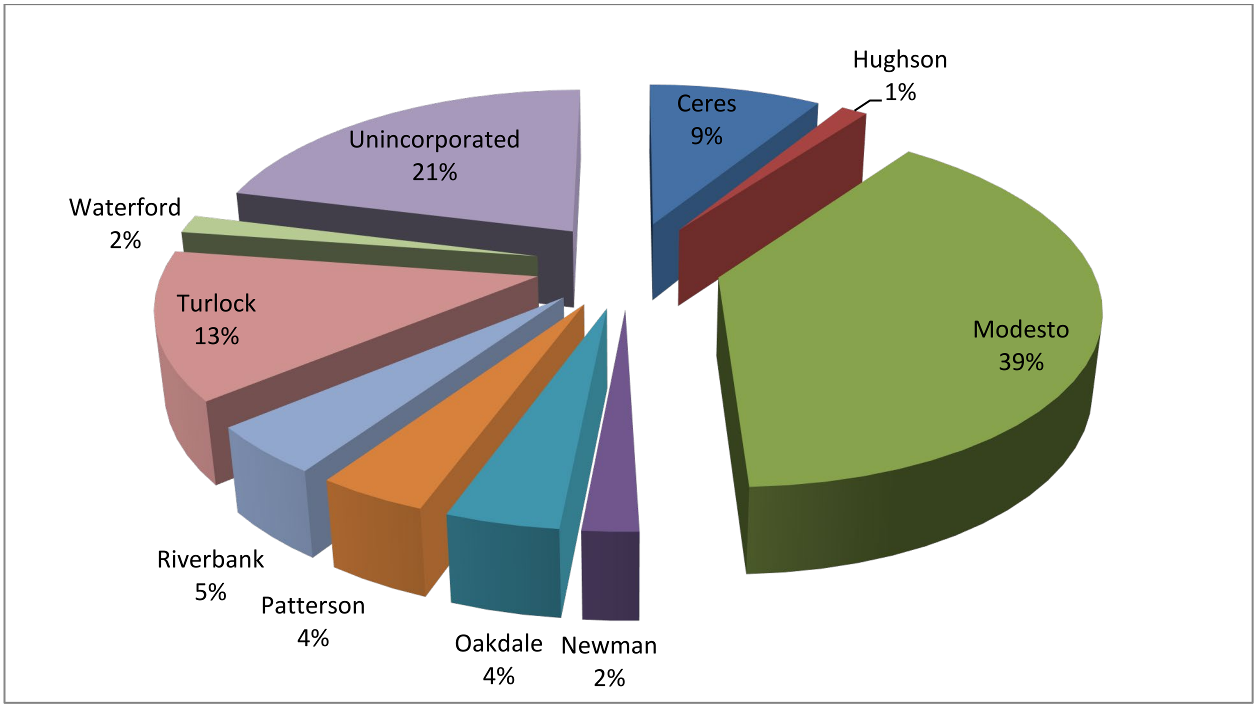
2.3 Rivers

There are four major rivers in Stanislaus County. Three of these rivers, the Stanislaus, Calaveras, and Tuolumne Rivers, run east to west, with the Calaveras River crossing the tip of the northeast County border. The fourth, the San Joaquin River, runs southeast to northwest. Dry Creek also runs east to west, and then merges with the Tuolumne River in Modesto. There are no flow control systems on Dry Creek. Rainfall and runoff in the eastern portion of the County directly affect this creek. The County also has three major reservoirs: Modesto, Woodward, and Turlock.

2.4 Population

Stanislaus County has nine municipalities: the cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford. Additionally, there are thirteen unincorporated communities within the County and large expanses of state- and federally-owned lands such as parks, wildlife areas and other public lands. As the County seat, the City of Modesto has the largest population. The United States Office of Management and Budget has designated Stanislaus County as the Modesto, CA Metropolitan Statistical Area (MSA). The U.S. Census Bureau ranked the Modesto, CA \MSA as the 104th most populous MSA of the United States as of 2020. Figure 2-2 breaks down the population of the County by cities and unincorporated areas.

Figure 2-2 Stanislaus County Population by City



Source: Source: 2015-2019 American Community Survey (ACS), 5-year estimates, U.S. Census Bureau

Table 2-2 lists the estimated population increases in Stanislaus County from 2020 through 2021 organized by city and the unincorporated area.

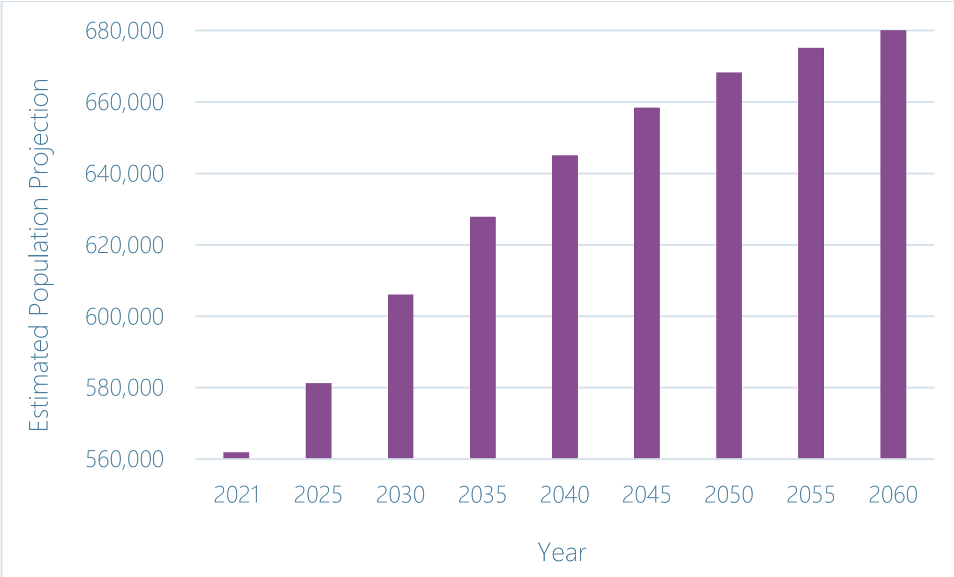
Table 2-2 Estimated Population Increase 2020 – 2021

County/City	2017 Census	2021 Estimate Population	% Change
Stanislaus	535,684	555,968	3.8
Ceres	47,650	48,901	2.6
Hughson	7,295	7,303	0.1
Modesto	210,166	219,294	4.3
Newman	10,951	11,962	9.2
Oakdale	22,256	23,237	4.4
Patterson	21,497	23,304	8.4
Riverbank	24,047	25,189	4.7
Turlock	71,906	74,820	4.1
Waterford	8,786	8,944	1.8
Unincorporated	111,130	113,014	1.7

Source: Population Estimates for Cities, Counties, and the State January 1, 2021, Demographic Research Unit, California Department of Finance; 2013 – 2017 American Community Survey (5-year estimates)

According to the Total Population Projections, 2010 – 2060, prepared by the State of California Department of Finance's (DOF) Demographic Research Unit, as of July 1, 2021, the estimated total population for Stanislaus County was 561,951. As shown in Figure 2-3, the DOF Demographic Research Unit projects the population for Stanislaus County in 2060 to be 680,311. This represents a 21% increase in population over the next 40 years.

Figure 2-3 Stanislaus County Projected Population Growth



Source: Total Population Projections, 2010 – 2060, California and Counties – 2019, Demographic Research Unit, California Department of Finance

Table 2-3 highlights the County's population characteristics in 2019.

Table 2-3 Stanislaus County Population Characteristics – 2019: ACS 5-Year Estimates

Population	Number	Percent
Total Population	543,194	100%
Sex and Age		
Male	268,881	49.5%
Female	274,313	50.5%
Median Age (years)	34.1	N/A
17 and Under	147,206	27.1%
65 Years and Older	69,529	12.8%
Disabled	71,158	13.1%
Total Households	173,898	
Persons per household	3.09	N/A
Median household income	$60,704	N/A
Persons in Poverty, Percent	82,022	15.1%
Language Other than English Spoken at Home	233,030	42.9%
Education		
High School Graduate or Higher, Percent (25 years and over)	271,121	78.9%
Bachelor's Degree or Higher	58,760	17.1%
Stanislaus County School Enrollment (K-12)	108,614	20%

Source: U.S. Census Bureau, 2015-2019 ACS

The median resident age for Stanislaus County residents is 34.1. Approximately 12.8% of the population is over the age of 65. The disability status of the civilian non-institutionalized population is 13.1%. Of the 13.4%, 8.2% are under 18 years, 51.4% are 18-64 years, and 40.5% are 65 years and older. For the total population five years and older, 57.1% speak English only in the home and 42.9% speak a language other than English.

Table 2-4 summarizes the estimated population statistics by race based on the U.S. Census ACS data.

Table 2-4 2015 – 2019 American Community Survey County Population by Race

Estimated Population	543,194	100%
Hispanic or Latino	251,259	46.3%
White	227,369	41.9%
Black	15,311	2.8%
American Indian and Alaska Native	2,481	0.5%
Asian	29,284	5.4%
Native Hawaiian and Other Pacific Islander	3,625	0.7%
Some Other Race	747	0.1%
Two or More Races	13,118	2.4%

Source: U.S. Census Bureau, 2015-2019 ACS

The 2015-2019 ACS (5-year estimates) provided by the California DOF shows that the total population of Stanislaus County is comprised of 46.3% Hispanic or Latino, 41.9% White, 2.8 % Black, 0.5% American Indian and Alaska Native, 5.4% Asian, 0.7% Native Hawaiian and Other Pacific Islander, 0.1% some other race, and 2.4% two or more races.

2.5 Economy

Stanislaus County's productive soils, long growing seasons, and extensive transportation network combine to make a successful farm and business region. Agriculture is the County's core industry with the value of agricultural commodities produced in 2020 valued at $3,476,093,000. This represents a 3% decrease from the 2019 gross production value and is primarily attributed to the COVID-19 pandemic and the 47-day SCU Lightening Complex fire that burned significant rangeland on the westside of the County. Figure 2-4 includes a bar graph that shows the value of the top agricultural commodities in Stanislaus County like fruit and nut crops followed by livestock and poultry products.

Figure 2-4 Stanislaus County Top Agricultural Commodities: 2019 – 2020 Dollar Value

Source: Stanislaus County Agricultural Crop Report 2020.

According to the Stanislaus County Comprehensive Economic Development Strategy 2021 – 2026, Stanislaus County ranks high in Capital-Intensive Manufacturing. Food and Beverage Manufacturing has long been a well-performing industry for the County. The manufacturing industry also continues to be an important employer in Stanislaus County. The top ten major manufacturing employers in 2020 are listed in Table 2-5.

Table 2-5 Major Manufacturing Employers – 2020

Employer	Description	Employees*
E & J Gallo	Winery	6,000
Foster Farms	Food Processing	2,000
Del Monte Foods	Food Processing	1,500
Stanislaus Food Products	Canning	1,500
Con Agra	Food Processing	1,000
Frito-Lay	Food Manufacturing	650
Blue Diamond Growers	Nut Processor	500
Pacific Southwest Containers	Container Manufacturing	451
Bronco Wine	Winery	450
Siligan Containers	Container Manufacturing	388

Source: Stanislaus County Comprehensive Economic Development Strategy 2021 – 2026

The top ten non-manufacturing employers in Stanislaus County for 2020 are listed in Table 2-6.

Table 2-6 Major Non-Manufacturing Private Employers in Stanislaus County – 2020

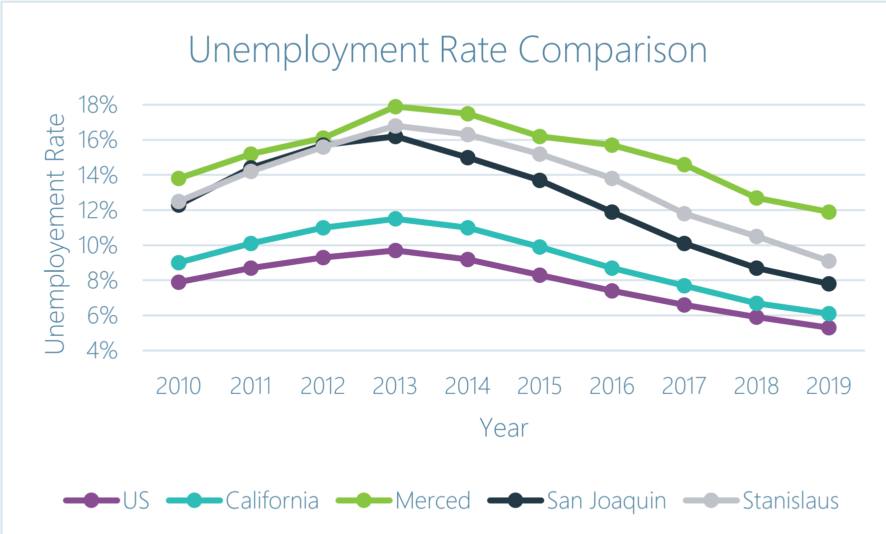
Employer	Description	Employees
Save Mart Supermarkets	Retail Grocery	10,500
Stanislaus County	County Government	3,887
Modesto City Schools	School District	3,200
Doctors Medical Center	Health Care	2,600
Turlock Unified School District	School District	2,000
Memorial Medical Center	Health Care	2,000
Ceres Unified School District	School District	1,500
Stanislaus County Office of Education	Education District	1,130
City of Modesto	City Government	1,200
CSU Stanislaus	Public University	1,000

Source: Stanislaus County Comprehensive Economic Development Strategy 2021 – 2026

2.6 Unemployment Rate Comparison

The County's unemployment rate rose to 16.8% in 2013, the highest figure recorded in 10 years, up from 12.5% in 2010, according to the ACS 5-year estimates. Since 2014, unemployment rates dropped to 9.1% in 2019, which was a decrease from a 10.5% unemployment rate in 2018. At this time, Stanislaus County's unemployment rate is higher than the nationwide and California rates, which are at 5.3% and 6.1%, respectively. Figure 2-5 compares the unemployment rates among the County, State, and surrounding counties in the Central Valley.

Figure 2-5 Unemployment Rates: Stanislaus County versus State and Surrounding Counties

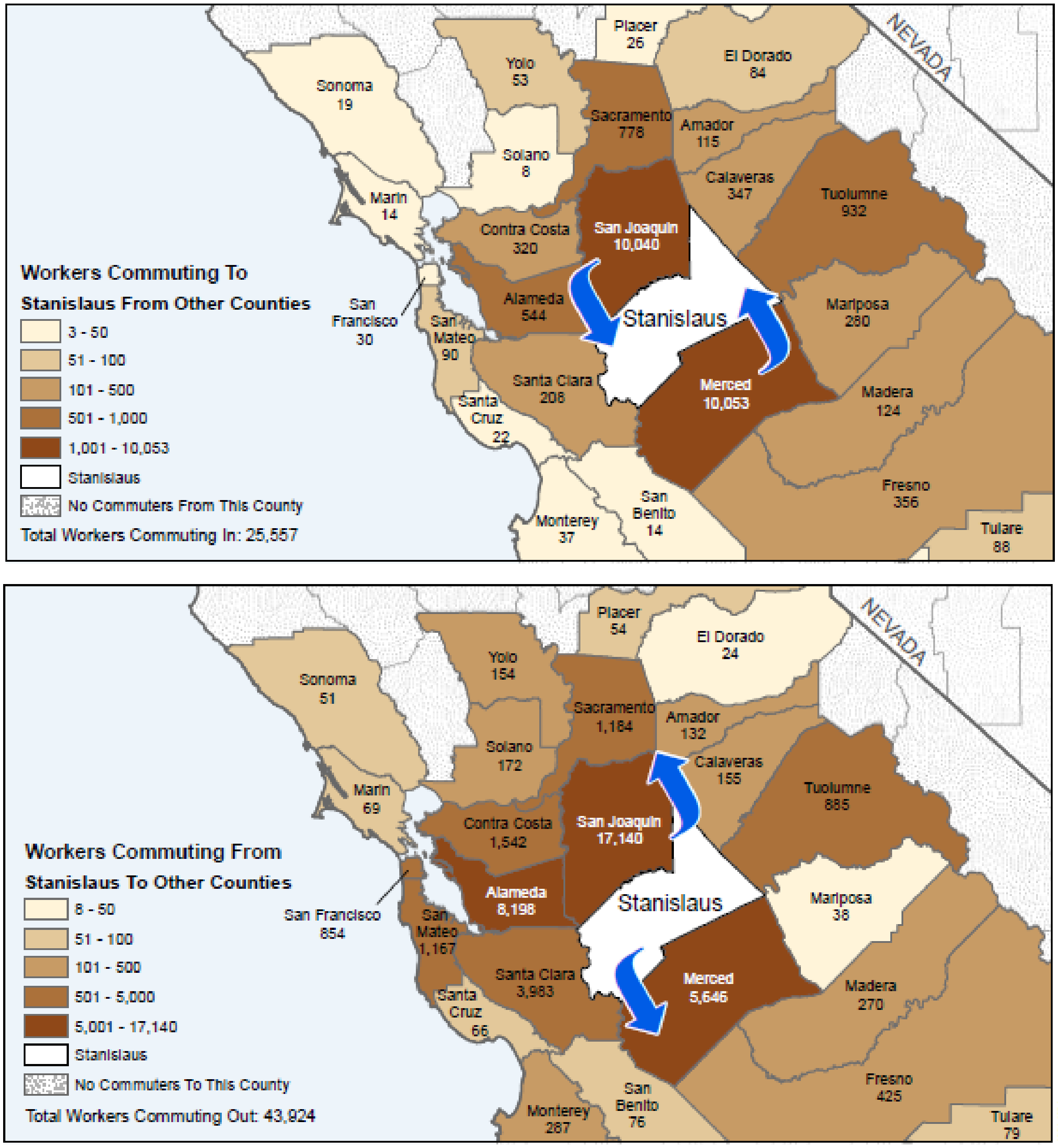


Source: American Community Survey 5-Year Estimates

2.7 Commuters

Unemployment rates can affect the number of commuters who must travel outside Stanislaus County for work. Based on a May 2017 report by the U.S. Census Bureau, the State of California Employment Development Department estimates that 28,612 workers commuted to work from other counties to Stanislaus County and 44,557 workers commuted from Stanislaus County to other counties, as shown in Figure 2-6. These estimates are based on the 152,239 total workers estimated to live and work in Stanislaus County.

Figure 2-6 Stanislaus County to Surrounding Counties Commuter Patterns in 2020



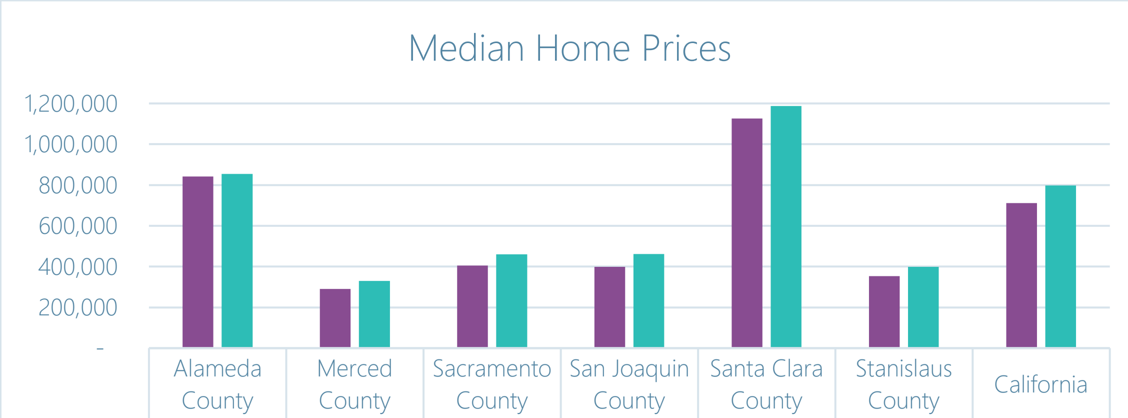
Source: Stanislaus County Commuter Study 2020

According to 2020 Stanislaus County Commuter Study, 24% of Stanislaus County residents work outside the County. Over half of these commuters travel to the Bay Area, specifically Alameda County (25%), Santa Clara County (13%), and Contra Costa County (5%). The other portion travels to San Joaquin County.

2.8 Housing

In 2020, median home values in Stanislaus County had reached $352,968, and by 2021, they had increased by 13.1% to $399,195. Although median home prices in Stanislaus County have increased, the County still lags behind four of the five comparison counties and the State. San Joaquin County had the largest increase with an 15.7% increase in median home values between 2020 and 2021. Figure 2-7 compares the median home prices in Stanislaus County to the State and several of the surrounding counties.

Figure 2-7 Comparison of Median Home Prices in Stanislaus County and Surrounding Counties



	Alameda County	Merced County	Sacramento County	San Joaquin County	Santa Clara County	Stanislaus County	California
2020	841,236	289,863	405,448	398,574	1,126,389	352,958	711,300
2021	854,696	329,284	459,373	461,150	1,187,214	399,195	798,440

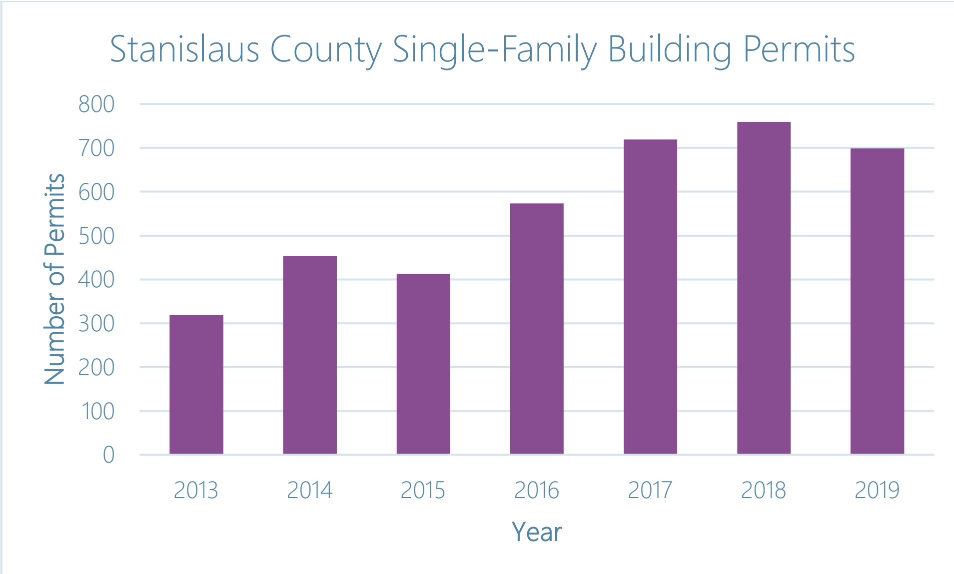
Source: Counties' data is from National Associate of Realtors; State data is from Norada Real Estate Investments.

2.9 Housing and Development Trends

Within the unincorporated area of Stanislaus County there has been no significant development since the previous plan was adopted in 2017. The exception to this is the planned community on the western side of the County called Diablo Grande near the City of Patterson. The community was largely developed in the 1990s, but the community was never built out due to financial issues and the housing crisis. In 2017, the County approved a revised plan for the community that reduced the overall number of single-family and multi-family housing units; the community design also clustered the housing and limited development along the hillsides. This development was also evacuated during the SCU Lightning Complex Fire in 2020. Other development within the County has mainly occurred within the nine cities.

Stanislaus County's Planning and Community Department tracks issued single-family residential construction permits as a way of monitoring the home construction, building materials and construction employment sector. After reaching a low of 413 in 2015, issued permits steadily increased to 759 permits issued in 2018. In 2019, issued permits decreased to 699 permits. These building permit trends are shown in Figure 2-8. The County's Planning and Community Development Department also issued 145 new single-family dwelling unit permits from 2016 through 2020; these permits include new dwelling units, not modifications or improvements to existing single-family residential uses (Stanislaus County 2021).

Figure 2-8 Stanislaus County Single-Family Building Permit Trends: 2013 – 2019



Source: United States Census Bureau

NOTE: The single-family building permit trends was derived from the US Census Bureau and does not include the County Community Development Department issued permit data.

2.10 Transportation

According to the California Department of Transportation (Caltrans), in 2019 Stanislaus County had 188 miles of State Highways, 1606 miles of county roads, 1,292 miles of city roads, and 383 bridges. There were 525,565 registered vehicles, including 327,336 registered automobiles, and 117,116 registered trucks. The County had 355,857 licensed drivers. Among all the workers who are 16 years and over (230,975), 93.7% commuted by driving alone or carpooling in a car, truck, or van.

2.11 Highways/Roads/Bridges

State Highways 99, 108/120, 33, 132, and Intestate 5 (I-5) are major transportation routes through the County. Highways 99, 33 and I-5 run north – south and Highways 108/120 and 132 run east – west. These major highway/freeway routes would be highly utilized by both County residents and tourists as possible evacuation routes.

Public roadways and bridges within Stanislaus County are owned and maintained by Caltrans, Stanislaus County Public Works Department, and the nine city Public Works Departments. A high potential exists for road closures due to flooding or earthquakes. Parts of the County may become isolated for a period of time when these conditions exist. While most secondary roads are paved, there are still a number of unpaved public roads within the County.

2.12 Airports

One joint County/City of Modesto operated airport is in Stanislaus County. The Modesto City-County-Harry Sham Field Airport's runways are 5904 feet and 3464 feet, respectively. The airport operates 24 hours daily, although the tower is closed at night. It is capable of multiple engine propeller aircraft or jet aircraft, as large as a 737-400. There are an additional four airports in Stanislaus County: Oakdale Municipal Airport (2400 foot east-west runway), Turlock Municipal Airport (2985 foot north-south runway), Patterson Airport (2500 foot north-south runway) and the Crows Landing Naval Air Station. Both the Patterson Airport and the Crows Landing Naval Air Station are not functional airports. In Patterson, the runway and tarmac are leased by a private company and a landing area is used for medical helicopters.

2.13 Railroads

The Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) Railroads are the freight lines serving Stanislaus County. Both have tracks running north – south in the County. Amtrak passenger service is provided on the BNSF track with a passenger station located in eastern Modesto. Sierra Railroad serves between Tuolumne County and the City of Oakdale in Stanislaus County. Also, the Modesto and Empire Traction Company (M&ET), a short line freight railroad, provides interconnection services between UP and BNSF Railroads, as well as serving the industrial hub of the County. M&ET operates 5 miles of yard main track and an additional 48.7 miles of track within the Beard Industrial District.

2.14 Medical Facilities

Stanislaus County is home to Doctors Medical Center, Emanuel Medical Center, Memorial Medical Center, Kaiser Permanente Modesto Medical Center, Oak Valley Hospital, and Stanislaus Surgical Hospital. All but the Stanislaus Surgical Hospital provide Basic Emergency Services. These medical facilities are listed in Table 2-7. Only Doctor's Medical Center and Memorial Hospital provide Level II Trauma Services.

The County also has approximately 20 licensed Nursing and Rehabilitation Care Centers that can coordinate with hospitals to alleviate surge during an incident. In addition, Stanislaus County Health Services Agencies has medical offices in Ceres, Hughson, Modesto, and Turlock, and provides a variety of medical services throughout the County.

Table 2-7 Medical Facilities in Stanislaus County

Hospital	Number of Staffed Beds	ER Services	Trauma Services
Doctor's Medical Center, Modesto	461	Basic Emergency	Level II
Emanuel Medical Center, Turlock	209	Basic Emergency	None
Kaiser Permanente Modesto Medical Center, Modesto	140	Basic Emergency	None
Memorial Hospital, Modesto	423	Basic Emergency	Level II
Oak Valley Hospital, Oakdale	150	Basic Emergency	None
Stanislaus Surgical Hospital, Modesto	23	None	None

Source: California Office of Statewide Health Planning and Development

2.15 Arts, Entertainment and Recreation

Stanislaus County offers a variety of arts, entertainment, and recreation opportunities. The County is home to a vibrant arts community with the world class Gallo Center for the Arts, a symphony orchestra, and abundant visual and performing arts. Notable places of interest include the McHenry Mansion, McHenry Museum, the State Theater in Modesto, the Carnegie Arts Center in Turlock, and the Assyrian Cultural Center in Ceres.

For sports enthusiasts, John Thurman Field, located in the City of Modesto, is home to the Modesto Nuts, a minor league baseball team, aligned in the Low-A West North Division as an affiliate of the Seattle Mariners.

Stanislaus County maintains five regional parks, 22 neighborhood parks, eight special interest parks, 9 miscellaneous parks and open space assets, community parks, two off-highway vehicle parks, five fishing access points along rivers and lakes, and two swimming pool. Day use and camping is available at Frank Raines Regional Park and La Grange Regional Park, and camping, boating and other recreational activities are available at the Modesto Reservoir Regional Park and Woodward Reservoir Regional Park.

2.16 County's Mitigation Capabilities

The following section assesses the County's and each participating jurisdictions' existing capabilities to pursue hazard mitigation. The capability assessment analyzes Stanislaus County's capabilities that can be leveraged to mitigate hazards. Combining the risk assessment and consequence analysis with the mitigation capability assessment results in the County's "net vulnerability" to disasters, and more accurately focuses the goals, objectives, and proposed actions of this plan.

The Hazard Mitigation Planning Committee (HMPC) used a two-step approach to conduct this assessment for the County and jurisdictions. First, an inventory of common mitigation activities was made using a matrix. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

This assessment is divided into four sections: regulatory mitigation capabilities; administrative and technical mitigation capabilities; fiscal mitigation capabilities; and mitigation outreach and partnerships. Additional information on jurisdiction capabilities can also be found in the participating jurisdiction's annexes.

2.16.1 Regulatory Mitigation Capabilities

The regulatory and planning capabilities listed in Table 2-8 outline planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicate those that are in place in Stanislaus County.

Table 2-8 Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Stanislaus County	Ceres	Hughson	Modesto	Newman	Oakdale	Patterson	Riverbank	Turlock	Waterford	Office of Education
General plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Zoning ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Subdivision ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Growth management ordinance	No	No	No	No	No	No	No	No	No	No	N/A
Floodplain ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Other special purpose ordinance (storm water, steep slope, wildfire)	Yes	Yes	Yes	Yes	Yes,	Yes	Yes	Yes	Yes	Yes	N/A
Building code	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Fire department ISO rating	Yes	Yes, Rating 3	Yes, Rating 4/8B	Yes Rating 2	Yes, Rating 3	Yes, Rating 3/6	Yes, Rating 2/2Y	4/4Y	Yes, Rating 2	4/4Y	See Note 1
Erosion or sediment control	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	N/A
Storm water management program	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	N/A
Site plan review requirements		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	N/A
Capital improvements plan	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	N/A
Economic development plan	Yes	Yes	No	No	No	No	No	Yes	Yes	No	N/A
Local EOP	Yes	No	No	No	No	No	No	Yes	No	Yes	N/A
Other special plans	N/A	N/A	n/a	No	No	N/A	N/A	N/A	N/A	N/A	N/A
Flood insurance study or other engineering study for streams	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	N/A
Elevation certificates	Yes	Yes	Yes	No	Yes	N/A	Yes	Yes	No	No	N/A

Source: Hazard Mitigation Planning Committee
NOTES: 1 – New K-12 school construction and modernization projects must submit site plans for review through the Division of State Architect's (DSA) process.

2.16.2 Related Plans and Regulations

Stanislaus County General Plan, 2015

The General Plan guides the physical development, preservation, and conservation of areas within the unincorporated areas of the County. The General Plan covers the entire Stanislaus County and discusses various subjects comprehensively. The General Plan plans for the long term – ranging from 15 to 30 years. The General Plan identifies adopted goals, policies and implementation that govern the development in the County. In addition, the General Plan includes a Land Use Diagram for all areas within its jurisdiction.

The General Plan is further carried out by the following tools:

- Specific and Community Plans
- Zoning Ordinance
- Subdivision Ordinance
- Approval of Individual Development Applications
- The County's five-year Capital Improvement Program (CIP)
- Environmental Assessment and Review Procedures under the California Environmental Quality Act (CEQA)

The County's General Plan includes the seven mandatory elements: the Land Use Element, Circulation Element, Conservation/Open Space Element, Noise Element, Safety Element, 2015-2023 Housing Element, and the Agricultural Element. The Safety Element contains the goals and policies that address natural and human-caused hazards in the County.

Safety Element

The Safety Element policies focus on the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure; tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides, subsidence; liquefaction; and other geologic hazards known to the legislative body; flooding; military installations; and wildland and urban fires. The County is susceptible to all the main safety hazards with the exception of tidal waves associated with a tsunami, military installations, and major hazardous waste disposal sites. There are also no special airspace and aircraft training routes in Stanislaus County. The County's Safety Element, therefore, focuses its goals, policies, and implementation programs on seismic and geologic hazards, dam inundation, flood hazards, fire hazards, hazardous materials, airports, and other safety hazards related to unprotected canals, insufficient safety lighting, antennas, communication towers, and wind generation facilities near agricultural areas. Additionally, the Safety Element integrates a brief section on climate vulnerability and climate adaptation information. The Safety Element also fully incorporates the County's 2010 MJHMP by reference to meet the requirements under California Government Code Section 65302(g)(4). During the 2022-2027 MJHMP update, the County OES and Planning and Community Development Department collaborated so that the forthcoming Safety Element update would complement and be consistent with the efforts already underway associated with the MJHMP, such as the climate-related hazards profiled and the other climate change considerations addressed in the risk and vulnerability assessment.

Stanislaus County Emergency Operations Plan, 2021

The Emergency Operations Plan (EOP) "Basic Plan" updated in 2021 addresses the planned response to extraordinary emergency situations associated with natural or human-caused disasters, technological incidents, and national security emergencies in or affecting Stanislaus County. This EOP focuses on operational concepts and would be implemented relative to large-scale disasters which can pose major threats to life, property and the environment requiring unusual emergency responses.

This EOP establishes the emergency management organization required to mitigate any significant emergency or disaster affecting Stanislaus County. It also identifies the roles and responsibilities required to protect the health and safety of Stanislaus County residents, public and private property, and the environmental effects of natural, man-made, and technological emergencies and disasters. The EOP further establishes the operational concepts associated with a field response to emergencies, the Stanislaus County Emergency Operations Center (EOC) activities, and the recovery process.

In addition, the EOP is based on the National Incident Management System (NIMS) and its component parts, along with the California Standardized Emergency Management System (SEMS), including the five functional areas of the Incident Command System (ICS): Management/Command, Operations, Planning, Logistics, and Finance/Administration. The 2021 EOP is organized into the Basic Plan, Emergency Support Functions, and annexes that contain general and specific information related to County emergency management operations.

Disaster Council and Emergency Services Ordinance, (County Code Chapter 2.52)

The purpose of this chapter is to provide for: 1) The preparation and effectuation of plans to protect persons and property in this County in emergencies; 2) the creation, direction, and operation of the County emergency organization; and 3) the coordination of the County's emergency services and functions with those of other public and private entities, organizations, and persons. (Ord. CS 1288 §1, 2020).

Building Code (County Code Chapter 16.05)

The County adopted the California Building Code, as published by the International Code Council, 2019 Edition, Part 2, Volume 1, Chapter 1, Division II Scope and Administration and Part 2, Volume 2, Appendix "C" "Group U – Agricultural Buildings," Appendix "H" "Signs," and Appendix "J" "Grading." The code updates are adopted by reference and incorporated to also include the California Building Code, 2019 Edition, Chapter 1, Division II requirements. Section C101.4 in the County Code is also added to cover earthquake loads for agricultural structures.

Floodplain Management Ordinance (County Code Chapter 16.50)

The purpose and objective of these regulations and the flood load and flood resistant construction requirements of the building codes are to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific flood hazard areas through the establishment of comprehensive regulations for management of flood hazard areas, designed to:

- Minimize unnecessary disruption of commerce, access, and public service during times of flooding.
- Require the use of appropriate construction practices in order to prevent or minimize future flood damage.
- Manage the alteration of natural floodplains, stream channels and shorelines to minimize the impact of development on the natural and beneficial functions of the floodplain.
- Manage filling, grading, dredging, mining, paving, excavation, drilling operations, storage of equipment or materials, and other development which may increase flood damage or erosion potential.
- Prevent or regulate the construction of flood barriers which will divert floodwater or increase flood hazards.
- Contribute to improved construction techniques in the floodplain.
- Minimize damage to public and private facilities and utilities.
- Help maintain a stable tax base by providing for the sound use and development of flood hazard areas.
- Minimize the need for rescue and relief efforts associated with flooding.
- Ensure that property owners, occupants, and potential owners are aware of property located in flood hazard areas.
- Minimize the need for future expenditure of public funds for flood control projects and response to and recovery from flood events.
- Meet the requirements of the National Flood Insurance Program for community participation as set forth in Title 44 CFR, Section 59.22. (Ord. CS 1301 §2, 2021).

Stanislaus County Extreme Heat Contingency Plan (2018)

The 2018 Stanislaus County Extreme Heat Contingency Plan, which functions as a supporting document to the Stanislaus County EOP and the State of California Contingency Plan for Excessive Heat Emergencies. The Extreme Heat Contingency Plan outlines the actions that will be taken by the Operational Area and local government when an extreme heat event is anticipated, is in the process of occurring, or has occurred. This plan is designed to facilitate preparedness for, and response to, future excessive heat events. It also provides guidance for local government and non-governmental organizations in the preparation of their heat emergency response plans and other related activities.

The plan describes Operational Area coordination during heat-related emergencies and provides guidance for Stanislaus County government, other governmental agencies, local businesses, community-based organizations, and faith-based organizations, in the preparation for, and response to, emergency incidents of extreme heat. The plan recognizes the need for the County of Stanislaus to: 1) identify when the health of populations and/or subpopulations of local residents may be threatened by extreme heat conditions; 2) communicate with the public to convey information about resources available for protection against extreme heat emergencies in time to allow for preparations to be made; 3) communicate and coordinate with State and local agencies; 4) mobilize resources and initiate actions to augment local resources as needed; and 5) employ the SEMS/NIMS in organizing a response to an extreme heat emergency. The plan also recognizes three phases of activation: 1) pre-seasonal readiness, 2) excessive heat watch/advisory, and 3) excessive heat warning. Specific actions are associated with each activate phase.

Modesto Subbasin Groundwater Sustainability Plan (2022)

The Sustainable Groundwater Management Act (SGMA) requires the formation of local Groundwater Sustainability Agencies (GSAs) to oversee the development and implementation of Groundwater Sustainability Plans (GSPs). The goal of the GSPs is to achieve sustainable management of the State's groundwater basins.

In 2017, member agencies of the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) – City of Modesto, Modesto Irrigation District, City of Oakdale, Oakdale Irrigation District, City of Riverbank, City of Waterford, and Stanislaus County – formed as a GSA. STRGBA GSA has the authority and responsibility to manage the groundwater basin. Many groundwater basins in the San Joaquin Valley have experienced heavy groundwater pumping – especially during the recent drought. Several are now in a condition of critical overdraft. The Modesto basin is not considered to be critically over drafted, but since most of the cities within the basin rely solely on groundwater, the Modesto basin is considered a high-priority basin. Due to that designation, SGMA requires that STRGBA adopts and begins implementation of a GSP by January 31, 2022.

East Stanislaus Integrated Regional Water Management Plan (IRWM) (2018)

The East Stanislaus Regional Water Management Partnership (ESRWMP) was formed in 2011 to create the East Stanislaus Integrated Regional Water Management (IRWM) planning region and began the planning process. The purpose of an IRWM Plan is to: develop regional understanding; identify water resources solutions; reflect the regional needs; maximize benefits through integration of water management strategies; leverage regional resources through partnerships; be eligible for State funding through the IRWM grant program.

The Region's first IRWM Plan, created in 2013, was updated in 2018 to comply with State guidelines for IRWM Plans. The Region was awarded a Proposition 1 (Prop 1) planning grant of $147,000 from the California Department of Water Resources (DWR) in order to help fund the update process. The main purpose of the IRWM update is for the Region to identify projects and measures to be implemented to meet the Region's goals. In addition, the updated IRWM Plan will achieve the following objectives: comply with Prop 1 IRWM Guidelines and Plan Standards; address new legislation requirements, including Senate Bill (SB) 985, Assembly Bill (AB) 1249, and AB 52; and reflect current conditions and water resources-related work completed in the region since completion of the original IRWMP in 2013.

Mid San Joaquin River Regional Flood Management Plan (MSJR RFMP) (2017)

The Mid San Joaquin River Regional Flood Management Plan (MSJR RFMP) was first developed in 2013 and 2014, and was updated in 2017, through the participation of a range of stakeholders primarily from Stanislaus County. This regional planning effort was created to give stakeholders the opportunity to develop a plan to reduce flood risks in the area from the confluence of the Merced and the San Joaquin Rivers to the confluence of the Stanislaus and the San Joaquin Rivers. The result of these efforts is a vision for a safer and more flood-resilient region that identifies challenges and opportunities for flood management and a prioritized list of actions for DWR to consider in their Central Valley Flood Protection Plan (CVFPP). The

MSJR RFMP also identifies priority flood protection projects to be carried out by local sponsors. Millions of dollars have been raised by local sponsors from a variety of state, federal and other sources to make these projects a reality. The major focuses of MSJR RFMP include identifying new projects consistent with regional flood management goals and state polices, ways to improve regional coordination of flood management, and ways to improve regional resilience to evolving flood hazards.

Stanislaus County has numerous other plans, programs, and procedures in place that support hazard mitigation, public health and safety, hazardous materials management, and emergency operations. Some of these plans will also be incorporated by reference in this plan. These plans are listed below.

- Alert & Warning Plan (Under development based on 2021 EOP Basic Plan)
- Agriculture Response Plans
- Animal Disease Response Plan
- Area Plan for Emergency Response to Hazardous Materials Incidents in Stanislaus County
- Avian Influenza Plan
- Care and Shelter Operations Plan
- Continuity of Operations/Continuity of Government Plans (COOP/COG)
- Ethanol Facility Emergency Response Plan
- Extreme Cold and Freeze Plan
- Exotic Newcastle Disease (END) Task Force Plan
- Mass Fatality Plan
- Public Health All Hazards Emergency Operations Plan (AHEOP)
- Stanislaus County Flood Emergency Operations Plan (RDs 2063, 2091, and 1602)
- Stanislaus County Water Contingency Plan
- Stanislaus County Health Services Agency Crisis & Risk Communication Plan

Related partner agency plans, some of which were reviewed to inform the MJHMP update risk assessment and mitigation strategies based on public availability, as they relate to flooding, drought and water supply, and PSPS events are listed below.

- American Red Cross Emergency Plan
- Cal State University Stanislaus EOP
- Department of Water Resources Directory of Flood Officials
- Del Puerto Canyon Water District HMP
- East Side Mosquito-Borne Disease Guidance
- Merced Irrigation District EAP
- Modesto Irrigation District ERP
- Modesto Irrigation District Capacity and Energy Emergency Load Reduction Plan
- Modesto and Empire Traction Company EOP
- Pacific Gas and Electric (PG&E) ERP
- Reclamation EAP
- San Luis Field Division EOP
- Tri-Valley Dam Project EAP
- Turlock Irrigation District EOP
- Turlock Irrigation District LHMP
- Turlock Lake EAP
- United Way Emergency Volunteer Center Operations Plan
- Yosemite Community College District EOP

2.16.3 Administrative and Technical Mitigation Capabilities

Table 2-9 below identifies the County personnel responsible for activities related to mitigation and loss prevention in Stanislaus County and the unincorporated areas. Many positions are full time and/or filled by the same person. A summary of technical resources follows.

Table 2-9 Stanislaus County Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Public Works Department
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Public Works Department
Planner/engineer/scientist with an understanding of natural hazards	Yes	Public Works Department
Personnel skilled in Geographic Information System (GIS)	Yes	IT Central Department
Full time building official	Yes	Planning and Community Development
Floodplain manager/Floodplain Administrator	Yes	Planning and Community Development
Emergency manager	No	Office of Emergency Services
Grant writer	Yes	
Other personnel	N/A	
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	Yes	Stanislaus County Open Data
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Yes	Office of Emergency Services
Other	N/A	

Source: Hazard Mitigation Planning Committee

Office of Emergency Services

The Office of Emergency Services (OES) Division is responsible for the day-to-day administration of Stanislaus County's disaster preparedness, mitigation, response, and recovery programs. OES develops and maintains the Stanislaus County LHMP and EOP and its associated annexes. OES also coordinates training, planning and exercises for first responders throughout the Stanislaus Operational Area. StanEmergency.org keeps the public informed regarding fire safety, the recent COVID-19 pandemic, drought, extreme heat, Pacific Gas & Electric (PG&E) Public Safety Power Shutoffs and other hazard events.

StanAware is the Stanislaus County OES communications system that allows the public to be contacted directly in case of a large-scale emergency and keep local citizens informed in the event of an emergency or disaster.

StanAware utilizes the Everbridge Mass Notification System in use by many other government agencies, universities, and corporations. In the event of an emergency or disaster, residences and businesses within Stanislaus County can be contacted by telephone, text, or email with emergency alert information. The Stanislaus County OES can send a message regarding a situation to residences and businesses within a certain geographical area(s) that will contain special notice and instructions to be followed by citizens in the area. Emergencies are defined as situations or impending situations caused by forces of nature, accident or an intentional act that constitutes a danger of major proportions to life and property.

In the County's 2017 LHMP, the County's OES and its CEO were assigned 10 mitigation actions, including one for earthquake, three for dam incidents, two for flooding, and four to address multiple hazards.

Stanislaus County Fire Prevention Bureau

The Fire Prevention Bureau's mission is to reduce the risk of fire; thus, protecting the lives, welfare, and economic vitality of the community. This is accomplished by providing a variety of services such as plan checking of new construction and tenant improvement projects, issuing permits for various operations involving fire safety, public fire safety education and enforcement of California Fire Code regulations. The Fire Prevention Bureau is composed of highly trained professionals consisting of the Fire Marshal, Fire Prevention Inspectors, and administrative assistants.

Stanislaus County Fire Warden

The Fire Warden supports and coordinates all public fire services agencies in the County, with an emphasis on special fire districts. Activities include fire prevention and plan review, training, and fire and rescue mutual aid management. The Fire Warden's provides various responsibilities to the community, including the following:

- Serves as Stanislaus County's Fire and Rescue Operational Area Coordinator;
- Coordination and assistance to fire departments and fire districts within Stanislaus County;
- Serves as a liaison between local fire agencies and County departments;
- Provides coordination efforts for local fire representatives to establish and implement operational level standards;
- Manages and directs the multi-jurisdictional "OES On-Call Duty Officer" program;
- Manages the Fire Prevention Bureau;
- Provides operational level support to the multi-jurisdictional Arson Task Force; and
- Manages the Operational Area's California Incident Command Certification System (CICCS).

Moreover, in the County's 2017 LHMP, the County's Fire Prevention Bureau and Fire Warden were assigned five mitigation actions. All five actions were to address wildfire hazard.

Stanislaus Consolidated Fire Protection District

The Stanislaus Consolidated Fire Protection District (SCFPD) was formed on March 3, 1995 as a result of Project 94, an exploratory project with the goal of providing the most effective and efficient method of public fire service delivery by reorganizing or combining fire service agencies. SCFPD serves a territory of 195 square miles within the original boundaries of the Riverbank Fire Protection District, Empire Fire Protection District, Waterford-Hickman-LaGrange Fire Protection Districts, and the Stanislaus County Fire. SCFPD serves a population of 50,000+ residents within its geographical boundaries. Within these boundaries SCFPD provides service to two cities (Riverbank & Waterford), and unincorporated areas within the County (Empire, La Grange, Hickman, Eastern Stanislaus County, Airport District, Gallo Winery, and Beard Industrial Tract).

Stanislaus County Planning and Community Development Department

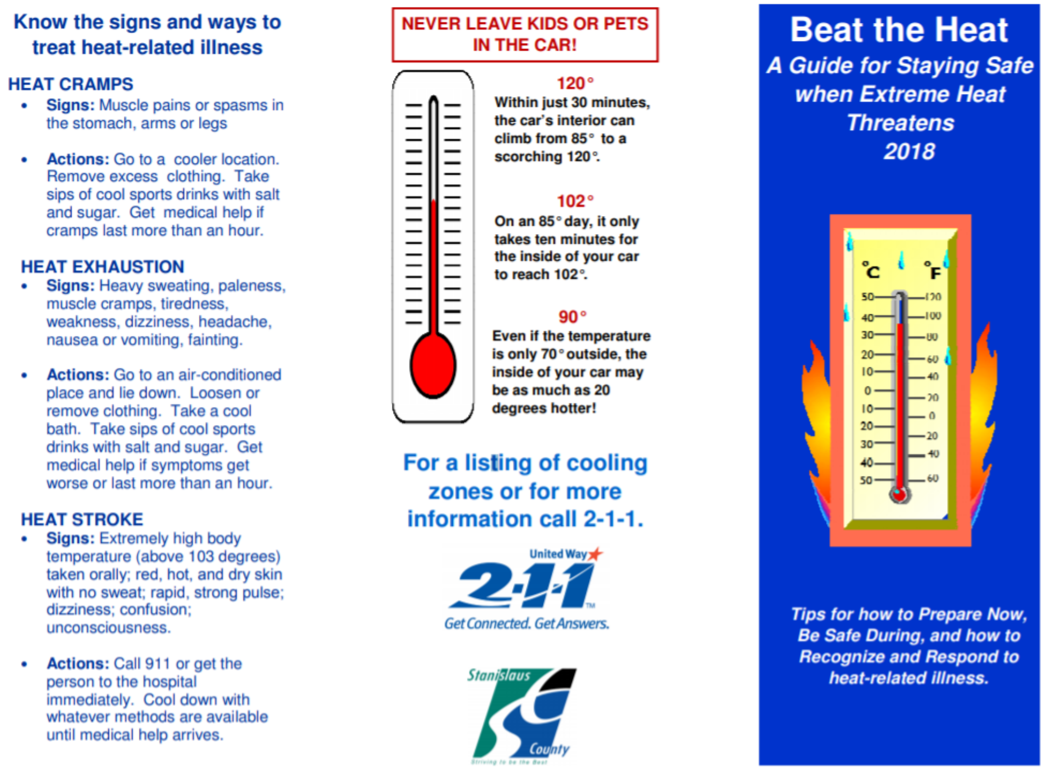
The Planning and Community Development Department promotes community and economic development by providing a diverse land use base focused on promoting and protecting local agriculture, enhancing community infrastructure and public services, and providing high quality, streamlined permit processing services.

The Planning and Community Development Department has three primary divisions. These divisions include 1) managing building permits, which include construction permits; floodplain administration; and abandoned and dangerous building abatement; 2) governing Community Development, including administrating Stanislaus Urban County Community Development Block Grant (CDBG) and Emergency Solutions Grant (ESG) fund administration; and housing programs (first-time home buyer and rehabilitation programs); and 3) Planning, which includes General Plan, Zoning Ordinance, and Subdivision Ordinance administration and implementation; California Land Conservation Act (Williamson Act) administration; and State Mining and Reclamation Act administration.

StanEmergency – "Beat the Heat" Webpage

StanEmergency maintains a webpage to offer insights regarding extreme heat prevention and preparedness, which includes tips to beat the heat, heat safety tips for pets, cooling zone locations, heat hotline and other relevant information available in English and Spanish. "Tips to beat the heat" information is shown in Figure 2-9.

Figure 2-9 Publicly Available Information Regarding Extreme Heat on StanEmergency.org



Source: StanEmergency.org

2.16.4 Fiscal Mitigation Capabilities

Table 2-10 identifies financial tools or resources that the County could potentially use to help fund mitigation activities.

Table 2-10 Stanislaus County Financial Capabilities

Financial Resources	Accessible/ Eligible to Use	Comments/Has this been used for mitigation in the past?
Community Development Block Grants	Yes	No. The County can use U.S. Department of Housing and Urban Development (HUD) funds to acquire real property, relocate and demolish structures in hazard areas, rehabilitate residential and non-residential structures, and construct or improve public facilities. Such funding is available through the CDBG Entitlement Communities Grants. The Planning and Community Development Department also administers the Stanislaus Urban County CDBG and Emergency Solutions Grant (ESG) funds.
Capital improvements project funding	Yes	No.
Authority to levy taxes for specific purposes	Yes	Has not been used. Must be approved by voters.
Fees for water, sewer, gas, or electric services, new development	Yes	Has not been used. Services provided through cities or districts and levied through property assessments.

Financial Resources	Accessible/ Eligible to Use	Comments/Has this been used for mitigation in the past?
Incur debt through general obligation bonds	Yes	No.
Incur debt through special tax bonds	Yes	Has not been used. Must be approved by two-thirds voters.
Incur debt through private activities	Yes	Has not been used. Do not have any in place.
Federal Grant Programs (HMGP)	Yes	Has not been used. Various departments in Stanislaus County are eligible and will remain eligible for HMA BRIC funding that focuses on risk reduction and funding of public infrastructure projects that increase the County's resilience to disasters. The County is eligible for HMA FMA funding that funds projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the NFIP. The County is also eligible for Homeland Security Preparedness Technical Assistance Program funding. This funding source builds preparedness technical assistance activities in support of the four homeland security mission areas related to prevention, protection, response, and recovery.

Source: HMPC 2021

2.16.5 Other Mitigation Programs and Partnerships

Table 2-11 below summarizes some of the mitigation partnerships and education or outreach capabilities available to Stanislaus County.

Table 2-11 Stanislaus County Education and Outreach Capabilities

Education & Outreach	Yes/No	Comments
Local Citizen Groups That Communicate Hazard Risks	Yes	See below.
Firewise USA	No	There are currently no Firewise USA communities in the County.
StormReady	Yes	Both the County and California State University are participants.
Other		

Source: HMPC 2021

American Red Cross: The American Red Cross identified several capability enhancements through collaboration with the County, cities, and fire departments of Stanislaus County. Programs such as outreach campaigns for preparedness education, continuing shelter inspections, and updating existing points of contact for shelter sites. These efforts will improve the American Red Cross' ability to conduct mitigation, preparedness, and response efforts in Stanislaus County.

Dam Owners and Operators Coordination: Stanislaus County coordinates with numerous dam owners and operators, including owners upstream of the County. Coordination involves partnerships with federal, state, and local officials, agency engineers, emergency managers, emergency preparedness coordinators, dam owners and operators, and property owners near areas that can be potentially affected by dam incidents. Key agencies within the County's partnership include the FEMA's National Dam Safety Program (NDSP), Army Corps of Engineers (USACE), Bureau of Reclamation, California Division of Safety of Dams (DSOD), Pacific Gas and Electric (PG&E), Modesto Irrigation District (MID), Turlock Irrigation District (TID), Merced Irrigation District, Del Puerto Canyon Water District, and others such as South San Joaquin Irrigation District (SSJID), Modesto Irrigation District, the City of Modesto, and Oakdale Irrigation District (OID). Given there are range of mitigation actions that can be taken to reduce the risk of dam incidents and the effects of dam failure, the County has an ongoing partnership with key dam owners and operators in order to ensure each agency is aware of each other's actions and to coordinate them effectively, recognizing that working together maximizes risk reduction. As a result, many of these dam owners and operators were invited as stakeholders to inform and support the update of the County's MJHMP. Information on these dam owners and operators are shown in the table below.

Table 2-12 Stanislaus County Dams of Concern Owner/Operator & Emergency Information

County	Dam Name	Dam Owner/Operator	Whether or not an office, department, or agency supports dam mitigation actions
Stanislaus	Modesto Reservoir	MID	Yes
	Woodward	SSJID	Yes
	Turlock Lake	TID	Yes
	Modesto Effluent Storage	City of Modesto	Yes
	Conagra Aerated and Settling Ponds	ConAgra Grocery Products Company, LLC	Yes
Tuolumne	Don Pedro	TID	Yes
	Don Pedro Dike A	TID	Yes
	Don Pedro Dike B	TID	Yes
	Don Pedro Dike C	TID	Yes
	Relief	PG&E	Yes
Calaveras	Goodwin	Tri-Dam Project (Oakdale Irrigation District & South San Joaquin Irrigation District)	Yes
	New Melones	Bureau of Reclamation	Yes
	Tulloch	SSJID	Yes
Mariposa	Exchequer Dike	Merced Irrigation District	Yes
	Exchequer Main (New Exchequer)	Merced Irrigation District	Yes
	Mcswain	Merced Irrigation District	Yes
Merced	San Luis Reservoir	Bureau of Reclamation, California DWR	Yes
Fresno	Pine Flat	USACE – Sacramento District	Yes

2.16.6 Opportunities for Enhancement

The 2021 MJHMP update provided the County and the participating jurisdictions an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Specific opportunities could include:

Safety Plan Update: Stanislaus County has identified several plans which could be updated, specifically the County's General Plan Safety Element last updated in 2016. During the MJHMP update process, the County also indicated they are in the process of soon updating the Safety Element. The County's Safety Element was last updated in 2016 to incorporate by reference the 2010 LHMP, the County's Planning and Community Development Department began scoping the Safety Element update as the MJHMP went out for public review. The County should incorporate the 2021-2022 MJHMP to become eligible again for CDAA funding in the event of a disaster; this process also ensures further consistency of each plan and provides an opportunity to reference the MJHMP and enhance the capabilities for implementation of goals and objectives of each plan. The Safety Element does not currently cover extreme heat, smoke, drought, and how these hazards disproportionately impact vulnerable and environmental justice communities. A comprehensive update of the Safety Element to include hazards and mitigation strategies addressed in the 2010-2022 MJHMP update will align and integrate each plan.

Training: Provide training opportunities to help inform County staff on how best to integrate hazard information and mitigation projects into their departments. Stanislaus County has identified a multi-year training and exercise plan which would cover all county departments. There are also several financial resources that the County could leverage in the future for funding mitigation efforts. In particular, the MJHMP provides eligibility for the FEMA HMA grants. County OES staff can attend workshops and training regarding the grant application process and how to develop successful grant applications under the HMGP. Cal OES periodically hosts related training and webinars. Understanding the types of projects that can be funded, and the components of a successful application will enhance the chances of a successful grant award.

Hazard Mitigation Specialist: The County could appoint or assign someone in OES to oversee hazard mitigation grant opportunities. This could be a follow-up goal to the Cal OES grant training. This specialist can notify the County departments/agencies of upcoming grant cycles, and support tracking and completing the Notice of Intent (NOI) applications, grant applications, and final grant management reporting requirements. Related financial opportunities for enhancement should include applying for HMA grants, such as BRIC and HMGP funding as it becomes available. The Hazard Mitigation Specialist should also focus on funding mitigation actions that mitigate critical infrastructure, provide protection for those most vulnerable in the community, address climate change, public health hazards, extreme heat, flooding, other climate-related hazards and needed and related climate adaptation strategies.

HMGP Technical Assistance: HMGP funding opportunity provides support for communities to implement mitigation activities to reduce risk to life and property from natural hazards. In California, natural hazards include wildfire, earthquake, drought, extreme weather, flooding, and other impacts of climate change. Cal OES technical subject-matter experts are available to discuss project eligibility, benefit cost analysis, technical feasibility, and Environmental and Historic Preservation (EHP) requirements.

Firewise: Firewise USA® is a voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the ignition resistance of their homes and community. The program is co-sponsored by the USDA Forest Service, the U.S. Department of the Interior, and the National Association of State Foresters. As of June 2021, neither Stanislaus County nor any of the incorporated jurisdictions in the County were participants in the program. In order to become a Firewise USA site, a neighborhood, community, city, or county must form a board or committee comprised of residents and stakeholders, obtain a written wildfire risk assessment, develop and maintain an action plan, and contact the applicable state liaison to the program.

Storm Ready: Neither Stanislaus County nor any of the incorporated jurisdictions in the County are certified as Storm Ready communities. Cal State Stanislaus is certified Storm Ready. The National Weather Service's Storm Ready program helps local governments handle extreme weather and improve the timeliness and effectiveness of hazardous weather-related warnings for the public. To be officially Storm Ready, a community must:

- Establish a 24-hour warning point and EOC
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars, and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

Community Rating System (CRS): An additional indicator of floodplain management capability is the active participation of local jurisdictions in the CRS. The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP, adding extra local measures to provide protection from flooding. All 18 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class. Class ratings, which run from 10 to 1, are tied to flood insurance premium reductions. As class ratings improve (decrease), the percent reduction in flood insurance premiums for NFIP policy holders in that community increases. These potential discounts in flood insurance premiums through CRS are summarized in Table 2-12 below.

As of 2021, City of Newman and City of Patterson currently participate in the CRS. Both cities have a Class 9 and received 5% discount. Neither Stanislaus County nor any of the other incorporated jurisdictions in the County participate in the CRS. Should the other jurisdictions and Stanislaus County decide to join the CRS, it would be an opportunity for enhancement of existing mitigation capabilities and help make flood insurance more affordable in the future.

Table 2-13 CRS Premium Discounts

Class	Discount		Class	Discount	**SFHA (Zones A, AE, A1-A30, V, V1-V30, AO, and AH): Discount varies depending on class. SHFA (Zones A99, AR/A, AR/AE. AR/A1-A30, AR/AH, and AR/AO): 10% discount for Classes 1-6; 5% discount for Classes 7-9. Non-SFHA (Zones B, C, X, D): 10% discount for Classes 1-6; 5% discount for Classes 7-9. In determining CRS premium discount, all AR and A99 Zones are treated as non-SFHAs.**
1	45%		6	20%	
2	40%		7	15%	
3	35%		8	10%	
4	30%		9	5%	
5	25%		10	--	

Source: FEMA CRS Coordinators Manual

3 Planning Process

Requirement §201.6(b) and §201.6(c)(1):
An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.* *[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

3.1 Background on Mitigation Planning in Stanislaus County

The primary purpose of the Stanislaus County MJHMP update is to reduce or eliminate long-term risk to people and property from natural hazards and their effects on the Stanislaus County planning area. Stanislaus County recognized the need and importance of a MJHMP and initiated its development in 2017 after receiving a grant from FEMA, which also served as the primary funding source for this plan.

The plan underwent a comprehensive update in 2021-2022. The planning process followed during the update was similar to what was used in the original plan development, except that the 2021-2022 planning process involved participation from the nine municipalities in the County and the Stanislaus County Office of Education. The 2021-2022 planning process also involved a multi-jurisdictional HMPC. Wood Environment & Infrastructure Solutions, Inc. (Wood) was procured to assist with the update in 2021. The process is described further in this section and documented in Appendix B.

3.2 What's New in the Plan Update

DMA Requirement §201.6(d)(3):	*A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.*

The updated MJHMP complies with FEMA guidance and California OES guidelines for LHMPs. The update followed the requirements noted in the DMA of 2000 and FEMA's 2013 Local Hazard Mitigation Planning Handbook.

This MJHMP update involved a comprehensive review and update of each section of the 2017 LHMP, the integration of a detailed risk assessment and consequence analysis, and an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. The planning process provided an opportunity to review jurisdictional priorities related to hazard significance and mitigation actions, and revisions were made where applicable to the base plan. Another change in priority was the desire to engage the nine incorporated jurisdictions in the County, including annexes for the municipalities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford and the Stanislaus County Office of Education. While each jurisdiction participated in pervious MJHMP updates, representatives from multiple departments representing a Local Planning Team (LPT) were engaged and involved in the development of the 2022 MJHMP through multiple planning workshops and numerous one-on-one work sessions (See Section 1.8 for more information). Only the information and data still valid from the 2017 plan was carried forward as applicable into this MJHMP update. The 2017 LHMP Prerequisite section was integrated into the Executive Summary of the 2021-2022 MJHMP update. Also, given the nine municipalities and the Office of Education participation, significant new hazard information was integrated into the base plan and into each annex. The 2017 LHMP assessed five priority hazards, including dam failure, earthquake, flooding, landslide, and wildfire. The 2021-2022 MJHMP update assessed 11 natural, human-caused, and human-health hazards, including agricultural pests and disease, aquatic invasive species (AIS), cyber threats, dam incidents, earthquake, extreme heat, flooding, landslides, public health hazards: epidemic/pandemic, Severe Weather: Dense Fog, Severe Weather: Heavy Rain, Thunderstorms, Hail, and Lightning, Severe Weather: High Wind/Tornado, and wildfire. As a result, there are 14 new countywide mitigation actions, plus 75 jurisdiction-specific mitigation actions that were developed for the 10 annexes.

3.2.1 Plan Section Review and Analysis – 2021 Update

During the 2021-2022 MJHMP update, the HMPC updated each of the sections of the previously approved plan to include new information. Wood developed a summary of each section in the plan and guided the HMPC through the elements that needed updating during the kick-off webinar n May 2021. This included analyzing each section using FEMA's Local Mitigation Planning Handbook (2013) and the Local Mitigation Planning Policy Guide (2022; Effective April 19, 2023) to ensure that the plan met the latest requirements. In addition, the FEMA Local Mitigation Plan Review Tool that was provided with the approval of the 2017 version of this plan was referenced, in particular the 2017 FEMA comments on opportunities for improvement were considered and addressed in the 2021-2022 update. The HMPC and Wood determined that nearly every section of the plan would need revision to align the plan with the latest FEMA planning guidance and requirements and recent California legislation. A detailed summary of the changes in this plan update is highlighted in the table below.

Table 3-1 Stanislaus County Hazard Mitigation Plan Update Highlights

Plan Section	Summary of Plan Review, Analysis, and Updates
1. Introduction	• Revised to reflect updated plan and 2021-2022 planning process
2. County Profile and Capability Assessment	• Updated with recent census data and current economy description • Updated land use and development trends
3. Planning Process	• Describes and documents the planning process for the 2021-2022 update, including coordination among agencies • Describes how 2017 plan was integrated with/into other planning efforts • Removed 2017 planning process information • Describes changes to jurisdictional participation • Describes 2021-2022 public participation process • Summarizes the results of the Public Survey • Describes the HMPC • Describes the 10-step process followed for the update
4. Hazard Identification and Risk Assessment and Consequence Analysis	• Climate change information has been added to each hazard profile • Updated list of disaster declarations to include recent data • Updated tables to include recent National Center for Environmental Information data • Updated past occurrences for each hazard to include recent data • 2017 Plan Vulnerability Assessment is now included with the Risk Assessment and an integrated Consequence Analysis section organized by hazard • The Consequence Analysis considers the impacts on the following assets: public; (2) responders; (3) continuity of operations including continued delivery of services; (4) property, facilities, and infrastructure; (5) environment; (6) economic condition of the jurisdiction; and (7) public confidence in the jurisdiction's governance • Updated critical facilities identified from the 2017 plan; the critical facilities database now includes over 1,000 assets organized by Community Lifeline

Plan Section	Summary of Plan Review, Analysis, and Updates
	• Updated growth and development trends to include recent Census and local data sources from the County Community and Planning Department permit database • Updated historic and cultural resources using local/state/national sources • Updated property values for vulnerability and exposure analysis, using updated building information based on assessor's data • Updated estimate flood losses using the latest Digital Flood Insurance Rate Map (DFIRM) and assessor's data • Updated National Flood Insurance Program (NFIP) data and Repetitive Loss structure data from the previous plan • Incorporated new hazard loss estimates since 2017, as applicable • Used updated GIS inventory data to assess wildfire threat to the County • Updated HAZUS-MH Level I earthquake vulnerability analysis data with two scenarios performed (one probabilistic scenario and one ShakeMap scenario) • Six additional hazards that were not included in the 2017 plan are added and profiled, which include: Agricultural Pests and Disease, AIS, Cyber Attack, Drought, Extreme Heat, Public Health Hazards: Pandemics/Epidemics, Severe Weather: Dense Fog, Severe Weather: Heavy Rain, Thunderstorms, Hail, and Lightning, Severe Weather: High Wind/Tornado • Updated information regarding specific vulnerabilities to hazards, including maps and tables of specific assets at risk, specific critical facilities at risk, and specific populations at risk • Revisited and updated hazard significance/priority levels • Updated maps in plan where appropriate
5. Mitigation Strategy	• Indicated what actions have been implemented that may reduce previously identified vulnerabilities • Updated mitigation strategy based on the results of the updated risk assessment, consequence analysis, completed mitigation actions, and implementation obstacles and opportunities since the completion of the 2017 plan • Reviewed and updated goals and objectives based on HMPC input • Added new objectives that are linked to the six new hazards profiled in the risk assessment and consequence analysis • Included updated information on how actions are prioritized, or how priorities changed • Reviewed mitigation actions from the 2017 plan and developed a status report for each • Identified if actions have been completed, deleted, or deferred/carried forward • Updated priorities on actions • Combined similar mitigation actions from the 2017 plan related to CEQA review, floodplain management coordination, and avoiding development in hazard zones • Identify examples of successful implementation to highlight positive movement on actions identified in 2017 plan • Identified new mitigation actions proposed by the HMPC with more detail on implementation than the previous plan • 14 new countywide mitigation actions were added to address existing hazards and new hazards • 75 new jurisdiction-specific mitigation actions were included in the annexes • Developed a summary table of mitigation actions for all participating jurisdictions
6. Plan Review, Evaluation, and Implementation	• Reviewed and updated procedures for monitoring, evaluating, and updating the plan • Revised to reflect current methods • Updated the system for monitoring progress of mitigation activities by identifying additional criteria for plan monitoring and maintenance • Added a process for incorporation of the MJHMP update into existing mechanisms

Plan Section	Summary of Plan Review, Analysis, and Updates
	• Clarified future public involvement activities and tied them to the Outreach Strategy in Appendix F
7. Plan Adoption	• Updated to reflect 2022 adoption process
Jurisdictional Annexes	• *Developed annexes for new participating jurisdictions in 2021-2022 • Updated previous participants' annexes with recent Census data • Updated past event history and hazard loss estimates • Added new maps and updated old maps as needed • Updated mitigation actions from 2017 and added new mitigation actions • Integrated the following annexes: A City of Ceres B City of Hughson C City of Modesto D City of Newman E City of Oakdale F City of Patterson G City of Riverbank H City of Turlock I City of Waterford J Office of Education
Appendices	• Appendix A: Planning Committee • Appendix B: Planning Process Documentation • Appendix C: Approval and Adoption • Appendix D: Mitigation Categories and Alternatives • Appendix E: Annual Progress Meeting Agenda and Report Template • Appendix F: Outreach Strategy

3.3 Multi-Jurisdictional Participation

In the 2021-2022 MJHMP update, the following jurisdictions participated in the planning process and will be adopting the updated plan following FEMA approval. All incorporated cities in the County participated in this planning process. As noted previously, all the incorporate cities in Stanislaus County are new to the multi-jurisdictional planning process.

Lead Jurisdiction:

- Stanislaus County

Municipalities:

- City of Ceres
- City of Hughson
- City of Modesto
- City of Newman
- City of Oakdale
- City of Patterson
- City of Riverbank
- City of Turlock
- City of Waterford

Other Jurisdictions

- Stanislaus County Office of Education

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC
- Detail areas within the planning area where the risk differs from that facing the entire area
- Identify potential mitigation actions
- Formally adopt the plan

For the Stanislaus County planning area's HMPC, "participation" meant the following:

- Providing facilities for meetings
- Attending and participating in the HMPC meetings
- Completing and returning Wood Plan Update Guide worksheets
- Collecting and providing other requested data (as available)
- Identifying mitigation actions for the plan
- Reviewing and providing comments on plan drafts and jurisdictional annexes
- Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan
- Coordinating, and participating in the public input process
- Coordinating the formal adoption of the plan by the governing boards

The County and all jurisdictions with annexes to this plan and seeking FEMA approval met all these participation requirements. In most cases one or more representatives for each jurisdiction attended the multi-jurisdictional webinars/meetings described in Table 3-4 and brought together a local Planning Committee to help collect data, identify mitigation actions and implementation strategies, and review and provide data on annex drafts. In some cases, the jurisdictions had limited capacity to attend or had conflicts with HMPC meetings; in these cases, alternative forms of communication were used to provide input into the process, and some instances a representative from a different jurisdiction's department attended the HMPC meeting on behalf of the main representative. County OES and Wood staff also meet via virtual meetings with individual jurisdictions, such as the cities of Hughson and Modesto to gather input on the planning process, existing capabilities, and new mitigation actions. Appendix B provides additional information and documentation of the planning process.

3.4 Planning Process

Wood established the planning process for the Stanislaus County MJHMP using the DMA planning requirements and FEMA's associated guidance. The original FEMA planning guidance is structured around a four-phase process:

- Organize Resources
- Assess Risks
- Develop the Mitigation Plan
- Implement the Plan and Monitor Progress

Into this process, Wood integrated a more detailed 10-step planning process used for FEMA's CRS and FMA programs. Thus, the modified 10-step process used for this plan meets the requirements of major grant programs including: FEMA's HMGP, BRIC program, FMA Program, and flood control projects authorized by the U.S. Army Corps of Engineers.

In 2013, FEMA released the Local Mitigation Planning Handbook that has become the official guide for local governments to develop, update and implement local mitigation plans. While the requirements under §201.6 have not changed, the Handbook provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements under the CFR Title 44 – Emergency Management and Assistance §201.6, Local Mitigation Plans for FEMA approval and eligibility to apply for FEMA HMA grant programs. It also offers practical approaches, tools, worksheets, and local mitigation planning examples for how communities can engage in effective planning to reduce long-term risk from natural hazards and disasters. The Handbook complements and liberally references the Local Mitigation Plan Review Guide

(October 1, 2011), which is the official guidance for federal and state officials responsible for reviewing local mitigation plans in a fair and consistent manner.

Table 3-2 shows how the modified 10-step process fits into FEMA's four-phase process, and how these elements correspond to the tasks in the FEMA Mitigation Planning Handbook.

Table 3-2 Stanislaus County Hazard Mitigation Planning Process

FEMA's 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
1) Organize Resources		
201.6(c)(1)	1) Organize the Planning Effort	1: Determine the planning area and resources
201.6(b)(1)	2) Involve the Public	2: Build the planning team - 44 CFR 201.6 (C)(1)
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies	3: Create an outreach strategy - 44 CFR 201.6(b)(1)
		4: Review community capabilities - 44 CFR 201.6 (b)(2)&(3)
2) Assess Risks		
201.6(c)(2)(i)	4) Identify the Hazards	5: Conduct a risk assessment - 44 CFR 201.6 (C)(2)(i) 44 CFR 201.6(C)(2)(ii)&(iii)
201.6(c)(2)(ii)	5) Assess the Risks	
3) Develop the Mitigation Plan		
201.6(c)(3)(i)	6) Set Goals	6: Develop a mitigation strategy - 44 CFR 201.6(c)(3)(i); 44 CFR 201(c)(3)(ii) and 44 CFR 201.6(c)(3)(iii)
201.6(c)(3)(ii)	7) Review Possible Activities	
201.6(c)(3)(iii)	8) Draft an Action Plan	
4) Implement the Plan and Monitor Progress		
201.6(c)(5)	9) Adopt the Plan	7: Review and adopt the plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan	8: Keep the plan current
		9: Create a safe and resilient community - 44 CFR 201.6(c)(4)

3.4.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

The 2021-2022 planning process and update of the 2017 LHMP had its roots in the development of a grant application. The County OES wrote the grant and in the process solicited commitments from local government jurisdictions that were interested in participating. With an understanding of the number of jurisdictions and their commitment to participate, the grant application was approved and awarded to the County in 2020.

Wood worked with the County to get organized for the plan update. Organizational efforts were initiated with the County and participating jurisdictions in May 2021 to inform and educate the plan participants of the purpose and need for updating the countywide hazard mitigation plan. An initial meeting between Wood and County OES was held to discuss the organizational aspects of this plan update process. Invitations to the kick-off meeting for this plan update were extended to key County departments, the nine incorporated communities, County Office of Education, and representatives from special districts for the County and municipalities, as well as to other federal, state, and local stakeholders that might have an interest in participating in the planning process. Representatives from participating jurisdictions and HMPC members to the 2017 plan were used as a starting point for the invite list, with additional invitations extended as appropriate throughout the planning process. The County OES expanded an initial invite list that included participants in a pre-planning exercise held in 2020 that was focused on the identification and prioritization of natural and non-natural hazards with and without mitigation capabilities in place. The list of initial invitees is included in Appendix A.

Representatives from the following County and municipal departments participated on the HMPC and the development of the plan update; these representatives are listed in Table 3-3. A list of specific HMPC representatives is included in Appendix A. Other local, state, federal, and private stakeholders invited to participate in the HMPC are discussed under Planning Step 3.

Table 3-3 List of HMPC Participants for 2021-2022 MJHMP Update

Role	Name	Department
Emergency Services Manager	Ruben Wegner	Stanislaus County Office of Emergency Services
Purchasing/Facility Manager	Javier Rocha	Community Services Agency
Deputy Chief	Darin Jesberg	City of Modesto, Fire Department, Community Risk Reduction
Community Services Agency Facility Manager	Mark Zachreus	Community Services Agency
Fire Chief/City Emergency Manager	Jeff Gregory	City of Patterson, Fire Department
Fire Chief*	Michael Botto	City of Turlock, Fire Department
Assistant Chief*	Kevin Wise	City of Turlock & City of Ceres Fire Department
Fire Chief, City Emergency Manager	Keith Bowen	City of Newman, Fire Department
City Manager	Marisela Garcia	City of Riverbank
Supervising Appraiser	Ursula Spani	Stanislaus County, Assessor's Office
City Emergency Manager	Lonnie Statzer	City of Waterford
Senior Management Analyst	Norma Manriquez	City of Riverbank
Division Chief	Jeffery Fyre	Patterson Fire Department
Senior Developer/Analyst	Neil Mazuelos	Stanislaus County, Assessor's Office
Stanislaus County Assessor	Don Gaekle	Stanislaus County, Assessor's Office
Staff Services Coordinator	Robert Riess	Stanislaus County, Health Services Agency, Emergency Preparedness
Deputy Director*	Amanda Sharp	Stanislaus County, Health and Human Services
Stanislaus County Fire Warden, Assistant Director of OES	Richard Murdock	Stanislaus County Office of Emergency Services
City Manager	Bryan Whitemyer	City of Oakdale
Community Services Agency/Public Information Officer	Dan Rosas	Stanislaus County Community Services Agency
Principal Planner	Kristin Doud	Stanislaus County, Planning & Community Development
Water Resource Engineering	Miguel Alvarez	City of Modesto, Utilities Department
Facilities Analyst	Sara Venicombe	Stanislaus County Office of Education
Public Information Officer	Judy Boring	Stanislaus County Office of Education
Assistant Agricultural Commissioner	Dan Bernaciak	Stanislaus County Department of Agriculture
Hazardous Materials Manager	Alvin Lal	Stanislaus County Department of Environmental Resources
City Manager	Merry Mayhew	City of Hughson
Public Works Superintendent	Jaime Velazquez	City of Hughson
City Manager*	Tom Westbrook	City of Ceres
Emergency Services Manager*	Shannon Williams	Stanislaus County Emergency Management Consultant

Source: HMPC 2022
*Indicates HMPC participants that changed or left positions during the HMPC planning process.

Planning Meetings

The planning process officially began with a kick-off meeting on May 26, 2021, which involved County OES staff and the Wood's team. On August 5, 2021, the HMPC convened for the first time. The first HMPC meeting covered the scope of work and an introduction to the DMA requirements. Participants were provided with a Multi-Jurisdictional Local Hazard Mitigation Plan Update Workbook, which included worksheets to facilitate the collection of information necessary to support update of the plan. Using FEMA guidance, Wood designed these worksheets to capture information on past hazard events, identify hazards of concern to each of the participating jurisdictions, quantify values at risk to identified hazards, inventory existing capabilities, and record possible mitigation actions. A copy of Wood's Multi-Jurisdictional Local Hazard Mitigation Plan Update Guide for this project is included in Appendix B. The County and each jurisdiction seeking FEMA approval of their plan completed and returned the worksheets in either the Multi-Jurisdictional Local Hazard Mitigation Plan Update Guide Workbook or shared their most recent local hazard mitigation plan for incorporation into the plan document.

During the planning process, the HMPC communicated through virtual meetings, email, and telephone conversations. With the exception of one in-person meeting with the County OES staff early in the planning process, all three HMPC meetings were held virtually due to social distancing requirements associated with the ongoing COVID-19 pandemic. Draft documents were emailed so that the HMPC members could easily access and review them. The County's OES staff and HMPC formally met four times during the planning period (May 26, 2021 – January 13, 2022). The purposes of these meetings are described in Table 3-4. The planning consultant sent meeting handouts ahead of time to the participating jurisdictions to review and provide feedback before or at the meeting. In addition to these meetings some jurisdictions held meetings with subcommittees to discuss the needed input for the plan update. In a couple cases some municipalities were not able to attend the planning workshops due to scheduling conflicts or limited staff capacity. The Emergency Services Coordinator of the County's OES and the planning consultant worked with the jurisdictions individually in those cases to obtain necessary information and input into the planning process. This was done through direct emails from the planning consultant and follow-up phone conversations with the consultant and County OES where necessary.

Table 3-4 Summary of Planning Meetings

Meeting Number	Meeting Topic	Date	Location
1	Kick-off/Planning Committee Roles and Expectations (Stanislaus County OES staff only)	May 26, 2021	Virtual/Webinar – Microsoft Teams
2	Overview of DMA 2000 & Hazard Mitigation Planning Process / Review 2017 LHMP	August 5, 2021	Virtual/Webinar – BlueJeans
3	Hazard identification and Risk Assessment	November 9, 2021	Virtual/Webinar – Microsoft Teams
4	Mitigation Strategy and Goals Update / New Mitigation Actions Brainstorm	January 13, 2022	Virtual/Webinar – Microsoft Teams

Meeting #1 – Kick-off Meeting

On May 26, 2021, Stanislaus County's OES staff and the Wood's team convened and discussed the project background and the overall MJHMP update process, as well as the scope of work and project goals. County OES staff and Wood's team also discussed the hazards that need to be profiled in this MJHMP update based on pre-planning exercises held in 2020 among the initial HMPC participants. In addition, County OES staff and Wood's team reviewed potential additional HMPC members, partners, and stakeholders. Moreover, the outreach plan needed for the MJHMP update and GIS data needs were also discussed during the kick-off meeting.

Meeting #2 – HMPC Meeting #1

On August 5, 2021, the HMPC convened virtually to discuss the process for completing the update of this plan. This first HMPC meeting was well attended with twenty-six (26) individuals present. The audience was a mix of county departments, local governments, special districts, and stakeholders. A complete list of those in attendance at the first HMPC meeting can be found in the sign-in sheets in Appendix B.

Following introductions, Wood reviewed the DMA requirements and the suggested planning process to follow to meet the requirements as well as the expected schedule of the process. The roles of the HMPC and stakeholder were discussed including the participation requirements for the different roles.

During the first HMPC meeting, the HMPC validated the identified hazards within the 2017 plan, together with additional hazards that are added and profiled in this 2021-2022 MJHMP update. The HMPC collaboratively prioritized the hazards for the purpose of identifying which are "of most concern" to the County. More details are included in Section 4: Hazard Identification and Risk Assessment.

The group also discussed other agencies that should be part of this planning process, as well as related planning efforts to be coordinated with and recent studies to be incorporated. Part of this discussion was also related to creating a public outreach strategy to involve the public throughout the planning process. This outreach strategy is included in Appendix F. The first HMPC meeting ended with Wood sharing handouts to assist in the planning process. These handouts included the Multi-Jurisdictional Local Hazard Mitigation Plan Update Workbook which outlined data collection needs for each participating jurisdiction.

Meeting #3 – HMPC Meeting #2: Risk Assessment and Mitigation Goal Refinement

On November 9, 2021, the HMPC convened virtually to discuss the results of the risk and vulnerability assessment. Twenty (20) members of the HMPC were present for the discussion. Wood began the meeting with a presentation on the results the risk assessment and preliminary consequence findings for natural hazards and public health hazards. The group went through each hazard together and discussed the results as well as shared any local insight to inform the HIRA update. Refer to the meeting summary in Appendix B for notes related to each hazard discussed.

Following the discussion on the results of the risk assessment and consequence analysis findings, Wood explained this update process provides an opportunity to review the previous plan's goals to determine if they are still valid, comprehensive, and reflect current priorities, updated risk assessment, and new consequence analysis. Inputs on mitigation goals and objectives were also solicited via virtual polls. The group was also encouraged to share insights on the development of mitigation goals, objectives, and specific actions and projects.

Wood shared with HMPC that the online public survey had been opened. A link was shared with the HMPC to easily distribute by email and for posting on each of the participating jurisdiction's websites and MJHMP webpages. This was encouraged to promote engagement and input from the public and participating jurisdiction communities. The meeting ended with a review of the next steps and planning process schedule.

Meeting #4 – HMPC Meeting #3: Mitigation Strategy

The HMPC convened virtually on January 13, 2022, with 29 people participating to update the plan's mitigation strategy. The group finalized the plan's goals and objectives (Step 6) and reviewed the progress made on the previous mitigation actions from the 2017 LHMP. The group then discussed the criteria for mitigation action selection and prioritization using a worksheet provided by Wood. The group reviewed each possible new mitigation action. Additional details were provided by the Planning Committee (Step 7). This was followed by a brainstorming session to elicit the development of new mitigation actions. Wood then briefly explained the plan implementation and maintenance process. The meeting ended with a review of the next steps and planning process schedule. Wood provided the HMPC with a link to an online form to submit new mitigation actions. During the HMPC review of the full plan, each member was provided a handout on prioritizing new mitigation actions and asked to focus on prioritizing each new mitigation action for their jurisdiction.

Planning Step 2: Involve the Public

Involving the public assures support from the community at large and is a required part of the planning process per the DMA 2000. Early discussions with Stanislaus County and input received in the first HMPC meeting established the initial plan for public involvement in the plan update. Public outreach began with the development of an online public survey that was shared with each participating jurisdiction to post on their websites and disseminate via email to local stakeholders. The public outreach activities described here were conducted with participation from and on behalf of all jurisdictions participating in this plan.

Throughout the planning process, two public workshops were held to inform the public of the purpose of the DMA and the hazard mitigation planning process for the Stanislaus County planning area. At each workshop, the public in attendance was provided links to electronic comment forms to leave any comments related to the County's MJHMP as well as provide their contact information if they would like to receive ongoing updates and information related to the planning process.

At the first HMPC meeting, the HMPC discussed additional options for public involvement and agreed to an approach using established public information mechanisms and resources within the community. These additional options are outlined in the Community Outreach Strategy. Additional public involvement activities included press releases, website postings, flyer development and distribution, two public workshops, and the collection of public comments on the draft plan. Details on the outreach methods and approach are also summarized in the Community Outreach Strategy included in Appendix F.

Plan Facts

Plan Facts was created to increase public awareness of the hazard mitigation plan process by providing a simple two-page handout that could be used to inform the public and community leaders and other stakeholders about the importance of hazard mitigation planning and the plan update. Plan Facts is included on the County's MJHMP webpage. The Wood team also provided the County with a Webpage Backgrounder document that included MJHMP update information for the MJHMP Webpage. Figure 3-1 includes a screenshot of the County's MJHMP Webpage.

Figure 3-1 Stanislaus County's MJHMP Webpage and Information Resource Portal

Office of Emergency Services

NEWS & EVENTS ▾ DIVISIONS ▾ TRAINING C.E.R.T STANAWARE EMERGENCY MANAGERS

Stanislaus County > OES/Fire Warden > OES > Local Hazard Mitigation Plan

Local Hazard Mitigation Plan

PLAN UPDATE IN PROGRESS

Disasters can cause loss of life; damage buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard mitigation planning reduces disaster damages and is defined as sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards.

The Stanislaus County Office of Emergency Services in collaboration with the cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, Waterford, and the County Office of Education is updating their 2017 Local Hazard Mitigation Plan (LHMP). The LHPM 2017 recognized earthquakes, floods, dam inundation, landslides and wildfire as the local natural hazards. The LHMP also states mitigation strategies and actions that serve as the long-term blueprint for reducing potential losses. Activities such as issuing building permits, repairing roads and training first responders are examples of specific actions which can be taken to prevent or minimize damage. Such activities have been identified for each hazard in the LHMP.

The LHMP must be updated every five years. It may be used as a base plan by cities and special districts within Stanislaus County for the development of their own specific plan. Federal emergency management agencies will only provide disaster relief funds to local government that have shown positive steps to prevent loss and damages from disasters by adopting a Hazard Mitigation Plan.

During the update of the LHMP, we are requesting public input on the hazards in our community. To participate and assist us in updating the plan, please click the Survey link below and fill out the survey prior to November 12th, 2021.

Take the Public Survey! The survey will be open until Novembr 12th, 2021
Public Input Survey

Please join us for our Virtual Public Workshop on November 4th 2021 from 6pm-8pm

Public Workshop Press Release

For more information please refer to the following links:

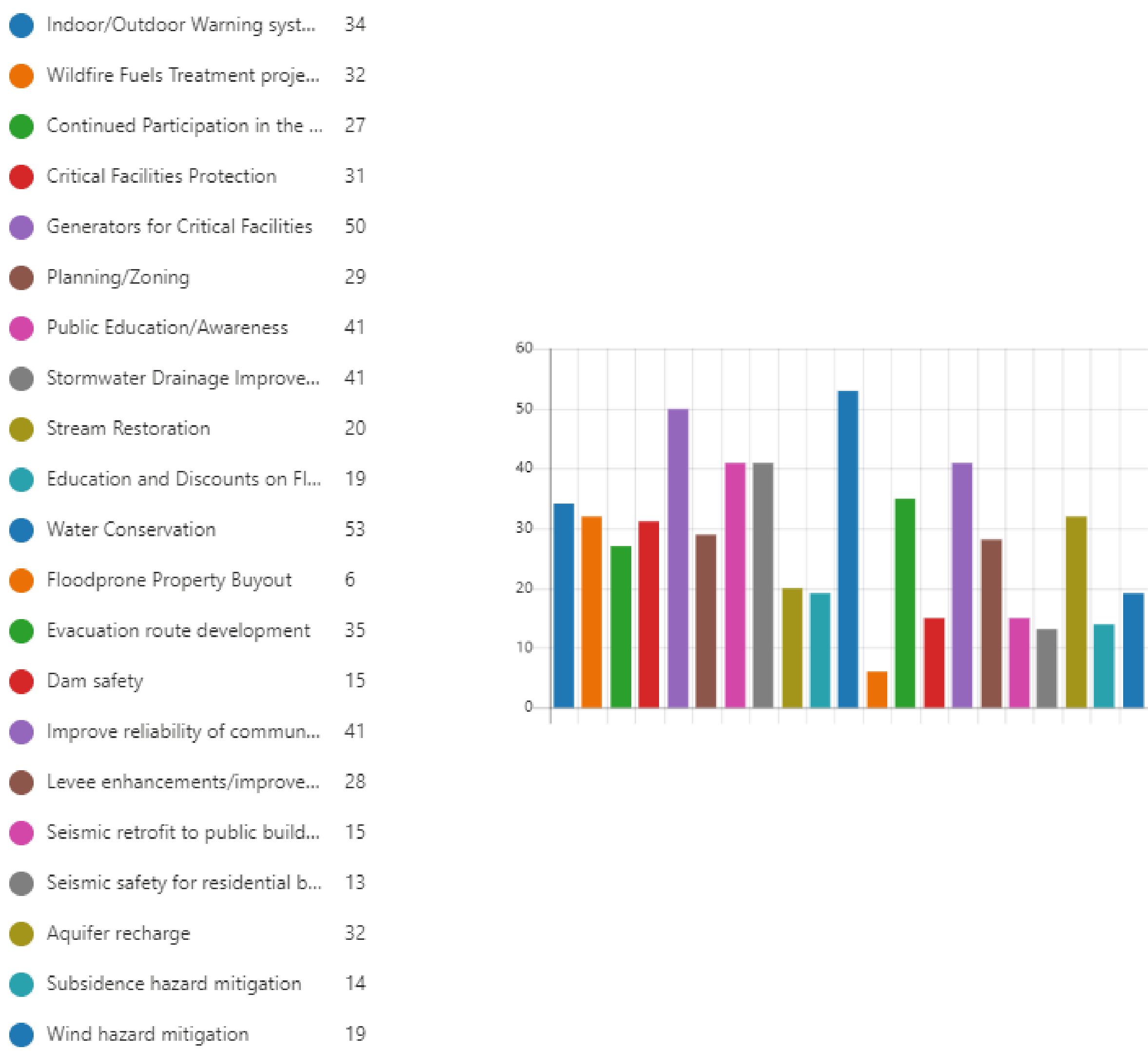
- **Plan Facts [PDF]**

Source: Stanislaus County 2022

Online Public Survey

During the plan update's initial drafting stage, an online public survey was used to gather public input to the Planning Committee. The survey provided an opportunity for public input during the planning process before the finalization of the plan update. The survey gathered public feedback on concerns about hazards and input on mitigation strategies to reduce their impacts. The survey was released on October 13, 2021 and closed on November 12, 2021 (one-month input period). The HMPC provided links to the public survey by distributing it using social media, email, and posting the link on websites. A link to the survey was also posted on some of the participating jurisdictions' websites as well as through social media posts; screenshots from both can be found in Appendix B. A total of 77 people filled out the survey online. Results showed that the public perceives the most significant hazards to be drought, extreme temperatures, pandemic/epidemic, and climate change. Figure 3-2 shows the results of a question from the survey, which asked the public's opinion on what mitigation actions should have the highest priority in the updated MJHMP. Water conservation, generators for critical facilities, public education/awareness, stormwater drainage improvements and improve reliability of communication systems were cited as the most popular mitigation actions. This information was shared with the HMPC during the update of the mitigation strategy to consider when evaluating hazard rankings and as a source of potential mitigation ideas. A summary of all the survey data and documentation of the public feedback can be found in Appendix B.

Figure 3-2 Results from Question 4: The following types of mitigation actions may be considered in Stanislaus County. Please indicate the types of mitigation actions that you think should have the highest priority in the Stanislaus County MJHMP.



Source: Wood 2022

Online Public Workshops

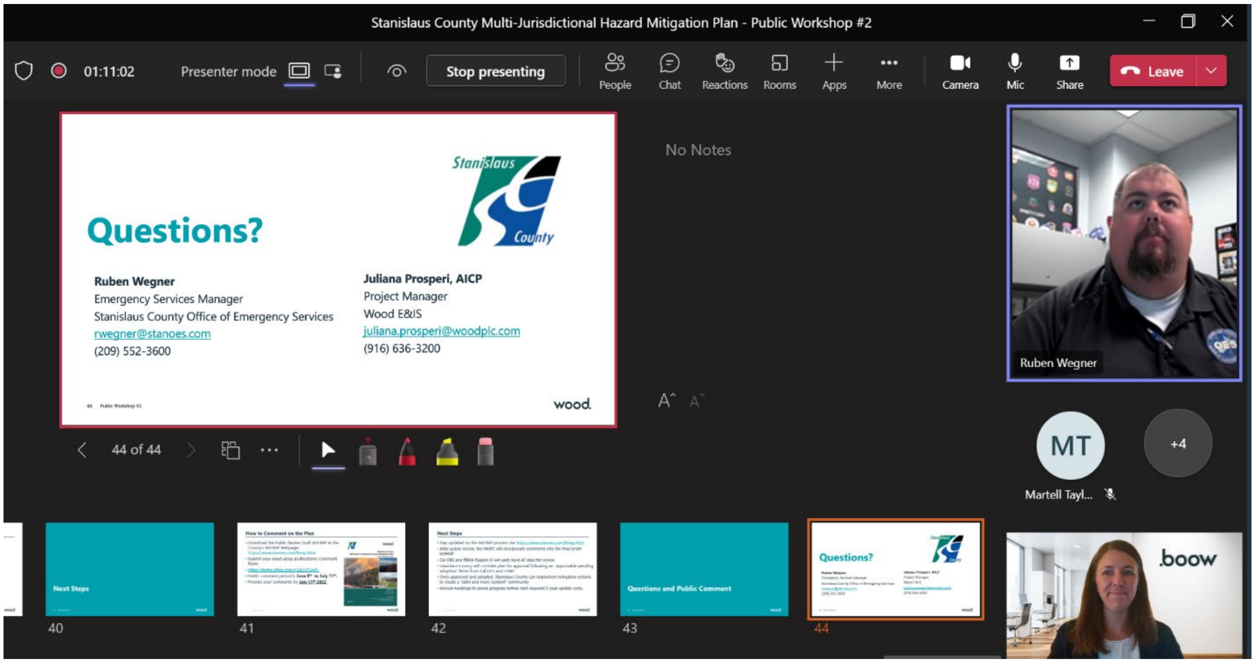
Two online public workshops were held during the planning process to inform the public, receive input to integrate into the plan update, and keep the public updated on the progress being made in the planning process. Both workshops were held virtually as webinars followed by question and answer sessions (Q&A) due to social distancing requirements associated with the ongoing COVID-19 pandemic.

The first workshop took place on November 4, 2021 through Microsoft Teams. The workshop introduced the public to the hazard mitigation planning process for the County's Plan Update and answered any questions and gather public input to be integrated into the plan update. In addition, it was an opportunity to help staff identify risks, hazards, and vulnerabilities from the public's perspective. Fifteen individuals not including County staff participated in the first workshop. Members of the public were able to submit comments and ask questions verbally or via the chat function. Meeting participants such as the Environmental Justice Program of Catholic Charities of Stockton expressed their willingness to be involved in the MJHMP's development. Stakeholder participants from the Mid San Joaquin River Flood Management Plan inquired about how their working group can integrate flood management projects into the County MJHMP. The HMPC also received various questions and comments from the workshop on the public's priority hazards in their community and possible mitigation ideas to reduce hazard risk. From this input the County updated information in the risk assessment on flood hazard risk with specific information from the Mid San Joaquin River Flood Management working group. The County also inquired about potential mitigation action ideas from the Environmental Justice Program of Catholic Charities of Stockton, integrated these mitigation ideas into the mitigation strategy, and included the organization as a key mitigation partner. Figure 3-3 is a snapshot from the first workshop.

Figure 3-3 First Public Workshop for the Stanislaus County MJHMP

The second public workshop took place on June 23, 2022 while the draft plan was out for public review. The workshop was noticed with a press release and social media postings. The workshop was online using MS Teams and was simultaneously broadcasted as a Facebook Live event by the County. The second virtual public workshop was an opportunity to learn more about the updated draft MJHMP including the planning process, the hazards assessed, and the mitigation actions proposed in the MJHMP. The second virtual public workshop was also an opportunity to explain how the community can review and comment on the MJHMP update. Following the public workshop was an opportunity for the public to comment on the draft MJHMP during the meeting. Seven persons attended the Teams session. There were no comments received during the workshop. The recording of the meeting was subsequently posted on the County's Facebook Webpage. The County encouraged participation and feedback by attending the public workshop, visiting the County's Project Webpage, and/or commenting on the Public Review Draft MJHMP. Figure 3-4 is a snapshot from the second workshop.

Figure 3-4 Second Public Workshop for the Stanislaus County MJHMP



Geographic Information System (GIS) Data Collection

When the Risk Assessment for the LHMP was originally prepared in 2017, the County's OES was responsible for all the GIS mapping. The Project Manager, who previously served as the County's former Chief Information Officer in the previous LHMP in 2011, scheduled a GIS internal meeting on April 6, 2016, to discuss the update process and schedule, plan review, data gathering, and GIS hazard mapping for the Plan update. A similar process occurred for the 2021-2022 MJHMP update. The GIS Manager compiled and provided the Wood team with access to the County's GIS data.

During the kick-off meeting, which the County's OES staff and Wood participated in, the MJHMP update process and schedule, plan review, data gathering, and GIS hazard mapping for the Plan update were discussed. In attendance were representatives from the County's Information Technology Central (ITC), Public Works, and the Assessor's Office. The County's GIS Manager reviewed a GIS Data Needs List provided by Wood. The GIS team proceeded to discuss the details of the GIS mapping requirements, such as including inventory and valuation information for public infrastructure for each of the five identified hazards: earthquake, landslide, dam failure, flood, and wildfire. The team also discussed GIS data sources for the potential new hazards. Other related comprehensive inventory information that was discussed included: roads, traffic signals, drainage facilities, lighting facilities, bridges, and airports.

Most of the inventory and risk data can be layered to provide aggregation of asset values within specifically identified risk areas. Additional hazard-specific data and layers were acquired, layered, and analyzed to quantify the geographic extent as well as the magnitude and severity of hazards for each of the five identified hazards in the 2017 LHMP: earthquake, landslide, dam failure, flood, and wildfire. Data sources include USACE, DWR, HIFLD, NID, FEMA, CALFIRE, FRAP, DOC and California Geological Survey. Additional GIS spatial data was integrated to assess agricultural pests and disease (important farmland) and severe weather.

During the HIRA process, to assess hazards' potential impacts on the County's critical facilities, a critical facilities GIS database was needed and then established. While building the critical facilities GIS database, each participating jurisdiction's assistance was requested to validate the critical facilities GIS data. There were two primary aspects of this: data completeness/correctness and alignment/classification with FEMA Lifelines framework. The County and ten participating jurisdictions each reviewed the critical facility database and were encouraged to edit descriptive attributes and add new point data for critical facilities. Specifically, the following jurisdictions, agencies and County departments' staff provided inputs on the database: Keith Bowen from the City of Newman provided input on critical facilities within the City of

Newman. Alvin Lal from the County's Department of Environmental Resources provided inputs regarding critical facilities that carry extremely hazardous substances within the County. Merry Mayhew from the City of Hughson provided input on critical facilities within the City of Hughson. Judy Boring from the Office of Education provided inputs on facilities that are related to the Office of Education, such as schools. This process further engaged participating jurisdictions that saw the value of the MJHMP and long-term use and maintenance of the critical facility data moving forward. The result was an updated comprehensive critical facilities database with over 1,000 facilities.

Risk Assessment and GIS Methodology

- Identify Structures—buildings, infrastructure, critical facilities, structures that house elderly or disabled and transportation systems—both for present assets and those planned—categorized by FEMA Lifelines.
- Address Repetitive Loss Properties for flood hazard.
- Estimate Potential Property Losses. The development of the MJHMP includes an inventory of assets from each publicly governed jurisdiction, coordinated by Stanislaus County, and an assessment of hazard risks: AIS, agricultural pest and disease, cyber threats, dam incidents, earthquakes, extreme heat, flooding, landslides, severe weather and wildfires.
- The asset inventory provided by the County Assessor's Office database includes individual parcels, various lands use codes, and various taxing agencies or districts.
- County property (building asset) inventory and valuation—for both present assets and those planned (within jurisdictions' Sphere of Influence [SOI]).
- Each property within this County property inventory has its Assessor's Parcel Number (APN), assessor's use code, government jurisdiction, and valuation data. Property value includes both improved value and estimated content value.
- County property type includes commercial, residential, agricultural, industrial, and vacant.
- From Census data, the number of people that would be affected by each natural hazard is calculated, which is the product of the number of properties that would be affected and average household size.
- During an update to the risk assessment, local jurisdictions must consider current and expected future vulnerability to all hazards and integrate new hazard data such as flood studies. Local jurisdictions were asked to incorporate replacement costs for vulnerable buildings and impacts of population growth or loss in vulnerable areas. Wood staff integrated this information, if available from each jurisdiction after the critical facilities assessment was complete. This process helped the jurisdictions understand what facilities were vulnerable to hazards and gather replacement value for these facilities.
- The Consequence Analysis is a qualitative summary that addresses the impacts on the public; responders; continuity of operations including continued delivery of services; property, facilities, and infrastructure; environment; economic condition of the jurisdiction; and public confidence in the jurisdiction's governance.

Strategic Business Technology (SBT)—Geographical Information System (GIS)

The County's GIS system used for the MJHMP update and is based on ESRI's ArcGIS Desktop software and is capable of performing sophisticated GIS layer creation, analysis, and mapping tasks. ESRI's software is the County GIS standard, used by most, if not all other County departments actively involved in GIS—including SBT, the EOC, and 9-1-1.

Public Review Period

The County OES department circulated the Public Review Draft MJHMP for a 30-day period from June 20, 2022 through July 22, 2022. The Public Review Draft was released for comment and made available for download via the County OES website. The Public Review Draft MJHMP was advertised through social media, mass emailing, and an advertisement through the media mechanisms noted previously. An electronic comment form through Microsoft Forms was provided with the draft plan. One comment was received on the Public Review Draft MJHMP. The comment received was shared with the HMPC and incorporated into the plan. The comment and response are briefly summarized in Table 3-5.

Table 3-5 Summary of Comments Received during Public Review

Comment	Response
Electronic Written Comment #1	
• There was a written comment on Table 4-16, noting that the storage noted for Don Pedro dam is incorrect, while the correct number is 2,030,000 acre-feet.	• Comment noted. Table 4-16 is updated. The County appreciates the time and effort to provide feedback on the Draft MJHMP.

3.4.2 Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, state and local agencies and organizations were invited to participate as stakeholders in the process through email. Stakeholders include local and regional agencies involved in hazard mitigation activities or those beyond the County and local government that have the authority to regulate development. The Stanislaus County Cooperator's List provided the basis for a contact list, which was maintained by County OES and updated by both the County and the planning consultant. Some of the cooperators invited to review the Administrative Draft MJHMP included surrounding counties, such as Merced, San Joaquin, and Tuolumne counties. Stakeholders could participate in various ways, either by contributing input at HMPC meetings, being aware of planning activities through an email group, providing information to support the effort, or reviewing and commenting on the draft plan. Based on their involvement in other hazard mitigation planning efforts, and status in the County, representatives from the following agencies and organizations were invited to participate as stakeholders in the process by email; an asterisk indicates they participated in HMPC meetings. More specific on stakeholder agency representatives can be found in Appendix A and documentation in Appendix B.

Neighboring Counties

- County of Alameda
- County of Calaveras
- County of Merced
- County of Santa Clara
- County of San Joaquin
- County of Tuolumne

Federal, State, and Local Agencies

- USACE
- California OES
- California Department of Fire Protection and Forestry
- California Natural Resource Agency
- California DSOD
- California DWR
- California Department of Parks and Recreation
- FEMA Region IX
- San Joaquin River National Wildlife Refuge
- National Oceanic Atmospheric Administration/National Weather Service
- County Agricultural Commissioner*
- Stanislaus Council of Governments
- SCFPD*

Businesses, Academia, Utility Providers, Dam Owners and Operators and Non-Profits

- American Red Cross
- California State University, Stanislaus
- PG&E
- Central Valley Specialty Hospital

- Oakdale Irrigation District
- Turlock Irrigation District
- Merced Irrigation District
- Modesto Irrigation District
- South San Joaquin Irrigation District
- West Stanislaus Irrigation District
- Environmental Justice Program of Catholic Charities of Stockton
- Mid San Joaquin River Regional Flood Management Planning Group (one of six DWR flood management regional planning groups in the Central Valley)

Incorporation or Existing Plans and Other Information

The coordination and synchronization with other community planning mechanisms and efforts are vital to the success of this plan. To have a thorough evaluation of hazard mitigation practices already in place, appropriate planning procedures should also involve identifying and reviewing existing plans, policies, regulations, codes, tools, and other actions are designed to reduce a community's risk and vulnerability from natural hazards. Stanislaus County uses a variety of mechanisms to guide growth and development. Integrating existing planning efforts, mitigation policies, and action strategies into this plan establishes a credible, comprehensive document that weaves the common threads of a community's values together. The development and update of this plan involved a comprehensive review of existing plans, studies, reports, and initiatives from Stanislaus County and each participating municipality that relate to hazards or hazard mitigation. A high-level summary of the key plans, studies and reports is summarized in the table below. Information on how they informed the update is noted and incorporated where applicable.

Table 3-6 Summary of Review of Key Plans, Studies and Reports

Plan, Study, Report Name	How Plan Informed LHMP
Stanislaus County General Plan	The Stanislaus County General Plan was adopted by the Board of Supervisors on August 23, 2016. The County proactively addresses hazards through the General Plan Safety Element and has many references to the MJHMP, which is synonymous with the LHMP. Representatives from the work group for the General Plan are also members of the MJHMP HMPC, ensuring that both plans are integrated and contain mutually-reinforcing policies. The General Plan and the 2021 MJHMP Update work together to achieve the goal of hazard risk reduction. Future updates of the General Plan, including incorporation by reference of the 2021-2022 MJHMP into the Safety Element will continue to ensure consistency between both plans. The General Plan also includes the Housing Element chapter. The Housing Element is incorporated into the MJHMP to identify development trends.
Stanislaus County Capital Improvement Plan	The Stanislaus County Capital Improvement Plan, along with the Capital Project Program, supports the goal of the County to protect critical facilities and infrastructure. The Capital Projects Team is actively working to incorporate MJHMP priorities in the CIP development to protect facilities and infrastructure important to the County Areas of repetitive loss are high priorities for mitigation funding as they can negatively affect County coffers.
Stanislaus County Emergency Operations Plan	The Stanislaus County 2021 EOP establishes an emergency management organization and assigns functions and tasks consistent with California's SEMS

Plan, Study, Report Name	How Plan Informed LHMP
	and the NIMS. It provides for the integration and coordination of planning efforts of multiple jurisdictions. This plan was developed utilizing the "whole community" planning process as outlined in FEMA's Comprehensive Preparedness Guide 101 and was reviewed and approved by representatives from each Stanislaus County department as well as members of the Operational Area Council and County/City Disaster Council. The content is based on guidance approved and provided by the State of California and FEMA. The EOP provides direction on how to respond to an emergency from the initial onset, through an extended response, and into the recovery process. A key element of the update process for this hazard mitigation plan was the annual review of the EOP. The HMPC remained informed of major review findings of the EOP with the intent to integrate with key components of the hazard mitigation plan. Future updates to the EOP will coincide with the future updates of the MJHMP.
Stanislaus County Code, Title 16 Buildings and Construction	The Stanislaus County Code, Title 16 provides minimum standards to safeguard life, health, property, and the public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within the unincorporated areas of the County.
Stanislaus County Code, Chapter 16.50, Floodplain Management	The purpose of this Chapter is to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas through specific provisions. This ordinance was used as a reference to assess County's mitigation capabilities and design mitigation actions and projects.
Stanislaus County Code, Chapter 16.55, Fire Code	Addresses requirements, responsibilities, and provisions for the prevention of fires and the spreading of fires as it pertains to structures. This ordinance was used as a reference to assess County's mitigation capabilities and design mitigation actions and projects.
Stanislaus County 2017 LHMP	The plan was reviewed to provide a basis for the current update.
Assessor for parcel data including Use Codes; assessed categories; and values	Used for quantitative vulnerability assessment for hazards. Parcel information was integrated into each hazard "Property" section in the vulnerability assessment.
Public Works for current infrastructure list (Bridges, Drainage, Street Lights, and Traffic Lights) and their geographic placement	Used to establish critical facilities GIS database.
GIS for numerous base map shape files such as cities, county, parcels, rivers, and roads	Used to establish critical facilities GIS database.
Modesto Subbasin Groundwater Sustainability Plan (January 2022)	Provided policy context for drought hazard; used as a reference to design mitigation actions and projects.
East Stanislaus Integrated Regional Water Management Plan (IRWM) (2018)	Provided policy context for drought hazard; used as a reference to design mitigation actions and projects.

Plan, Study, Report Name	How Plan Informed LHMP
Mid San Joaquin River Regional Flood Management Plan (MSJR RFMP) (2017)	Provided policy context for flood hazard; used as a reference to design mitigation actions and projects.
Central Valley Flood Protection Plan (2022 Update)	Provided policy context for flood hazard; used as a reference to design mitigation actions and projects.
FEMA Flood Insurance Rate Map	100- and 500-year floodplain data was acquired to profile flood hazard and carry out the related vulnerability assessment.
USACE Comprehensive Study; DWR Awareness Floodplain Mapping project	USACE 100-year flood event layer and DWR Best available maps in 200-year flood event layer were acquired to profile flood hazard and carry out the related vulnerability assessment.
FEMA Technical Bulletin 11-01 Crawlspace Construction for Buildings located in Special Flood Hazard Areas NFIP Interim Guidance	Provides guidance on crawlspace construction; used as a reference to design mitigation actions and projects.
NFIP	This program aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. NFIP data was incorporated into the vulnerability assessment for flood hazard.
NIMS	This system directs the creation of a comprehensive, national approach to incident management by federal, state, territorial, Tribal, and local responders and across all functional disciplines.
Federal Energy Regulatory Commission (FERC)	FERC is an independent agency that regulates interstate transmission of electricity, natural gas, and oil. FERC also reviews proposals to build liquefied national gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects and providing regulations of dams.
California Geological Survey, USGS	Data was acquired to profile and carry out vulnerability assessment for earthquake and landslide hazard.
California Code of Regulations, Title 24, Part 9 (California Building Standards Code) (Fire Code)	CCR Title 24 governs the design and construction of all building occupancies and associated facilities and equipment throughout California and is also known as building standards. It contains requirements for the structural, mechanical, electrical, and plumbing systems, and requires measures for energy conservation, green design, construction and maintenance, fire and life safety, and accessibility. The code is used as a reference to design mitigation actions and projects.
Alquist-Priolo Earthquake Fault Zoning Act	The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Relevant data was acquired to profile earthquake hazard.
CEQA	CEQA is a California statute passed in 1970 (shortly after the United States Federal Government passed the National Environmental Policy Act 9NEPA), to institute

Plan, Study, Report Name	How Plan Informed LHMP
	statewide policy of environmental protection. The County will complete supporting CEQA documentation prior to board approval and adoption.
California Public Resources Code (PRC) Section 4291 – Structures in Fire Hazard Areas	This code provides direction for persons owning, leasing, controlling, operating, or maintaining any building or structure in, upon, or adjoining any mountainous area of forest-covered lands, brush-covered lands, or grass-covered lands, or any lands which is covered with flammable material. The code is used as a reference to design mitigation actions and projects.
Municipal General Plans (including Safety Elements, Land Use Elements, and Housing Elements)	Informed the municipal annexes and in some cases the community service district annexes on past hazard events, mitigation policies, combining designations and existing and projected development.
Stanislaus County Flood Insurance Study	Reviewed for information on past floods and flood problems to inform risk assessment and consequence analysis (Section 4). Utilized Digital Flood Insurance Rate Maps effective
2018 State of California Multi-Hazard Mitigation Plan	Reviewed information on climate change and hazard assessment data to ensure consistency with this plan update. Reviewed list of hazards to inform risk assessment and consequence analysis (Section 4). Reviewed goals for consistency
California Department of Forestry and Fire Protection (CALFIRE) and the Fire and Resource Assessment Program (FRAP)	Data was acquired to profile and carry out vulnerability assessment for wildfire hazard.
NOAA National Centers for Environmental Information-State Climate Summaries	Reviewed information on climate change to inform risk assessment and consequence analysis.
California DOF/U.S. Census Bureau, ACS, 2015-2019	Informed the background on the community including demographic trends and the calculation of population at risk.
USDA Risk Management Agency Crop Indemnity Reports, 2007-2020	Informed the adverse weather section vulnerability assessment on how crops have been impacted by weather events in the past. Also informed the Drought, Severe Weather and Agricultural Pests and Disease sections of the HIRA.
California Climate Adaptation Strategy, 2018 and California OES Contingency Plan for Excessive Heat Emergencies (2014)	Informed the Extreme Heat profile and climate change considerations in the risk assessment and consequence analysis.
All relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, economic development plans, and emergency response plans were reviewed	Reviewed and used to profile and carry out vulnerability assessment for hazards. Used as references to design mitigation actions and projects.

In the process of preparing this hazard mitigation plan, many other existing plans, studies, reports, and technical information were evaluated or used as guidance. The HMPC for the development of the MJHMP Update included representatives who are charged with developing the Stanislaus County General Plan, the Stanislaus County CIP, and the Stanislaus County EOP. The Planning Committee members work to ensure that local plans are integrated with the MJHMP and provide expertise for the integration of other local, state, and federal plans, codes, and regulations.

Other technical data, reports and studies were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Information from the following agencies and groups were reviewed in the development and update of this plan. Specific references relied on in the development of this plan are also sourced throughout the document as appropriate.

- California Department of Forestry and Fire Protection
- California Department of Parks and Recreation Office of Historic Preservation
- California Department of Transportation
- California Department of Public Health
- California Natural Resources Agency
- California DSOD
- California DWR
- California Geological Survey
- Stanislaus County Agricultural Department
- Stanislaus OES
- California Water Foundation
- FEMA
- National Oceanic and Atmospheric Administration National Climatic Data Center
- National Register of Historic Places
- Natural Resource Conservation Service
- National Weather Service
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Western Regional Climate Center
- Center for Western Weather and Water Extremes

Integration of 2017 Plan into Other Plans and Planning Mechanisms

While the 2017 LHMP was not specifically incorporated or referenced in county or municipal plans and planning mechanisms, a process to do so with the 2021-2026 plan is outlined in Subsection 6.3.3. For example, the County amended the General Plan Safety Element to incorporate the 2010 LHMP; however, the 2017 LHMP was not incorporated into the Safety Element. There is a process noted in both Subsection 6.3.3 and corresponding mitigation actions in Subsection 5.3 that outline how the County and municipalities can achieve Assembly Bill (AB) 2140 compliance, which recommends adoption by reference or incorporation of the MJHMP into the Safety Element of the General Plan. The County was actively coordinating an amendment of the General Plan Safety Element to accommodate this during the finalization of this MJHMP in 2022. The County Planning and Community Development Department also intends to use that process to address compliance with Assembly Bill (AB) 747 and Senate Bill 99 related to evacuation route capacity and the identification of residential neighborhoods that do not have at least two ingress/egress routes.

3.4.3 Phase 2: Assess Risks

Planning Step 4: Identify the Hazards

Wood led the HMPC in an effort to review the list of hazards identified in the 2017 plan and document all the hazards that have, or could, impact the planning area, including documenting recent drought, flood, wildfire and severe storm events that were not included in the 2017 LHMP. Data collection worksheets were used in this effort to aid in determining hazards and vulnerabilities and where risk varies across the planning area. The profile of each of these hazards was then updated in 2021 with information from the HMPC and additional sources. Web resources, existing reports and plans, and existing GIS layers were used to compile information about past hazard events and determine the location, previous occurrences, probability of future occurrences, and magnitude/severity of each hazard. GIS was used to display, analyze, and quantify hazards and vulnerabilities where data permitted. The potential for climate change to affect the frequency and intensity of the hazards was summarized based on latest available science, where applicable. A more detailed description of the HIRA process and the results are included in Section 4: Hazard Identification and Risk Assessment.

Planning Step 5: Assess the Risks

After updating the profiles of the hazards that could affect the County, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. This step included two parts: a vulnerability assessment and a capability assessment.

Vulnerability Assessment – Participating jurisdictions updated their assets at risk to natural hazards—overall and in identified hazard areas. These assets included total number and value of structures; critical facilities and infrastructure; natural, historic, and cultural assets; and economic assets. The HMPC also analyzed development trends in hazard areas. Population at risk was also assessed and calculated for dam incidents, earthquake, flood, landslide, and wildfire hazards. The latest DFIRM was used to refine the estimate flood losses during the update, where available for the NFIP participating communities.

Consequence Analysis – New to the MJHMP is a Consequence Analysis to align the plan update with the Emergency Management Accreditation Program (EMAP) standards. The EMAP is a voluntary standards, assessment, and accreditation process for disaster preparedness programs throughout the country. It provides emergency management programs the opportunity to be recognized for compliance with industry standards, to demonstrate accountability, and to focus attention on areas and issues where resources are needed. The EMAP program consists of 66 standards, last updated in 2019 that evaluate all aspects of a jurisdiction’s comprehensive emergency management program.

Two EMAP standards specifically address hazard assessment and mitigation planning:

- Standard: 4.1 Hazard Identification, Risk Assessment and Consequence Analysis
- Standard: 4.2 Hazard Mitigation

EMAP Standard 4.1 identifies the natural and human-caused hazards that potentially impact a jurisdiction using multiple sources and assesses the risk and vulnerability of people, property, the environment, and its own operations from these hazards. The Consequence Analysis also considers the hazard impacts on the public; responders; continuity of operations including continued delivery of services; property, facilities, and infrastructure; environment; economic condition of the jurisdiction; and public confidence in the jurisdiction’s governance. Refer to Subsection 3.4.6 for a crosswalk that describes how the 2021-2016 Stanislaus County Multi-Jurisdictional Hazard Mitigation Plan is prepared in compliance with the EMAP standards.

Capability Assessment – The HMPC conducted a capability assessment update to review and document the planning area’s current capabilities to mitigate risk and vulnerability from hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. This information for the County is included in Section 6 and in the respective jurisdictional annexes. This addressed FEMA planning task 4: Review community capabilities - 44 CFR 201.6 (b)(2) & (3).

Results of the risk assessment was presented, and comments discussed at the second HMPC meeting in November 2021. A more detailed description of the risk assessment and consequence analysis process and the results are included in Section 4: Hazard Identification and Risk Assessment.

3.4.4 Phase 3: Develop the Mitigation Plan

Planning Step 6: Set Goals

Wood facilitated a discussion session with the HMPC to review the 2017 LHMP’s goals and objectives. The HMPC discussed definitions and examples of goals, objectives, and actions and considered the goals of in the SHMP and other relevant local plans when reviewing and revising the goals and objectives. The resulting updated goals and objectives are presented in Section 5: Mitigation Strategy. For the 2021-2022 MJHMP, goals were modified and several objectives specific to each hazard were added.

Planning Step 7: Review Possible Activities

Wood facilitated a discussion at an HMPC meeting to review the alternatives for mitigating hazards. This included a brainstorming session with the HMPC to identify a comprehensive range of mitigation actions for each identified hazard, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. More specifics on the process and the results of this collaborative process are captured in Section 5: Mitigation Strategy.

As part of the review of mitigation options long-term climate change adaptation strategies were also discussed. HMPC members were encouraged to incorporate climate change adaptation measures into the mitigation strategy of their respective jurisdictions utilizing resources and guidance available on the Cal-Adapt website and the California Adaptation Planning Guide.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, Wood produced a complete first draft of the plan. This complete Administrative Draft MJHMP was shared electronically with the HMPC for review and comment. Other agencies were invited to comment on this draft as well, specifically surrounding counties. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Neighboring county emergency managers and interested stakeholders identified under Step 3 were also solicited to provide comments on the draft plan during the public review period; no comments were received. Wood integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the California OES and FEMA Region IX to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

3.4.5 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction on the dates included in the adoption resolutions in Appendix C. The final plan will be incorporated by reference in the Safety Element of the County General Plan and result in the County's eligibility for Assembly Bill (AB) 2140. This adoption makes the jurisdiction eligible for consideration for part or all its local costs on eligible public assistance to be provided by State share funding through the CDDA.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the plan update process, all the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and updating and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as hazard(s) addressed, lead manager and priority, to help initiate implementation. An overall implementation strategy is described in Section 6: Plan Adoption, Implementation, and Maintenance.

Finally, there are numerous organizations within the Stanislaus County planning area whose goals and interests' interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and of mitigation in Stanislaus County and is addressed further in Section 6. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Section 6.

Implementation and Maintenance Process: 2017 LHMP

The 2017 LHMP included a process for implementation and maintenance which was generally followed, with some variation. Implementation of the plan including the status of mitigation actions is captured in Section 5 and the jurisdictional annexes. In general, the County and participating jurisdictions have made progress in the implementation of the plan. Successes of note are detailed in the mitigation strategy in Section 5. An updated implementation and maintenance section can be referenced in Section 6.

3.4.6 EMAP Standards Crosswalk

This crosswalk demonstrates compliance with the EMAP standards described in Subsection 3.4.3 – Phase 2: Assess Risks. The associated subsections and references where the information that demonstrates compliance with the EMAP standards that related to hazard mitigation planning are cross referenced in Table 3-6.

Table 3-6 EMAP Standards Crosswalk

Standard: 4.1 Hazard Identification, Risk Assessment and Consequence Analysis		
An Accredited Emergency Management Program has a Hazard Identification, Risk Assessment (HIRA), and Consequence Analysis.		
Subsection 4.1.1	**Location**	**Notes**
The Emergency Management Program identifies the natural and human-caused hazards that potentially impact the jurisdiction using multiple sources. The Emergency Management Program assesses the risk and vulnerability of people, property, the environment, and its own operations from these hazards.	Section 4 (pgs. 4-1 to 4-194)	See Section 4.1 for identification of natural hazards, summarized in Table 4-2. Sections 4.3.1 through 4.3.15 assess the risk and vulnerability from each identified hazard. These are organized in alphabetical order.
Subsection 4.1.2	**Location**	**Notes**
4.1.2 The Emergency Management Program conducts a consequence analysis for the hazards identified in Standard 4.1.1 to consider the impact on the following:	Section 4.3.1 through 4.3.15 (pgs. 4.21 to 4.194)	See the Vulnerability Assessment section of each hazard profile.
(1) public		"People" subsection
(2) responders		"Government Services" subsection
(3) continuity of operations including continued delivery of services		"Government Services" subsection
(4) property, facilities, and infrastructure		"General Property" and "Critical Facilities and Infrastructure" subsections
(5) environment		"Historic, Cultural and Natural Resources" subsection
(6) economic condition of the jurisdiction		"Economy" subsection
(7) public confidence in the jurisdiction's governance		"Government Services" subsection
Subsection 4.1.3	**Location**	**Notes**
The Emergency Management Program has a maintenance process for its HIRA identified in Standard 4.1.1 and the Consequence Analysis identified in Standard 4.1.2, which includes a method and schedule for evaluation and revision.	Section 6.3 (pgs. 6-2 to 6-5)	See Subsection 6.3.2 Maintenance and Evaluation Process for the maintenance process and the method and schedule for evaluation and revision.
Standard: 4.2 Hazard Mitigation		
An Accredited Emergency Management Program has a mitigation program that regularly and systematically utilizes resources to mitigate the effects of emergencies/disasters associated with the risks identified in the HIRA.		

Subsection 4.2.1	Location	Notes
The Emergency Management Program has a plan to implement mitigation projects and sets priorities based upon loss reduction.	Section 5 (pgs. 5-5 to 5-28) and Section 6 (pgs. 6-1 to 6-2)	See Section 5.3 for progress on implementing the mitigation program to date. See Section 5.2 on how actions were prioritized. See Sections 6.2 for how the plan will be implemented.
(1) The plan is based on the natural and human-caused hazards identified in Standard 4.1.1 and the risk and consequences of those hazards.	Section 5.2 and 5.3 (pgs. 5-5 to 5-28)	See Table 5-4 “Hazards” column for hazards mitigated. See Section 5.2 for how risk and consequences were considered when developing and prioritizing actions.
(2) The plan is developed through formal planning processes involving Emergency Management Program stakeholders.	Section 3 (pgs. 3-1 to 3-22)	Summarized in Table 3-2, Table 3-3 and Table 3-4. See also Appendix A and Appendix B for documentation.
(3) The plan establishes short and long-term strategies, actions, goals, and objectives.	Section 5 (pgs. 5-1 to 5-28) and Section 6.3 (Insert pgs. 6-2 to 6-5)	See Table 5-4 “Priority” and “Timeline” columns for short and long-term strategies and actions.
Subsection 4.2.2	**Location**	**Notes**
The Emergency Management Program documents project ranking based upon the greatest opportunity for loss reduction and documents how specific mitigation actions contribute to overall risk reduction.	Section 5.2.1 (pgs. 5-7 to 5-8), Section 5.2.2 (pgs. 5-12 to 5-28) and Section 6.3 (pgs. 6-2 to 6-4)	See Prioritization subsection (pgs. 5-7 to 5-8) for how projects were ranked based on loss reduction; See Table 5-4 “Description/Background/ Benefits” column for how specific mitigation actions contribute to overall risk reduction; See Maintenance and Monitoring subsections (pgs. 6-2 to 6-4) for how the contribution of specific actions will be tracked and documented.
Subsection 4.2.3	**Location**	**Notes**
The Emergency Management Program has a process to monitor overall progress of the mitigation activities and documents completed initiatives and their resulting reduction or limitation of hazard impact on the jurisdiction.	Section 6.3 (pgs. 6-2 to 6-4)	See Maintenance and Monitoring subsections (pgs. 6-2 to 6-4) for how progress will be tracked and documented.
Subsection 4.2.4	**Location**	**Notes**
The Emergency Management Program, consistent with the scope of the mitigation program, does the following:	---	---
(1) identifies ongoing mitigation opportunities and tracks repetitive loss;	Section 4.3.8, Flood Hazards – Insurance Coverage, Claims Paid, and Repetitive Loss Properties (under Flood Hazard Profile) (pgs. 4-115 to 4-117); Section 6.3 (pgs. 6-2 to 6-4)	See Maintenance and Monitoring subsection (pgs. 6-2 to 6-4)

(2) provides technical assistance in implementing mitigation codes and ordinances;	Section 6.2 (pgs. 6-1 to 6-2) and Section 6.3 (pgs. 6-3 to 6-4)	See Role of the Planning Committee in Plan Adoption, Implementation and Maintenance subsection (pgs. 6-1 to 6-2), and Incorporation into Existing Planning Mechanisms (pgs. 6-3 to 6-4)
(3) participates in jurisdictional and multijurisdictional mitigation efforts.	Section 3.3 to 3.4 (pgs. 3-4 to 3-7); Section 5.3.2 (pgs. 5-12 to 5-28); Section 6.2 to 6.3 (pgs. 6-1 to 6-4); Section 7.1 (pg. 7-1)	See 3.4.2 Coordinate with Other Departments and Agencies (pgs. 3-14 to 3-15), and Table 5-4 “Lead Agency and Partners” column.
Subsection 4.2.5	**Location**	**Notes**
The Emergency Management Program has a maintenance process for the plan identified in Standard 4.2.1, which includes a method and schedule for evaluation and revision.	Section 6.3 (pgs. 6-2 to 6-5)	See Maintenance and Monitoring subsections (pgs. 6-2 to 6-5) for method and schedule.

4 Hazard Identification and Risk Assessment

Requirement §201.6(c)(2)(i):
The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(ii):
The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:
§201.6(c)(2)(ii)(A):
The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
§201.6(c)(2)(ii)(B):
An estimate of the potential dollar losses to vulnerable structures identified in this section and a description of the methodology used to prepare the estimate.
§201.6(c)(2)(ii)(C):
Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Risk to natural hazards is a combination of hazard, vulnerability and capability. This section of the MJHMP will look at both hazards and vulnerability. The risk assessment process identifies and profiles relevant hazards and assesses the exposure to lives, property and infrastructure to these hazards. The goal of the risk assessment is to estimate the potential losses in Stanislaus County from a hazard event. This process also allows communities in Stanislaus County to better understand their potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce the risks from future hazard events in Stanislaus County.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1. Describe Hazards
2. Identify Community Assets
3. Analyze Risks
4. Summarize Vulnerability

In essence, the risk assessment evaluates potential loss from hazards by assessing the vulnerability of the County's population, build environment, critical facilities, and other assets. The updated risk assessment also identifies natural and human-caused hazards and includes a consequence analysis for these hazards consistent with the Emergency Management Accreditation Program (EMAP) standards. Data collected through this process has been incorporated into the following sections of this section:

Subsection 4.1: Hazard Identification—identifies the natural, human-caused, and human-health hazards that threaten the Planning Area and describes why some hazards have been omitted from further consideration.

Subsection 4.2: Asset Summary—describes the methodology for inventorying assets as the basis for determining vulnerability of the Planning Area to the identified hazards.

Subsection 4.3: Hazard Analysis, Risk Assessment, and Consequence Analysis—discusses the threat to the Planning Area and describes previous occurrences of hazard events and the likelihood of future occurrences (2013 FEMA Local Mitigation Planning Handbook Risk Assessment Step 1). It includes a vulnerability assessment considering assets at risk, critical facilities, and development trends (2013 FEMA Local Mitigation Planning Handbook Risk Assessment Steps 2, 3 and 4). The updated risk assessment also includes a consequence analysis that assesses the hazard impacts on the public; first responders; continuity of operations; property, facilities, and infrastructure; environment; economic conditions; and public confidence in government.

This risk assessment covers the entire geographical area of Stanislaus County. Since this plan is a multi-jurisdictional plan, the HMPC was required to evaluate how the hazards and risks vary from jurisdiction to jurisdiction. While these differences are noted in this section, they are expanded upon in the annexes of the participating jurisdictions. If no additional data is provided in an annex, it should be assumed that the risk and potential impacts to the affected jurisdiction are similar to those described here for the entire Stanislaus County Planning Area.

4.1 Hazard Identification

The San Joaquin Valley region and Stanislaus County are susceptible to a number of hazards. This MJHMP profiles the most significant of these hazards. In the early meetings with Stanislaus County and the HMPC, data was reviewed from the following sources on hazards affecting the County, those sources were: Federal and State Disaster Declaration History, the California State Hazard Mitigation Plan (SHMP) (2018), the Safety Element of the Stanislaus County 2015 General Plan, results from an initial risk assessment and hazard ranking exercise conducted by the Stanislaus County Office of Emergency Services (OES) in 2020 that addressed 48 natural and human-caused hazards, and interviews of staff that live and work in Stanislaus County.

Using existing natural hazards data and input gained through planning meetings during both the 2017 Local Hazard Mitigation Plan (LHMP) and 2021 update, the HMPC agreed upon a list of hazards that could affect Stanislaus County. The following table explains the changes in the hazards profiled in 2017 LHMP and the 2021 update.

Table 4-1 Updates to Hazards Profiled, 2017 LHMP and 2021 Update

2017 Hazards	2021 Hazards	Comments
Earthquake	Earthquake	No Changes.
Landslide	Landslide	No Changes.
Dam Failure	Dam Incidents	No Changes.
Flood	Flood	No Changes.
Wildfire	Wildfire	No Changes.
	Agriculture Pest and Disease	New in 2021. Added due to significant agricultural industry in the County and the impacts to the local economy.
	Aquatic Invasive Species (AIS)	New in 2021. Added due to the worsening AIS situation in the County, the nearby region, and Northern California.
	Cyber Attacks	New in 2021. Added due to worldwide uptick in number and extent of attacks.
	Drought	New in 2021. Profiled separately in 2021 Update due to the unique nature of the hazard and the consequences on the County.

2017 Hazards	2021 Hazards	Comments
	Pandemic/Epidemic	New in 2021. Included due to extent of impacts associated with the ongoing COVID-19 pandemic.
	Severe Weather: Hail, Heavy Rain, Lightning	New in 2021. Included because severe weather data and HMPC input show that these events occur in the County regularly and have caused damages.
	Severe Weather: Wind, Tornado	New in 2021. Included because weather data and HMPC input show that these severe weather events occur in the County regularly and have caused property damages.
	Severe Weather: Dense Fog	New in 2021. Included to assess the tule fogs that cause issues for the County and the San Joaquin Valley region.

The 2021 MJHMP update included a significant re-evaluation of the hazards with the latest, best available data. Hazards data from Stanislaus County, Cal OES, FEMA, the National Oceanic and Atmospheric Administration, and many other sources were examined to assess the significance of these hazards to the Planning Area. The update process included a comprehensive, parcel-level risk analysis with GIS where available data permitted. Many new maps and tables were added that capture the potential losses.

4.1.1 Overall Hazard Significance Summary

Overall hazard significance was based on a combination of Geographic Area, Probability of Future Occurrence and Potential Magnitude/Severity as defined below. The individual ratings are based on or interpolated from the analysis of the hazards in the sections that follow. During the 2021 Stanislaus County MJHMP update the individual ratings and significance of the hazards was revisited and updated. Public concern was also considered via input at public webinars, two public workshops, and an online survey.

Table 4-2 Stanislaus County Hazard Significance

Hazard	Geographic Area	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Agriculture Pest and Disease	Extensive	Likely	Limited	Low
Aquatic Invasive Species	Limited	Likely	Negligible	Low
Cyber Attack	Significant	Likely	NA	Medium
Dam Incidents	Significant	Unlikely	Catastrophic	Medium
Drought	Extensive	Likely	Critical	High
Earthquake	Extensive	Occasional	Critical	Medium
Extreme Temperatures: Freeze and Extreme Heat	Extensive	Highly Likely	Critical	High
Flood	Significant	Likely	Critical	Medium
Landslide	Significant	Occasional	Negligible	Low
Public Health Hazards: Pandemic/Epidemic	Extensive	Occasional	Critical	High
Severe Weather: Dense Fog	Extensive	Likely	Critical	Medium
Severe Weather: Heavy Rain, Thunderstorm, Hail, and Lightning	Extensive	Highly Likely	Critical	High
Severe Weather: High Wind and Tornado	Extensive	Highly Likely	Critical	High
Wildfire	Significant	Occasional	Negligible	Medium

Geographic Area Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area **Probability of Future Occurrences** Highly Likely: Near 100% chance of occurrence in next year or happens every year.	**Magnitude/Severity (Extent)** Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability

<table>
<tr><th>Hazard</th><th>Geographic Area</th><th>Probability of Future Occurrence</th><th>Magnitude/Severity (Extent)</th><th>Overall Significance</th></tr>
<tr><td colspan="2">Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.</td><td colspan="3">Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact</td></tr>
</table>

4.1.2 Non-Profiled Hazards

The HMPC reviewed data and discussed several other hazards, which were eliminated from further discussion because they occur rarely and/or their impacts are not significant. The list below details these hazards and provides a brief explanation for their omission from further profiling.

- **Avalanche** – Snowfall is extremely rare to nonexistent across the Planning Area.
- **Coastal Erosion/Storm** – This hazard does not occur due to distance from coasts and the ocean.
- **Hurricane** – This hazard does not occur due to distance from ocean.
- **Tsunami** – This hazard does not occur due to distance from ocean.
- **Volcano** – The U.S. Geological Survey (USGS) does not include Stanislaus County in their map of areas identified as subject to hazards from potential eruptions in California.

The HMPC acknowledges there are other human-caused hazards that can affect the County. They are recognized in this MJHMP and risk assessment, with notes below how they are considered as consequences of other hazards or how they addressed in other State or County planning mechanisms:

- **Civil Unrest and Terrorism** – More commonly addressed in the local emergency operations plans (EOPs).
- **Power outages/Utility Failure** – This is addressed as a consequence of other hazards such as severe weather, earthquakes, and wildfires.
- **Transportation Hazards** – Transportation safety is typically addressed in other planning mechanisms. Transportation hazards are also noted as a consequence of other hazards where applicable, e.g. severe weather sections, earthquakes, floods.

4.1.3 Disaster Declaration History

One method to identify hazards is to look at the events that have triggered federal and/or state disaster declarations that included Stanislaus County. Federal and state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance. In other words, a presidential disaster declaration puts federal recovery programs in place to help disaster victims, business, and public agencies.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations (Farm Service Agency 2018). The quantity and types of damage are the determining factors. This section focuses on state and federal disaster and emergency declarations.

The communities throughout Stanislaus are among the many in California that are susceptible to disaster. Details on federal and state disaster declarations were obtained by the HMPC, FEMA, and Cal OES and compiled in chronological order in Table 4-3. A review of state and federal declared disasters indicates that Stanislaus County received 16 proclamations between 1950 and March 2020. Of the 16 declarations, four were associated with severe storm(s); three were for flood; two were for freezing; another two were for fire;

and another two were for the COVID-19 pandemic; one was for coastal storm, one was for hurricane and another one was for drought.

This disaster history (combined federal and state) suggests that Stanislaus County experiences a major event worthy of a disaster declaration about every few years. The County has a 23 percent chance of receiving a disaster declaration in any given year. With the exception of the declarations for drought and the COVID-19 pandemic, every declaration resulted directly or indirectly from severe weather. Further, a review of these events helps Stanislaus County, and its jurisdictions identify risk reduction targets and ways to improve capabilities to avoid large-scale hazard events in the future.

The following table lists the declarations where Stanislaus County was included in federal and/or state disaster declarations from 1950 to the present. Also included are Fire Management Assistance (FM) and Emergency Declarations (EM).

Table 4-3 Stanislaus County Disaster Declaration History 1950-present

Hazard Type	Disaster Name	Disaster Number
Flood	1965 Heavy Rains & Flooding (Statewide)	DR-183
Flood	1969 Severe Storms & Flooding (Multiple Counties)	DR-253
Drought	1977 California Drought (Statewide)	EM-3023
Coastal Storm	1983 Coastal Storms, Floods, Slides & Tornadoes (Multiple Counties)	DR-677
Freezing	1991 Severe Freeze (Multiple Counties)	DR-894
Severe Storm(s)	1995 Severe Winter Storms, Flooding Landslides, Mud Flow (Multiple Counties)	DR-1046
Severe Storm(s)	1997 Severe Storms, Flooding, Mud and Landslides (Statewide)	DR-1155
Severe Storm(s)	1998 Severe Winter Storms and Flooding (Statewide)	DR-1203
Hurricane	2005 Hurricane Katrina Evacuation (Statewide)	EM-3248
Severe Storm(s)	2006 Severe Storms, Flooding, Landslides, and Mudslides (Statewide)	DR-1646
Freezing	2007 Severe Freeze (Multiple Counties)	DR-1689
Flood	2017 Severe Winter Storms, Flooding, and Mudslides (Statewide)	DR-4308
Biological	2020 Covid-19	EM-3428
Biological	2020 COVID-19 pandemic	DR-4482
Fire	2020 Santa Clara Unit (SCU) Lightning Complex Fire	FM-5338
Fire	2020 Wildfires (Multiple Counties)	DR-4558

Source: Stanislaus OES, Cal OES and FEMA

Since 2012, there have been 21 disaster designations issued by the Secretary of Agriculture in Stanislaus County, 16 of which were for drought and three were for excessive rain, of which one was also for high winds, hail, excess rain, and cold temperatures. Of the drought designations, 11 are classified as "*Drought-Fast Track*" Secretarial disaster designations. According to the Secretary of Agriculture, a Fast Track designation is for a severe drought and provides an automatic designation when during the growing season any portion of the County meets the severe drought intensity value for eight consecutive weeks. Refer to the Drought hazard profile for more information of disaster declarations from the Secretary of Agriculture related to drought events.

Table 4-4 USDA Agricultural Declarations in Stanislaus County, 2012-2020

Year	Hazard	Designation Number	Approval Date
2012	Drought	S3248	5/31/2012
	Drought-Fast Track	S3268	7/12/2012
	Hailstorm, rain, cold temperatures	S3320	8/3/2012
	Drought	S3379	9/5/2012
2013	Drought	S3452	12/19/2012
	Drought-Fast Track	S3547	7/3/2013
	Drought-Fast Track	S3558	7/31/2013
	Drought-Fast Track	S3569	8/21/2013
2014	Drought-Fast Track	S3626	1/15/2014
	Drought	S3743	9/17/2014

Year	Hazard	Designation Number	Approval Date
2015	Drought-Fast Track	S3784	2/4/2015
	Drought	S3943	12/23/2015
2016	Drought-Fast Track	S3952	2/17/2016
	Severe weather including excessive rainfall and high winds	S4164	3/31/2017
2017	Excessive rain, high winds, cold temperatures, and hail	S4170	4/28/2017
2017	Drought-Fast Track	S4144	2/23/2017
2020	Drought-Fast Track	S4163	3/22/2017
	Excessive rain	S4237	10/13/2017
2019	Excessive rain	S4656	3/11/2020
2020	Drought-Fast Track	S4697	6/16/2020
2021*	Drought-Fast Track	S4916	3/5/2021

Source: USDA Secretary of Agriculture

*2021 data is as of August 20, 2021.

4.1.4 Climate Change Considerations Summary

Stanislaus County is part of the San Joaquin Valley part of California's Central Valley. The region is known as one of the world's most productive agricultural regions and is also vulnerable to the impacts of climate change. The following are highlights from California's Fourth Climate Change Assessment, San Joaquin Valley Region Report (Preview), of projected impacts to the State of California and the Central Valley due to climate change:

- Acceleration of higher temperatures across California.
- More intense and frequent heat waves.
- Increasing evapotranspiration.
- More intense and frequent droughts.
- More intense rainstorms.
- Higher frequency of catastrophic floods.
- More severe and frequent wildfires.
- Declining and change in timing of snowmelt.
- Increased susceptibility to rain-on-snow events from atmospheric rivers.
- Increased stream temperatures resulting in decreased water quality.

In addition, the 2017 Stanislaus County Climate Change and Health Profile Report, supported by the Center for Disease Control (CDC) and California Department of Public Health (CDPH) summarized climate projections specifically to the Northern Central Valley region, which includes Stanislaus County. These projections align with those mentioned in the California's Fourth Climate Change Assessment, San Joaquin Valley Region Report (Preview). The 2017 Stanislaus County Climate Change and Health Profile Report made the following findings related to temperature changes:

- Temperatures are expected to rise substantially throughout this century.
- Average annual temperature is projected to increase from 60.6 °F to 64.6 °F (under the low-emissions scenario) or 67.2 °F (under the high-emission scenario).

Both the California's Fourth Climate Change Assessment and the 2017 Stanislaus County Climate Change and Health Profile Report contain data derived from web-based Cal-Adapt tool, which was used to summarize the projected changes through the end of the century. Cal-Adapt is a scenario planning tool that was developed by the California Energy Commission (CEC) and the University of California, Berkeley Geospatial Innovation Facility. The Cal-Adapt tool uses global climate simulation model data downscaled to a local and regional resolution to identify localized impacts. The Cal-Adapt tool makes predictions under two Representative Concentration Pathways (RCP) scenarios. RCP scenarios are not specific policies but defined by the total solar radiative focusing anticipated by 2100 and address the uncertainty in future concentrations of greenhouse gas (GHG) emissions. Each RCP scenario is described below:

- **RCP 4.5** – a low-emissions scenario, which assumes that emissions peak around 2040 and then decline, and

- **RCP 8.5** – a high-emissions scenario, which assumes that emissions continue to rise strongly through 2030 and plateau around 2100. Climate change projected under RCP 8.5 will typically be more severe than under RCP 4.5.

Both scenarios help municipalities in California assess emissions-dependent variability and evaluate a moderate scenario alongside a worst-case scenario. The important consideration for hazard mitigation is that climate change is exacerbating the hazards that are already identified and profiled. Additional specifics associated with the hazards are discussed in the Climate Change Considerations portion of each hazard profile. The County and California are also already experiencing the impacts of climate change including prolonged drought, increased flooding due to shifts in peak runoff, increased average temperatures, shifts in the water cycle, and changes to precipitation patterns and the intensity of extreme events resulting from hazards. Climate change not only results in progressive changes, such as shifting weather patterns but also affects the frequency and severity of hazard events (SHMP 2018). Furthermore, climate change also generates an increase in the variance of climate patterns, and this increased variance creates challenges for hazards planning, which previously used historic recurrence rates to predict future events, and now must incorporate changes to the frequency, severity, and location due to climate change.

Risk assessment for hazards is built upon the frequency of past events and the assumption that historic occurrence rates are a good predictor of future event probability. With climate change, however, history is not an adequate predictor of the probability of future occurrences (SHMP 2018). Planning for climate change (and understanding the probability of future occurrences [see Subsection 4.3 below]) is therefore now based on understanding and integrating evolving climate change science and modeled projections that account for shifts in historic conditions due to climate change (SHMP 2018) into hazard mitigation planning.

Additional specifics associated with the hazards are discussed in the Climate Change Considerations subsection of each hazard profile.

4.1.5 Overview of Hazard Identification, Risk Assessment, and Consequence Analysis

Subsection 4.3 contains detailed hazard profiles for the identified hazards. Each hazard profile includes the following subsections:

- **Hazard/Problem Definition** – This section gives a description of the hazard and associated issues followed by details on the hazard specific to the Stanislaus County Planning Area.
- **Geographic Area** – This section gives a spatial description of the potential location or areas of Stanislaus County where the hazard expected to impact.
- **Extent (Magnitude/Severity)** – This section gives a description of the potential strength or magnitude of the hazard as it pertains to Stanislaus County. It describes how much damage could occur as a result of a hazard event.
- **Previous Occurrences** – This section contains information on historical incidents, including impacts where known. Historical incident worksheets were used to capture information from participating jurisdictions on past occurrences.
- **Probability of Future Occurrence** – The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. It is determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percent chance (probability) of an event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:
  - **Highly Likely** – Near 100 percent chance of occurrence in next year or happens every year.
  - **Likely** – Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.
  - **Occasional** – Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
  - **Unlikely** – Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.
- **Climate Change Considerations** – This describes the potential for climate change to affect the frequency and intensity of the hazard in the future.

- **Vulnerability** – Following the hazard profiles is a vulnerability assessment for each identified hazard. The assessment was conducted through the study of potential impacts to the following specific sectors, including those sectors assessed in a Consequence Analysis:
  - General Property
  - People (including the public)
  - Government Services (including the public's confidence in governance)
  - Critical Facilities and Infrastructure (including the continuity of operations)
  - Economy
  - Historic, Cultural, and Natural Resources
  - Future Development
  - Risk Summary – Each vulnerability assessment includes a risk summary of the key issues/problems based on threat, vulnerability and consequence to the Planning Area and jurisdictions from the specific hazard.

Vulnerabilities are summarized for all natural hazards, and the consequences are summarized for both natural hazards, public health hazards, and human-caused hazards in a consequence analysis. The vulnerability assessment addresses who or what is vulnerable to natural hazards or climate stressors, where is someone or a critical facility susceptible to damage, and when and why these assets may be vulnerable. The assessment is used to inform strategic decision-making by identifying the assets or portions of the Planning Area most vulnerable to natural hazards.

The consequence analysis addresses impacts on the public; first responders; continuity of operations; property, facilities, and infrastructure; the environment; economic conditions; and public confidence in governance. The government services section assesses the impacts on the first responders and public confidence in governance. The other sections cover the public, continuity of operations, property, environment, and economy.

Data used to support this assessment included the following:

- County GIS data (hazards, base layers, and assessor's data);
- Statewide and nationwide GIS datasets to support mitigation planning;
- California SHMP 2018;
- Stanislaus County LHMP 2017;
- Neighboring Jurisdictional HMPs;
- Cal FIRE datasets;
- California's Fourth Climate Change Assessment;
- Written descriptions of inventory and risks provided by the jurisdictions;
- Online data sources (cited where applicable);
- Data and information from existing plans and studies; and
- Input from the HMPC members and staff from the County and local, state, and federal agencies.

4.2 Asset Summary

4.2.1 Assets Exposure

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Planning Area, this section describes significant assets exposed or at risk in the Planning Area. Data used in this baseline assessment included:

- Total assets at risk;
- Critical facility inventory;
- Cultural, historical, and natural resources; and
- Population growth and land use/development trends.

Total Assets at Risk

Building value assessments in this plan are based on data from the Stanislaus County's Assessor's Office. This data provided the baseline for an inventory of the total exposure of developed properties within the County and helps to ensure that the updated MJHMP reflects changes in development. It is important to note that depending on the nature and type of hazard event or disaster, it is generally the value of the infrastructure or improvements to the parcels that are of concern or at risk. Generally, the land itself is not a total loss, but may see a reduction in value. Thus, the parcel analysis excludes land value.

Parcel Exposure and Preparations for Analysis

Stanislaus County Assessor data was used to inventory the total number and types of parcels with improvements, defined as parcels with an improvement value greater than zero in the County. Building content values were estimated based on the following formulas based on FEMA/Hazus methods: a) Residential properties received content values worth 50% of the improved values; b) Agricultural, Commercial, Exempt, and Mixed Use related properties received content values worth 100% of the improved values; and c) Industrial properties received content values worth 150% of the improved values. Adding up these content and original improved values yields the Total Value of Improved Parcels, which is an estimation of the total property exposure within the County. Table 4-6 summarizes the property inventory for the County and each participating jurisdiction with detail by property type. Table 4-5 shows the total property inventory from the Assessor's Office.

Table 4-5 Total Exposure Summary by Jurisdiction

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
Ceres	11,462	$2,511,485,475	$1,760,538,649	$4,272,024,124
Hughson	2,086	$494,398,275	$313,490,178	$807,888,453
Modesto	60,673	$14,126,321,781	$9,767,800,876	$23,894,122,657
Newman	3,385	$590,163,657	$344,071,684	$934,235,341
Oakdale	7,298	$1,685,764,252	$1,150,181,302	$2,835,945,554
Patterson	6,318	$1,771,624,046	$1,230,025,611	$3,001,649,657
Riverbank	6,757	$1,405,026,457	$847,415,697	$2,252,442,154
Turlock	19,413	$5,311,625,963	$3,985,984,895	$9,297,610,858
Waterford	2,376	$389,884,917	$233,731,703	$623,616,620
Unincorporated	33,626	$8,094,078,660	$7,355,080,468	$15,449,159,128
Total	153,394	$36,380,373,483	$26,988,321,061	$63,368,694,544

Source: Stanislaus County Assessor's Office, Wood Analysis

Table 4-6 Total Exposure by Jurisdiction and Property Type

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
Ceres	Commercial	295	$274,772,405	$274,772,405	$549,544,810
	Industrial	207	$249,762,103	$374,643,155	$624,405,258
	Non-Assessable	5	$938,099	$938,099	$1,876,198
	Residential	10,555	$1,721,767,451	$860,883,726	$2,582,651,177
	Residential-Income	75	$29,383,391	$14,691,696	$44,075,087
	Rural, Farm, Agricultural	16	$1,426,848	$1,426,848	$2,853,696
	Unclassified	272	$230,204,065	$230,204,065	$460,408,130
	Vacant Commercial	34	$2,726,199	$2,726,199	$5,452,398
	Vacant Residential	3	$504,914	$252,457	$757,371
	Total	**11,462**	**$2,511,485,475**	**$1,760,538,649**	**$4,272,024,124**
Hughson	Commercial	76	$88,461,818	$88,461,818	$176,923,636
	Industrial	20	$19,160,207	$28,740,311	$47,900,518

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
	Residential	1,929	$376,068,623	$188,034,312	$564,102,935
	Residential-Income	22	$4,907,515	$2,453,758	$7,361,273
	Rural, Farm, Agricultural	6	$562,163	$562,163	$1,124,326
	Unclassified	23	$4,935,480	$4,935,480	$9,870,960
	Vacant Commercial	9	$302,206	$302,206	$604,412
	Vacant Residential	1	$263	$132	$395
	Total	**2,086**	**$494,398,275**	**$313,490,178**	**$807,888,453**
Modesto	Commercial	2,071	$3,304,473,791	$3,304,473,791	$6,608,947,582
	Industrial	318	$396,367,700	$594,551,550	$990,919,250
	Non-Assessable	6	$2,427,991	$2,427,991	$4,855,982
	Residential	55,011	$9,002,867,528	$4,501,433,764	$13,504,301,292
	Residential-Income	510	$109,144,569	$54,572,285	$163,716,854
	Rural, Farm, Agricultural	12	$1,448,594	$1,448,594	$2,897,188
	Unclassified	2,606	$1,288,060,077	$1,288,060,077	$2,576,120,154
	Vacant Commercial	120	$20,134,118	$20,134,118	$40,268,236
	Vacant Residential	19	$1,397,413	$698,707	$2,096,120
	Total	**60,673**	**$14,126,321,781**	**$9,767,800,876**	**$23,894,122,657**
Newman	Commercial	100	$35,962,668	$35,962,668	$71,925,336
	Industrial	36	$18,733,108	$28,099,662	$46,832,770
	Residential	3,172	$507,471,566	$253,735,783	$761,207,349
	Residential-Income	26	$2,781,981	$1,390,991	$4,172,972
	Rural, Farm, Agricultural	4	$373,507	$373,507	$747,014
	Unclassified	33	$24,092,050	$24,092,050	$48,184,100
	Vacant Commercial	10	$85,269	$85,269	$170,538
	Vacant Residential	4	$663,508	$331,754	$995,262
	Total	**3,385**	**$590,163,657**	**$344,071,684**	**$934,235,341**
Oakdale	Commercial	327	$202,961,845	$202,961,845	$405,923,690
	Industrial	208	$153,308,947	$229,963,421	$383,272,368
	Non-Assessable	3	$60,695	$60,695	$121,390
	Residential	6,355	$1,210,767,189	$605,383,595	$1,816,150,784
	Residential-Income	64	$13,323,410	$6,661,705	$19,985,115
	Rural, Farm, Agricultural	17	$4,549,891	$4,549,891	$9,099,782
	Unclassified	292	$99,950,578	$99,950,578	$199,901,156
	Vacant Commercial	27	$457,449	$457,449	$914,898
	Vacant Residential	5	$384,248	$192,124	$576,372
	Total	**7,298**	**$1,685,764,252**	**$1,150,181,302**	**$2,835,945,554**
Patterson	Commercial	169	$115,891,266	$115,891,266	$231,782,532
	Industrial	72	$99,219,330	$148,828,995	$248,048,325
	Residential	5,889	$1,157,277,335	$578,638,668	$1,735,916,003
	Residential-Income	73	$11,291,796	$5,645,898	$16,937,694
	Rural, Farm, Agricultural	31	$3,007,864	$3,007,864	$6,015,728
	Unclassified	61	$370,566,992	$370,566,992	$741,133,984
	Vacant Commercial	16	$522,393	$522,393	$1,044,786
	Vacant Residential	7	$13,847,070	$6,923,535	$20,770,605
	Total	**6,318**	**$1,771,624,046**	**$1,230,025,611**	**$3,001,649,657**
Riverbank	Commercial	242	$134,243,147	$134,243,147	$268,486,294

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
	Industrial	36	$36,455,827	$54,683,741	$91,139,568
	Non-Assessable	1	$16,336	$16,336	$32,672
	Residential	6,294	$1,144,317,711	$572,158,856	$1,716,476,567
	Residential-Income	51	$7,178,599	$3,589,300	$10,767,899
	Rural, Farm, Agricultural	22	$2,897,415	$2,897,415	$5,794,830
	Unclassified	93	$79,144,886	$79,144,886	$158,289,772
	Vacant Commercial	14	$591,499	$591,499	$1,182,998
	Vacant Residential	4	$181,037	$90,519	$271,556
	Total	**6,757**	**$1,405,026,457**	**$847,415,697**	**$2,252,442,154**
Turlock	Commercial	832	$924,925,946	$924,925,946	$1,849,851,892
	Industrial	357	$579,530,828	$869,296,242	$1,448,827,070
	Non-Assessable	4	$244,121	$244,121	$488,242
	Residential	17,103	$3,163,378,554	$1,581,689,277	$4,745,067,831
	Residential-Income	227	$61,684,538	$30,842,269	$92,526,807
	Rural, Farm, Agricultural	72	$8,988,896	$8,988,896	$17,977,792
	Unclassified	739	$556,407,740	$556,407,740	$1,112,815,480
	Vacant Commercial	60	$10,715,467	$10,715,467	$21,430,934
	Vacant Residential	19	$5,749,873	$2,874,937	$8,624,810
	Total	**19,413**	**$5,311,625,963**	**$3,985,984,895**	**$9,297,610,858**
Waterford	Commercial	117	$38,179,265	$38,179,265	$76,358,530
	Industrial	18	$4,182,790	$6,274,185	$10,456,975
	Residential	2,114	$311,482,233	$155,741,117	$467,223,350
	Residential-Income	29	$5,006,986	$2,503,493	$7,510,479
	Rural, Farm, Agricultural	20	$2,708,574	$2,708,574	$5,417,148
	Unclassified	76	$28,263,326	$28,263,326	$56,526,652
	Vacant Commercial	2	$61,743	$61,743	$123,486
	Total	**2,376**	**$389,884,917**	**$233,731,703**	**$623,616,620**
Unincorporated	Commercial	798	$597,932,090	$597,932,090	$1,195,864,180
	Industrial	952	$1,322,266,361	$1,983,399,542	$3,305,665,903
	Non-Assessable	28	$49,799,273	$49,799,273	$99,598,546
	Residential	16,992	$2,737,798,000	$1,368,899,000	$4,106,697,000
	Residential-Income	477	$60,911,214	$30,455,607	$91,366,821
	Rural, Farm, Agricultural	13,863	$3,114,041,506	$3,114,041,506	$6,228,083,012
	Unclassified	384	$206,801,166	$206,801,166	$413,602,332
	Vacant Commercial	94	$2,975,519	$2,975,519	$5,951,038
	Vacant Residential	38	$1,553,531	$776,766	$2,330,297
	Total	**33,626**	**$8,094,078,660**	**$7,355,080,468**	**$15,449,159,128**
Grand Total		**153,394**	**$36,380,373,483**	**$26,988,321,061**	**$63,368,694,544**

Source: Stanislaus County Assessor's Office, Wood Analysis

Critical Facility/Lifeline Inventory

A significant aspect of the 2021 HIRA update was the update of critical facilities and an alignment/classification with the FEMA Lifelines framework. The critical facilities/lifelines GIS database was based on a combination of County-provided data, Homeland Infrastructure Foundation-Level Data (HIFLD), and local and jurisdiction-specific input. Jurisdictions were able to review critical facility data, edit descriptive attributes and address information, and add new critical facilities. The results are summarized here and provided the basis for GIS-based vulnerability analyses, where data permitted.

For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA sorts critical facilities into seven lifeline categories as shown in Figure 4-1.

Figure 4-1 Lifeline Categories

Source: FEMA 2020.

These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans, easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.

- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

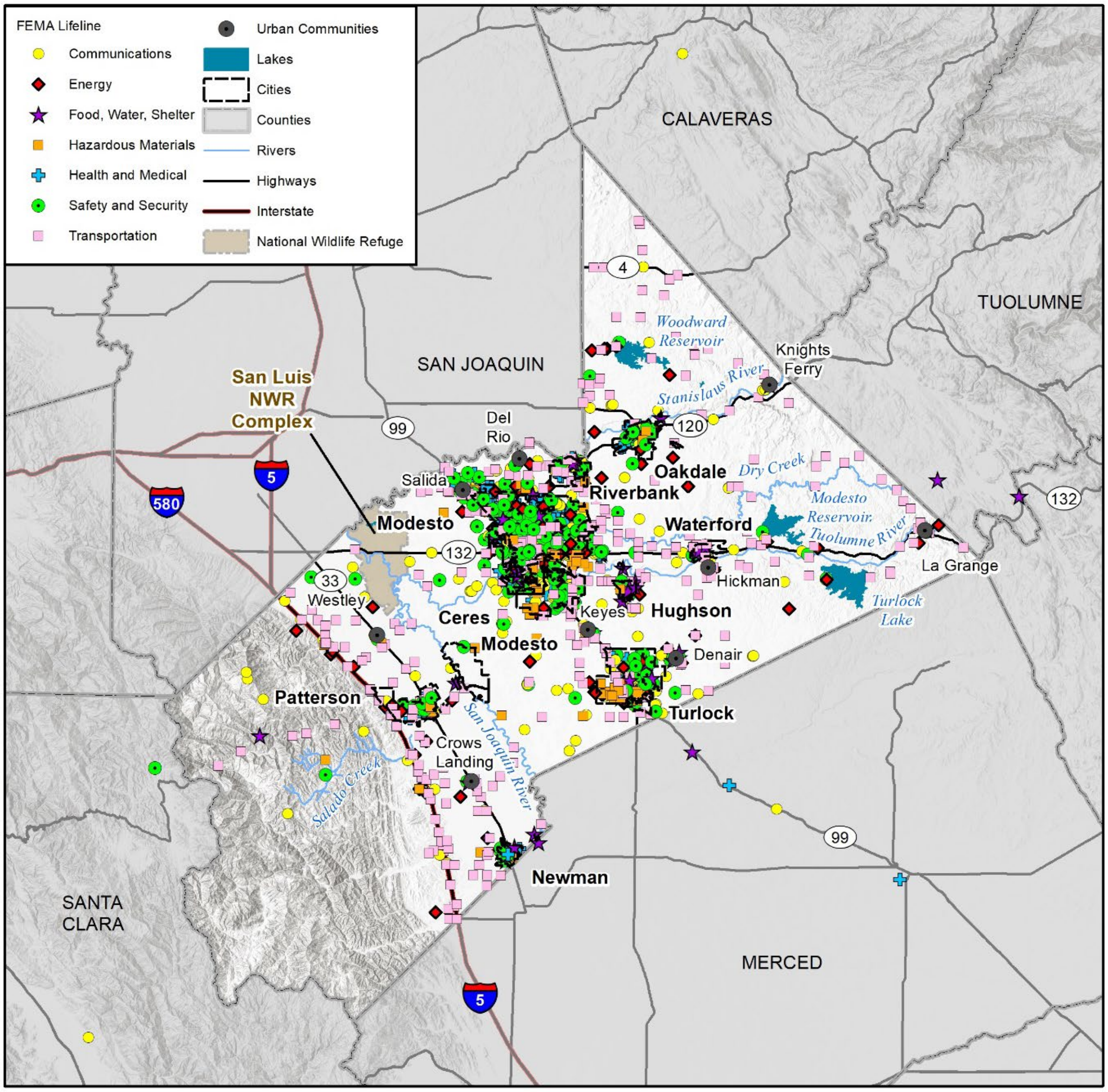
Table 4-7 shows a summary of the critical facilities inventory grouped by lifeline. Figure 4-2 illustrates the location of critical facilities in Stanislaus County.

Table 4-7 Summary of Critical Facilities by Jurisdiction and Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	17	4	2	1	9	14	14	**61**
Hughson	1	-	17	1	2	10	3	**34**
Modesto	52	24	25	9	112	90	32	**344**
Newman	-	-	-	-	-	-	-	**-**
Oakdale	-	-	-	1	1	1	-	**3**
Patterson	-	-	1	-	-	-	-	**1**
Riverbank	-	1	-	1	-	-	1	**3**
Turlock	13	7	13	21	27	23	20	**124**
Waterford	-	-	6	-	-	7	3	**16**
Unincorporated	107	40	18	27	14	59	153	**418**
Other Counties	1	-	-	-	1	-	-	**2**
Total	**191**	**76**	**82**	**61**	**166**	**204**	**226**	**1,006**

Sources: HIFLD, National Inventory of Dams (NID), Department of Water Resources (DWR), Stanislaus County, City of Hughson, City of Newman

Figure 4-2 Stanislaus County Critical Facilities



Map compiled 1/2022;
Intended for planning purposes only.
Data Source: Stanislaus County, USFWS
HIFLD, NID, DWR, City of Newman,
City of Hughson

0 5 10 Miles

N

Other critical facilities unique to the County are the California Aqueduct, Hetch Hetchy Aqueduct, the Delta-Mendota Canal, and the NASA Crows Landing Airport. These facilities are better addressed in the EOPs for the County and federal emergency plans.

The California Aqueduct, part of the California State Water Project, runs through the western part of Stanislaus County. The State Water Project is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. Seventy percent of the contracted water supply goes to urban users and thirty percent goes to agricultural users. The State Water Project makes deliveries to two-thirds of California's population. Earthquakes, landslides, flooding, or other hazard events that disrupt the aqueduct's ability to deliver water could have serious impacts to agriculture in the County and water users in many areas of California.

Cultural, Historical and Natural Resources

Assessing Stanislaus County's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical, and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Historic and Cultural Resources

Historical resources are buildings, structures, objects, places, and areas that are eligible for listing in the National Register of Historic Places (NRHP), the California Register of Historic Resources (CRHR), or the County's List of Historic Resources, have an association with important persons, events in history, or cultural heritage, or have distinctive design or construction method.

For purpose of federal actions, a qualified historic resource is defined as a property listed in or formally determined eligible for listing in the NRHP before a disaster occurs. The NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the U.S. Department of the Interior National Park Service. Local and state agencies may consider a broader definition of qualified historic properties in the review, evaluation, and treatment of properties damaged during a disaster.

The State of California Office of Historic Preservation can provide technical rehabilitation and preservation services for historic properties affected by a natural disaster. Depending on the hazard, protection could range from emergency preparedness, developing a fire safe zone around sites susceptible to wildfires, or seismically strengthening or structurally reinforcing structures.

State and local registers of historic resources provide designated Historical Landmarks, Points of Historical Interest, and Historic Buildings. These resources include, but are not limited to:

- The California Register of Historical Resources
- The California Historical Landmarks
- The California Inventory of Historical Resources
- The California Points of Historical Interest

Historical Resources designated on a federal, state or local level are listed in Table 4-8.

Table 4-8 Stanislaus County Historical Resources

Property Name	Register	Jurisdiction	Date Listed
Hotel Covell	National	Modesto	12/29/1994
Kingen Hotel	National	La Grange	8/24/1979
Knights Ferry	National & State Historical Landmark	Knights Ferry	8/8/1939
La Grange	State Historical Landmark	La Grange	11/15/1948
La Grange Dam	Point of Interest	La Grange	7/31/1979
Louie's Place	National	La Grange	8/24/1979
Mchenry Mansion	National	Modesto	4/4/1978
Mchenry Mansion	Point of Interest	Modesto	7/31/1979
Odd Fellows Hall	National	La Grange	8/24/1979
Old Adobe Barn	National	La Grange	8/24/1979
Old La Grange Schoolhouse	National	La Grange	8/24/1979
Paradise	Point of Interest	Modesto	7/31/1979
Patterson Branch Library	National	Patterson	12/10/1990
Plaza Building	National	Patterson	1/6/2004
Riverbank Branch Library	National	Riverbank	10/10/1996
Shell Gas Station	National	La Grange	8/24/1979
St. Louis Catholic Church	National	La Grange	8/24/1979
Stage Stop	National	La Grange	8/24/1979
Temporary Detention Camps for Japanese Americans-Turlock Assembly Center	State Historical Landmark	Turlock	5/13/1980
Tuolumne City	Point of Interest	Westley	7/31/1979
Turlock Carnegie Library	National	Turlock	1/7/1993
Turlock High School Auditorium and Gymnasium	National	Turlock	1/11/1991
U.S. Post Office	National	Modesto	2/10/1983
Walton, Dr. Robert And Mary, House	National	Modesto	12/14/2006
Whitmore, Daniel, House	National	Ceres	4/5/1989
Willms Ranch	State Historical Landmark	Knights Ferry	11/15/1948
Wood, Walter B., House	National	Modesto	5/20/1988

Source: California Office of Historic Preservation

Other historic sites of local importance also exist. These include Gold Dredge, First National Bank of Oakdale Building and Bald Eagle Ranch House, which have local significance, based on the NRHP's database, as well as the Knight's Ferry Bridge, which has national significance.

Lists of designated historical resources change periodically, and they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Cultural resources defined in California Environmental Quality Act (CEQA) Section 15064.5 as include prehistoric and historic archeological resources; historic-period resources (buildings, structures, area, place, or objects). Archeological resources reflect past human activity extending from Native American prehistoric cultures throughout the early 20th century. The artifacts left by previous occupants may be encountered in small to large residential sites, or special use areas.

Many cultural and historical resources in the County are vulnerable to several hazards due to location and the nature of their construction. Some of these risks include earthquakes, wildfires, or adverse weather.

Natural Resources

Natural resources are important to include in benefit/cost analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Inventory and awareness of natural resource assets is vital to meeting conservation objectives. For example, protecting wetland areas provides sensitive habitat protection as well as floodwater conveyance and storage, which further enhances public safety.

Established in 1987, the San Joaquin River National Wildlife Refuge is 7,000 acres in size and located in Stanislaus County. The Refuge is situated where three major rivers (Tuolumne, Stanislaus and San Joaquin) join in the San Joaquin Valley, creating a mix of habitats that provide ideal conditions for high wildlife and plant diversity. The Refuge was initially established primarily to protect and manage habitat for the Aleutian cackling goose – a federally listed endangered species at that time. Today, the Refuge is managed with a focus on migratory birds and endangered species, including Riparian Woodlands, Swainson's hawks and Riparian Brush Rabbits.

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (endangered and threatened species) in the Planning Area. The U.S. Fish and Wildlife Service (USFW) maintains a list of federally listed threatened and endangered species for the country, which can be queried at the state or even county levels through the Information for Planning and Consultation (IPaC) database. The California Department of Fish and Wildlife (CDFW) also maintains species lists and accounts for threatened and endangered species. State and federal laws protect the habitat of these species through the environmental review process. Species of special concern may additionally include species that meets the State definition of threatened or endangered but has not been formally listed, experiences seriously population declines, or habitat decline, or has naturally small populations exhibiting high susceptibility to population decline (USFW 2019).

Table 4-9 summarizes Stanislaus County's special status animal species as indicated in the IPaC database, within the Environmental Conservation Online System.

Table 4-9 Threatened and Endangered Species in Stanislaus County

Group	Common Name	Scientific Name	Status
Amphibians	California tiger Salamander	*Ambystoma californiense*	Endangered
	California red-legged frog	*Rana draytonii*	Threatened
Birds	Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened
	California least tern	*Sterna antillarum browni*	Endangered
	Least Bell's vireo	*Vireo bellii pusillus*	Endangered
Crustaceans	Conservancy fairy shrimp	*Branchinecta conservatio*	Endangered
	Vernal pool fairy shrimp	*Branchinecta lynchi*	Threatened
	Vernal pool tadpole shrimp	*Lepidurus packardi*	Endangered
Fishes	Delta smelt	*Hypomesus transpacificus*	Threatened
	longfin smelt	*Spirinchus thaleichthys*	Candidate
Flowering Plants	Chinese Camp brodiaea	*Brodiaea pallida*	Threatened
	Colusa grass	*Neostapfia colusana*	Threatened
	Fleshy owl's-clover	*Castilleja campestris ssp. succulenta*	Threatened
	Greene's tuctoria	*Tuctoria greenei*	Endangered
	Hairy Orcutt grass	*Orcuttia pilosa*	Endangered
	Hartweg's golden sunburst	*Pseudobahia bahiifolia*	Endangered
	Hoover's spurge	*Chamaesyce hooveri*	Threatened
	Large-flowered fiddleneck	*Amsinckia grandiflora*	Endangered
	Red Hills vervain	*Verbena californica*	Threatened
	San Joaquin Orcutt grass	*Orcuttia inaequalis*	Threatened
	Santa Clara Valley dudleya	*Dudleya setchellii*	Endangered
Insects	Monarch Butterfly	*Danaus plexippus*	Candidate
	Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	Threatened
Mammals	Fresno kangaroo rat	*Dipodomys nitratoides exilis*	Endangered
	Riparian brush rabbit	*Sylvilagus bachmani riparius*	Endangered
	Riparian woodrat (=San Joaquin Valley)	*Neotoma fuscipes riparia*	Endangered
	San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered

Group	Common Name	Scientific Name	Status
Reptiles	Blunt-nosed leopard lizard	*Gambelia silus*	Endangered
	Giant garter snake	*Thamnophis gigas*	Threatened

Source: Source: US Fish and Wildlife Service – Environmental Conservation Online System

Growth and Development Trends

Population and Projected Growth

According to the Department of Finance (DOF) the 2020 population of Stanislaus County as a whole was 555,955. The DOF projects the total population will increase by 9% to 606,128 by 2030. While total households in the County are also projected to increase from 173,951 in 2020 to 193,658 in 2030, people per household is projected to slightly decrease from 3.19 in 2020 to 3.1 person per household in 2030. All of the incorporated communities, except Turlock (slight decrease -0.3), experienced an increase or no change in population between 2020 and 2021. The City of Modesto is also ranked No.38 among 482 California cities by the California DOF in 2020 – 2021 with a numeric increased change in population (+854).

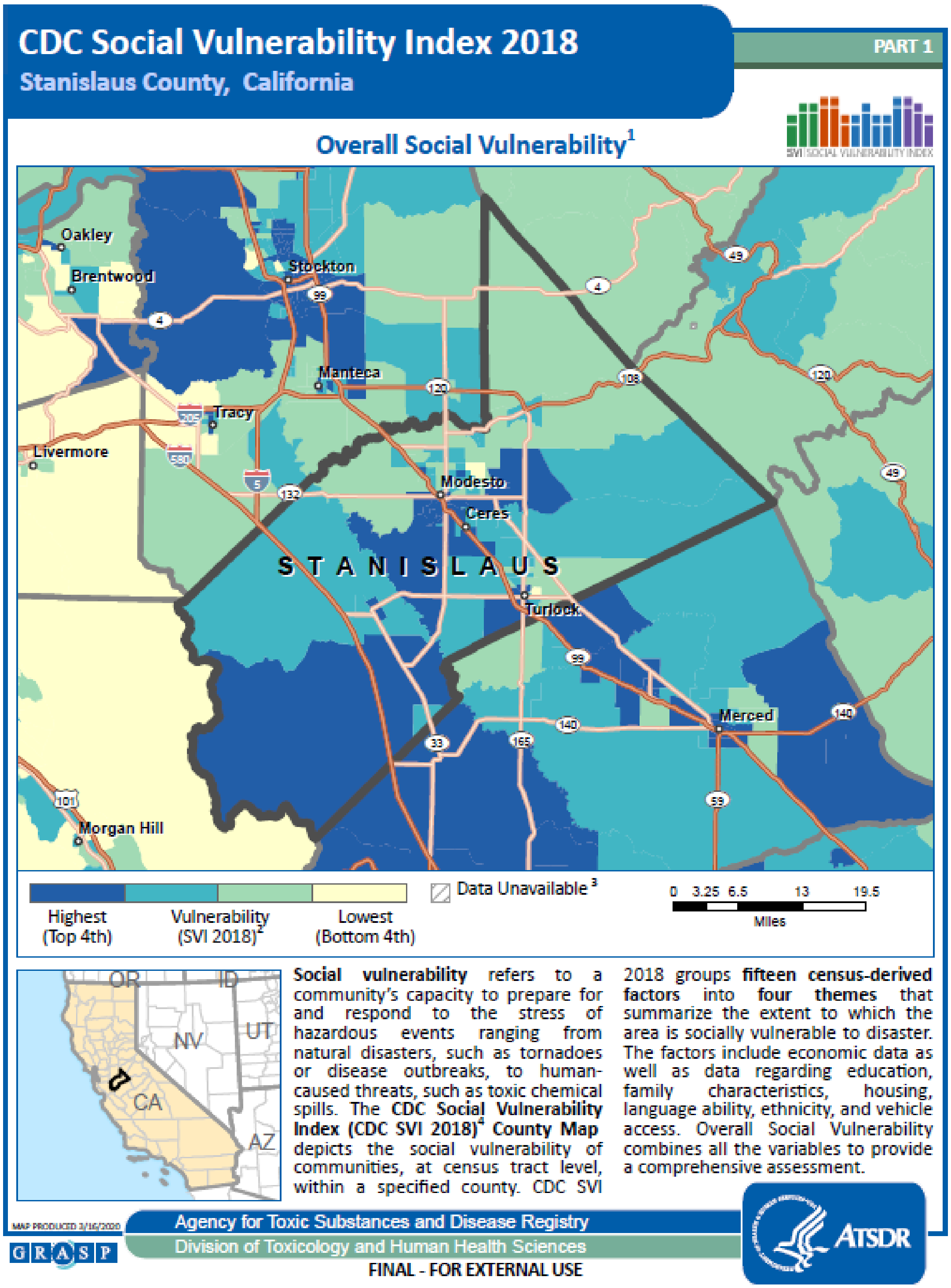
Social Vulnerability

Social vulnerability considerations were included in the update of this plan in 2021 to identify areas across the County that might be more vulnerable to hazard impacts based on a number of factors. A social vulnerability index (SoVI) was developed by the CDC Agency for Toxic Substances and Disease Registry (ATSDR) and their Geospatial Research, Analysis & Services Program teams, as a way to portray communities' capacities to prepare for and respond to natural and manmade disasters. The SoVI does so by providing insight into particularly vulnerable populations to in turn assist emergency response planners and even public health officials identify communities more likely to require additional support before, during, and after a hazardous event. The CDC's SoVI create county- and state-level maps to show relative vulnerability and hence provide key socially and spatially relevant information on communities' populations, and these maps compare the SoVI based on Census Tracts. The overall social vulnerability based on the SoVI data is shown for Stanislaus County by Census Tracts in Figure 4-3 below, based on statewide ranking. This overall index combines four main themes of vulnerability, namely: socioeconomic status; household composition and disability; minority status and language; and housing and transportation, which in turn are comprised of subcategories for a total of 15 variables accounting for various vulnerability factors. For additional information on the CDC's SoVI, refer to their documentation and materials online at https://svi.cdc.gov/. Based on this data, the areas with the highest level of social vulnerability in the County are in the central, southern and southwestern portions, including some of the incorporated jurisdictions such as the cities of Modesto, Ceres, and Turlock.

In California, socially vulnerable populations, also referred to as disadvantaged communities (DACs) are mapped through several State-developed mapping tools, including but not limited to the Delta Social Vulnerability Index, CalEnviroScreen, DWR Mapping Tools (DAC and Economically Distressed Areas [EDAs]), and FEMA's National Risk Index for Natural Hazards. The California Office of Environmental Health Hazard Assessment (OEHHA) CalEnviroScreen tool applies a formula to generate a combined ranking score that considers 21 indicators for each census tract that cover pollution indicators, such as diesel emissions and concentrations of toxic clean-up sites and population indicators, such as poverty and unemployment rates. Census tracts with CalEnviroScreen rankings between 75 and 100 percent (i.e., a combined score in the top 25 percent of all census tracts in the State) are considered to be DACs. One of the population indicators for the CalEnviroScreen identifies housing burdened communities. Housing-burdened low-income households are households that are both low income and highly burdened by housing costs. California has very high housing costs relative to the rest of the country, which can make it hard for households to afford housing (OEHHA 2022). Households with lower incomes may spend a larger proportion of their income on housing and may suffer from housing-inducted poverty (OEHHA 2022). Housing affordability is an important determinant of health and well-being. Low-income households with high housing costs may suffer adverse health impacts. These households are also more likely to be adversely affected during a hazard event and less likely to recover as quickly as other communities.

There are numerous communities within Stanislaus County with a higher housing burden; these communities are concentrated in the cities of Modesto, Ceres, Turlock, and Patterson, which is similar to the socially vulnerable populations identified by SoVI. Several of the census tracts in these cities rank between 75 and 100 percent and are considered DACs; they also consist of low income and severely burdened by housing costs. Some of these communities housing burden is also higher than 90 percent of the rest of California. The County can use information about these communities to conduct targeted outreach and engage community members to consider what other hazards and mitigation strategies or programs should be considered to meet community needs. The County can also engage these communities to proactively prioritize hazard mitigation projects that benefit DACs.

Figure 4-3 Social Vulnerability in Stanislaus County based on the SoVI, by Census Tracts



Development Trends

The areas located in the Sphere of Influence (SOI) for each incorporated jurisdiction are areas each City plans to grow into and potentially slated for future development. Understanding the potential hazard exposure in each area can help to mitigate the impacts of events before development occurs in those areas. Development trends since the previous 2017 LHMP update are also addressed. These growth and development trends are assessed in the future development trends subsection of the vulnerability assessment, each annex, and broadly summarized below. In general, most residential development has occurred or is proposed within the city limits of each jurisdiction.

During this plan update process a parcel analysis was also conducted using the SOI areas for each incorporated jurisdiction and overlaid with available hazard risk layers to determine where future development may be at risk of natural hazard events. The results of the analysis have been integrated into the applicable hazard sections: dam, flood, wildfire and landslide. Table 4-10 is the summary of the SOI total exposure by jurisdiction.

Table 4-10 Total Exposure Summary by Jurisdiction Sphere of Influence Areas

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value
Ceres	1,974	$268,710,296	$200,638,561	$469,348,857
Hughson	76	$19,505,347	$18,760,196	$38,265,543
Modesto	6,691	$1,673,437,332	$1,885,783,247	$3,559,220,579
Newman	4	$705,813	$705,813	$1,411,626
Oakdale	51	$12,457,109	$6,404,678	$18,861,787
Riverbank	65	$11,209,681	$8,512,805	$19,722,486
Turlock	656	$122,502,912	$105,060,814	$227,563,726
Waterford	82	$15,139,178	$14,810,922	$29,950,100
Total	**9,599**	**$2,123,667,668**	**$2,240,677,035**	**$4,364,344,703**

- **City of Ceres** – According to the City's 2014 – 2023 General Plan Housing Element, the Stanislaus Council of Governments (StanCOG) allocated 2,571 housing units to the City for the period 2014 to 2023. The time frame for this Regional Housing Needs Allocation (RHNA) process is January 1, 2014, through September 30, 2023, (a nine-year planning period), equivalent to a yearly need of approximately 264 housing units for the 9 -year time period. There are 168 single-family units and 44 multi-family units in projects that are anticipated to be built in during the 2014-2023 Housing Element timeframe. The City of Ceres has also been working on other master and specific plans, including Eastgate Revised Master Plan (revised in 2004), Mitchell Road Corridor Specific Plan (adopted in 1995, which establishes comprehensive guidance and regulations for the development of approximately 450 acres located along a 2.5 mile stretch of Mitchell Road between Highway 99 and the Tuolumne River within the City of Ceres), West Landing Specific Plan (which encompasses 960 acres of developed, underdeveloped and agricultural land that was annexed and is now part of the western area of the City limits, bounded by Whitmore Avenue to the north, Service Road to the south, Ustick Road to the west and the Union Pacific rail line to the east), and the Whitmore Ranch Specific Plan (that was annexed into the City of Ceres, and includes approximately 94 acres that is bounded by Whitmore Avenue on the north, Moore Road on the west, and the east side of La Rosa Elementary School on the east).
- **City of Hughson** – On June 18, 2014, StanCOG adopted its RHNA plan for the January 1, 2014, through September 20, 2023, projection period. Hughson's RHNA share includes 26 units for the extremely low-income category, 27 for very low, 34 for low income, 38 for moderate income, and 93 above moderate-income units for this RHNA period – a total of 218 housing units. The City also has an ongoing Parkwood Subdivision Project that includes 299 single-family residential lots with one single-family home per lot. This site is approximately 56.04 acres and is located at the southeastern corner of the Santa Fe Avenue and Hatch Road intersection in the City.
- **City of Modesto** – According to the City's 2015 – 2023 Housing Element, the City of Modesto's RHNA is 6,361 units. Based on the Opportunity Sites webpage published by the City's Planning Division, as of August 2, 2017, the City has 1,192 acre of sites with available infrastructure, 175 acres within close proximity to infrastructure, and 704 acres of sites that would require infrastructure extensions. The City's Planning Division also has various ongoing specific plans designated for various development

projects, such as Carver Bangs, Empire North and Fairview Village. In addition, to ensure that Modesto's growth is handled in a fiscally responsible manner, the Modesto City Council adopted an Urban Growth Policy on March 25, 1974. One goal of the 1974 Urban Growth Policy was to maintain a three- to five-year supply of vacant residential land for future development. The most recent urban growth review report goes back to 2015.

- **City of Newman** – According to the City's 2030 Housing Element, the City of Newman's RHNA is 778 units. The City also has a Highway 33 Specific Plan that is ongoing.
- **City of Oakdale –** to the City's 2015 – 2023 Housing Element, the City of Oakdale's RHNA is 1,247 units. The City's Planning Division has various ongoing specific plans designated for various development projects, such as Burchell Hill, Bridle Ridge and East F Street.
- **City of Patterson** – The City's updated Housing Element is still in the process. According to the City's Community Development webpage, the City has various businesses pending, as well as various housing projects, including apartment development projects.
- **City of Riverbank** – According to the City's 2015 – 2023 Housing Element, the City of Riverbank's RHNA is 1,247 units. According to the City's Planning Division's Current Planning Projects documentation, the City's Planning Division has various ongoing development projects, such as Bruin Heights Subdivision, Diamond Bar East Subdivision and Countryside 1 and 2 Subdivision.
- **City of Turlock** – According to the City's 2015 – 2023 Housing Element, the City of Turlock's RHNA is 3,618 units. The City's Planning Division also has various ongoing specific plans designated for various development projects, such as the Morgan Ranch Mater Plan and the North Turlock Master Plan. The City's Planning & Land Use Permitting division also keeps track of active ongoing residential and commercial & industrial projects.
- **City of Waterford** – According to the City's 2015 – 2023 Housing Element, the City of Waterford's RHNA is 882 units.

4.3 Hazard Analysis and Risk Summary

Requirement §201.6(c)(2)(i):
[The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

4.3.1 Agricultural Pests and Disease

Hazard/Problem Description

Located in the Central San Joaquin Valley, Stanislaus County's farming and agricultural industry is ranked as the top agriculture-producing County in California and the country. Agriculture is the dominant land use in Stanislaus County, accounting for 86% of all land, or approximately 832,453 acres out of the 970,168 acres inventoried in the County (Stanislas County 2016). According to the Stanislaus County Department of Agriculture, agriculture grossed more than $2.9 billion dollars in 2020. Top commodities in 2020 included almonds, milk, chickens, and cattle & calves (see table below).

Table 4-11 Top 10 Commodities in Stanislaus County in 2020

Rank	Crop	2020 Value	Top 10 Share
1	Almonds	$1,123,961,000	32%
2	Milk	$736,644,000	21%
3	Chickens	$342,099,000	10%
4	Cattle & Calves	$201,783,000	6%
5	Nursery, Fruit & Nut Trees & Vines	$163,123,000	5%
6	Walnuts	$103,040,000	3%
7	Silage	$99,498,000	3%
8	Almond Pollination	$88,800,000	3%
9	Turkeys	$54,117,000	2%
10	Tomatoes	$37,991,000	1%
	Top 10 Total	**$2,951,056,000**	

Source: 2020 Report on Agriculture

Agricultural pests and pathogens (insects, fungi, bacteria, viruses and invasive plants) cause injury or severe destruction to crops or livestock. From exotic fruit flies to noxious weeds, California's agriculture can be impacted by a wide variety of invasive pests and pathogens. These pests pose significant threats to the state's agricultural crops, farm workers, economy, food supply and native habitat. They can also result in increases in food prices for consumers. The number of invasive pests and pathogens newly detected in California and the rest of the United States has increased at alarming rates in recent years, and that trend is projected to continue into the future. Insect pests and diseases, such as bark beetles and Sudden Oak Death in trees can also destroy forests and oak woodland habitat located along the eastern and western perimeters of Stanislaus County, which can in turn increase the fuel load and lead to greater fire risk. Agricultural disasters could also occur due to severe weather events, such as extreme heat, freeze cycles, and heavy rainfall and these hazards are covered under Subsections 4.3.10 through 4.3.14. Drought events are covered under Subsection 4.3.5.

Agricultural pest and disease management programs are managed at the state level in California. The California Food and Agricultural Code mandates pest prevention programs to prevent the introduction and spread of pests in the state, funds such programs, and directs administration of the programs to the local municipalities. These include the Pest Exclusion Program, Pest Detection Program, Pierce's Disease Control Program, and Federal Phytosanitary Certificate Program. Target pests addressed by each program are listed in Table 4-12, but also include dairy, livestock, and poultry pests and diseases, such as *Mycobacterium bovis* and pathogenic avian influenzas. Animal agriculture, such as dairy farms also result in copious amounts of manure, which contain zoonotic pathogens, which are viruses, bacteria, and parasites of animal origin that cause disease in humans.

Table 4-12 Target Pests in Stanislaus County

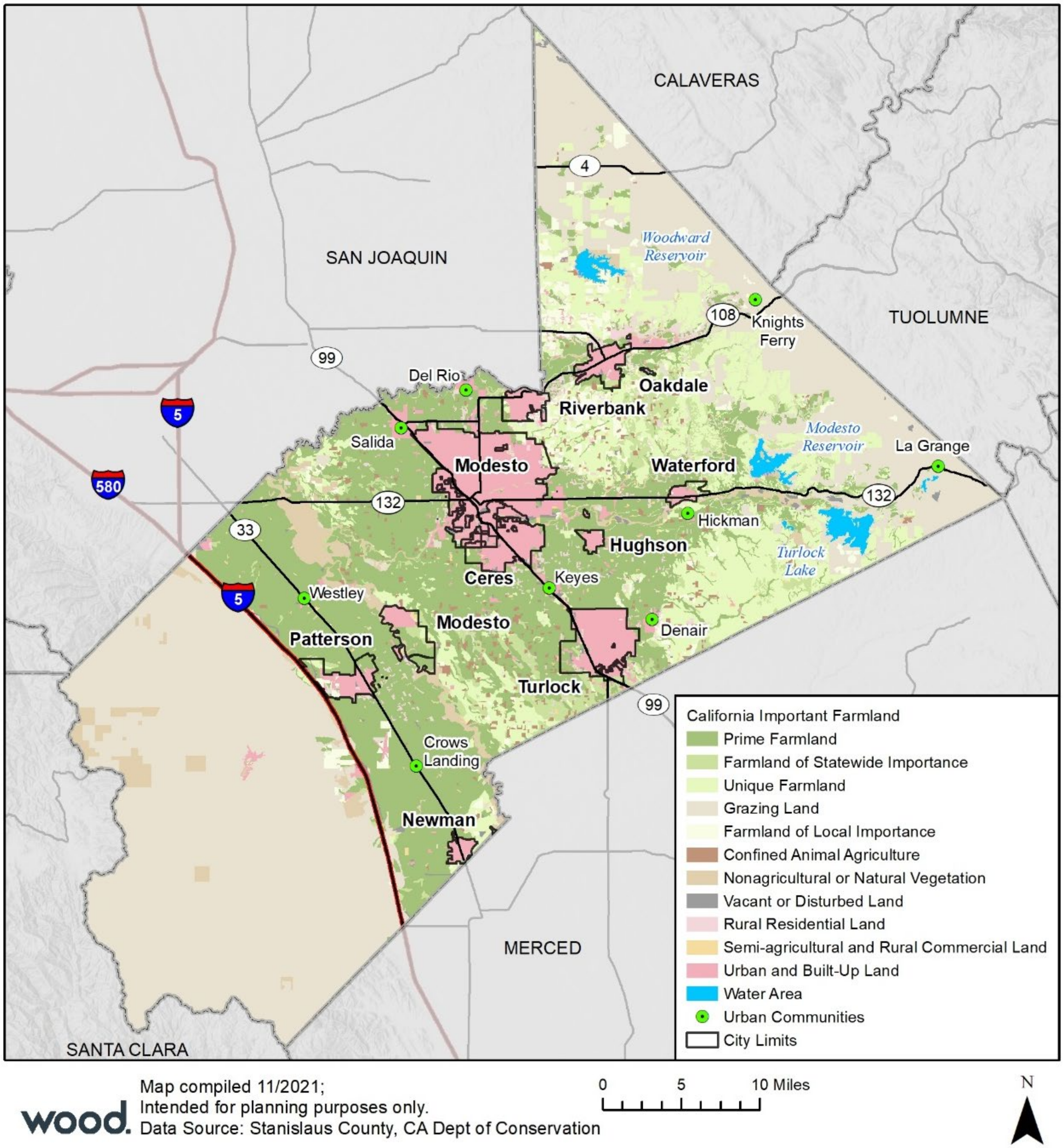
Target Pest	Crops Affected	Traps Deployed
Melon Fruit Fly	Apple, bean, cantaloupe, cucumber, grape, orange, peach, pear, tomato & watermelon	315
Asian Citrus Psyllid	Citrus	591
Glassy-Winged Sharpshooter	Almond, Citrus, Grape & Peach	1,926
Apple Maggot	Pome & Stone Fruit	15
Gypsy Moth	Most Trees	204
Mexican Fruit Fly	Apple, Apricot, Citrus, Nectarine, Pear, Plume, Peach & Pomegranate	224
Japanese Beetle	Roses & Turf	204
European Corn Borer	Corn, Green Bean, Oat, Potato & Rhubarb	8
Light Brown Apple Moth	Alfalfa, Almond, Apple, Berries, Broccoli, Citrus, Corn, Grapes, Stone Fruit, & Tomato	433
Mediterranean Fruit Fly	Almond, Apple, Apricot, Citrus, Fig, Grape, Nectarine, Olive, Peach, Pear, Plum, Pomegranate, Tomato, & Walnut	433
Oriental Fruit Fly	Apple, Citrus, Cucumber, Fig, Grape, Pear, Pomegranate, Stone Fruit, Tomato & Walnut	433
Red Imported Fire Ant	Agricultural and residential settings	81
European Grapevine Moth	Grapes & Spurge Laurel	297
Vine Mealybug	Grapes	22
Khapra Beetle	All grain & grain-products	107

Source: 2020 Report on Agriculture

Geographic Area

Extensive – According to the 2017 Census for Agriculture, Stanislaus County contains 722,546 acres of land in farms. Cropland accounts for 56% of agricultural land, while pastureland accounts for 36%. There are approximately 3,621 farms (as of 2017) in the County. Most of these important farmlands are located within the County's unincorporated area and are currently zoned for agricultural use. Figure 4-4 illustrates the geographic extent of the important farmlands across the County.

Figure 4-4 Stanislaus County Important Farmland



Extent (Magnitude/Severity)

Limited – Different pests can impact different crops in different ways; while there is no scale to define the extent of an infestation, a pest could have a major economic impact on the value of infested crops.

Another large factor that may influence crop yield is the spread of invasive plants, which may compete with crops for resources and in some cases also introduce pests. According to California Invasive Plant Council (Cal-IPC), invasive plants cost California $82 million every year in control, monitoring and outreach; estimated actual impacts can reach into the billions. Based on the USDA's Risk Management Agency (RMA) Crop Indemnity Reports, between 2007 and 2018 (no losses were reported in 2019 or 2020), there were 1,755 acres lost due to plant disease and insects and $792,604 indemnity payments made. This results in an annualized loss of $72,055 due to agricultural pests.

Past Occurrences

Based on information from the USDA, Stanislaus County received several USDA disaster declarations since 1950 (see Table 4-3 above). All the declarations were associated with flood, drought or severe weather events, and most recently, the COVID-19 pandemic. None were related to agricultural disease.

Probability of Future Occurrences

Likely – While probability of future occurrence is usually calculated based on past impacts, different pests have different recidivism rates across the County. Based on past occurrences, pests and invasive species will continue to present a constant threat to the County and its jurisdictions. These events are therefore expected to occur on an annual basis or have a 100% chance of occurring each year due to economic impacts and number of control measures (e.g., traps) deployed annually.

Climate Change Considerations

California's Fourth Climate Change Assessment (2018) notes that "climate change impacts terrestrial ecosystems and wildlife in multiple ways, including invasion by exotic species, prevalence of wildlife disease, and loss of native habitats." Changing climate conditions can impact viable living areas of species and cause migration; shift the spread of pests and disease northward by changing habitat temperatures and making previously undesirable habitats welcoming for new species and lengthen habitable seasons (CNRA 2018a). Longer growing seasons may also allow agricultural pests to persist longer, which can increase the severity of infestations on agricultural operations. Further, weather events have become more numerous and more severe. Changes in weather patterns can also have dramatic impacts on the ecosystem, including agriculture systems, and more severe impacts can be expected into the future.

Vulnerability Assessment

Agricultural losses occur on an annual basis and are usually associated with severe weather events, including heavy rains, floods, hail, freeze, and drought. The California SHMP attributes most of the agricultural disasters statewide to drought, freeze, and also insect infestations. Other agricultural hazards include fires, crop and livestock disease, noxious weeds, and contamination of animal food and water supplies.

General Property

Infestation of agriculture pests could result in negative consequences associated with decreased crop yields, potential destroying whole fields with farmland property. Between 2015 and 2018, the USDA's RMA paid no indemnities due to damage from insects but paid $22,900 in indemnities due to damage from crop disease.

People

A widespread infestation of livestock and crops could result in severe consequences to the economic base of the County and its communities employed by the agriculture industry. According to the USDA 2017 Census of Agriculture, Stanislaus County has 2,337 farms, which is a -6% change from the previous census in 2012. While agricultural production in the County can enhance the economy and improve human health and ensure stable food prices in California and the U.S., certain habitats established for irrigation and agricultural output can also threaten human health by increasing the risk of vector-borne diseases (e.g. mosquitos, etc.). Agricultural pests and disease or significant crop loses can also impact communities if they result in limited food supplies and rises in food prices. Widespread crop losses due to contamination issues (foreign agents, biological disease) could also decrease the public's confidence in food safety. Rural communities, residing closest to these agricultural operations may also be most vulnerable to these diseases, as livestock pathogens are capable of infecting host species, which may include wildlife and human.

Stanislaus County's General Plan Agricultural Element contains Policy 1.10 designed to protect agricultural operations from conflicts with non-agricultural uses by requiring buffers between proposed non-agricultural uses and adjacent agricultural operations (Stanislaus County 2017). The Agricultural Element also contains

Buffer and Setback Guidelines that provide further direction on how to protect the long-term health of local agriculture resulting from new or expanding uses in or adjacent to the General Agricultural zoning district. Buffers consist of a physical separation, such as a topographic feature, stand of trees, waterway, landscaped berm, or a similar feature that serves as a barrier between agricultural uses and the people in non-agricultural areas. Buffers lessen the impacts of surrounding development by minimizing conflicts between agricultural and non-agricultural uses.

Jobs could be negatively impacted during an agriculture emergency; jobs tangentially tied to the agriculture industry could also be affected. According to "*The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*", rising temperatures and drought conditions due to climate change could also lead to increases in the occurrence and transport of pathogens in agricultural environments, which will increase the risk of food contamination and direct human exposure to pathogens and toxins (SGCRP 2016). In turn, this will increase health risks and require greater vigilance in food safety practices and regulation.

Disease can also exacerbate the impacts from other natural hazards. An example of this is adverse weather. Dead branches can be broken by high winds, and there are reports of these branches falling and causing harm to people.

Social Vulnerability

Based on the SoVI data presented and discussed in Subsection 4.2.1, the areas with the highest level of social vulnerability are in the central, southern and southwestern portions of the County, including some of the incorporated jurisdictions such as the Cities of Modesto, Ceres, and Turlock. These communities as well as those working in the agricultural sector would likely be impacted by the effects of agricultural hazards.

Government Services

Few consequences are anticipated related to agricultural pests and related crop loss on first responders, the continuity of operations, delivery of services. However, if significant crop losses are associated with perceived poor management of adhering to health and safety requirements, it could lead to a loss in confidence in state governance. When coupled with rises in food prices, this could lead to greater economic impacts on the County, and those most vulnerable to food price increases.

Critical Facilities

Critical facilities assessed in this plan would not be directly impacted by agricultural pests or diseases; however, the food and agriculture industry is considered critical infrastructure in Stanislaus County and California. Impacts to this infrastructure, such as farms, diary operations, and processing facilities would have debilitating effects of food security, the economy, and public health and safety. Stanislaus County farms and ranches, and the associated food processing facilities would be directly impacted economically by long-term disruptions in the food supply associated with crop losses due to agricultural pests and disease.

Economy

According to the University of California's Center for Invasive Species Research, it has been estimated in California alone that invasive pests cost the State at least $3 billion per year. Nationally, it is estimated that invasive species cost the U.S. $138 billion per year. Economic impacts include both prevention, response and recovery costs. Given the contribution of agriculture to the local economy, pest impacts could be significant. The value of agricultural commodities noted at the beginning of this hazard profile is $2,526,335,000. Based on that a hypothetical loss of 5% to due to agricultural pest or disease would equate to approximately $126 million in total economic losses.

Historic, Cultural and Natural Resources

Invasive species typically harm native species through predation, habitat degradation and competition for shared resources; they can outcompete native species out of natural habitats and are a leading cause of population decline and extinction in animals. Tree mortality raises the wildfire threat in healthy forests, increasing the vulnerability, strength, speed and destruction of fires in the area. Significant crop failures can also result in impacts on the environment if they result in contamination or the need for groundwater or surface water monitoring.

Future Development

Most likely, good development practices and the ongoing implementation of the buffer policies included in the County's Agricultural Element would not have an impact on Stanislaus County's vulnerability to agricultural pests, plant diseases, or tree mortality.

Risk Summary

- Stanislaus County's farming and agricultural industry is ranked as the top agriculture-producing county in California and the country.
- Agriculture is the dominant land use in Stanislaus County, accounting for 86% of all land, or approximately 832,453 acres out of the 970,168 acres inventoried in the County.
- Invasive plants cost California $82 million every year in control, monitoring and outreach and over a 11-year period there were 1,755 acres lost due to plant disease and insects and $792,604 indemnity payments made that resulted in an annualized loss of $72,055 due to agricultural pests.
- Based on USDA disaster declarations since 1950, none were related to agricultural pests or disease.
- Changes in weather patterns can have dramatic impacts on the ecosystem, including agriculture systems, and more severe impacts associated with agricultural pests and disease can be expected into the future.
- Policies in the Stanislaus County's General Plan Agricultural Element require buffers between proposed non-agricultural uses and adjacent agricultural operations to minimize incompatible use conflicts and to protect the long-term health of local agriculture resulting from new or expanding uses in or adjacent to the General Agricultural zoning district.
- Changing climate conditions can shift the spread of pests and disease northward by changing habitat temperatures and making previously undesirable habitats welcoming for new species through longer growing seasons. This may increase the severity of pest infestations on agricultural operations.
- **Related hazards** – Drought

Table 4-13 Hazard Risk Summary by Jurisdiction – Agricultural Pests and Disease

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Likely	Limited	Low	No
City of Ceres	Extensive	Likely	Negligible	Low	No
City of Hughson	Extensive	Likely	Negligible	Low	No
City of Modesto	Extensive	Likely	Negligible	Low	No
City of Newman	Extensive	Likely	Negligible	Low	No
City of Oakdale	Extensive	Likely	Negligible	Low	No
City of Patterson	Extensive	Likely	Negligible	Low	No
City of Riverbank	Extensive	Likely	Negligible	Low	No
City of Turlock	Extensive	Likely	Negligible	Low	No
City of Waterford	Extensive	Likely	Negligible	Low	No
County Office of Education	Extensive	Likely	Negligible	Low	No

4.3.2 Aquatic Invasive Species (AIS)

Hazard/Problem Description

Aquatic Invasive Species (AIS) is a non-native aquatic species that invade ecosystems beyond their natural, historic range. They are spread either intentionally; someone dumping their aquarium contents into a lake or unintentional by way of ships, fishing, hunting and boating, to name a few. AIS might also be called exotics, nonindigenous or non-native. They are a growing problem due primarily to increased global trade (California State Parks 2021).

Many AIS arrive in the United States by being accidentally transported here in the ballast water of oceangoing ships – and then they move from lake to lake by hitching rides with unsuspecting boaters and anglers. A whole population of invasive plants or mussels can start from a tiny fragment of a leaf or a microscopic larva, so it is easy for these invaders to reach new water bodies by clinging to our gear. (Izaak Walton League of America 2021)

AIS—plants, quagga, and zebra mussels—are invading California's Sacramento-San Joaquin Delta and reservoirs and lakes. These pests can increase dramatically under the right conditions, displacing native species, clogging waterways, and creating hazardous conditions for navigation and recreation. Once introduced, they are nearly impossible to eradicate. Egeria densa, water hyacinth, and quagga and zebra mussels are some of the nuisance species that can be accidentally transported by recreational boaters when caught in propellers or intakes or attached to hulls. Controlling these AIS is a multi-million-dollar problem in California. (USFWS 2021)

According to University of California Agricultural and Natural Resources (UCANR)' research, symbolic AIS that have been impacting the Central Valley and the San Francisco Bay and Delta region include Giant reed (*Arudno donax*), American bullfrog (*Lithobates catesbeianus*), Nutria (*Myocastor coypus*) and Quagga & zebra mussels (*Driessena bugensis* and *Driessena polymorpha*). Key AIS in Stanislaus County are described below.

Giant Reed (Arudno donax)

Giant Reed (*Arundo donax*) is an extremely fast-growing perennial grass that can reach heights of over 20 feet. It is often found in riparian and wetland ecosystems, sand dunes, and disturbed areas. Arundo is native to the Greater Mediterranean Area and was introduced to California for erosion control. It outcompetes important stream-side species (such as willows) for water and habitat, leading to altered ecosystem function and less shade along riparian ecosystems. Its stems and leaves are not used as habitat or food by native animals and contain harmful chemicals that make it unappealing to insects and grazing animals.

American Bullfrog (Lithobates catesbeianus)

American Bullfrogs (*Lithobates catesbeianus*) are a large species of frog native to Central and Eastern United States. They prefer shallow, slow-moving, or stagnant freshwater pools and ponds but have been found in the shorelines of lakes and rivers. They have been known to not only outcompete native species for food and habitat but have been documented as predators of native California birds, fish, reptiles, amphibians, and invertebrates. Additionally, they are linked to the introduction of the deadly chytrid fungus, a disease known to have caused population declines and the extinction of amphibian populations around the world.

Nutria (Myocastor coypus)

Nutria (*Myocastor coypus*) is a large, aquatic rodent reaching 1.64 feet in length and weighing up to 22 lbs. They were first found in California in 2017 and have since been confirmed in several counties including San Joaquin, Stanislaus, Merced, Fresno, Mariposa, and Tuolumne. Nutria are exceptional herbivores that consume large amounts of wetland vegetation, up to 25% of their body weight daily. In regions where they have been introduced, they have devastated marsh and wetland habitats through their consumption and burrowing and in some cases, converting vegetated marsh lands to unvegetated open water habitats.

Quagga and Zebra mussels (Driessena bugensis and Driessena polymorpha)

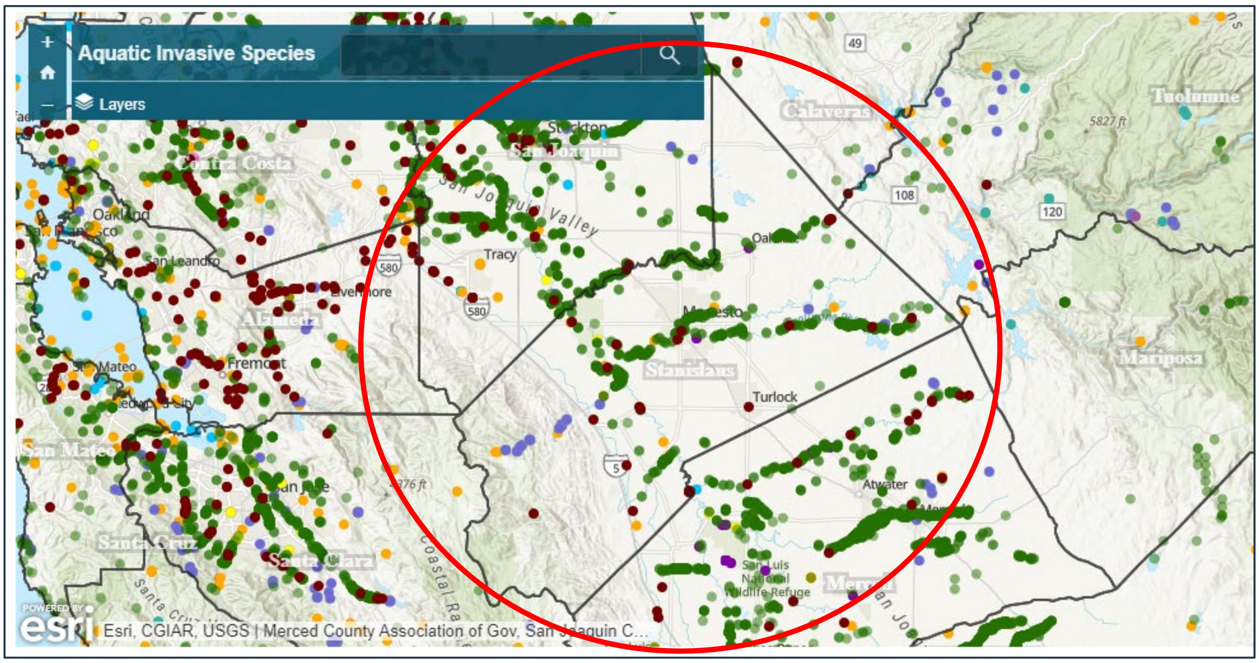
The quagga mussel (*Driessena bugensis*) and zebra mussel (*Driessena polymorpha*), known together as Eurasian mussels, are originally from Ukraine and were first detected in California in 2007 and 2008 and have since spread to canals, rivers, and lakes around the state. Although they measure under 2 inches long, they can cause major ecological harm by modifying aquatic habitats and pose a threat to the environment and to California's water supply. They reproduce rapidly and in high densities, competing for space with native species. They filter phytoplankton out of huge volumes of water which can change the physical and biological properties of an ecosystem. Eurasian mussels also cause significant economic harm by damaging boat engines, clogging pipes, covering infrastructure such as docks, dam gates, and irrigation channels, and reducing the recreational and economic value of lakes.

Geographic Area

Limited – The UCANR California Aquatic Invasive Species Site maintains a web-based GIS map that shows the distribution of AIS in California. According to their GIS data and online maps, various AIS grow in Stanislaus County and the Central Valley in general. Within the County, AIS tend to grow and develop the major waterways, for example, the Stanislaus River, Dry Creek, Tuolumne River, and San Joaquin River. However, as AIS only tend to grow along and impact major waterways instead of the County's land area, the overall geographic area that AIS impact is then limited.

Figure 4-5 below shows the AIS distribution in Stanislaus County. The dots with different colors on the map represent different types of AIS, including snails, mussels, and clams; plant and algae; mammals; herps; flatworms and flukes; fishes; crustaceans; and colonial invertebrates that occur in the County.

Figure 4-5 AIS Distribution in Stanislaus County



Source: UCANR 2021

Extent (Magnitude/Severity)

Negligible – Invasive species infest, disrupt, and degrade the ecology of native habitats, and cause negative economic impacts. AIS weaken fisheries, reduce biodiversity, heighten levels of toxins throughout the water and food chain, and outcompete native species, resulting in dramatic overgrowth in many cases. They also cause harm to human health and negatively impact the economies of communities that rely on tourism and outdoor recreation. Personal property values and tax revenues for local governments can decrease when AIS invade recreational waterbodies, but they rarely directly impact infrastructure. The cumulative impacts of several invasive species in an area can degrade natural resources and diminish human enjoyment.

Invasive species are easily spread through connected waterways in Stanislaus County, and most are unintentionally transported by trailered recreational boats and on fishing gear and equipment. Once introduced, AIS take root in new environments very quickly. They typically do not have natural predators, and it is difficult for human management to eradicate an infestation. Clean-ups are beneficial, but there are rarely 100% effective eradication efforts once an invasive species is established in a waterbody. (Adirondack Council 2021). The severity of AIS in Stanislaus County mainly impacts environmental resources, which is evident in the impacts from the semi-aquatic rodent Nutria, but the severity of impacts on property is negligible given the state and county capabilities already in place.

Past Occurrences

There have been no federal or state disaster declarations from AIS. The HMPC have noted past occurrences due to various AIS, and Nutria in the County. As mentioned above, AIS has been invading the environment and causing problems in Stanislaus County, the nearby counties, and the entire State of California. The San Francisco Bay Delta, which covers the very northern portion of Stanislaus County near the San Joaquin River has more identified nonindigenous species present than any other estuary in North America (California SHMP 2018).

Probability of Future Occurrences

Likely – AIS is expected to continue being a hazard to Stanislaus County and California, given its already established presence and the fact that AIS can be easily introduced to California waters from throughout the world as regional and international trading and transporting grows and develops, as well as unintentional behavior such as dumping unwanted aquarium contents into a lake.

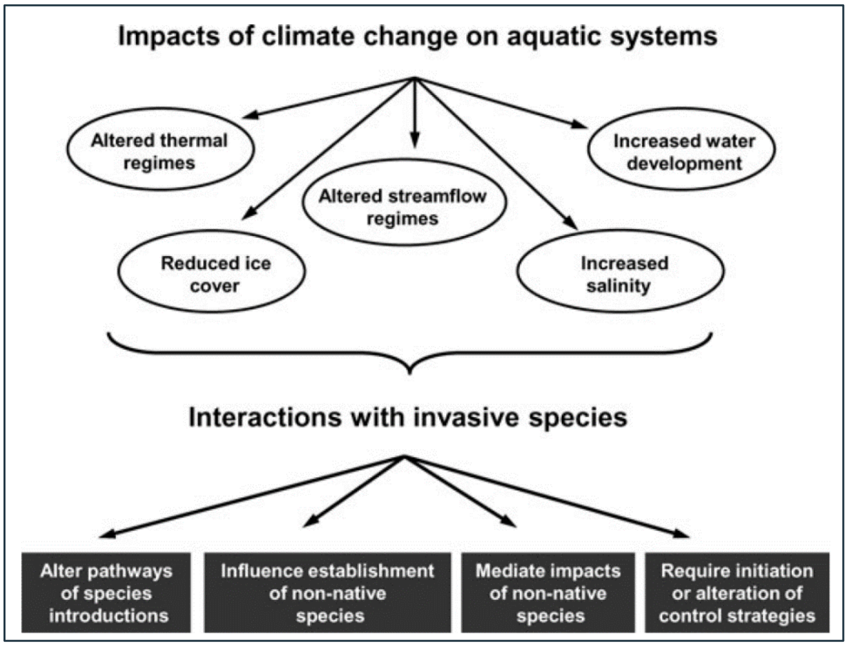
The State has several programs in place to prevent the introduction of AIS. The Ballast Water Management for Control of Nonindigenous Species Act of 1999, as amended and reauthorized by the Marine Invasive Species Act of 2003, targets at preventing the introduction of nonindigenous species via vessel vectors (ballast water and biofouling). The Marine Invasive Species Act applies to all U.S. and foreign vessels that are 300 gross registered tons or more that arrive at California ports. Under the Marine Invasive Species Act, vessels are required to submit a Ballast Water Management Report for each arrival at a California port or place and an Annual Vessel Reporting Form that requests information on vessel biofouling management practices and the use of ballast water treatment technologies. (California SHMP 2018). These programs are the State's capabilities that aim to inhibit the introduction of AIS, which decrease AIS' future occurrences.

The CDFW also administers the State's Invasive Species Program. The goal of the Invasive Species Program is to prevent, detect, and respond to species introductions when they occur and prevent the spread of species that have become established. CDFW is responsible for the State's Dreissenid Mussel Prevention Program. In 2016, CDFW adopted new regulations to prevent the spread of quagga and zebra mussels in California freshwater environments. The new regulations include provisions requiring vulnerability assessments, prevention programs, monitoring, and management of state reservoirs. (California SHMP 2018). These existing plans also minimize the probability of future occurrences of AIS in Stanislaus County. Although various capabilities are place at both the state and county level, AIS events are expected to continue to occur once or more per year and have up to a 100% chance of probability in any given year.

Climate Change Considerations

Climate change is expected to result in warmer water temperatures, a shorter duration of ice cover, altered streamflow patterns, increased salinization, and increased demand for water storage and conveyance structures. These changes will alter the pathways by which non-native species enter aquatic systems by expanding fish-culture facilities and water gardens to new areas and by facilitating the spread of species during floods. Climate change will influence the likelihood of new species becoming established by eliminating cold temperatures or winter hypoxia that currently prevent survival and by increasing the construction of reservoirs that serve as hotspots for invasive species. Climate change will also modify the ecological impacts of invasive species by enhancing their competitive and predatory effects on native species and by increasing the virulence of some diseases. As a result, new prevention and control strategies such as barrier construction or removal efforts may be needed to control AIS that currently have only moderate effects or that are limited by seasonally unfavorable conditions. Although most researchers focus on how climate change will increase the number and severity of invasions, some cold-water AIS may be unable to persist under the new climate conditions. Figure 4-6 shows the impacts of climate change on aquatic systems and the interactions with invasive species.

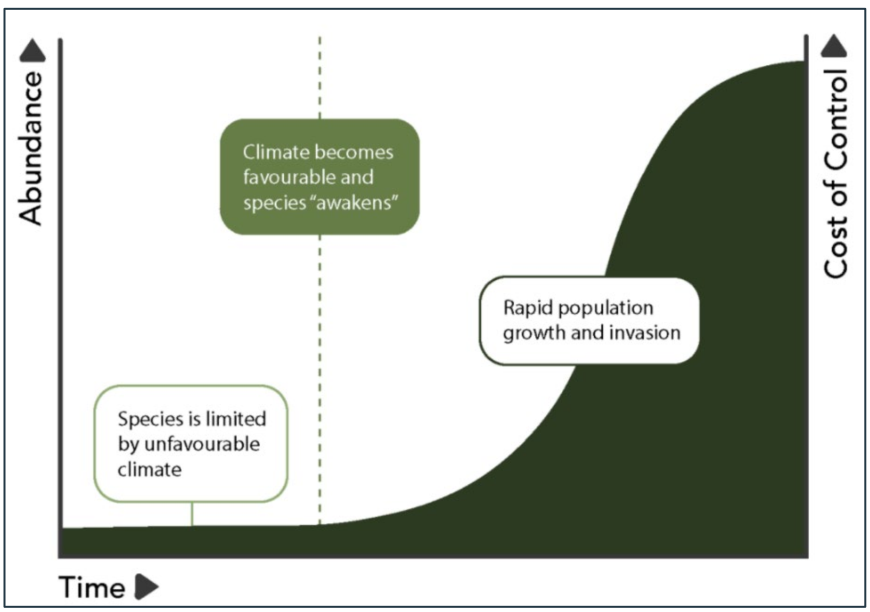
Figure 4-6 Impacts of climate change on aquatic systems & the interactions with invasive species



Source: Rahel et al. 2008, 521-33

Furthermore, according to Canada's Invasive Species Centre's findings, changes to climate can create favorable conditions for the increased spread of invasives, causing "*sleeper species*" to awaken. Sleeper species are non-native species already present in an ecosystem that have the potential to be invasive but are limited by factors such as climate or other species. Figure 4-7 shows that is species that were limited by unfavorable climate can awaken once climate becomes favorable, which could lead to the species growth and invasion of this species as well as the need for additional controls. (Invasive Species Centre 2021)

Figure 4-7 Sleeper species abundance vs. time vs. cost of control



Source: Invasive Species Centre 2021

Vulnerability Assessment

General Property

AIS often does not pose any direct threat on the general property. Meanwhile, aquatic invasive vegetation damages marina structures and boat launches. Dense mats of aquatic weeds create hazards for boaters, anglers, and swimmers. (California State Parks 2021)

People

The most significant impact related to people from AIS is its effects on human recreation. As mentioned in the General Property subsection above, boaters, anglers, and swimmers face potential hazards imposed by dense mats of aquatic weeds. Sharp mussel shells can leave beach areas unsuitable for recreation. Non-native aquatic invasive vegetation obstructs waterways, entangles boat propellers, overheats motors, and can completely disable vessels. These quick-growing plants can hide dangerous obstructions and cause hull damage and accidents. Species like Tiny Dreissenid mussels can ruin boat hulls and engines (California State Parks 2021). Moreover, AIS can result in negative consequences on fishing and make water sports like kayaking more difficult. With AIS competing and preying on native species, important native fish species' population can also reduce. This in turn can make an infested lake harder to fish, which can impact the business of resorts, restaurants, and guiding services (Hubbard SWCD 2021).

Moreover, Invasive species can cause impacts ranging from psychological effects, phobias, discomfort, and nuisance to allergies, poisoning, disease, and even death. According to the U.S. Federal Aquatic Nuisance Species Task Force's, the effect of AIS on public health extends beyond the immediate effects of disease and parasites as chemicals used to control invasive species can pollute soil and water. Other AIS, such as invasive mussels, may also increase human and wildlife exposure to organic pollutants such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) as these toxins accumulate in their tissues and are passed up the food chain.

Government Services

Public confidence may be hindered if warnings and alerts related to AIS removal and prevention are not communicated effectively. The government's ability to respond and recover may be questioned if planning, response, and recovery is not timely and effective, particularly in areas where AIS significantly impacts the economy, including recreation, tourism, shipping, transportation, and other related industries.

Damage to public water and sewer systems, water transportation networks, and flood control facilities can hinder the ability of the government to deliver services. Drinking water and wastewater treatment facilities may be temporarily out of operation due to AIS-related issues. Responders employed by AIS-control-related agencies such as CDFW will be expected to respond and mitigate AIS outbreaks. Otherwise, the AIS' impacts on responders would resemble its impacts on the general population.

Critical Facilities

AIS can significantly damage critical facilities and infrastructure. Thick mats of non-native aquatic invasive vegetation can quickly grow around and block water intakes for municipal water supply and agricultural irrigation. Dreissenid mussels can invade and grow on or inside of water supply and irrigation equipment, causing the pumps to work harder and/or eventually break down (California State Parks 2021).

The invasive species Advisory Committee under the U.S. Department of the Interior summarized several AIS impacts on infrastructure. Nutria negatively impact infrastructure in two ways: herbivory that leads to habitat destruction and burrowing behavior. Nutria burrows can weaken flood control levees that protect low-lying areas as well as roadbeds, stream banks, dams, and dikes under heavy weight. Giant reed chokes riversides and stream channels, crowds out native plants, interferes with flood control, and increases fire potential. The long, fibrous, interconnecting root mats of giant reed form a framework for debris dams behind bridges, culverts, and other structures that lead to damage. Dreissenid mussels also attach to locks, the faces, and interiors of dams and canal systems, greatly impacting operation and maintenance costs.

Economy

AIS impacts can cause economic loss in the tourism and recreation industry and the shipping and transportation industries. AIS also require control and inspection programs that require funding to prevent and remove AIS in waterways. AIS can reduce important native fish species' population and make fishing harder, impacting resorts, restaurants, and guiding services. AIS can also impact human recreation, including waters sport like kayaking or boating, as well as swimming. Beaches can be closed due to AIS.

In California's freshwater lakes, rivers, and reservoirs, zebra and quagga mussel infestations pose a significant threat to the State's complex water conveyance system. As of 2016, more than $24 million has been spent on the control and management of these species. Water hyacinth, an invasive aquatic plant, has clogged the waterways of the Delta. In 2014, shipping traffic to the Port of Stockton was restricted to daylight hours due to high densities of hyacinth in waterways. The Port spent $200,000 to mechanically remove the plant. Meanwhile, the shipping industry lost an estimated $300,000 due to delays in cargo operations. (California SHMP 2018)

Historic, Cultural and Natural Resources
AIS' impacts on historical and cultural resources would be similar to its impact on general property. Although the direct impact would be minimal, property values can decrease when AIS invade recreational waterbodies.

As far as AIS' impacts on natural resources, U.S. Federal Aquatic Nuisance Species Task Force states that introduced species are a greater threat to native biodiversity than pollution, harvest, and disease combined. AIS cause severe and permanent damage to the habitats they invade by reducing the abundance of native species and altering ecosystem processes. AIS prey on other species, compete with native species for food and space, live on or in another organism (parasitism), or degrade or even destruct ecosystems and fish habitat via eroding or destroying vegetation for example. AIS can also introduce harmful pathogens and parasites. Moreover, AIS may alter ecosystem function by altering fire regimes, hydrology, nutrient cycling, and productivity (Government of Canada 2019; U.S. Federal Aquatic Nuisance Species Task Force 2021). Giant reed, for example, can outcompete and completely suppress native vegetation once established. Meanwhile, giant reed reduced habitat for wildlife, including the least Bell's vireo, listed as a federal and state endangered bird species.

Future Development
Federal, state, and local efforts and programs are in place to remove AIS and mitigate its existing impacts, as well as prevent the introduction of new AIS. These programs include the Marine Invasive Species Act as well as CDFW's Invasive Species Program and Dreissenid Mussel Prevention Program. Stanislaus County also implements the Invasive Species Program online under the County's Department of Parks and Recreation, which includes a prevention program and guidebooks regarding zebra and quagga mussel and other invasive mussels. Given that AIS can be introduced to the County and the surrounding areas' waters via various pathways, agencies are encouraged to promote the education and outreach efforts to raise the boaters, water transportation workers, and the general public's awareness of AIS. Such efforts are critical in many aspects, such as minimizing the unintentional introduction of AIS, teaching people how to prevent the spread of AIS, and the timely reporting of potential AIS when observed.

Risk Summary

- AIS can be introduced and then spread via various pathways. For example, unintentional behavior such as dumping aquarium contents into a lake can trigger the introduction of AIS.
- Several symbolic AIS already established in Stanislaus County and within the Central Valley include Giant reed, American bullfrog, Nutria and Quagga and zebra mussels.
- Although various capabilities are place at both the state and county level in Stanislaus, AIS events are expected to continue to occur once or more per year and have up to a 100% probability of future occurrence.
- It is expected that AIS will continue causing damages to the County; climate change can introduce and even accelerate the spread of AIS.
- AIS can have various impacts on the environment and economy, by destructing the environment and natural resources as well as threatening economic development and damaging recreation and tourism industries.
- **Related Hazards** – Agricultural Pests and Disease, Drought, Flooding.

Table 4-14 Hazard Risk Summary by Jurisdiction – Aquatic Invasive Species

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Limited	Likely	Negligible	Low	No
City of Ceres	Limited	Likely	Negligible	Low	No
City of Hughson	Extensive	Likely	Negligible	Low	No
City of Modesto	Limited	Likely	Negligible	Low	No
City of Newman	Limited	Likely	Negligible	Low	No
City of Oakdale	Limited	Likely	Negligible	Low	No
City of Patterson	Limited	Likely	Negligible	Low	No
City of Riverbank	Limited	Likely	Negligible	Low	No
City of Turlock	Limited	Likely	Negligible	Low	No
City of Waterford	Limited	Likely	Negligible	Low	No
County Office of Education	Limited	Likely	Negligible	Low	No

4.3.3 Cyber Attack

Hazard Problem/Definition

The 2018 California SHMP defines cyber attacks as "attempts by cyber criminals to attack a government, organization, or private party by damaging or disrupting a computer or computer network, or by or stealing data from a computer or computer network for malicious use." Cyber attacks use malicious code to alter computer operations or data. The vulnerability of computer systems to attacks is a growing concern as people and institutions become more dependent upon networked technologies. The Federal Bureau of Investigation (FBI) reports that, "*cyber intrusions are becoming more commonplace, more dangerous, and more sophisticated*," with implications for private- and public-sector networks. Cyber threats can take many forms, including:

- **Phishing attacks** – Phishing attacks are fraudulent communications that appear to come from legitimate sources. Phishing attacks typically come through email but may come through text messages as well. Phishing may also be considered a type of social engineering meant to exploit employees into paying fake invoices, providing passwords, or sending sensitive information.
- **Malware attacks** – Malware is malicious code that may infect a computer system. Malware typically gains a foothold when a user visits an unsafe site, downloads untrusted software, or may be downloaded in conjunction with a phishing attack. Malware can remain undetected for years and spread across an entire network.
- **Ransomware** – Ransomware blocks access to a jurisdiction's/agency's/ business' data by encrypting it. Perpetrators will ask for a ransom to provide the security key and decrypt the data, although many ransomware victims never get their data back even after paying the ransom.
- **Distributed Denial of Service (DDoS) attack** – The most common type of cyber attack, a DDoS attack seeks to overwhelm a network and causes it to either be inaccessible or shut down. A DDoS typically uses other infected systems and internet connected devices to "request" information from a specific network or server that is not configured or powerful enough to handle the traffic.
- **Data breach** – Hackers gaining access to large amounts of personal, sensitive, or confidential information has become increasingly common in recent years. In addition to networked systems, data breaches can occur due to the mishandling of external drives.
- **Critical Infrastructure/SCADA System attack** – There have been recent critical infrastructure Supervisory Control and Data Acquisition (SCADA) system attacks aimed at taking down lifelines such as power plants and wastewater facilities. These attacks combine a form of phishing, malware, or other social engineering mechanisms to gain access to the system.

The 2018 California SHMP states: "*Nationally, cybersecurity incidents such as financial fraud and government database breaches have increased from 5,503 in 2006 to 67,168 in 2014.*" This is more than a 1200% increase in occurrence over just an 8-year period. As this trend continues and society and government functions become more technologically dependent, this hazard is of increasing concern.

In one recent attempt to combat this threat, the State of California adopted Senate Bill (SB) 327 in September of 2018. This bill seeks to improve information privacy, specifically pertaining to connected devices. Existing laws in California require businesses to take all reasonable steps to dispose of customer records within their custody containing personal information and require businesses that own, license, or maintain personal information about a California resident to implement and maintain reasonable security procedures. SB 327, which went into effect January 1, 2020 further requires the manufacturer of connected devices to equip the device with a reasonable security feature to protect user information.

Geographic Area

Significant – Cyber attacks can and have occurred in every location regardless of geography, demographics, and security posture. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the state can still impact people, businesses, and institutions within the County. All of Stanislaus County is potentially susceptible to cyber attacks, making the geographic extent significant.

Extent (Magnitude/Severity)

Not Applicable – There is no universally accepted scale to explain the severity of cyber attacks. The strength of a DDoS attack is often explained in terms of a data transmission rate. One of the largest DDoS disruptions ever, the October 21, 2016 Dyn attack, peaked at 1.2 terabytes per second and impacted some of the internet’s most popular sites that included Amazon, Netflix, PayPal, Twitter, and several news organizations.

Data breaches are often described in terms of the number of records or identities exposed. The Privacy Rights Clearinghouse, a nonprofit organization based in San Diego, maintains a database of data breaches in the United States. The largest data breach ever reported occurred in August 2013, when hackers gained access to all three billion Yahoo accounts. This incident is associated with California in the Privacy Rights Clearinghouse database as the company is headquartered in Sunnyvale, California. As the location of the headquarters of many large tech businesses and server farms, California as a state is potentially a greater target for cyber attacks. There have been many other instances in California where millions of records have been breached.

Ransomware attacks are typically described in terms of the amount of ransom requested, or by the amount of time and money spent to recover from the attack. One report from cybersecurity firm Emsisoft estimates the average successful ransomware attack costs $81 million and can take organizations 287 days to recover. Overall, the potential magnitude of a cyber attack can be seen as limited due to the lack of deaths and injuries, but the economic costs can be significant.

Past Occurrences

The cybersecurity firm Symantec reports there were a total of 1,209 data breaches worldwide in 2016. While the number of breaches has remained relatively steady, the average number of identities stolen has increased to almost one million per incident. The report also found that one in every 131 emails contained malware, and the company’s software blocked an average of 229,000 web attacks every day.

California is by far the state with the highest number of data breaches. The Privacy Rights Clearinghouse database lists 1,338 data breaches against systems located in California, totaling over 5.7 billion impacted records; however, it is difficult to know how many of those affected Stanislaus County residents. Attacks happening outside of the State can also impact local businesses, personal identifiable information, and credit card information.

A 2017 study found ransomware payments over a two-year period totaled more than $16 million. Even if a victim is perfectly prepared with full offline data backups, recovery from a sophisticated ransomware attack typically costs far more than the demanded ransom. However, according to a 2016 study by Kaspersky Lab, roughly one in five ransomware victims who pay their attackers never recover their data.

Recent years have seen an increase in ransomware attacks, particularly against local government systems. The City of Atlanta was hit by a major ransomware attack in 2018, recovery from which wound up costing a reported $2.6 million, significantly more than the $52,000 ransom demand. A similar attack against the

City of Baltimore in 2019 affected the city government's email, voicemail, property tax portal, water bill, and parking ticket payment systems, and delayed more than 1,000 pending home sales. In March 2019, Orange County, North Carolina was attacked with a ransomware virus, causing slowdowns and service problems at key public offices such as the Register of Deeds, the Sheriff's Office, and County libraries. The attack impacted a variety of county services, including disrupting the County's capability to process real estate closings, issue marriage licenses, process fees or permits, process housing vouchers, and verify tax bills. Each of these past events are examples of the range of risks posed to county and municipal governments by various cyber attacks.

Reports of successful attacks against SCADA systems are less common. In February 2021, a hacker gained system access to a water treatment plant in Oldsmar, Florida and increased the levels of sodium hydroxide to dangerous levels; however, this change was immediately detected by plant staff and corrected.

A large, sophisticated malware attack, known as Olympic Destroyer, was launched against the 2018 Winter Olympics in PyeongChang, South Korea. The attack initially took down servers, email, Wi-Fi, and ticketing systems, which could have severely disrupted the games. Fortunately, the organizing committee had a robust cybersecurity group that was able to quickly restore most functions.

Probability of Future Occurrences

Likely – Small-scale cyber attacks such as DDoS attacks occur daily, but most have negligible impacts at the local or regional level. Data breaches are also extremely common, but again most have only minor impacts on government services.

Perhaps of greatest concern to Stanislaus County are ransomware attacks, which are becoming increasingly common. It is difficult to predict the odds of Stanislaus County being hit with a successful ransomware attack in any given year, but it is safe to say it is likely to be attacked in the coming years. The possibility of a larger disruption affecting systems within the County is a constant threat, but it is difficult to quantify the exact probability due to such highly variable factors as the type of attack and intent of the attacker, as such a specific probability of future occurrence was not quantified. Nonetheless, major attacks specifically targeting systems or infrastructure in the County cannot be ruled out.

Climate Change Considerations

There are no known effects of climate induced impacts on cyber attacks.

Vulnerability Assessment

The impact of a cyber attack can vary depending on the type of attack and the intent of the malicious actor. Though a cyber disruption can have limited impacts within a system's own operations, it may cause cascading impacts.

General Property

The vast majority of cyber attacks affect only data and computer systems and have minimal impact on general property.

People

Injuries or fatalities from cyber attacks would generally only be possible from a major cyber terrorist attack against critical infrastructure, such as potable water treatment and delivery systems. If such an event would occur it could indirectly impact the customers served by water utility. More likely impacts to the public are financial losses and an inability to access systems such as public websites and permitting sites. Indirect impacts could include interruptions to traffic-control systems or other infrastructure

Data breaches and subsequent identify thefts can have huge impacts on the public. The Internet Crime Complaint Center (IC3) estimates that identity theft alone resulted in $2.7 billion in losses to businesses and $149 million in losses to individuals.

According to the Cyber & Infrastructure Security Agency (CISA), cyber risks to 9-1-1 systems can have "*severe impacts, including loss of life or property; job disruption for affected network users; and financial costs for the misuse of data and subsequent resolution.*" CISA compiled a recent list of attacks on 9-1-1 systems including a DDoS in Arizona, unauthorized access with stolen credentials in Canada, a network outage in New York, and a ransomware attack in Baltimore.

Government Services
Cyber attacks have the potential to interfere with emergency response communication and activities. For example, many response agencies rely on IT technology to log incidents, notify response, and route responders to emergency events. 911 dispatch centers also rely on technology, which makes them vulnerable to cyber attacks. The County may be susceptible to cyber attacks if they rely on electronic backup of sensitive files that may impact their ability to continue to provide services during cyber attacks.

If personal and confidential data is not protected, this would impact the public's confidence in the County. The public may then be concerned on the security of electronic systems used for government services.

Critical Facilities and Infrastructure
While the vast majority of cyber attacks affect only data and computer systems, sophisticated attacks against utilities and infrastructure sites have occurred. Such attacks typically target the SCADA systems of critical infrastructure, which can potentially result in system failures on a scale equal with natural disasters. Facilities and infrastructure, such as the electrical grid, could become unusable as a result of a cyber attack. A cyber attack took down the power grid in Ukraine in 2015, leaving over 230,000 people without power. Agencies that rely on electronic backup of critical files are also vulnerable.

The delivery of services can be impacted since governments rely to a great extent upon electronic delivery of services. Most agencies rely on server backups, electronic backups, and remote options for the continuity of operations or the continuity of government. Many departments in the participating jurisdictions have the option to move to a paper method including permitting, DMV services, payments to and from the County, and payroll. However, access to documents on the network, OneDrive access, and other operations that require collaboration across the County will be significantly impacted.

Loss of government servers due to a cyber attack could affect the ability of responders to do their jobs. Cyber attacks can interfere with emergency response communications, access to mobile data terminals, and access to critical preplans and response documents. The delivery of services can be impacted since governments rely, to a great extent, upon electronic delivery of services. An attack could also raise questions regarding the security of using electronic systems for government services.

Economy
Economic impacts from a cyber attack can be debilitating. The cyber attack in 2018 that took down the City of Atlanta cost at least $2.5 million in contractor costs and an estimated $9.5 million additional funds to bring everything back online. The attack in Atlanta took "*more than a third of the 424 software programs offline*" and recovery lasted more than 6 months. A 2018 cyber attack on the Colorado Department of Transportation (CDOT) cost an estimated $1.5 million. None of these statistics take into account the economic losses to businesses and ongoing IT configuration to mitigate from a future cyber attack. Similar events may result in economic impacts in Stanislaus County.

Historic, Cultural, and Natural Resources
The vast majority of cyber incidents have little to no impact on historic, cultural or natural resources. A major cyber terrorism attack could potentially impact the environment by triggering a release of a hazardous materials, or by causing an accident involving hazardous materials by disrupting traffic-control devices.

Future Development

Changes in development have no impact to the threat, vulnerability, and consequences of a cyber attack. Cyber attacks can and have targeted small and large jurisdictions, multi-billion-dollar companies, small mom-and-pop shops, and individual citizens. The decentralized nature of the internet and data centers means that the cyber threat is shared by all, regardless of new construction and changes in development.

Risk Summary

- The overall significance of cyber attacks in Stanislaus County is Medium. These incidents occur frequently, with California being the State with by far the most reported incidents. The possibility of an attack of any scale impacting the County is almost certain.

- There have been 1,338 data breaches statewide over a 14-year period, averaging approximately 96 incidents per year, or up to eight incidents each month.
- Nationwide the increase in cyber attacks has been dramatic year over year. As this trend continues it is safe to assume there is a threat to Stanislaus County.
- Injuries and fatalities to people are unlikely, unless in a widescale attack that affected infrastructure and resulted in indirect impacts on communities. People may also be impacted financially.
- The vast majority of attacks do not affect property.
- Economic impacts from a cyber attack can be debilitating, sometimes costing local governments millions of dollars.
- The vast majority of attacks target only computer systems, however sophisticated attacks against utilities and infrastructure, such as electrical grids, have occurred.

Table 4-15 Hazard Summary – Cyber Attack

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Significant	Likely	NA	Medium	No
City of Ceres	Significant	Likely	NA	Medium	No
City of Hughson	Significant	Likely	NA	Medium	No
City of Modesto	Significant	Likely	NA	Medium	No
City of Newman	Significant	Likely	NA	Medium	No
City of Oakdale	Significant	Likely	NA	Medium	No
City of Patterson	Significant	Likely	NA	Medium	No
City of Riverbank	Significant	Likely	NA	Medium	No
City of Turlock	Significant	Likely	NA	Medium	No
City of Waterford	Significant	Likely	NA	Medium	No
County Office of Education	Significant	Likely	NA	Medium	No

4.3.4 Dam Incidents

Hazard/Problem Description

Dam failure is the breakdown, collapse or other failure of a dam structure characterized by the uncontrolled release of impounded water that results in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream. An uncontrolled breach is the unintentional discharge from the impounded water body and is considered a failure. Dam failure can result from natural events or human-induced events. Dams have received more attention recently in the emergency management community as a potential target for terrorist acts.

Dams are built for a variety of uses, including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they usually are engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped and fail. Overtopping is the primary cause of earthen dam failure in the United States. Dam failures can also result from any one or a combination of the following causes:

- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Associated water quality and health concerns could also be issues. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure. The best way to mitigate dam failure is through the proper construction, inspection, maintenance, and operation of the dam.

Controlled release or spillway flooding – Spillways are designed to relieve pressure on dams and prevent dam failures. Flooding downstream often results when spillways flow, though the potential for flooding as a result of discharge from dam outlet structures can also result from excessive rain events. However, controlled releases of water from dams is a measure that can prevent or minimize spillway flooding or structure failure, by regulating capacity in a managed way. Even controlled releases can lead to unwanted or unpredicted flooding, depending on environmental and weather conditions, or even human error.

In general, there are three types of dams: concrete arch or hydraulic fill, earth-rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously: the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach: the downstream flood wave will build gradually to a peak and then decline until the reservoir is empty. And a concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

Geographic Area

Significant – According to the California Department of Water Resources' (DWR) Jurisdictional Dams and the National Inventory of Dams (NID) databases there are 18 dams of concern to Stanislaus County; five of which are in the County and 13 upstream of the County. Table 4-16 lists the high and significant hazard dams within and upstream of Stanislaus County. Figure 4-8 shows where the high and significant hazard dams are located, and the potential inundation areas based on the best available data. It is important to note that the inundation areas shown do not represent all dams that pose a risk; some of this information is not available in GIS or allowed for release in a public document. Virtually no urban area except the cities of Patterson and Newman in the County is free from flooding in the event of dam failure. Potential impacts are greatest for all the other major cities in Stanislaus County as well as urban communities such as Knights Ferry, Hickman, Denair, and Keyes.

Figure 4-8 Stanislaus County Dam Inundation Map

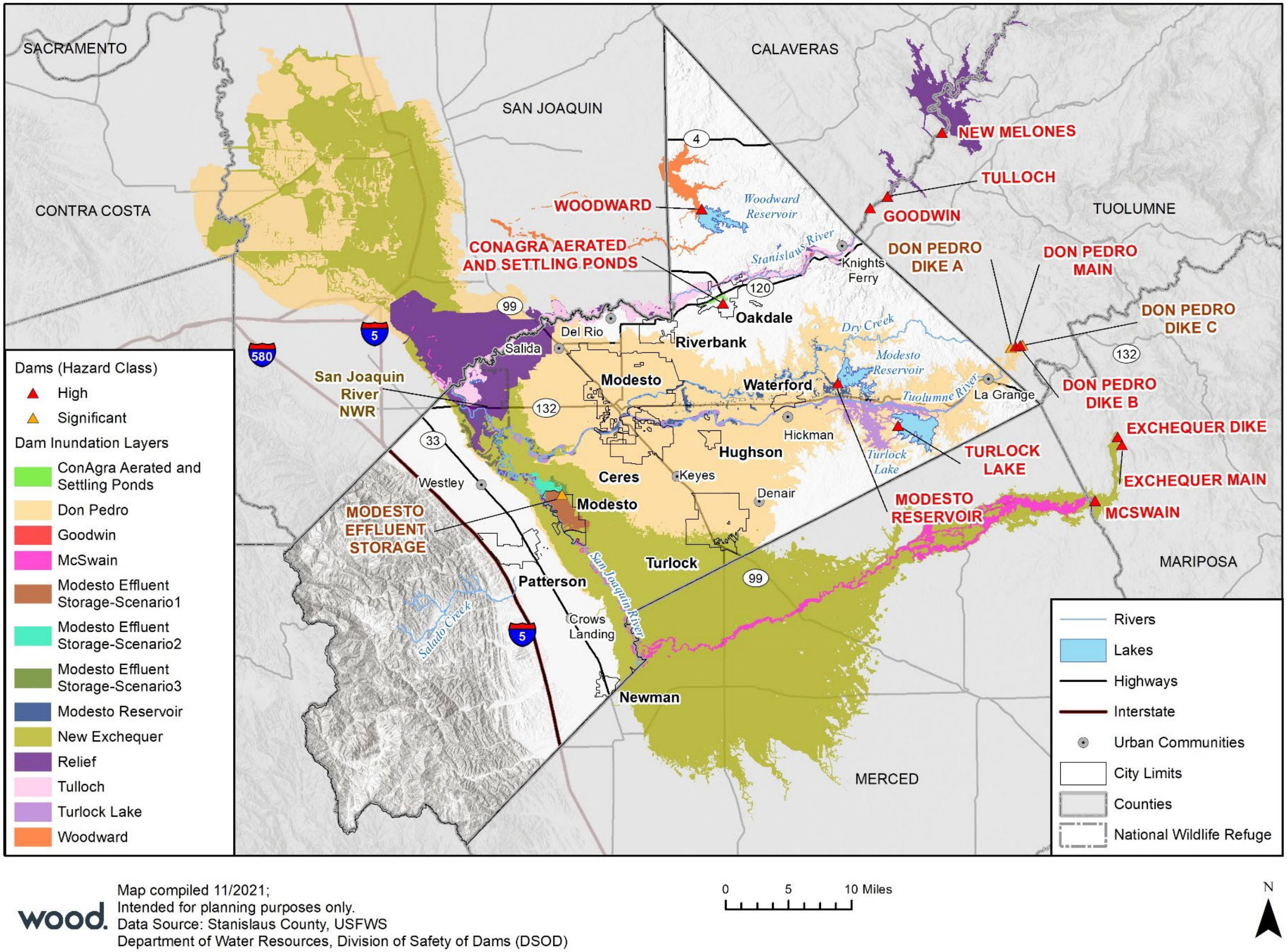


Table 4-16 Dams of Concern Within and Upstream of Stanislaus County

County	Dam Name	Dam Owner/Operator	River	Downstream City	Normal Storage Capacity (Acre-Feet)	Emergency Action Plan (EAP)?	NID Hazard Rating	CA DSOD Hazard Rating*
Stanislaus	Modesto Reservoir	MID	TR Tuolumne RV River	Waterford, Hughson, Ceres, Modesto	40,000	No	High	Extremely High
	Woodward	SSJID	Simmons Creek		49,340	Yes	High	Extremely High
	Turlock Lake	TID	TR Tuolumne RV River	Waterford, Hughson, Ceres, Modesto	63,406	Yes	High	High
	Modesto Effluent Storage	City of Modesto	Off-stream River	Modesto	7,830	No	Significant	Significant
	Conagra Aerated and Settling Ponds	ConAgra Grocery Products Company, LLC	Off-Stream River	Oakdale	140	No	High	High
Tuolumne	Don Pedro (In Old Plan)	TID	Tuolumne River	Waterford, Hughson, Turlock, Ceres, Modesto, Patterson. Newman, Riverbank	2,030,000	Yes	High	Extremely High
	Don Pedro Dike A	TID	Tuolumne River	Waterford, Hughson, Turlock, Ceres, Modesto, Patterson. Newman, Riverbank	2,030,000	Yes	Significant	
	Don Pedro Dike B	TID	Tuolumne River	Waterford, Hughson, Turlock, Ceres, Modesto, Patterson. Newman, Riverbank	2,030,000	Yes	High	
	Don Pedro Dike C	TID	Tuolumne River	Waterford, Hughson, Turlock, Ceres, Modesto, Patterson. Newman, Riverbank	2,030,000	Yes	Significant	
	Relief	PG&E	Summit Creek	Oakdale, Riverbank, Modesto	15,600	Yes	High	Extremely High
Calaveras	Goodwin	Tri-Dam Project	Stanislaus River	Oakdale	500	Yes	High	High
	New Melones (in Old Plan)	Bureau of Reclamation	Stanislaus River	Oakdale, Riverbank and Modesto	2,870,000	Yes	High	
	Tulloch (in GP)	SSJID	Stanislaus River	Oakdale, Riverbank	68,400	Yes	High	Extremely High
Mariposa	Exchequer Dike	Merced Irrigation District	Merced River	Snelling	1,100,000	Yes	High	
	Exchequer Main (New Exchequer) (In Old Plan)	Merced Irrigation District	Turlock, Modesto, Ceres	Snelling	1,100,000	Yes	High	Extremely High
	Mcswain	Merced Irrigation District	Modesto, Patterson	Snelling	9,730	Yes	High	High
Merced	San Luis Reservoir (in GP)	Bureau of Reclamation, California DWR	The California Delta		2,031,000			
Fresno	Pine Flat (in GP)	USACE – Sacramento District	Kings River		1,000,000	Yes	High	

Sources: California DSOD and the NID
* DSOD added a fourth category ("Extremely High") to the FEMA categories for downstream hazard potential. Extremely High is defined as Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

There were some data limitation associated with the risk assessment for dam incidents. Analysis using inundation data and mapping associated with New Melones, Pine Flat and San Luis dams was not possible for the plan due to information being considered sensitive and restricted, per communication with OES and the dam owners. As a result, the dam risk assessment does not quantify the entire risk to the County and the nine participating jurisdictions in the event of a dam incident. However, these deficiencies have been noted and a qualitative summary of risk is provided instead.

Extent (Magnitude/Severity)

Catastrophic – Standard practice among federal and state dam safety offices is to classify a dam according to the potential impact a dam failure (breach) or mis-operation (unscheduled release) would have on downstream areas. The hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental and lifeline facilities. The U.S. Army Corp of Engineers uses three categories to classify a dam's potential hazard to life and property:

- High hazard indicates that a failure would most probably result in the loss of life.
- Significant hazard indicates that a failure could result in appreciable property damage.
- Low hazard indicates that failure would result in only minimal property damage and loss of life is unlikely.
- Undetermined hazard dams have not been rated or their hazard rating is not known.

In addition to these, high, significant, and low hazard classifications the California DSOD adds the fourth category of "*Extremely High*". The DSOD defines this fourth category as "*expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more (DSOD 2020). As shown in Table 4-16, five dams – Modesto Reservoir, Woodward, Don Pedro, Tulloch and New Exchequer dams are classified as "Extremely High*".

Since the County has several high and significant hazard dams, there is potential for loss of life and property damage. The inundation areas for each of the dams are generally downstream and include large rural and urban areas on the valley floor below the dams. Adjacent jurisdictions could also be affected by a dam failure. The extent of impacts depends on the nature of failure and location of the dam. The largest populations potentially at risk would be in Modesto, Ceres, Hughson, and Turlock. As mentioned previously, except Patterson and Newman, all the major cities would be impacted were a dam to fail and flood downstream. The hazard risk also applies to the County's most urban communities.

A severe storm, earthquake or erosion of the embankment and foundation leakage may cause the collapse and structural failure of dams in Stanislaus County or other nearby counties. Seismic activity may also cause inundation by the action of a seismically induced wave that overtops the dam without causing failure of the dam, but significant flooding downstream. Landslides flowing into lakes and reservoirs may also cause dams to fail or overtop.

Past Occurrences

There is no history of dam failure affecting the County, but according to the HMPC there have been recurring issues with flooding due to high flows released below dams in the area.

Probability of Future Occurrences

Unlikely – The County remains at risk to dam failures from numerous dams under a variety of ownership and control and of varying ages and conditions. However, based on historical experience dam failure is unlikely in the area based on the frequency of past dam incidents. Dams are regulated and inspected by either the State of California's DSOD or the Federal Energy Regulatory Commission (FERC) or both with follow up written inspection reports. There have been no findings that would raise concern for a potential dam failure. Nevertheless, given the number of dams of concern in the County, the potential exists for future dam failures in Stanislaus County, but the likelihood of this is low. Uncontrolled or controlled release flooding as well as spillway flooding below dams due to excessive rain or runoff are more likely to occur than failures.

Climate Change Considerations

UC Davis researchers discussed the effects of climate change on reservoir operations in a journal published in 2014. This journal and other relevant studies imply that climate change will impact the traditional operation measures and flow regimes used for dams because river conditions and water levels will be fluctuating due to climate change. For example, climate change may worsen drought conditions, which lessen the water available while climate change can also produce intense sudden storms that causes water levels to suddenly increase. Therefore, reservoir operators may need to change operations to mitigate for climate change's impact on rivers and overall water levels (Rheinheimer and Viers 2014).

However, the potential for climate change to affect the likelihood of dam failure is not fully understood now. With a potential for more extreme precipitation events as a result of climate change, this could lead to large inflows to reservoirs. However, this could be offset by generally lowering reservoir levels if storage water resources become more limited or stretched in the future due to climate change, drought and/or population growth.

Vulnerability Assessment

A dam incident can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to dam failures is confined to the areas and populations subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the dam itself and associated revenues that accompany those functions.

General Property

In the unlikely event of a complete dam failure, the majority of the populated areas within Stanislaus County are impacted, specifically, those areas along the Stanislaus, Tuolumne and San Joaquin Rivers. Areas around Dry Creek will also flood. Inundation due to dam failure within the San Joaquin Valley is a low probability but high-risk hazard. The potential risk for inundation of property is present in nearly all of the developed areas of Stanislaus County; however, catastrophic failure or flood release of water from multiple dams at a single point in time is considered to be extremely unlikely.

In general, communities located below a high or significant hazard dam and along a waterway are potentially exposed to the impacts of a dam failure. Inundation maps that identify anticipated flooded areas (which may not coincide with known floodplains) are typically produced for all high hazard dams and included in the Emergency Action Plan (EAP) required for each dam. The FERC also requires annual training and exercises for each individual EAP. Stanislaus County maintains copies of the dam EAPs at its Emergency Operations Center (EOC) and participates in exercises with the dam operators.

A GIS layer that contained inundation maps for 10 of the 18 high and significant hazard dams that affect the County was analyzed to quantify risk across the Planning Area. Table 4-17 summarizes the results of the GIS analysis and includes a population estimate based on the number of residential parcels exposed, multiplied by an average household size estimate from the U.S. Census. Exposure estimates from failure of other high hazard dams were not possible due to data restrictions and/or limitations.

Table 4-17 Summary of Dam Inundation by Jurisdiction

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	11,462	$2,511,485,475	$1,760,538,649	$4,272,024,124	38,906
Hughson	2,086	$494,398,275	$313,490,178	$807,888,453	5,853
Modesto	60,673	$14,126,321,781	$9,767,800,876	$23,894,122,657	161,011
Oakdale	408	$92,838,755	$51,332,522	$144,171,277	1,106
Riverbank	1,601	$438,053,010	$257,818,591	$695,871,601	5,415
Turlock	19,413	$5,311,625,963	$3,985,984,895	$9,297,610,858	49,737
Waterford	2,376	$389,884,917	$233,731,703	$623,616,620	7,651
Unincorporated	25,617	$5,856,860,233	$5,498,466,160	$11,355,326,393	46,718
Total	**123,636**	**$29,221,468,409**	**$21,869,163,571**	**$51,090,631,980**	**316,395**

Source: California DSOD, NID, Stanislaus County Assessor's Office

People

Persons located underneath or downstream of a dam are at risk of a dam failure, though the level of risk can be tempered by topography (specifically where populations are located within the inundation path of a dam), amount of water in the reservoir and time of day of the breach. Injuries and fatalities can occur from debris, bodily injury, and drowning. Once a dam has breached, standing water presents all the same hazards to people as floodwater from other sources. People in the inundation area may need to be evacuated, cared for, and possibly permanently relocated. Impacts could include thousands of evacuations and likely hundreds of casualties, depending on the dam involved.

The populations most vulnerable are those that have the least time to evacuate and need assistance. Populations that may need assistance to evacuate include the elderly, disabled and young. The vulnerable population also includes those who may not have adequate warning to evacuation from emergency notification systems. The loss of life is impacted by the amount of early warning time first responders and the public has prior to the incident.

Specific population impacts are noted in Table 4-17, and total people at risk were calculated by multiplying the average number of persons per household in Stanislaus County (3.09) and each applicable incorporated jurisdiction (Ceres 3.66, Hughson 3, Modesto 2.9, Newman 3.41, Oakdale 2.91, Patterson 3.7, Riverbank 3.44, Turlock 2.87, and Waterford 3.57) times the number of residential parcels where dam inundation occurs. Based on the best available data accessible to the HMPC at this time of this analysis, the City of Modesto has the most people (161,011) potentially exposed to a dam inundation event, followed by City of Turlock and the unincorporated areas of the County with potentially 49,737 and 46,718 people exposed to a dam inundation event, respectively.

Social Vulnerability

As shown in Figure 4-3 Overall Social Vulnerability in Stanislaus County based on the SoVI, by Census Tracts, the areas with the highest level of social vulnerability in the County are in the central, southern, and southwestern portions of the County, including some of the incorporated jurisdictions such as the Cities of Modesto, Ceres, and Turlock. These socially vulnerable areas are also within the inundation areas of New Exchequer and Don Pedro dams. Therefore, socially vulnerable populations who live in these areas are exposed to a higher risk of dam inundation incidents.

Government Services

Short-term accessibility issues may limit staffs' abilities to perform routine duties or report to work locations, and delivery of services may be affected. Damage to facilities/personnel in incident area may require temporary relocation of some operations. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult.

Responders in flooded areas at the time of incident or assisting in evacuations could be at risk. Impacts to transportation corridors and communications lines could affect first responders' ability to effectively respond. Public confidence in government may be challenged by the public if planning, response, and recovery are not timely and effective, regardless of the dam owner.

Critical Facilities and Infrastructure

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam failure. Of particular risk would be roads and bridges that could be vulnerable to washouts, further complicating response and recovery by cutting off impacted areas. Impacts to cities would affect key infrastructure including hospitals, fire stations, clinics, and businesses.

Based on the critical facility inventory considered in this plan update and intersected with the dam inundation extents available, 1,006 critical facilities were found to be potentially at risk. The unincorporated County has the greatest number of facilities at-risk followed by City of Modesto and City of Turlock. These at-risk facilities are listed in the tables below by jurisdiction and critical facility classification as based on the FEMA Lifeline categories.

Table 4-18 Critical Facilities in Dam Inundation Areas – Estimates by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	17	4	2	1	9	14	14	61
Hughson	1	-	17	1	2	10	3	34
Modesto	52	24	25	9	112	90	32	344
Newman	-	-	-	-	-	-	-	-
Oakdale	-	-	-	1	1	1	-	3
Patterson	-	-	1	-	-	-	-	1
Riverbank	-	1	-	1	-	-	1	3
Turlock	13	7	13	21	27	23	20	124
Waterford	-	-	6	-	-	7	3	16
Unincorporated	107	40	18	27	14	59	153	418
Other Counties	1	-	-	-	1	-	-	2
Total	191	76	82	61	166	204	226	1,006

Source: Homeland Infrastructure Foundation – Level Data, Stanislaus County, Cities of Newman, and Hughson

Economy

Extensive and long-lasting economic impacts could result from a major dam failure including the long-term loss of water in a reservoir after a failure event. Based on the analysis there are approximately 8,612 buildings that are designated as farm and agricultural properties potentially exposed to dam inundation event. A major dam incident and loss of water from the associated reservoir could include direct business and specifically impacts to the agricultural industry, resulting in damages and indirect disruption of the local economy. Economic impacts related to agriculture in the unincorporated areas of the County would be the most severe. According to the 2020 Stanislaus County Agriculture Report, the value of agricultural commodities produced in Stanislaus County was $3.5 billion.

Historic, Cultural and Natural Resources

Dam failure effects on the environment would be similar to those caused by flooding from other causes. Water could erode stream channels and topsoil and cover the environment with debris. For the most part the environment is resilient and would be able to rebound from whatever damages occurred, though this process could take years. However, historic and cultural resources could be affected just as housing or critical infrastructures would, were a dam to fail and cause downstream inundation that could further erode surfaces or cause scouring of structural foundations.

Future Development

GIS was used to analyze parcels exposed to dam inundation areas that are located within each city's SOI boundary. These parcels are also included in Table 4-18, and they fall under "*Unincorporated*" in terms of their jurisdiction. Parcels shown below in Table 4-19 are those that fall within each jurisdiction's SOI and are exposed to dam inundation areas. The results shown in Table 4-19 show that there is a total of 9,599 improved parcels worth more than $4.36 billion currently exposed to dam inundation within the SOI areas. 23,465 people would also be exposed to dam inundation within the SOI areas.

Table 4-19 Total Dam Inundation Summary by Dam within Sphere of Influence Areas

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	1,974	$268,710,296	$200,638,561	$469,348,857	5,995
Hughson	76	$19,505,347	$18,760,196	$38,265,543	9
Modesto	6,691	$1,673,437,332	$1,885,783,247	$3,559,220,579	15,907
Newman	4	$705,813	$705,813	$1,411,626	-
Oakdale	51	$12,457,109	$6,404,678	$18,861,787	134
Riverbank	65	$11,209,681	$8,512,805	$19,722,486	107
Turlock	656	$122,502,912	$105,060,814	$227,563,726	1,300
Waterford	82	$15,139,178	$14,810,922	$29,950,100	14
Total	**9,599**	**$2,123,667,668**	**$2,240,677,035**	**$4,364,344,703**	**23,465**

Sources: California DSOS, NID, Stanislaus County Assessor's Office

The areas located in the SOI for each incorporated jurisdiction are areas each city plans to grow into and potentially slated for future development. In addition to the SOI areas, there are also 91 vacant parcels countywide that are within dam inundation areas. These areas should take into consideration potential impacts from dam failure risk upstream and should attempt to overlay the existing dam inundation maps with proposed future development.

In the case of a dam failure, inundation would likely follow some existing FEMA-mapped floodplains, which contain development restrictions for areas in the 1% annual chance floodplain, but it could exceed those floodplains and affect areas that are not regulated for flood hazards. Also, of note is that development below a low or undetermined hazard dam could increase its hazard rating, while there are quite a few low hazard dams in the County. Finally, added development could compromise dams and reservoir resources if populations depend on them for critical needs such as potable water during or after a dam failure event.

The Stanislaus County Board of Supervisors has maintained support for the preservation of agricultural resources through the adoption of the Agricultural Element of the County's General Plan. Related policies, such as encouraging higher density development and in-filling of already existing urban areas as well as directing away development from the County's most productive agricultural areas are in place to reduce development pressures on agricultural lands.

There has been no significant change in development in the unincorporated areas impacted by dam failure within Stanislaus County since the last LHMP update. The proposed industrial development at the Crows Landing Airfield on the western side of the County along Interstate 5 would be impacted by inundation caused by the failure of the San Luis Dam and Exchequer Dam. Because the Crows Landing Industrial Business Park is currently in the CEQA process no firm date for development has been identified.

Risk Summary

- There are 18 dams of concern for Stanislaus County. Five are within the County (four High Hazard Potential and one Significant) and 13 dams are upstream of the County (10 High Hazard and two Significant).
- Of the four high hazard potential rated dams in the County, two (Modesto Reservoir and Woodward) are rated as "*Extremely High*" by the State of California DSOD.
- Countywide there are a minimum of 123,636 parcels at risk based on limited available inundation mapping, with greatest number of buildings exposed in the City of Modesto (60,673) followed by the unincorporated area (26,617), City of Turlock (19,413) and City of Ceres (11,462).
- Residential property types make up the most parcels (104,648) at risk of flooding from dam failures, followed by commercial (4,113).
- An estimated 316,395 people countywide might be displaced from their homes based the location of their residences along the inundation areas; actual amounts would vary.
- A total of 1,006 critical facilities are within dam inundation areas. The greatest number are unincorporated Stanislaus County (418) and Transportation lifeline is most at risk countywide.
- **Related Hazards** – drought, flooding, earthquake/liquefaction, landslide, and severe weather.

Table 4-20 Hazard Risk Summary by Jurisdiction – Dam Incidents

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Significant	Unlikely	Catastrophic	Medium	Yes
City of Ceres	Extensive	Unlikely	Catastrophic	High	Yes
City of Hughson	Extensive	Unlikely	Catastrophic	Medium	Yes
City of Modesto	Extensive	Unlikely	Catastrophic	High	Yes
City of Newman	Limited	Unlikely	Negligible	Low	No
City of Oakdale	Extensive	Unlikely	Catastrophic	Medium	Yes
City of Patterson	Limited	Unlikely	Negligible	Low	No
City of Riverbank	Significant	Unlikely	Limited	Medium	Yes
City of Turlock	Extensive	Unlikely	Catastrophic	High	Yes
City of Waterford	Extensive	Unlikely	Catastrophic	High	Yes
County Office of Education	Extensive	Unlikely	Catastrophic	High	Yes

4.3.5 Drought

Hazard/Problem Description

Drought is a gradual phenomenon. Normally, one dry year does not constitute a drought in California, but rather serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure (reservoirs, groundwater basins, and interregional conveyance facilities) generally mitigates the effects of short-term dry periods for most water users.

Drought can have secondary impacts. For example, drought is a major determinant of wildfire hazard, in that it creates greater propensity for fire starts and larger, more prolonged conflagrations fueled by excessively dry vegetation, along with reduced water supply for firefighting purposes. Drought is also an economic hazard. Significant economic impacts on California's agriculture industry can occur as a result of short- and long-term drought conditions; these include hardships to farmers, farm workers, packers, and shippers of agricultural products. In some cases, droughts can also cause significant increases in food prices to the consumer due to shortages.

Drought is a complex issue involving many factors—it occurs when a normal amount of moisture is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects:

- **Meteorological** drought is defined by a period of substantially diminished precipitation duration and/or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which the actual moisture supply at a given place consistently falls below the climatically appropriate moisture supply.
- **Agricultural** drought occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought usually occurs after or during meteorological drought, but before hydrological drought and can affect livestock and other dry-land agricultural operations.
- **Hydrological** drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. There is usually a delay between lack of rain or snow and less measurable water in streams, lakes, and reservoirs. Therefore, hydrological measurements tend to lag other drought indicators.
- **Socioeconomic** drought occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought starts to affect the supply and demand of an economic product.

The California DWR says the following about drought:

> *"One dry year does not normally constitute a drought in California. California's extensive system of water supply infrastructure—its reservoirs, groundwater basins, and interregional conveyance facilities—mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions."*

The drought issue in California is further compounded by water rights. Water is a commodity possessed under a variety of legal doctrines. The prioritization of water rights between farming and federally protected fish habitats in California is part of this issue.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Also, during a drought, allocations go down, which results in reduced water availability. Voluntary water conservation measures are typically implemented during extended droughts. A reduction of electric power generation and water quality deterioration are also potential problems that can occur as a result of drought conditions. The reduced demand for electrical power generation is commonly linked to higher electricity costs due to the loss of hydropower supplies. Water quality deterioration is due to lower levels of precipitation and limited water storage supply. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

Geographic Area

Extensive – Drought is a regional hazard, and at its worst can affect the entire State of California with varying levels of dryness and drought activity. It is safe to assume that unless the drought event is at its very beginning or very end, if any area of Stanislaus County is affected by any level of drought, the other areas of the County are experiencing varying effects as well.

Sustainable Groundwater Management Act (SGMA) of 2014

In January 2014, Governor Brown declared an emergency proclamation due to multiple years of drought. The proclamation called on citizens to reduce water use by 20 percent; with a subsequent Executive Order in April 2015 that directed urban water agencies to reduce water use by 25 percent (Ken Topping 2016). In September 2014, the Governor signed a three-bill package (California SBs 1168 and 1319, and Assembly Bill 1739), known as the Sustainable Groundwater Management Act of 2014 (SGMA). The SGMA provides for the establishment of local Groundwater Sustainability Agencies (GSAs) to manage groundwater sustainably within the groundwater subbasins defined by the California DWR. Within Stanislaus County there are portions of four groundwater subbasins, Eastern San Joaquin, Modesto, Turlock (east and west), Delta-Mendota, that are required under SGMA to conduct sustainable groundwater management. Each of the four subbasins are required to develop and implement a Groundwater Sustainable Plan (GSP) by 2020 or 2022. As of August 2021, GSAs formed for the four subbasins as shown in Table 4-21.

Table 4-21 Groundwater Sustainability Agencies (GSAs) in Stanislaus County

Subbasin	Groundwater Sustainability Agency (GSA)
Eastern San Joaquin	Eastside San Joaquin GSA
	Central Delta Water Agency
	Central San Joaquin Water Conservation District
	City of Lodi GSA
	City of Manteca GSA
	City of Stockton GSA
	Linden County Water District
	Lockeford Community Services District
	North San Joaquin Water Conservation District
	Oakdale Irrigation District
	San Joaquin County GSA
	South Delta Water Agency

Subbasin	Groundwater Sustainability Agency (GSA)
	South San Joaquin GSA
	Stanislaus Subbasin GSA
	Stockton East Water District
	Woodbridge Irrigation District GSA
Modesto*	City of Modesto
	City of Oakdale
	City of Riverbank
	City of Waterford
	Modesto Irrigation District
	Oakdale Irrigation District
	Stanislaus County
Turlock	West Turlock GSA
	East Turlock GSA
Delta-Mendota	City of Dos Palos GSA
	City of Gustine GSA
	City of Los Banos GSA
	Central Delta-Mendota GSA
	Turner Island Delta-Mendota GSA
	Northwestern Delta-Mendota GSA
	Grassland Water District GSA
	San Joaquin River Exchange Contractors GSA
	County of Stanislaus Chowchilla GSA

* In 2017, member agencies of the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA) - City of Modesto, Modesto Irrigation District, City of Oakdale, Oakdale Irrigation District, City of Riverbank, City of Waterford, and Stanislaus County – formed as a GSA.

Source: Stanislaus County Water Resources https://www.co.Stanislaus.ca.us/3140/Sustainable-Groundwater---SGMA

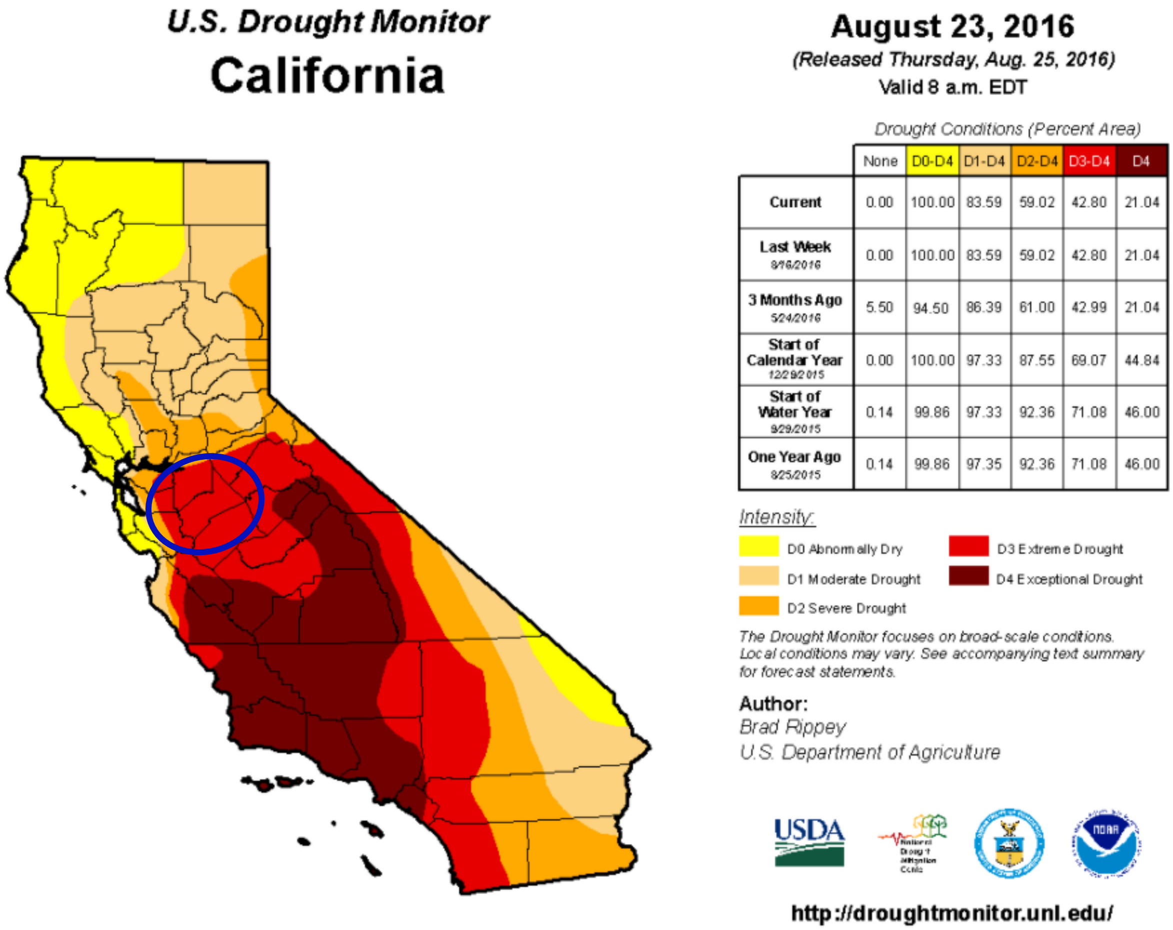
Extent (Magnitude/Severity)

Critical – The magnitude of a drought's impact is directly related to the severity and length. The severity of a drought depends on water availability and moisture deficiency, the time period, and the size and location of the affected area. The longer the drought persists and the larger the area impacted, the more severe the potential impacts. Droughts can be a short-term event over several months or a long-term event that lasts for years or even decades. In Stanislaus County, the onset of drought is often signaled by a lack of significant winter precipitation and snowfall (moisture deficiency) in the Sierra Nevada Mountains. Droughts typically do not result in direct impacts on people or property, but they can have significant impacts on agriculture, which can indirectly impact people and property. Hot and dry conditions that persist into spring, summer, and fall can aggravate drought conditions, making the effects of drought more pronounced as water demands increase during the growing season and summer months. Impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline (California DWR 2012).

The U.S. Drought Monitor is an accepted and widely used site for obtaining and summarizing drought information, as it integrates data from several other sources including the Palmer Drought Index, Soil Moisture Models, U.S. Geological Survey Weekly Stream Flows, Standardized Precipitation Index, and the Satellite Vegetation Health Index. It includes drought intensity categories for measuring dry conditions across counties, states, and regions of the U.S., so that drought can be quantified. These categories range from "*abnormally dry*" to "*exceptional drought.*" The following figures provide "*snapshots in time*" of the drought conditions in California as of August 2016 (during the period of the last multi-year drought in Stanislaus County and the state, from 2012- 2017) and August 24, 2021. The snapshots selected are instrumental in depicting both the historic and potential change in drought's geographic range and severity in the County (circled in blue).

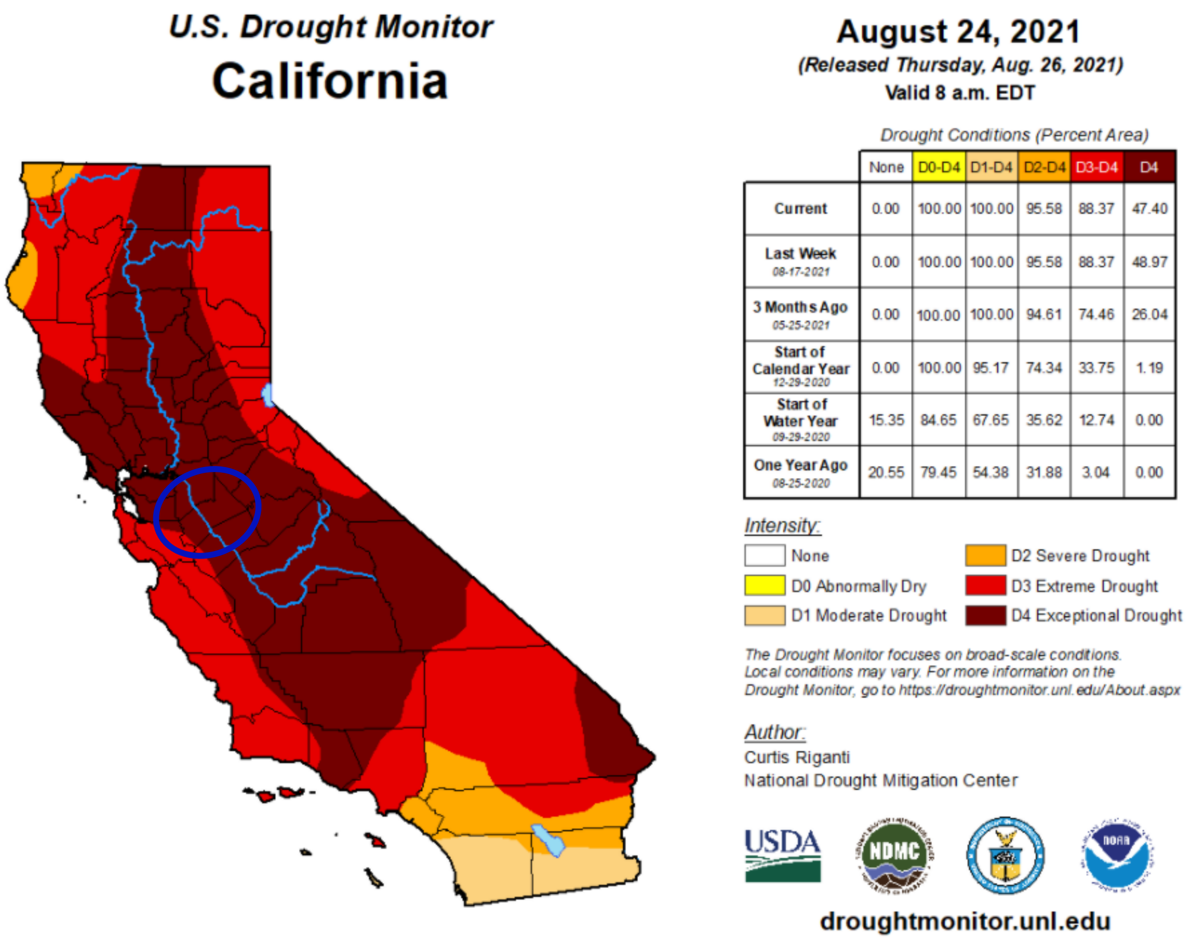
Note: The Drought Monitor maps integrate data from several sources including the Palmer Drought Index, Soil Moisture Models, U.S. Geological Survey Weekly Stream flows, Standardized Precipitation Index, and Satellite Vegetation Health Index. The drought status in California is noted on the following graphic from the National Drought Mitigation Center.

Figure 4-9 U.S. Drought Monitor for California: August 23, 2016



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	83.59	59.02	42.80	21.04
Last Week 8/16/2016	0.00	100.00	83.59	59.02	42.80	21.04
3 Months Ago 5/24/2016	5.50	94.50	86.39	61.00	42.99	21.04
Start of Calendar Year 12/29/2015	0.00	100.00	97.33	87.55	69.07	44.84
Start of Water Year 9/29/2015	0.14	99.86	97.33	92.36	71.08	46.00
One Year Ago 8/25/2015	0.14	99.86	97.35	92.36	71.08	46.00

Figure 4-10 U.S. Drought Monitor for California: August 24, 2021



Past Occurrences

Historically, California has experienced severe drought conditions. The state's available record for determining hydrologic risks is short, only going back about 100 years. Recent droughts affecting Stanislaus County are summarized below using data from Cal OES and from the County Agricultural Commissioner's Office.

- **1928-1937** – This drought affected the entire state and is the longest, most severe drought on record with a recurrence interval of greater than 100 years.
- **1947-1950** – Drought affected the entire state but was most extreme in Southern California. The drought in winter of 1950 affected the area from the Kern River basin north to the American River basin. The drought caused two deaths and $33 million in damages.
- **1976-1977** – The drought of 1976-1977 was most severe in the northern three-quarters of California, but the impact was experienced statewide because of the dependence of Southern California on water transfers from the north. FEMA declared emergency declaration for Stanislaus County and the Public Assistance program was declared. Year 1977 was the driest year of record at almost all gauging stations in the affected area in California, and the water year 1976 was among the five driest in the central and northern Sierra Nevada. The two-year deficiency in runoff accumulated during the drought is unequalled at gauging stations in the affected area; and this deficiency has a recurrence interval that exceeds 80 years. Crop damages statewide were $2.67 billion.
- **1987-1992** – California experienced a serious drought due to low precipitation and runoff levels. During this multi-year, multi-county drought, the runoff from the San Joaquin Valley was 47 percent of average. In 1991, the U.S. Department of Agriculture Economic Research Report Agricultural Outlook reported

that the Stanislaus River flow would be inadequate to provide sufficient water for agricultural uses for the fifth consecutive year. A USDA drought disaster declaration was declared.

- **2004-2005** – On January 15, 2005, the USDA designated 53 of California's 58 counties as natural disaster areas due to damages and losses caused by extreme drought.
- **2012 – 2017** – In September 2012, the USDA designated Stanislaus County a contiguous disaster area due to drought that occurred since January 1, 2012. In January 2014, the Governor proclaimed a state of emergency and directed state officials to take all necessary actions to prepare for these drought conditions: to assist farmers and communities that are economically impacted by dry conditions and to ensure the State can respond if Californians face drinking water shortages. The Governor also directed state agencies to use less water and hire more firefighters and initiated an expansive water conservation public awareness campaign. Drought produced severe impacts to water wells throughout the Planning Area, with a high number of wells running dry. Land subsidence due to increased groundwater pumping also occurred in areas of the San Joaquin Valley. Crop damage was also widespread. Water allotments were drastically reduced in many towns and water agencies, with extremely high costs for procuring water. In addition, job loss occurred with many families requiring food supply assistance, and water supply assistance provided to homeowners with dry wells. According to a report released by UC Davis Center for Watershed Sciences, the 2014 California drought cost the state's agriculture industry about $1 billion in lost revenue, with a total statewide economic cost of the drought calculated to be $2.2 billion. The 2014 drought, the report says, is responsible for the greatest water loss ever seen in California agriculture - about one-third less than normal. The report calls the groundwater situation in California "*a slow-moving train wreck*." (NCICS 2019). According to the 2018 California SHMP, by the time the drought was declared officially in 2017, the State had been declared a federal disaster area and had expended $6.6 billion in drought response and mitigation programs.

As shown in Table 4-4, of the 21 total Secretary of Agricultural Disaster Designations for Stanislaus County in the past 10 years, 16 were specific to drought. In addition to the USDA designations there have also been one federal disaster declarations due to drought in the County (refer to Table 4-3).

The National Drought Mitigation Center developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: online, drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time. The Drought Impact Reporter contains information on 281 impact reports from droughts that affected Stanislaus County between 2000 and 2021. Most of the impacts (228) were classified as "*relief, response and restrictions*", "*water supply and quality*" (181) and "*agriculture*" (178). Other impacts included "*society and public health*" (94), "*business and industry*" (46), "*general awareness*" (24) "*plants and wildlife*" (15), "*fire*" (8), and "*energy*" (4). These categories are described as follows:

- **Relief, Response, and Restrictions (228)** – This category refers to drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions. Examples include disaster declarations, aid programs, USDA Secretarial Disaster Declarations, Small Business Association Disaster Declarations, government relief and response programs, state-level water shortage or water emergency declarations, county-level declarations, a declared "*state of emergency*," requests for declarations or aid, nonprofit organization-based relief, water restrictions, fire restrictions, National Weather Service (NWS) Red Flag Warnings, and declaration of drought watches or warnings.
- **Water Supply and Quality (181)** – Drought effects associated with water supply and water quality include dry wells, voluntary and mandatory water restrictions, changes in water rates, increasing of water restrictions, increases in requests for new well permits, changes in water use due to water restrictions, greater water demand, decreases in water allocation or allotments, installation or alteration of water pumps or water intakes, changes to allowable water contaminants, water line damage or repairs due to drought stress, drinking water turbidity, change in water color or odor, declaration of drought watches or warnings, and mitigation activities.
- **Agriculture (178)** – Drought effects associated with agriculture, farming, aquaculture, horticulture, forestry, or ranching. Examples of drought-induced agricultural impacts include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; insect infestation; plant disease; increased irrigation costs; cost of new or supplemental water resource development (wells, dams, pipelines) for agriculture; reduced productivity of rangeland; forced reduction of

foundation stock; closure/limitation of public lands to grazing; high cost or unavailability of water for livestock, Christmas tree farms, forestry, raising domesticated horses, bees, fish, shellfish, or horticulture.

- **Society and Public Health (94)** – Drought effects associated with human, public and social health include: health-related problems related to reduced water quantity or quality, such as increased concentration of contaminants; loss of human life (e.g., from heat stress, suicide); increased respiratory ailments; increased disease caused by wildlife concentrations; increased human disease caused by changes in insect carrier populations; population migration (rural to urban areas, migrants into the United States); loss of aesthetic values; change in daily activities (non-recreational, like putting a bucket in the shower to catch water); elevated stress levels; meetings to discuss drought; communities creating drought plans; lawmakers altering penalties for violation of water restrictions; demand for higher water rates; cultural/historical discoveries from low water levels; cancellation of fundraising events; cancellation/alteration of festivals or holiday traditions; stockpiling water; public service announcements and drought information websites; protests; and conflicts within the community due to competition for water.
- **Business and Industry (46)** – This category tracks drought's effects on non-agriculture and non-tourism businesses, such as lawn care, recreational vehicles, or gear dealers, and plant nurseries. Typical impacts include reduction or loss of demand for goods or services, reduction in employment, variation in number of calls for service, late opening or early closure for the season, bankruptcy, permanent store closure, and other economic impacts.
- **General Awareness (24)** – General Awareness applies only to media reports and usually indicates that people are concerned about drought, but no specific impact has occurred yet or the information is too general to use for an impact.
- **Plants and Wildlife (15)** – Drought effects associated with unmanaged plants and wildlife, both aquatic and terrestrial, include: loss of biodiversity of plants or wildlife; loss of trees from rural or urban landscapes, shelterbelts, or wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers (as predators seek food from farms and producers are less tolerant of the intrusion); disease; increased vulnerability to predation (from species concentrated near water); migration and concentration (loss of wildlife in some areas and too much wildlife in others); increased stress on endangered species; salinity levels affecting wildlife; wildlife encroaching into urban areas; and loss of wetlands.
- **Fire (8)** – Drought often contributes to forest, range, rural, or urban fires, fire danger, and burning restrictions. Specific impacts include enacting or increasing burning restrictions, fireworks bans, increased fire risk, occurrence of fire (number of acres burned, number of wildfires compared to average, people displaced, etc.), state of emergency during periods of high fire danger, closure of roads or land due to fire occurrence or risk, and expenses to state and county governments of paying firefighters overtime and paying equipment (helicopter) costs.
- **Energy (4)** – This category concerns drought's effects on power production, rates, and revenue. Examples include production changes for both hydropower and non-hydropower providers, changes in electricity rates, revenue shortfalls and/or windfall profits, and purchase of electricity when hydropower generation is down.

Probability of Future Occurrences

Likely – Historical drought data for the County Planning Area and the San Joaquin Valley region indicate there have been five significant multi-year droughts in the last 91 years. This equates to a multi-year drought every 18 years on average, or a 5 percent chance of a drought in any given year (probability). Based on this data, droughts will likely affect the Planning Area. Given the historical occurrence of severe drought impacts throughout Stanislaus County and across the State, the HMPC understands that drought will continue to pose a high degree of risk to the entire Planning Area, potentially impacting crops, livestock, water resources, the natural environment at large, buildings and infrastructure (from cascading or compound hazards), and local economies.

In addition, although drought affects the entire planning equally, the potential impacts may be variable and specific to each jurisdiction, depending on contextual factors such as the degree of assets and activities historically impacted by drought within each jurisdiction, such as the agricultural and parks and tourism industries.

Climate Change Considerations

Water resources in California area already experiencing stresses related to population growth, increased water demand, poor water quality, groundwater overdraft, and aging infrastructure. Scientific studies prepared for various California climate assessments and adaptations strategies also already show that drought conditions in California are likely to become more frequent and persistent over the next century due to climate change. Temperatures are warming, heat waves are more frequent, and precipitation has become increasingly variable (CNRA 2018a). According to California's Climate Adaptation Strategy, also referred to as "*Safeguarding California Plan: 2018 Update*", climate change is likely to significantly diminish California's future water supply. As a result, the State must change its water management, as climate change will create greater competition for limited water supplies (California Natural Resources Agency 2018b). The recent drought conditions over the past decade underscore the need to examine water supply and distribution management, conservation, and use policies. California and the San Joaquin Valley region have experienced a succession of dry spells and with warmer temperatures and periodic droughts that frequently contribute to water shortages in the region.

Climate change projections of extreme prolonged droughts will exacerbate the San Joaquin Valley's existing water supply challenges. In an average year, approximately 40 percent of the State's total water supply comes from groundwater, and during a dry year this increases to more than half of the State's water supply, with groundwater acting as a critical buffer against the impacts of drought and climate change (CNRA 2018).

Table 4-22 Summary of Climate Change Impacts on Water Resources

Resource	Type of Impact	Description
Soil Moisture	Direct	Prolonged dry seasons can lead to decreases in soil moisture; drier vegetation
Vegetation	Indirect	Longer and more intense fire season with increased extent of area burned
Stream Conditions	Direct	Increases in water temperature; potential effects on fish
Snowpack	Indirect	Increases in temperature will lead to decreases in snowpack
Runoff	Direct	Warmer temperatures are likely to lead to a shift in peak runoff from spring to winter and a likely decrease in summer baseflow
Hydropower	Indirect	Decreased summer flows resulting from earlier snowmelt and a shift in peak runoff could affect hydropower generation during summer months
Precipitation	Direct	Warmer winter temperatures will result in a greater percentage of precipitation falling as rain rather than as snow
Groundwater	Indirect	Reduction in snowpack and extended periods of drought are likely to increase dependency on groundwater

Source: http://frap.fire.ca.gov/data/assessment2010/pdfs/3.1water.pdf p. 140

Vulnerability Assessment

All of Stanislaus County is vulnerable to drought. Drought is one of the few hazards with the potential to impact all the citizens of the County through water restrictions, economic losses, and increased energy costs. The urbanized areas of the County and the agriculture industry are most likely to experience hardships associated with reduced water supply. Impacts include water restrictions associated with domestic supplies, agricultural and livestock losses and economic impacts, hydroelectric power reductions, and increased costs for water. Secondary effects include susceptibility to wildfires and increased groundwater pumping that can contribute to land subsidence problems and degraded water quality.

General Property

Based on the USDA's RMA Crop Indemnity Reports, which were collected for the years 2007 through 2020, crop losses due to drought were only reported 2007 – 2009 and 2012 – 2014 across the County. Table 4-23 summarizes the agricultural losses. A total of $90,695 was indemnified for 1,177 acres of insured crops.

Table 4-23 Crops Loss Due to Drought, Risk Management Agency Crop Indemnity Reports, 2007-2020

Year	Crop	Net Determined Acres	Indemnity Amount
2007	Wheat	151.3	$9,655
2008	Wheat	43	$4,109
2009	Wheat	149	$14,142
	Oats	189.9	$10,927
	Barley	150	$4,500
	Total	**488.9**	**$29,569**
2012	Wheat	70.5	$9,356
	Oats	19.8	$902
	Barley	293.5	$13,611
	Total	**383.8**	**$23,869**
2013	Wheat	55.7	$9,671
2014	Wheat	55	$13,822
	Grand Total	**1,177.7**	**$90,695**

Source: USDA RMA Crop Indemnity Reports, 2007-2020

People

According to this California DOF, by January 1, 2021, the County population was 555,968 people. The County's population is currently growing at 0.2% annually. According to DOF's projection, the County's population is projected to reach 680,311 by the year 2060. In addition, according to the *Stanislaus County Forecast Summary* published by the Eberhardt School of Business at the University of The Pacific predict the County's population growth rate to be steady fluctuating between 0.85% and 1.15% annually until 2060. This projected population growth would add additional strain to the surface water supplies and already depleted groundwater supplies. The County Groundwater Ordinance, which prohibits the unsustainable groundwater extraction or conveyance, may help with reducing the impacts on drought on the regional groundwater supply.

The historical and potential impacts of drought on populations include agricultural sector job loss, secondary economic losses to local businesses and public recreational resources, increased cost to local and state government for large-scale water acquisition and delivery, and water rationing and water wells running dry for individuals and families. As drought is often accompanied by prolonged periods of extreme heat, negative health impacts such as dehydration can also occur, where children and elderly are most susceptible. Air quality often declines in times of drought which can affect those with respiratory ailments.

Government Services

Drought may require disaster declarations, aid programs, water restrictions, or fire restrictions. These needs could impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Water utilities are likely to face the greatest challenges to continuity of operations and delivery of services, especially during long-term widespread droughts, where opportunities for resource-sharing are limited. Water suppliers may need to change water rates, set usage restrictions, adjust to changes in demand, address water line damage or repairs due to drought stress, account for changes in water quality, and seek alternative water supplies. Should a public water system be severely affected, the cost of shipping in outside water could total into the millions of dollars.

The impact to first responders from drought events is likely to be similar to impacts on the general public. Public confidence may be affected because of the drought response process. Water usage restrictions and potential penalties for violations of these restrictions can cause frustration with government. Meetings to discuss drought, efforts to create community drought plans, and public service announcements and education efforts may affect public confidence. Elevated stress levels may result from these processes as well as from demand for higher water rates, cancellation of fundraising events, cancellation of festivals or holiday traditions, stockpiling water, or protests.

Critical Facilities and Infrastructure

Drought conditions rarely affect existing buildings, infrastructure, and critical infrastructure. However, severe to exceptional droughts can have significant consequences for water supply (drinking water and agriculture uses), water quality, firefighting, navigation, recreation, and other critical facilities. In some cases, when groundwater levels substantially decline, groundwater wells may need to be deepened in response. Additionally, a higher demand on the water system infrastructure can lead to disruption of service due to line breakage. Possible losses to infrastructure also include the loss of potable water.

The effect on local government infrastructure is the same as for the general public, and a drought may interrupt the normal operation of government in some places. For example, facilities dependent on wells may lose water supply.

Economy
Drought impacts to the local or regional economy can be difficult to quantify but can be extensive and long-lasting depending on the circumstances during, and after a severe drought event. If water resources are limited, effects would be more severe for industries that rely on large amounts of water and any prolonged drought would intensify these impacts. Sectors critical to the economy such as commerce, distribution, agriculture, tourism, related environmental resources, municipal and industrial water supply, key city assets, energy generation, and even socioeconomic aspects can be affected due to lack of, or even reduced quality of water resources.

Agriculture in the San Joaquin Valley relies on artificial irrigation using mostly imported water or groundwater. Local droughts are expected and accommodated for; however, a prolonged statewide drought could exceed local capabilities to handle reductions of imported surface water supplies. This could lead to reductions in distribution from local water storage districts.

The costs of drought are difficult to quantify because the impacts affect so many different sectors including wildlife and natural resources, business and industry, tourism and recreation, agriculture, and individual households. Agriculture often suffers the most financial losses from drought and is Stanislaus County's number one industry (2016 Stanislaus County Agricultural Report). For example, according to the California Integrated Climate Adaptation and Resiliency Program's 2020 Report and 2020 Recommendations, the 2014-2017 multi-year drought was estimated to cost over $6.6 billion once it was over and the loss of 5,000 jobs in 2016 (OPR 2020).

Historic, Cultural and Natural Resources
Established in 1987, the San Joaquin River National Wildlife Refuge is 7,000 acres in size and is situated where three major rivers (Tuolumne, Stanislaus and San Joaquin) join in the San Joaquin Valley, creating a mix of habitats that provide ideal conditions for high wildlife and plant diversity. The Refuge is managed with a focus on migratory birds and endangered species (Aleutian Cackling Geese, Riparian Woodlands, Riparian Brush Rabbits, etc.). The impacts of drought on vegetation and wildlife can include death from dehydration and spread of invasive species or disease because of stressed conditions, loss of biodiversity, loss of trees in rural and urban landscapes, loss of wetlands, and degradation of habitat.

In general, environmental impacts from drought are more likely at the interface of the human and natural world. The loss of crops or livestock due to drought can have far-reaching economic effects on communities, wind and water erosion can alter the visual landscape, and dust can damage property. Water-based recreational resources are also heavily affected by drought conditions. Indirect impacts from drought arise from increased wildfire risk and greater occurrence of fire.

Future Development

With the County's population projected to continue to steadily grow while climate change projections are showing an increased duration an intensity of drought events for the San Joaquin Valley, it will be important for each new development application to be reviewed with existing and future water supplies in mind. Because future development encompasses all forms of property, buildings, infrastructure, critical facilities and all related populations and their functions, drought impacts to future development align with the historical and potential impacts to populations, property, natural environment, and critical facilities discussed (above).

Risk Summary

- Due to the widespread impacts in San Joaquin Valley drought is considered a High significance hazard.
- There have been five multi-year droughts in the past 91 years, which equates to a multi-year drought every 18 years on average, or a 5 percent chance of a drought in any given year. The most recent drought lasted from 2012 to 2017 and resulted in a declared state of emergency.
- 16 USDA Disaster Designations due to drought have been made in the last 9 years.

- 281 reports of impacts related to drought were made within Stanislaus County between, 2000 and 2020.
- Between 2007-2014 a total of $90,695 crop indemnity claims was paid due to crop losses for a total of 1177.7 acres due to drought impacts; this also equals to an annualized crop loss of $11,337 due to drought impacts.
- Climate change projections show that extreme prolonged drought is likely to continue and will exacerbate existing water supply challenges.
- **Related Hazards** – Extreme Heat, Wildfire, Agricultural Pest Infestation and Disease

Table 4-24 Hazard Risk Summary – Drought

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Likely	Critical	High	Yes
City of Ceres	Extensive	Likely	Critical	High	Yes
City of Hughson	Extensive	Likely	Critical	Medium	Yes
City of Modesto	Extensive	Likely	Negligible	Low	No
City of Newman	Extensive	Likely	Critical	High	No
City of Oakdale	Extensive	Likely	Critical	High	Yes
City of Patterson	Extensive	Likely	Critical	High	Yes
City of Riverbank	Extensive	Likely	Critical	High	Yes
City of Turlock	Extensive	Likely	Critical	High	Yes
City of Waterford	Extensive	Likely	Critical	High	Yes
County Office of Education	Extensive	Likely	Critical	Low	No

4.3.6 Earthquake

Hazard/Problem Definition

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. The magnitude of earthquakes is usually measured using the Richter Scale; a logarithmic scale calculated from the amplitude of the largest seismic wave recorded for the earthquake.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of damage to structures during earthquakes. Seismologists have developed the Mercalli scale to quantify the shaking intensity of an earthquake's effects, which is measured by how an earthquake is felt by humans and the damage to buildings.

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks such as water, power, gas, communication, and transportation lines. Other damage-causing effects of earthquakes are surface rupture, fissuring, settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, and dam failure. Liquefaction occurs when ground shaking causes the mechanical properties of some fine-grained, saturated soils to liquefy and act as a fluid (liquefaction). It is the result of a sudden loss of soil strength due to a rapid increase in soil pore water pressures caused by ground shaking, in areas of shallow groundwater (within 10' of surface or less). Liquefaction that produces surface effects generally occurs in the upper 40 to 50 feet of the soil column, although the phenomenon can occur deeper than 100 feet. The duration of ground shaking is also an important factor in causing liquefaction to occur. The larger the earthquake magnitude, and the longer the duration of strong ground shaking, the greater the potential there is for liquefaction to occur.

In populated areas, the greatest potential for loss of life and property damage can come as a result of ground shaking from a nearby earthquake. The degree of damage depends on many interrelated factors. Among these are the moment magnitude, focal depth, distance from the causative fault, duration of shaking, type of surface deposits or bedrock, presence of high ground water, topography, and finally, the design, type, and quality of building construction.

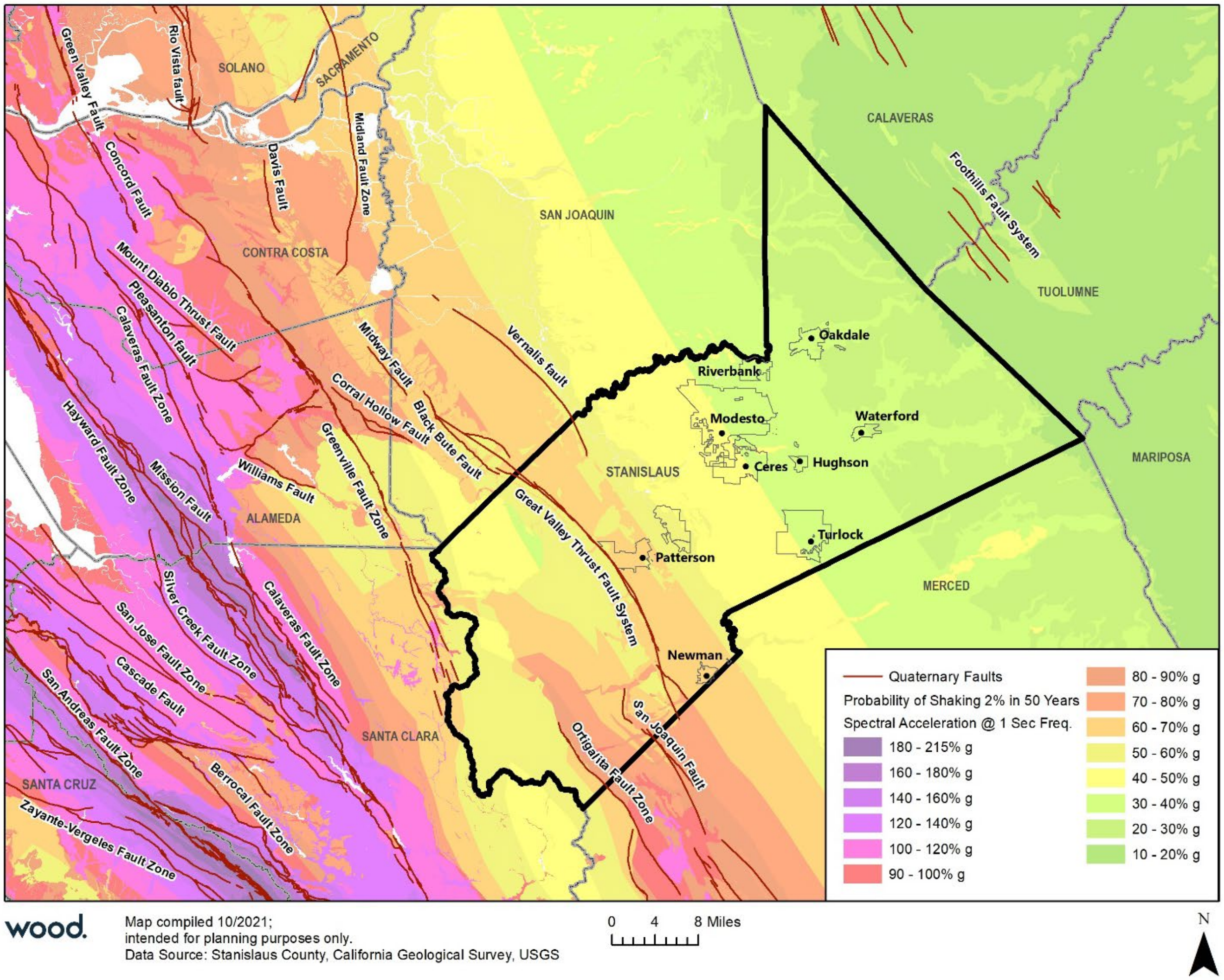
Geographic Area

Extensive – There are several faults known to exist within Stanislaus County. In the extreme eastern parts of the County, the Bear Mountain and Melones faults are found, though both are believed to have been inactive for the past 150 million years. Other faults are located in the western part of the County and consist of the Ortigalita Fault Zone, the Great Valley Thrust Fault System, and the San Joaquin Thrust Fault System. The Ortigalita Fault extends into Stanislaus County approximately 7 miles and is designated as an Alquist-Priolo Earthquake Fault Zone. This fault has not been active in historic times; however, there is no guarantee that it will never become active again. The nearest faults of major significance are the San Andreas to the west of Stanislaus County, a distance of approximately 25 miles from the County line; the Hayward and Calaveras faults to the northwest; the White Wolf, Garlock, and Sierra Nevada faults to the south; and the Bear Mountain Fault Zone about 5 miles east of and parallel to the eastern border of Merced County. These faults have been and will continue to be the principal source of seismic activity affecting the County of Stanislaus.

There have been no records of major seismic activity originating in the County, with most epicenters in the County being below a magnitude 4.0. However, the County has been impacted by earthquakes originating elsewhere. There is documented evidence of seven earthquakes that shook the area, those of 1872, 1906, 1952, 1966, 1984, and 1989, and more recently in 2021 when residents felt the 6.0 magnitude earthquake centered in the Little Antelope Valley along the California/Nevada border (Gerike 2021). Minor damage has been recorded throughout the County from earthquakes with epicenters in surrounding areas, though major damage occurred from the 1906 Los Banos earthquake.

The San Andreas Fault occurs where the North American and Pacific plates come together and grind in a side-by-side motion relative to each other. Another large known fault, the White Wolf fault, is located to the south near Arvin and Bakersfield in Kern County and produced a severe M 7.7 earthquake in 1952. Figure 4-11 below shows the known faults and potential for ground shaking resulting from earthquakes in and near Stanislaus County, based on USGS probabilistic ground shaking with a 2% in 50-year occurrence (AKA 2500-year probabilistic ground shaking).

Figure 4-11 Stanislaus County Earthquake Ground Shaking Potential and Nearby Faults



Earthquakes can occur at any time of the day or night and any time of the year. Earthquakes are particularly dangerous due to their rapid onset, generally without warning. Aftershocks can occur for days, weeks, and even months following a major earthquake. This additional damage to structures already weakened by the main earthquake increases the danger to rescue and recovery personnel.

Extent (Magnitude/Severity)

Catastrophic – For extent, the severity of an earthquake, or the amount of energy released during an earthquake is usually expressed in terms of intensity or magnitude as described further below.

Intensity – Intensity represents the observed effects of ground shaking at any specified location and earthquake shaking decreases with distance from the earthquake epicenter. Intensity is an expression of the amount of shaking at any given location on the ground surface based on felt or observed effects. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. Intensity is measured with the Modified Mercalli Intensity (MMI) scale. The intensity of ground shaking at a particular site or structure is a function of many factors including: 1) earthquake magnitude, 2) distance from the epicenter, 3) duration of strong ground motion, 4) local geologic conditions (soil type and topography), and 5) the fundamental period of the structure. A brief description of those factors is presented below. The MMI scale is summarized in Table 4-25, along with the effects associated with the MMI scale. Damage typically occurs in MMI of scale VII or above.

Table 4-25 Earthquake Magnitude and Intensity Measurements and Intensity Characteristics

Magnitude	Mercalli Intensity	Effects	Frequency
Less than 2.0	I	Microearthquakes, not felt or rarely felt; recorded by seismographs.	Continual
2.0-2.9	I to II	Felt slightly by some people; damages to buildings.	Over 1M per year
3.0-3.9	II to IV	Often felt by people; rarely causes damage; shaking of indoor objects noticeable.	Over 100,000 per year
4.0-4.9	IV to VI	Noticeable shaking of indoor objects and rattling noises; felt by most people in the affected area; slightly felt outside; generally, no to minimal damage.	10K to 15K per year
5.0-5.9	VI to VIII	Can cause damage of varying severity to poorly constructed buildings; at most, none to slight damage to all other buildings. Felt by everyone.	1K to 1,500 per year
6.0-6.9	VII to X	Damage to a moderate number of well-built structures in populated areas; earthquake-resistant structures survive with slight to moderate damage; poorly designed structures receive moderate to severe damage; felt in wider areas; up to hundreds of miles/kilometers from the epicenter; strong to violent shaking in epicentral area.	100 to 150 per year
7.0-7.9	VIII<	Causes damage to most buildings, some to partially or completely collapse or receive severe damage; well-designed structures are likely to receive damage; felt across great distances with major damage mostly limited to 250 km from epicenter.	10 to 20 per year
8.0-8.9	VIII<	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	One per year
9.0 and Greater	VIII<	At or near total destruction – severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations; permanent changes in ground topography.	One per 10-50 years

Source: USGS

Magnitude – Magnitude represents the amount of seismic energy released at the hypocenter of an earthquake. It is based on the amplitude of the earthquake waves recorded. Seismologists have developed several magnitude scales; one of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Scale is numeric and has a logarithmic relationship between scale factors, so that a difference of one scale number represents a tenfold increase in measured amplitude, which in turn corresponds to an approximate 31x energy release difference when compared to the next whole number value. The Moment Magnitude scale (M_w, or M), which is a measurement of energy released by the movement of a fault and is the modern method used by seismologists to measure earthquakes. Overall, as the amount of energy released by an earthquake increases, the potential for ground shaking impacts also increases.

Distance from Epicenter – Earthquake energy generally dissipates (or attenuates) with distance from a fault. Over long distances, this loss of energy can be significant, resulting in a significant decrease in ground shaking with increased distance from the epicenter.

Duration of Strong Shaking – The duration of the strong ground shaking constitutes a major role in determining the amount of structural damage and the potential for ground failure that can result from an earthquake. Larger magnitude earthquakes have longer durations than smaller earthquakes.

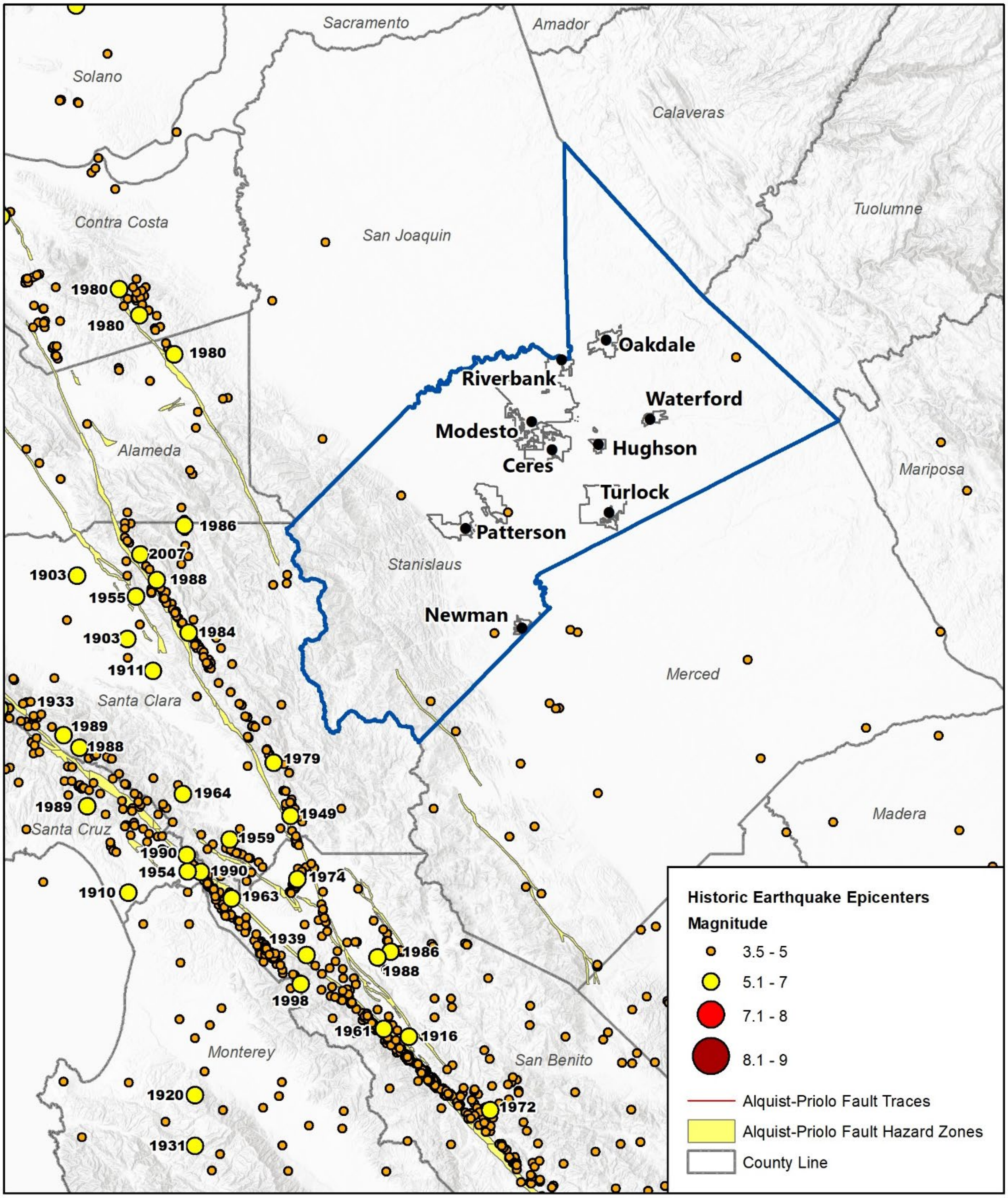
Local Geologic Conditions – The geologic and soil conditions at a particular site have the potential to substantially increase the effects of ground shaking. The thickness, density, and consistency of the soil, as well as shallow ground water levels, have the potential to amplify the effects of ground shaking depending on the characteristics of the earthquake. In general, the presence of unconsolidated soils above the bedrock surface can amplify the ground shaking caused by an earthquake.

Fundamental Periods – Every structure has its own fundamental period or natural vibration. If the vibration of ground shaking coincides with the natural vibration period of a structure, damage to the structure can be greatly increased. The extent of damage suffered during an earthquake can also depend on non-geologic factors. The type of building and its structural integrity will influence the severity of the damage suffered. Generally, small, well-constructed, one- and two-story wood and steel frame buildings have performed well in earthquakes because of their light weight and flexibility. Reinforced concrete structures will also usually perform well. Buildings constructed from non-flexible materials, such as unreinforced brick and concrete, hollow concrete block, clay tile, or adobe, are more vulnerable to earthquake damage.

Effects of Ground Shaking – The primary effect of ground shaking is the damage or destruction of buildings, infrastructure, and possible injury or loss of life. Building damage can range from minor cracking of plaster to total collapse. Disruption of infrastructure facilities can include damage to utilities, pipelines, roads, and bridges. Ruptured gas and water lines can result in fire and produce scour/inundation damage, respectively, to structures, as can fire from other causes, such as electrical damages. Secondary effects can include geologic impacts such as co-seismic fault movement along nearby faults, seismically induced slope instability, liquefaction, lateral spreading, and other forms of ground failure and seismic response. These secondary effects were demonstrated in Oceano by the San Simeon 2003 earthquake.

Figure 4-12 depicts the epicenters of the historic earthquakes that have occurred in Stanislaus County from 1855 through 2021. As shown in the figure, most of the epicenters have occurred along the San Andreas and Hayward faults to the west of the Planning Area.

Figure 4-12 Stanislaus County Historic Earthquake Epicenters: 1855 – 2021



Map compiled 10/2021;
intended for planning purposes only.
Data Source: Stanislaus County,
California Geological Survey, USGS

Past Occurrences

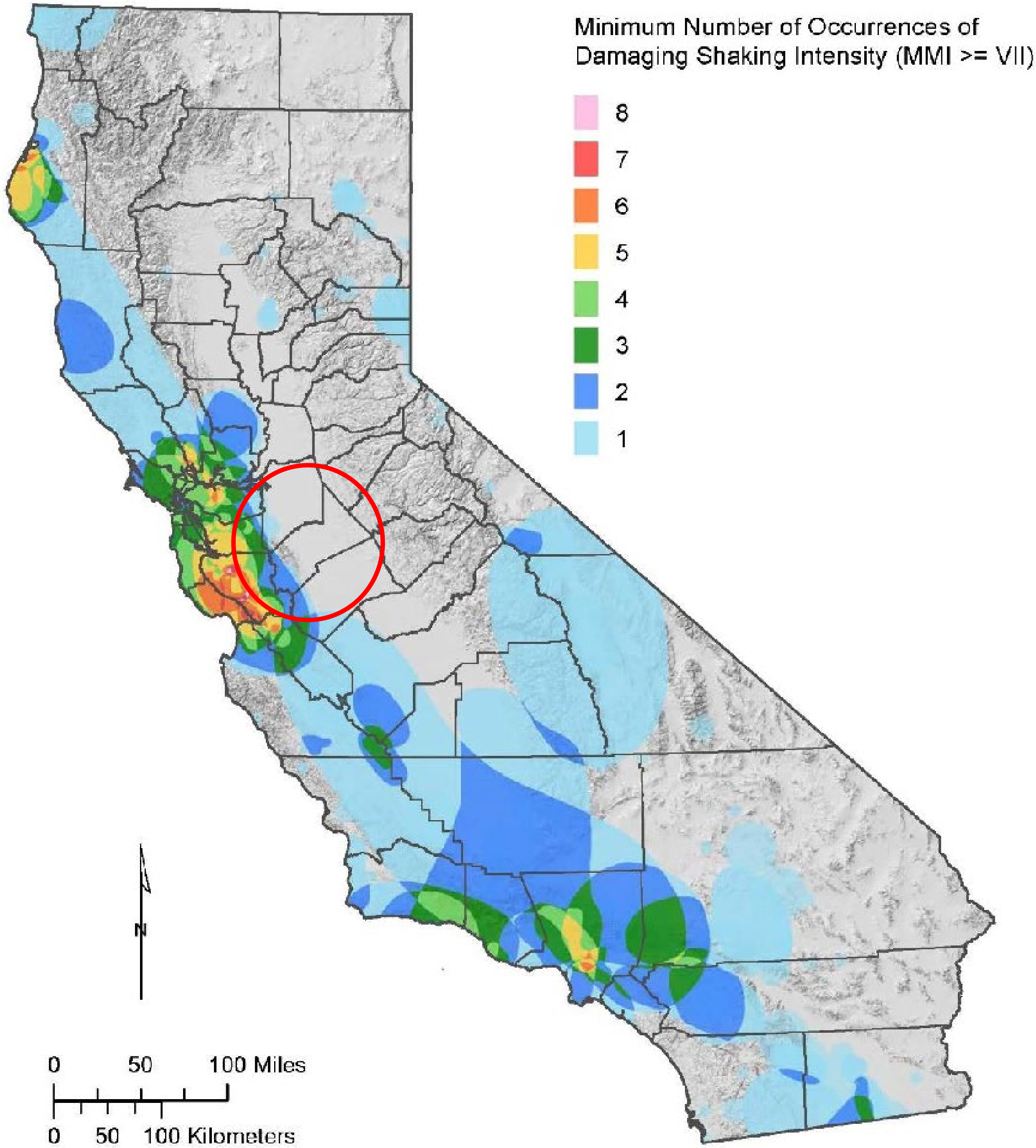
Based on the County's 2017 LHMP, since 1930, one earthquake epicenter of a magnitude greater than 4.0 on the Richter Scale was recorded within Stanislaus County. On June 27, 1986, an earthquake with a magnitude of 3.7 on the Richter Scale occurred with an epicenter several miles west of Crows Landing. Other than those, there have not been any damaging earthquakes greater than M 6.0 recorded in Stanislaus County in over 200 years and the County has not been included in any federal disaster declarations involving earthquakes, though several have been very close.

The most recent large earthquake near Stanislaus County was 16 miles east north-east of King City at a magnitude of 5.3 on October 20, 2012. Several aftershocks followed the main earthquake, including a 3.1 aftershock. This quake was preceded by an earthquake on October 31, 2007 (M 5.5) in the East Foothills of Santa Clara County, a 5.1 magnitude earthquake in 1990 near Ridgemark, California and two earthquakes along the Watsonville east quadrangle, between the Santa Cruz and Santa Clara County boundaries, located approximately 25 miles west of Stanislaus County. There was a low level of ground shaking reported.

Major earthquakes have occurred near Stanislaus County and resulted in ground shaking felt in the County. The Fort Tejon earthquake in 1857 of M 7.9 was one of the greatest earthquakes ever recorded in the United States and the largest in California. It left an extensive surface rupture scar over 215 miles in length along the San Andreas Fault. The epicenter is now thought to have been located near Cholame, approximately 134 miles southwest of Stanislaus. During the Fort Tejon earthquake, strong shaking lasted from one to three minutes. As a result of the shaking, the flow of the Kern River was turned upstream, and water ran four feet deep over its banks. The waters of Tulare Lake were thrown upon its shores, stranding fish miles from the original lakebed. Property loss was heavy at Fort Tejon, one of the only settlements at the time, an Army post in south-central Kern County about four miles from the San Andreas Fault. In 1857, two buildings were declared unsafe, three others were damaged extensively but were habitable, and still others sustained moderate damage. One person was killed in the collapse of an adobe house at Gorman.

Figure 4-13 below displays the common areas damaged by earthquakes based on historic evidence dating back to the year 1800. The occurrences are color-coded by damaging shaking intensity across California, and Stanislaus County is enclosed within a red circle. The figure shows that, per the MMI scale noting occurrences equal to or greater than an Intensity of VII, the County has experienced 1 to 3 earthquake events of this kind, mostly affecting the far western and southwestern portions of the County.

Figure 4-13 Areas Damaged by Earthquakes from 1800 to 2017



Source: California SHMP, 2018; California Geologic Survey

Probability of Future Occurrences

Occasional – It is estimated that major earthquakes (ranging from a magnitude of 7 to 7.9) occur in California one out of every 10 years. However, strong earthquakes (from magnitudes 6 to 6.9) strike the State about once every two to three years. A strong earthquake can cause major damage depending on the epicenter's location with regards to populated areas, and can lead to billions of dollars in disasters, deaths, injuries, and disruptions in services and communities' way of life. Moderate earthquakes (around magnitudes of 5.5) can occur three to four times a year in the State. For Stanislaus County, as previously mentioned there is documented evidence of seven earthquakes that shook the area, (1872, 1906, 1952, 1966, 1984, and 1989, and more recently in 2021) over a 150-year period equating to a 4.6% probability of future occurrence.

Along the San Andreas Fault, segments exist where no large earthquakes have occurred for long intervals of time. These areas accumulate potential energy and provide clues as to where the next earthquake may occur and when. Scientists term these segments "*seismic gaps*" and, in general, have been successful in forecasting the time when some of the seismic gaps will produce large earthquakes. Geologic studies show that over the past 1,400 to 1,500 years, large earthquakes have occurred at about 150-year intervals on the southern San Andreas Fault. As the last large earthquake on the southern San Andreas was the Fort Tejon earthquake in 1857, that section of the fault is considered a likely location for an earthquake within the next few decades (USGS 1997).

Climate Change Considerations

Climate change is not expected to directly affect earthquake frequency or intensity.

Vulnerability Assessment

Earthquake loss estimation for the 2021 MJHMP update utilized FEMA's Hazus-MH 5.0 natural hazard loss estimation software. Hazus is a GIS-based, standardized, nationally applicable multi-hazard loss estimation methodology and software. Local, state, and federal government officials use Hazus for preparedness, emergency response, and mitigation planning. A Level 1 Hazus analysis was performed, which estimates damage based on an inventory database compiled at a national level aggregated to Census Tracts. As with any model there are uncertainties and the results should be considered approximate for planning purposes.

To evaluate potential losses associated with earthquake activity in the Planning Area, two Hazus scenarios were run for the Stanislaus County, including a Hazus 2,500-year probabilistic scenario and a Magnitude 6.9 – Great Valley ShakeMap Scenario.

The 2,500-year scenario considers multiple faults in the region. The methodology utilizes probabilistic seismic hazard contour maps developed by the USGS for the 2018 update of the National Seismic Hazard Maps that are included with Hazus-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500-year return period analyzes ground shaking estimates from the various seismic sources in the area with a 2 percent probability of being exceeded in 50 years. The International Building Code (IBC) uses this level of ground shaking for building design in seismic areas.

The Magnitude 6.9 Great Valley ShakeMap Scenario is a deterministic earthquake analysis that was modeled using Hazus for Stanislaus County. A deterministic scenario predicts the outcome of a specific earthquake event. This deterministic scenario used USGS provided ShakeMap datasets to model what a Magnitude 6.9 earthquake of the Great Valley Fault Thrust System would generate in terms of damages and losses for the chosen area of interest (i.e. Stanislaus County). The datasets used to import into Hazus 5.0 for the scenario included four USGS provided data layers in geospatial format: peak ground velocity, peak ground acceleration, peak spectral acceleration for 0.3 seconds (0.3 % g, or gravitational velocity), and peak ground acceleration for 1.0 seconds (1.0 % g).

Hazus estimates the number of people displaced, the number of buildings and facilities/infrastructure damaged, the number of casualties, and the damage to transportation systems and utilities. Results produced by Hazus are reported at the census tract level. These results and the estimated impacts are summarized below in the vulnerability assessment.

General Property

Unreinforced Masonry Building (URM)s – Unreinforced masonry building type structures consist of buildings made of unreinforced concrete and brick, hollow concrete blocks, clay tiles, and adobe. Buildings constructed of these materials are heavy and brittle, and typically provide little earthquake resistance. In small earthquakes, unreinforced buildings can crack, and in strong earthquakes, they have a tendency to collapse. These types of structures pose the greatest structural risk to life and safety of all general building types. Due to the public safety risks that are posed by unreinforced masonry (URM) buildings, the California legislature passed Senate Bill 547 (Government Code Section 8875 et seq.). This legislation went into effect

January 1, 1987, and required all cities and counties located in Seismic Zone 4 to conduct an inventory of potentially hazardous structures, including unreinforced masonry buildings.

Hazus estimates the number of buildings that will be damaged during a modeled earthquake, and these estimates are provided in the figures and tables below. According to Hazus results, under the 2,500-year probabilistic scenario, the total building-related losses were $6,162.70 (millions of dollars). By far, the largest loss was sustained by the residential occupancies which made up over 58% of the total loss. Under the Great Valley ShakeMap Scenario, total building-related losses were $1,395.79 (millions of dollars). By far, the largest loss was sustained by the residential occupancies, which made up over 64% of the total loss. Figure 4-14 and Figure 4-15 below provide summaries of the losses associated with the building damage under the two scenarios. The 2,500-Year Probabilistic Scenario is expected to result in more economic losses than the Great Valley ShakeMap Scenario.

Figure 4-14 Earthquake Losses by Loss Type and Occupancy Type – 2,500 Probabilistic Scenario (in Millions of Dollars)

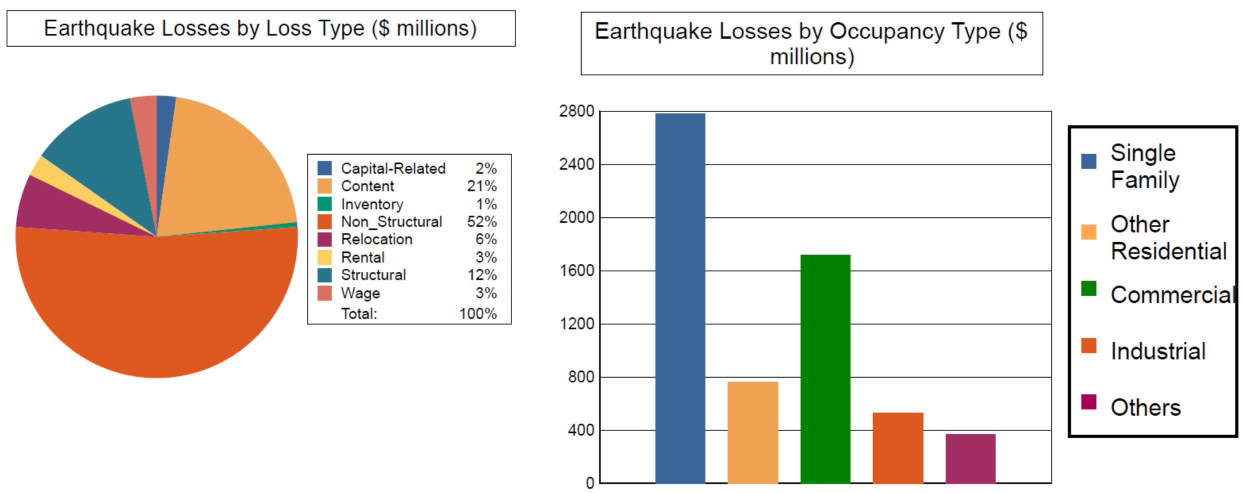


Figure 4-15 Earthquake Losses by Loss Type and Occupancy Type – Great Valley ShakeMap Scenario (in Millions of Dollars)

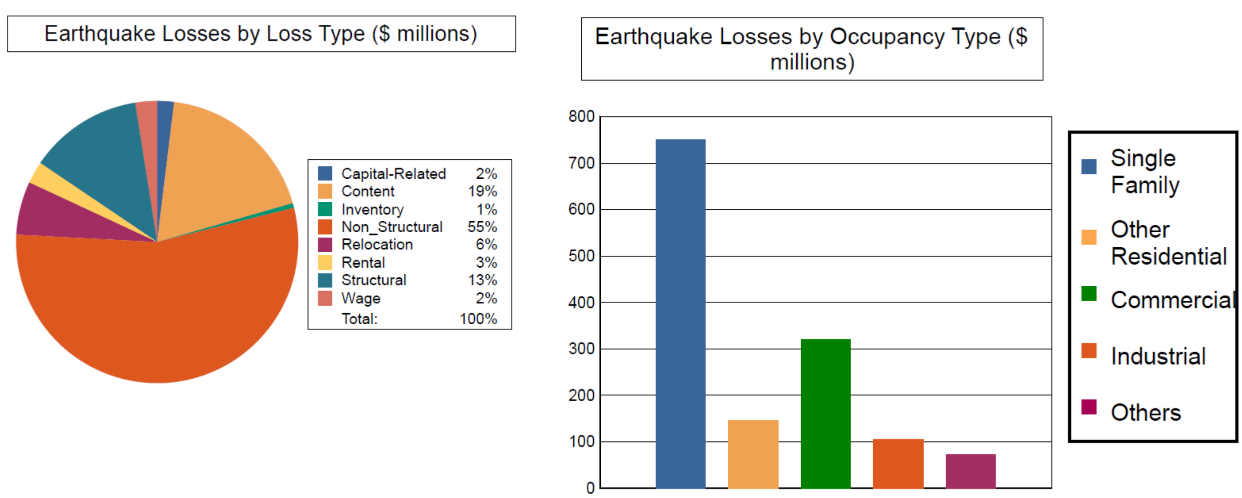


Table 4-26 and Table 4-27 show the expected building damage categorized by both building type and the degree of the expected damage. For each scenario, the majority of structures will either not be damaged or suffer slight to moderate damage. The 2,500-Year Probabilistic Scenario is expected to produce more severe building damage than the Great Valley ShakeMap Scenario.

Table 4-26 Expected Building Damage by Occupancy – 2,500-Year Probabilistic Scenario

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	County	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	295.23	0.44	250.84	0.40	213.49	0.77	97.34	1.50	48.10	1.69
Commercial	1,920.73	2.85	1,685.76	2.70	1,954.33	7.01	1,027.82	15.80	441.36	15.54
Education	100.22	0.15	77.36	0.12	61.47	0.22	26.03	0.40	9.92	0.35
Government	43.58	0.06	35.78	0.06	38.35	0.14	22.58	0.35	10.70	0.38
Industrial	464.15	0.69	428.20	0.69	539.56	1.94	304.41	4.68	143.67	5.06
Other Residential	2,592.67	3.85	2,904.41	4.65	3,528.24	12.65	3,326.69	51.14	1,742.98	61.38
Religion	184.35	0.27	153.22	0.25	142.22	0.51	74.63	1.15	32.58	1.15
Single Family	61,677.08	91.67	56,903.75	91.13	21,402.81	76.77	1,625.08	24.98	410.27	14.45
Total	**67,278**		**62,439**		**27,880**		**6,505**		**2,840**	

Source: Hazus-MH 5.0

Table 4-27 Expected Building Damage by Occupancy – Great Valley ShakeMap Scenario

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	County	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	615.58	0.51	165.73	0.47	94.05	1.01	24.63	2.06	5.00	2.54
Commercial	4,762.70	3.93	1,272.54	3.64	784.44	8.45	182.14	15.21	28.17	14.32
Education	199.10	0.16	47.93	0.14	22.62	0.24	4.66	0.39	0.68	0.34
Government	102.69	0.08	26.82	0.08	16.53	0.18	4.25	0.35	0.71	0.36
Industrial	1,238.71	1.02	344.33	0.98	231.73	2.50	56.51	4.72	8.72	4.43
Other Residential	8,163.63	6.73	3,073.08	8.79	2,158.38	23.26	624.56	52.16	75.35	38.30
Religion	413.11	0.34	103.90	0.30	54.79	0.59	12.99	1.08	2.20	1.12
Single Family	105,808.23	87.23	29,928.66	85.60	5,918.50	63.77	287.68	24.02	75.92	38.59
Total	**121,304**		**34,963**		**9,281**		**1,197**		**197**	

Source: Hazus-MH 5.0

Figure 4-16 and Figure 4-17 below display the census tracts within the County that were analyzed in the two scenarios, color-coded by the amount of total building loss each tract experienced.

Figure 4-16 Stanislaus County Hazus 2,500-Year Probabilistic Scenario Total Building Loss (in Thousands of Dollars)

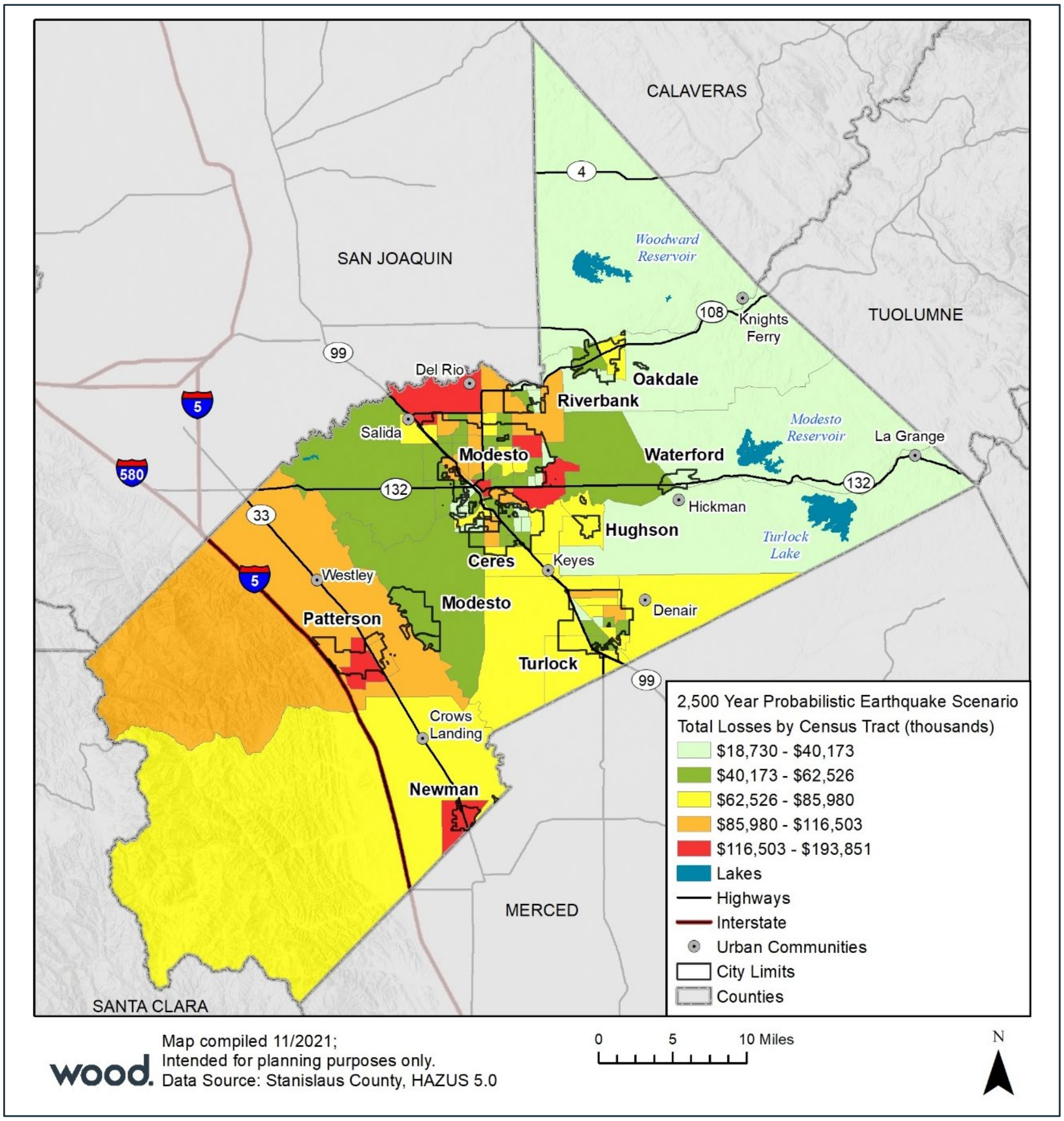
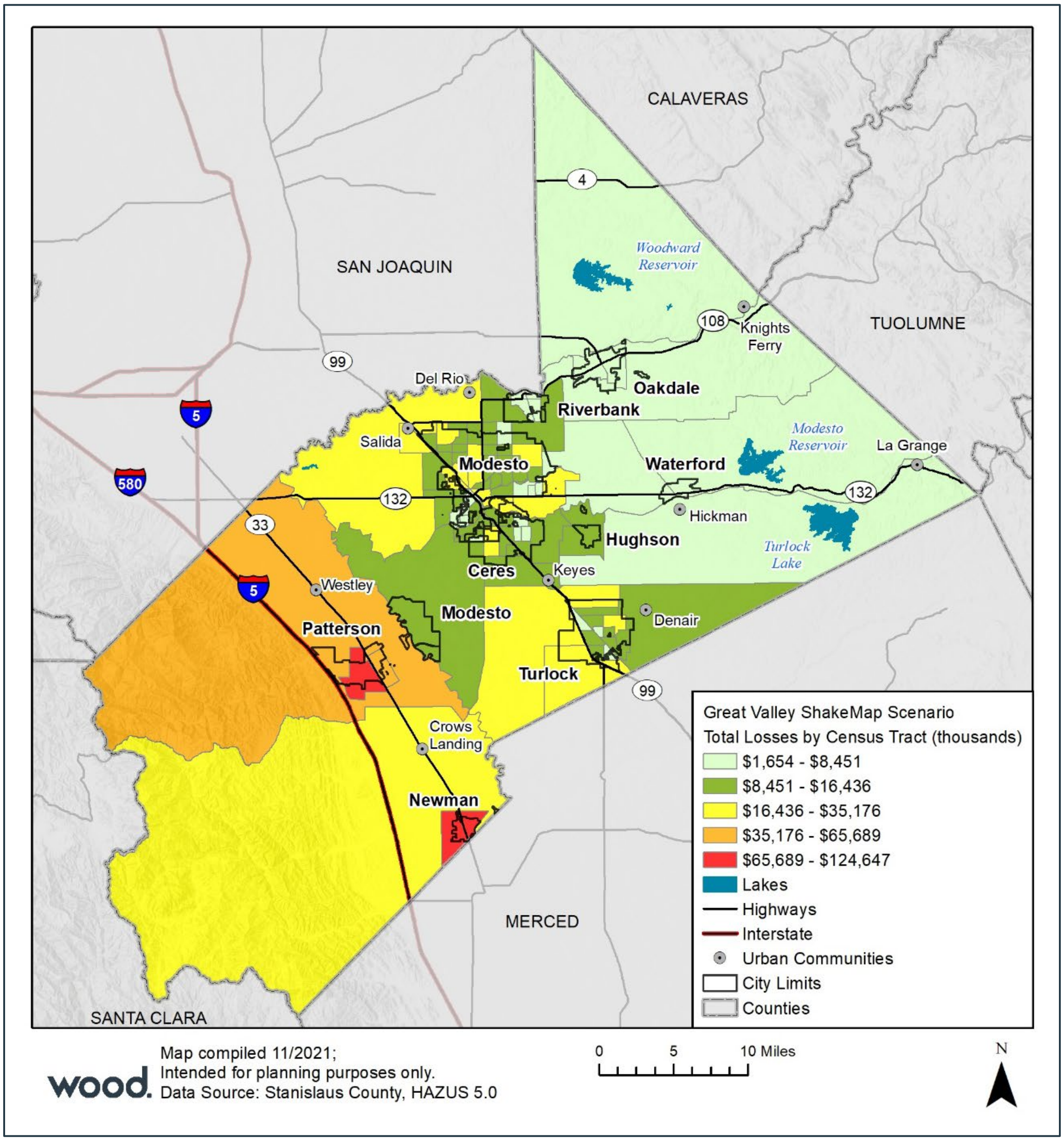


Figure 4-17 Stanislaus County Great Valley ShakeMap Scenario Total Building Loss (in Thousands of Dollars)



People

Loss of utility service would have major impacts on the people of the County. The following tables indicate the number of projected households that would experience power and water loss, and the number of days the loss would last. The 2,500-Year Probabilistic Scenario is expected to cause a longer delay in the recovery of potable water and electric power systems as well as cause more people to be without potable water or electric power compared to the Great Valley ShakeMap Scenario.

Table 4-28 Expected Potable Water and Electric Power System Performance – 2,500-Year Probabilistic Scenario

	Total Number of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	165,180	102,364	98,831	91,064	26,111	0
Electric Power		82,462	46,217	16,462	2,782	127

Source: Hazus-MH 5.0

Table 4-29 Expected Potable Water and Electric Power System Performance – Great Valley ShakeMap Scenario

	Total Number of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	165,180	1,676	246	0	0	0
Electric Power		0	0	0	0	0

Source: Hazus-MH 5.0

Sheltering is another concern during an earthquake – people may be displaced from their homes due to the earthquake, and those displaced people may need accommodations in temporary public shelters. Table 4-30 shows projected total displacement and projected shelter needs for each scenario. The 2,500-Year Probabilistic Scenario is expected to result in more displaced households and also people seeking shelter than the Great Valley ShakeMap Scenario.

Table 4-30 Shelter Requirements

2,500-Year Probabilistic Scenario		Great Valley ShakeMap Scenario	
Total Population	514,453	Total Population	514,453
Total Displaced Households	2,533	Total Displaced Households	351
Total Seeking Shelter	2,020	Total Seeking Shelter	293

Source: Hazus-MH 5.0

The Hazus models potential casualty numbers based on magnitude and time of occurrence for the earthquake. Casualties are broken out by occupancy class, and severity is separated into one of four categories.

- **Level 1** – Injuries will require medical attention but hospitalization not needed
- **Level 2** – Injuries will require hospitalization but are not considered life-threatening
- **Level 3** – Injuries will require hospitalization and can become life-threatening if not promptly treated
- **Level 4** – Victims are killed by the earthquake

Hazus estimates are provided for three times of day – 2 AM, 2 PM, and 5 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2 AM estimate considers that the residential occupancy load is maximum, the 2 PM estimate considers that the educational, commercial, and industrial sector loads are maximum, and 5 PM represents peak commute time. The following tables show casualty estimates for the different times of day for each scenario. The 2,500-Year Probabilistic Scenario is expected to result in more casualties and also more severe casualties than the Great Valley ShakeMap Scenario.

Table 4-31 Casualty Estimates – 2,500-Year Probabilistic Scenario

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	24.58	6.64	1.03	2.04
	Commuting	0.19	0.24	0.42	0.08
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	40.54	10.72	1.57	3.07
	Other- Residential	427.20	97.83	9.29	17.05
	Single Family	369.73	47.32	2.32	4.12
	Total	**862**	**163**	**15**	**26**
2 PM	Commercial	1,512.41	408.03	63.78	124.99
	Commuting	1.71	2.20	3.82	0.73
	Educational	575.58	157.52	25.43	49.77
	Hotels	0.00	0.00	0.00	0.00
	Industrial	298.45	78.75	11.56	22.44
	Other- Residential	97.87	22.49	2.20	3.98
	Single Family	83.61	10.88	0.61	0.94
	Total	**2,570**	**680**	**107**	**203**
5 PM	Commercial	1,107.33	298.11	46.77	90.57
	Commuting	26.95	34.67	60.07	11.55
	Educational	48.06	13.10	2.11	4.13
	Hotels	0.00	0.00	0.00	0.00
	Industrial	186.53	49.22	7.23	14.02
	Other- Residential	156.48	35.94	3.51	6.36
	Single Family	141.62	18.43	1.03	1.58
	Total	**1,667**	**449**	**121**	**128**

Source: Hazus-MH 5.0

Table 4-32 Casualty Estimates – Great Valley ShakeMap Scenario

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	3.32	0.64	0.08	0.16
	Commuting	0.01	0.02	0.03	0.01
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	5.83	1.13	0.14	0.26
	Other- Residential	54.09	7.72	0.47	0.86
	Single Family	108.89	9.75	0.29	0.48
	Total	**172**	**19**	**1**	**2**
2 PM	Commercial	205.12	39.49	4.93	9.61
	Commuting	0.12	0.16	0.27	0.05
	Educational	78.53	14.87	1.87	3.64
	Hotels	0.00	0.00	0.00	0.00
	Industrial	42.81	8.33	1.00	1.94
	Other- Residential	12.10	1.72	0.11	0.19
	Single Family	23.97	2.21	0.08	0.11
	Total	**363**	**67**	**8**	**16**
5 PM	Commercial	151.85	29.45	3.71	7.16
	Commuting	1.82	2.44	4.11	0.80
	Educational	6.15	1.13	0.14	0.27
	Hotels	0.00	0.00	0.00	0.00
	Industrial	26.76	5.21	0.63	1.21
	Other- Residential	19.76	2.85	0.18	0.32

		Level 1	Level 2	Level 3	Level 4
	Single Family	40.90	3.79	0.14	0.19
	Total	**247**	**45**	**9**	**10**

Source: Hazus-MH 5.0

Social Vulnerability

Populations most vulnerable to earthquake hazards would be those that rely on specific services or electrical power, which may not be available during or after an earthquake, or those which are homeless, would have a difficult time evacuating due to age or disability, cannot communicate easily due to speaking English less than well, for example.

Government Services

Damage to government facilities and infrastructure from a major earthquake would likely interrupt or delay the ability of local governments to delivery of services and could require temporary relocation of some operations. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. Responders will initially experience similar impacts as the general public. However, in the aftermath of a major earthquake responders would likely be put in very hazardous circumstances as they attempt to save lives, protect property, and deliver essential services. Public confidence in government may be challenged by the public if planning, response, and recovery are not timely and effective.

Economy

Depending on its location and magnitude, an earthquake could have a devastating impact on the County's economy. Impacts would be related to debris cleanup and management, building and infrastructure damage, and losses related to business and infrastructure interruption. Hazus estimates economic impacts for earthquakes modeled. Losses estimated include building-related losses, and transportation and utility lifeline losses. The model estimates loss over a 15-year span after the incident.

Building losses are broken into two categories – direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake. Table 4-33 shows the economic losses under the two scenarios broken down by loss categories and occupancy types. The 2,500-year probabilistic scenario is expected to cause more economic losses.

Table 4-33 Economic Losses (Millions of Dollars)

2,500-Year Probabilistic Scenario						
Category	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	$208.58	$82.39	$485.06	$30.09	$48.26	$854.37
Capital Stock Losses	$2,575.12	$678.65	$1,236.6	$500.42	$317.54	$53,08.33
Total	**$2,783.70**	**$761.03**	**$1,721.65**	**$530.51**	**$365.80**	**$6,162.70**
Great Valley ShakeMap Scenario						
Category	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses	$53.69	$16.76	$95.65	$7.21	$9.78	$183.09
Capital Stock Losses	$696.22	$130.29	$224.82	$97.65	$63.72	$1,212.7
Total	**$749.92**	**$147.05**	**$320.47**	**$104.86**	**$73.49**	**$1,395.79**

Source: Hazus-MH 5.0

The total building-related losses under the 2,500-Year Probabilistic Scenario were $6.16 billion. Fourteen percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up over 58% of the total loss.

The total building-related losses under the Great Valley ShakeMap Scenario were $1.4 billion. Thirteen percent of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up over 64% of the total loss. The 2,500-Year Probabilistic Scenario is expected to result in more economic losses than the Great Valley ShakeMap Scenario. The economic loss associated with the disruption of lifeline systems, specifically transportation and utility lifelines are shown in Table 4-34 and Table 4-35.

Table 4-34 Lifeline System Losses for 2,500-Year Probabilistic Scenario – Transportation and Utility (Millions of Dollars)

2,500-Year Probabilistic Scenario		
System	**Inventory Value**	**Economic Loss**
Highway	$3,898.68	$77.03
Railways	$1,052.92	$30.62
Light Rail	$0	$0
Bus	$7.32	$2.58
Ferry	$0	$0
Port	$0	$0
Airport	$158.47	$0
Potable Water	$166.82	$19.9
Wastewater	$1,408.98	$419.8
Natural Gas	$210.59	$3.43
Oil Systems	$0	$0
Electrical Power	$4,800.8	$1,338.7
Communication	$2.24	$0.59

Source: Hazus-MH 5.0

Table 4-35 Lifeline System Losses for Great Valley ShakeMap Scenario – Transportation and Utility (Millions of Dollars)

Great Valley ShakeMap Scenario		
System	**Inventory Value**	**Economic Loss**
Highway	$3,898.68	$15.2
Railways	$1,052.92	$4.28
Light Rail	$0	$0
Bus	$7.32	$0.79
Ferry	$0	$0
Port	$0	$0
Airport	$158.47	$3.48
Potable Water	$166.82	$2.53
Wastewater	$1,408.98	$126.76
Natural Gas	$210.59	$0.44
Oil Systems	$0	$0
Electrical Power	$4,800.8	$312.97
Communication	$2.24	$0.2

Source: Hazus-MH 5.0

The 2,500-Year Probabilistic Scenario is also expected to result in more lifeline system losses than the Great Valley ShakeMap Scenario.

Critical Facilities and Infrastructure

Hazus breaks critical facilities into two groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. HPL facilities include dams, levees, military installations, nuclear power plants and hazardous material sites. There are 12 hospitals in Stanislaus with a total bed capacity of 1,584 beds. There are also 231 schools, 51 fire stations, 14 police stations and three emergency operation facilities. The inventory also includes 48 hazardous material sites.

On the day of the earthquake in the 2,500-Year Probabilistic Scenario, the model estimates that 729 hospital beds (46%) would be available for use by patients already in the hospital and those injured by the earthquake. After one week, 72% of the beds would be back in service. By 30 days, 92% will be operational. The expected damages from the earthquake event are provided in Table 4-36.

Table 4-36 Expected Damage to Essential Facilities – 2,500-Year Probabilistic Scenario

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	12	2	0	10
Schools	231	28	0	108
EOCs	3	0	0	3
PoliceStations	14	4	0	6
FireStations	51	9	0	18

Source: Hazus-MH 5.0

On the day of the earthquake for the Great Valley ShakeMap Scenario, the model estimates that 1,248 hospital beds (79%) would be available for use by patients already in the hospital and those injured by the earthquake. After one week, 93% of the beds would be back in service. By 30 days, 99% will be operational. The expected damages from the earthquake event are provided in Table 4-37.

Table 4-37 Expected Damage to Essential Facilities – Great Valley ShakeMap Scenario

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	12	0	0	12
Schools	231	1	0	205
EOCs	3	0	0	3
PoliceStations	14	0	0	10
FireStations	51	0	0	40

Source: Hazus-MH 5.0

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven transportation systems that include highways, railways, light rail, bus, ports, ferry, and airports. There are also six utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power, and communications. The transportation systems inventory and expected damages from the earthquake, in terms of number of structures and locations affected, are provided in Table 4-38 and Table 4-39 for the two scenarios, while losses in millions of dollars are summarized in Table 4-40 and Table 4-41.

The total value of the lifeline inventory is over $11.7 billion. This inventory includes over 323.7 miles of highways, 380 bridges, and 8,405.9 miles of pipes.

Table 4-38 Expected Damage to the Transportation Systems – 2,500-Year Probabilistic Scenario

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	168	0	0	168	168
	Bridges	380	24	0	357	361
	Tunnels	0	0	0	0	0
Railways	Segments	714	0	0	714	714
	Bridges	75	0	0	75	75
	Tunnels	0	0	0	0	0
	Facilities	6	5	0	6	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	4	4	0	4	4
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	3	2	0	3	3
	Runways	3	0	0	3	3

Source: Hazus-MH 5.0

Table 4-39 Expected Damage to the Transportation Systems – Great Valley ShakeMap Scenario

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	168	0	0	168	168
	Bridges	380	11	0	369	374
	Tunnels	0	0	0	0	0
Railways	Segments	714	0	0	714	714
	Bridges	75	0	0	75	75
	Tunnels	0	0	0	0	0
	Facilities	6	0	0	6	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	4	0	0	4	4
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	3	0	0	3	3
	Runways	3	0	0	3	3

Source: Hazus-MH 5.0

Table 4-40 Transportation System Economic Losses (Millions of dollars) – 2,500-Year Probabilistic Scenario

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2956.9497	0.0000	0.00
	Bridges	941.7281	77.0285	8.18
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**3898.6778**	**77.0285**	
Railways	Segments	607.8876	0.0000	0.00
	Bridges	429.0517	25.0533	5.84
	Tunnels	0.0000	0.0000	0.00
	Facilities	15.9780	5.5702	34.86
	Subtotal	**1052.9173**	**30.6235**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	7.3224	2.5790	35.22
	Subtotal	**7.3224**	**2.5790**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	25.8575	9.1655	35.45
	Runways	158.4711	0.0000	0.00
	Subtotal	**184.3286**	**9.1655**	
	Total	**5,143.25**	**119.40**	

Source: Hazus-MH 5.0

Table 4-41 Transportation System Economic Losses (Millions of dollars) – Great Valley ShakeMap Scenario

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2956.9497	0.0000	0.00
	Bridges	941.7281	15.1977	1.61
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**3898.6778**	**15.1977**	
Railways	Segments	607.8876	0.0000	0.00
	Bridges	429.0517	2.8907	0.67
	Tunnels	0.0000	0.0000	0.00
	Facilities	15.9780	1.3883	8.69
	Subtotal	**1052.9173**	**4.2790**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	7.3224	0.7885	10.77
	Subtotal	**7.3224**	**0.7885**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	25.8575	3.4814	13.46
	Runways	158.4711	0.0000	0.00
	Subtotal	**184.3286**	**3.4814**	
	Total	**5,143.25**	**23.75**	

Source: Hazus-MH 5.0

The replacement value of the transportation and utility lifeline systems is estimated to be $5.14 billion and $6.59 billion, respectively. The expected utility system facility damages in terms of total structures or systems affected, along with the inventory of this dataset, are summarized in Table 4-42 and Table 4-43 for the two scenarios respectively. Economic losses in millions of dollars are found in Table 4-44 and Table 4-45. Site specific expected utility system pipeline damages (including their inventory) are included in Table 4-46 and Table 4-47, while the potable water and electric power system performance limitations, damages, and inventory will be in Table 4-48 and Table 4-49.

Table 4-42 Expected Utility System Facility Inventory and Damages – 2,500-Year Probabilistic Scenario

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	166.8052
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**166.8052**
Waste Water	Distribution Lines	NA	100.0831
	Facilities	8	1308.8937
	Pipelines	0	0.0000
		Subtotal	**1408.9768**
Natural Gas	Distribution Lines	NA	66.7221
	Facilities	0	0.0000
	Pipelines	50	143.8702
		Subtotal	**210.5923**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	8	4800.8027
		Subtotal	**4800.8027**
Communication	Facilities	19	2.2420
		Subtotal	**2.2420**
		Total	**6,589.40**

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 % After Day 1	with Functionality > 50 % After Day 7
Potable Water	0	0	0	0	0
Waste Water	8	8	0	0	8
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	8	8	0	0	8
Communication	19	18	0	15	19

Source: Hazus-MH 5.0

Table 4-43 Expected Utility System Facility Inventory and Damages – Great Valley ShakeMap Scenario

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	166.8052
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**166.8052**
Waste Water	Distribution Lines	NA	100.0831
	Facilities	8	1308.8937
	Pipelines	0	0.0000
		Subtotal	**1408.9768**
Natural Gas	Distribution Lines	NA	66.7221
	Facilities	0	0.0000
	Pipelines	50	143.8702
		Subtotal	**210.5923**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	8	4800.8027
		Subtotal	**4800.8027**
Communication	Facilities	19	2.2420
		Subtotal	**2.2420**
		Total	**6,589.40**

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 % After Day 1	with Functionality > 50 % After Day 7
Potable Water	0	0	0	0	0
Waste Water	8	2	0	4	8
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	8	2	0	6	8
Communication	19	4	0	16	19

Source: Hazus-MH 5.0

Table 4-44 Utility System Economic Losses in Millions of Dollars – 2,500-Year Probabilistic Scenario

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	166.8052	19.9020	11.93
	Subtotal	**166.8052**	**19.9020**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	1308.8937	409.7983	31.31
	Distribution Line	100.0831	9.9973	9.99
	Subtotal	**1408.9768**	**419.7956**	
Natural Gas	Pipelines	143.8702	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	66.7221	3.4250	5.13
	Subtotal	**210.5923**	**3.4250**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	4800.8027	1338.7043	27.89
	Subtotal	**4800.8027**	**1338.7043**	
Communication	Facilities	2.2420	0.5916	26.39
	Subtotal	**2.2420**	**0.5916**	
	Total	**6,589.42**	**1,782.42**	

Source: Hazus-MH 5.0

Table 4-45 Utility System Economic Losses in Millions of Dollars – Great Valley ShakeMap Scenario

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	166.8052	2.5312	1.52
	Subtotal	**166.8052**	**2.5312**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	1308.8937	125.4853	9.59
	Distribution Line	100.0831	1.2715	1.27
	Subtotal	**1408.9768**	**126.7568**	
Natural Gas	Pipelines	143.8702	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Line	66.7221	0.4356	0.65
	Subtotal	**210.5923**	**0.4356**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	4800.8027	312.9741	6.52
	Subtotal	**4800.8027**	**312.9741**	
Communication	Facilities	2.2420	0.2047	9.13
	Subtotal	**2.2420**	**0.2047**	
	Total	**6,589.42**	**442.90**	

Source: Hazus-MH 5.0

Table 4-46 Expected Utility System Pipeline Damage (Site Specific) – 2,500-Year Probabilistic Scenario

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	5,182	4423	1106
Waste Water	3,109	2222	555
Natural Gas	114	36	9
Oil	0	0	0

Source: Hazus-MH 5.0

Table 4-47 Expected Utility System Pipeline Damage (Site Specific) – Great Valley ShakeMap Scenario

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	5,182	562	141
Waste Water	3,109	283	71
Natural Gas	114	4	1
Oil	0	0	0

Source: Hazus-MH 5.0

Table 4-48 Expected Potable Water and Electric Power System Performance – 2,500-Year Probabilistic Scenario

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	165,180	102,364	98,831	91,064	26,111	0
Electric Power		82,462	46,217	16,462	2,782	127

Source: Hazus-MH 5.0

Table 4-49 Expected Potable Water and Electric Power System Performance – Great Valley ShakeMap Scenario

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	165,180	1,676	246	0	0	0
Electric Power		0	0	0	0	0

Source: Hazus-MH 5.0

In summary, a major earthquake would result in serious impacts on critical infrastructure. Hazus estimates impacts to critical facilities including hospitals, schools, EOCs, police stations and fire stations. These impact estimates are shown in Table 4-50 and Table 4-51. As shown the two tables, the 2,500-Year Probabilistic Scenario is expected to cause more damage and also more severe damage to critical facilities, as well as result in delays for the critical facilities to recover than the Great Valley ShakeMap Scenario.

Table 4-50 Expected Damage to Critical Facilities – 2,500-Year Probabilistic Scenario

Classification	Total	Number of Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on Day 1
Hospitals	12	2	0	10
Schools	231	28	0	108
EOCs	3	0	0	3
Police Stations	14	4	0	6
Fire Stations	51	9	0	18
Total	311	43	0	145

Source: Hazus-MH 5.0

Table 4-51 Expected Damage to Critical Facilities – Great Valley ShakeMap Scenario

Classification	Total	Number of Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on Day 1
Hospitals	12	0	0	12
Schools	231	1	0	205
EOCs	3	0	0	3
Police Stations	14	0	0	10
Fire Stations	51	0	0	40
Total	311	1	0	270

Source: Hazus-MH 5.0

Historic, Cultural, and Natural Resources

Earthquake effects on the environment, natural resources, and historic and cultural assets could be very destructive depending on the type of seismic activity experienced and secondary/cascading effects from an event (e.g., wildfire). The biggest impact would likely be on older properties such as wooden or masonry buildings, though reinforced masonry structures would be much more resilient during earthquakes.

Future Development

Future development in the County is not anticipated to significantly affect vulnerability to earthquakes when designed according to modern building codes. However, future development will result in a slight increase in exposure of the population, building stock, and related infrastructure to earthquakes.

Risk Summary

- Stanislaus County is located in a geologically complex and seismically active region, albeit less so than other areas of California. There are numerous active and potentially active faults in close proximity to the County. The County does not have a history of significant damaging earthquakes.
- The overall significance of earthquakes is Medium but ranked High for communities on the western and southern sides of the County including cities of Patterson and Newman and in the more densely populated cities including Cities of Modesto and Oakdale.
- A moderate earthquake occurring in or near Stanislaus County could result in deaths, casualties, property damage, agricultural and environmental damage, and disruption of normal government and community services and activities.
- The location of the epicenter as well as the time of day and season of the year would have a profound effect on the number of deaths and casualties, as well as property damage.
- The hazard of earthquakes varies from place to place, dependent upon the regional and local geology.
- **Effects on people** – Hazus 2,500-year probabilistic scenario modeling results in estimates of 178 to 787 people needing hospitalization and between 26 to 203 deaths depending on the time of day the earthquake hits; Hazus Great Valley ShakeMap Scenario modeling results in estimates of 20 to 75 people needing hospitalization and between 2 to16 deaths depending on the time of day the earthquake hits.

- **Effects on property** – Hazus 2,500-year probabilistic scenario modeling indicates about 37,224 buildings will be at least moderately damaged, with approximately $6.16 billion in losses; Hazus Great Valley ShakeMap Scenario modeling indicates about 10,675 buildings will be at least moderately damaged, with approximately $1.4 billion in losses.
- **Effects on economy** – The total economic loss estimated under Hazus 2,500-year probabilistic scenario is $8.1 billion, which includes building and lifeline related losses based on the region's available inventory. The total economic loss estimated under Hazus Great Valley ShakeMap Scenario is $1.9 billion, which includes building and lifeline related losses based on the region's available inventory.
- **Effects on critical facilities and infrastructure** – Under the Hazus 2,500-year probabilistic scenario essential facility damage (police, fire, school, medical) is predicted to be low; only 729 hospital beds (46%) would be available during the earthquake. Under the Hazus Great Valley ShakeMap Scenario, essential facility damage (police, fire, school, medical) is predicted to be very low; 1,248 hospital beds (79%) would be available during the earthquake.
- **Cascading and Secondary Effects** – Earthquakes can cause many cascading effects such as fires, flooding, hazardous materials spills, utility disruptions, landslides, and transportation emergencies. Ground shaking may cause tsunamis or seiche, the rhythmic sloshing of water in lakes or bays.

Table 4-52 Hazard Risk Summary – Earthquake

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Occasional	Critical	Medium	Yes
City of Ceres	Extensive	Occasional	Critical	Medium	No
City of Hughson	Extensive	Occasional	Critical	Medium	No
City of Modesto	Extensive	Occasional	Critical	Medium	No
City of Newman	Extensive	Occasional	Critical	Medium	Yes
City of Oakdale	Extensive	Occasional	Limited	Medium	No
City of Patterson	Extensive	Occasional	Critical	Medium	Yes
City of Riverbank	Extensive	Occasional	Critical	Medium	Yes
City of Turlock	Extensive	Occasional	Critical	Medium	No
City of Waterford	Extensive	Occasional	Limited	Medium	Yes
County Office of Education	Extensive	Occasional	Critical	Medium	Yes

4.3.7 Extreme Temperatures: Freeze and Extreme Heat

Hazard/ Problem Description

Extreme temperature events, both cold and hot, can have severe impacts on human health and mortality, natural ecosystems, and agriculture and other economic sectors.

Freeze

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to cold can cause frostbite or hypothermia and can be life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Freezing temperatures can cause significant damage to the agricultural industry.

Extreme Heat

Extreme heat events can have severe impacts on human health and mortality, natural ecosystems, the agriculture sector, and other economic sectors. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. In other words, heat waves are periods of abnormally hot weather lasting days to weeks. Heat wave duration and the number of extreme heat events per year are common metrics used to describe extreme heat hazards.

Heat kills by taxing the human body beyond its abilities, usually from heat stroke. In a normal year, about 175 Americans succumb to the demands of summer heat. The average annual temperature increases in California have already exceeded 1°F, with some areas exceeding 2°F (CNRA 2021). The daily maximum average temperature, an indicator of extreme temperature shifts, is expected to rise 4.4°F – 5.8°F by 2050 and 5.6°F – 8.8°F by 2100 (CNRA 2021). Heat waves that result in public health impacts, also referred to as heat-health events, are also projected to worsen. By 2050, average heat-health events are projected to last two weeks longer in the Central Valley (CNRA 2021). According to the NWS, among natural hazards, only the cold of winter—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll. As a comparison, in the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died. The 2018 California SHMP notes the 2006 heat wave led to 650 deaths in a 13-day period (Cal OES 2018) and in the past 15 years heat waves have claimed more lives in California than all other declared disaster events combined (California Climate Adaptation Strategy 2018). According to the Draft Extreme Heat Action Plan, extreme heat ranks amongst the deadliest of all climate change-driven hazards in California.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. The elderly, small children, individuals who work outside, patients with chronic medical conditions, those on prescription medication therapy, and people with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails. In summary, extreme heat threatens public health and safety, economic prosperity, natural systems, and communities and has disproportionate consequences on vulnerable populations.

Geographic Area

Extensive – The entire County is susceptible to extreme cold temperatures. The climate in Stanislaus County is also hot and arid, and the entire County is susceptible to extreme heat and heat waves.

Freeze

The entire county is susceptible to extreme temperatures. Unseasonable cold temperatures can have substantial impacts on crops in Stanislaus County.

Extreme Heat

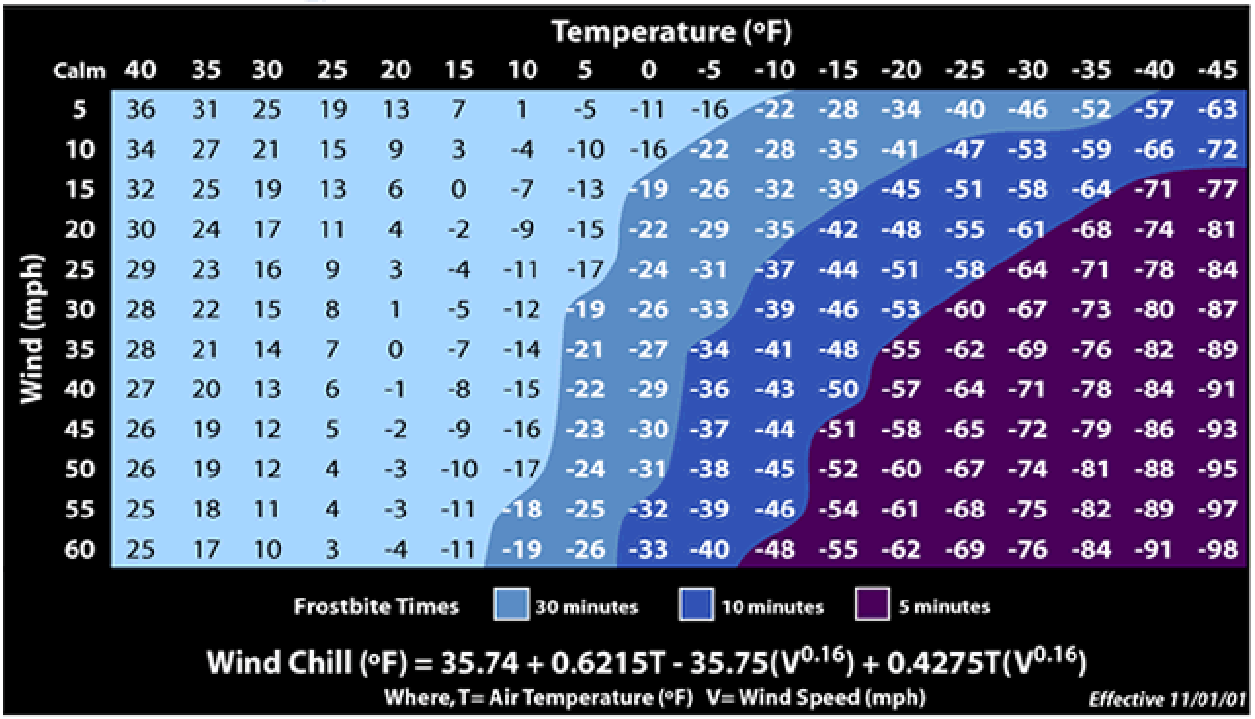
The agriculturally dominated central region of the County is likely to experience the greatest impacts from large or unseasonable temperature variations. The more urbanized areas of the County may experience the urban heat island effect due to the number of impervious surfaces in those areas that absorb and keep heat longer. Heat waves are also protected to cause two to three times more heat-related deaths by the mid-century (CNRA 2021). Socially vulnerable communities will experience the worst of these effects; these include impacts on aging populations, the elderly and children, people with chronic illness, and others that are sensitive to heat exposure. When combined with populations with inequities, such as poverty, housing, and language limitations, these populations are at a higher risk of heat-related illness and death.

Extent (Magnitude/Severity)

Freeze

Critical – In 2001, the NWS implemented an updated Wind Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. Overall, freeze impacts would likely be limited in the planning area, with the greatest impact being on the agricultural industry.

Figure 4-18 National Weather Service Wind Chill Chart



Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

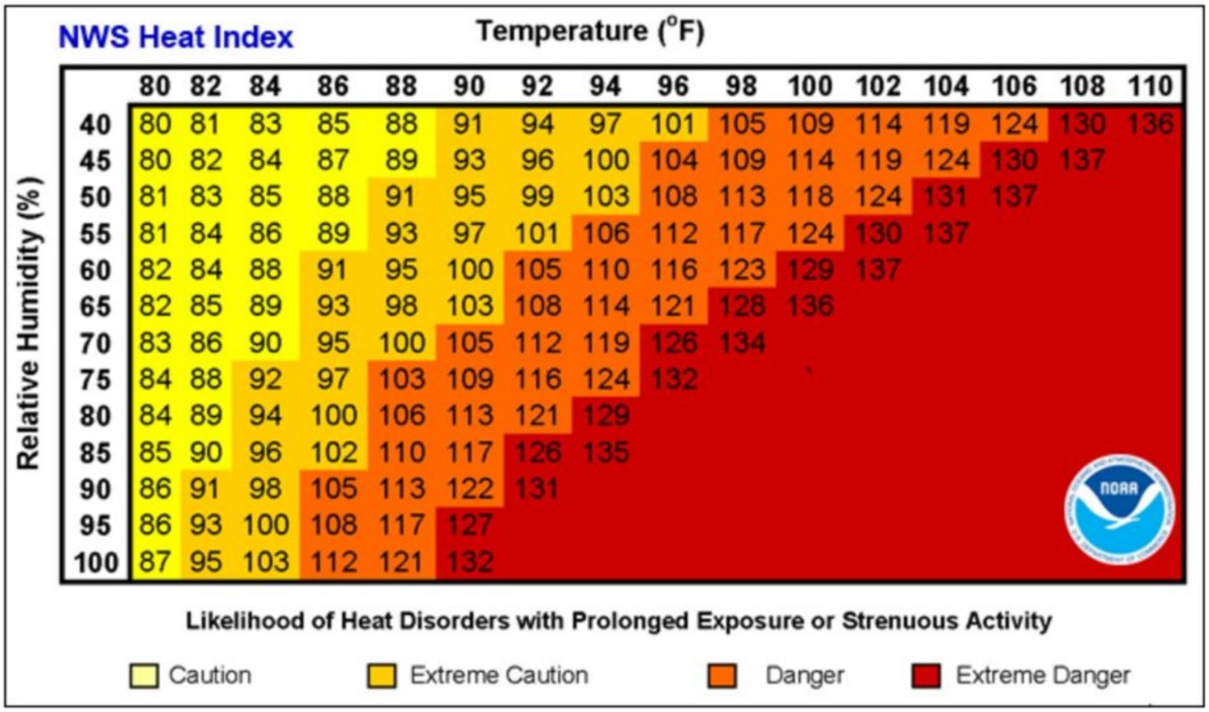
Source: National Weather Service

Extreme Heat

Critical – Stanislaus County begins to experience hot weather in April or May of each year and the heat continues throughout the summer months. According to the Western Regional Climate Center (WRCC), the average high temperature for Stanislaus County based on the City of Modesto Cooperative Observer Program (COOP) in July is 94.3°F. Temperatures that are 10 degrees above normal are considered excessive. Figure 4-19 illustrates the relationship of temperature and humidity to heat disorders. The heat index describes how hot the heat-humidity combination makes the air feel. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration. As the heat index rises, so do health risks. Specifically:

- When the heat index is 90°F, heat exhaustion is possible with prolonged exposure and/or physical activity.
- When it is 90° to 105°F, heat exhaustion is probable with the possibility of sunstroke or heat cramps with prolonged exposure and/or physical activity.
- When it is 105° to 129°F, sunstroke, heat cramps or heat exhaustion is likely, and heatstroke is possible with prolonged exposure and/or physical activity.
- When it is 130°F and higher, heatstroke and sunstroke are extremely likely with continued exposure. Physical activity and prolonged exposure to the heat increase the risks.

Figure 4-19 National Weather Service Heat Index Chart



Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Source: NWS

Note: Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

The NWS has a system in place to initiate alert procedures (advisories, watches, and warnings) when high temperatures are expected to have a significant impact on public safety. The expected severity of the heat determines which type of alert is issued. The "*California OES Contingency Plan for Excessive Heat Emergencies*" (2014) indicates that through the use of historical weather and mortality data, the NWS and the CDPH have identified five major types of climate regions within California to account for climate differences among regions in order to recognize what constitutes an excessive heat event in each of the regions. When temperatures spike for two or more consecutive days without an adequate drop in nighttime temperature to cool the outdoor and indoor environments, there is a significant increase in the risk to socially vulnerable populations.

Overall, extreme heat impacts would be critical in the Planning Area, with the central portions of the County being most affected; greater impacts may also occur within the larger cities in Stanislaus County. Extreme heat will have an impact on vulnerable populations as well as impact the agricultural industry if the event occurs during certain times of the year. High heat waves are also projected to worsen with climate change.

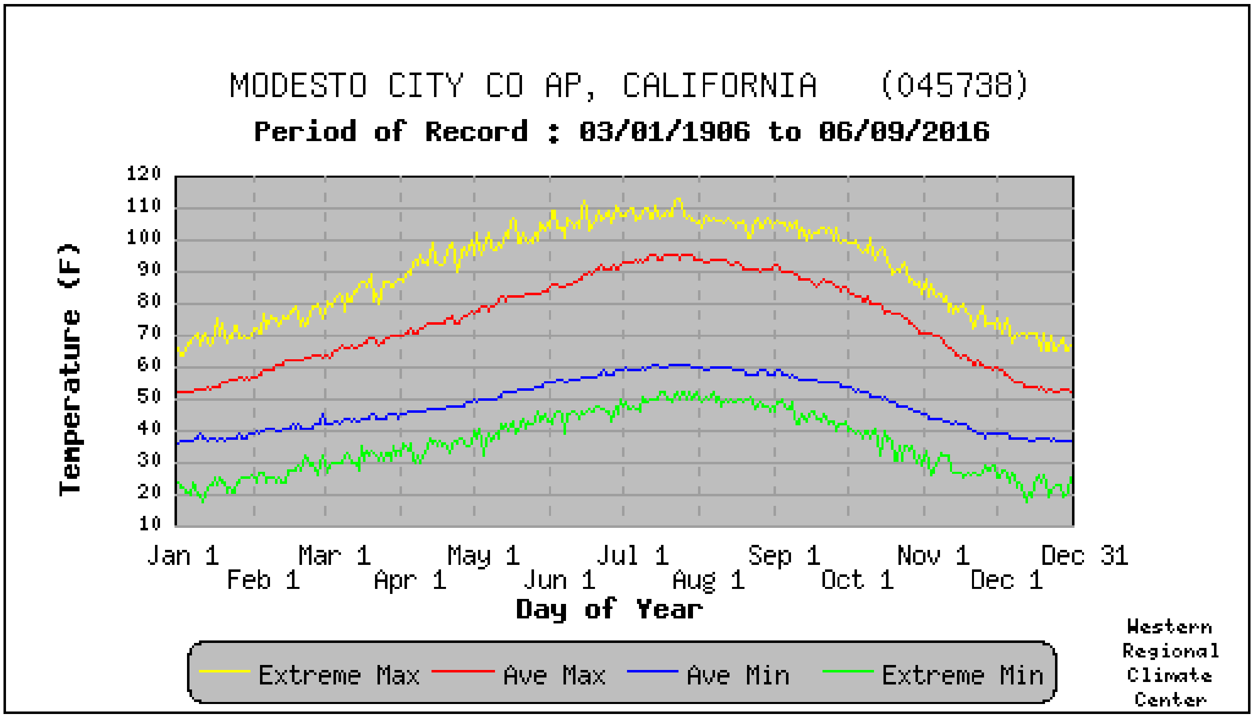
Past Occurrences

There are seven weather stations or COOPs in Stanislaus County. The most central station in the City of Modesto (045738) is summarized below and in Figure 4-20 to illustrate the daily temperature averages in the County's Planning Area.

Modesto City COOP Weather Station (045738), Period of Record 1906 to 2012

In Stanislaus County, monthly average maximum temperatures in the warmest months (May through October) range from the mid-60s to the upper 70s. Monthly average minimum temperatures from November through April range from the mid-40s to low-60s. The highest recorded daily extreme was 113°F on July 23, 2006. The lowest recorded daily extreme was 18°F on January 11, 1949. In a typical year, maximum temperatures do not exceed 84°F and minimum temperatures do not fall below 36°F. On average there is between 80 days per year above 90°F and about 20 days per year where the minimum temperatures is below freezing (32°F).

Figure 4-20 Stanislaus County's Daily Temperature Averages and Extremes



Source: WRCC, www.wrcc.dri.edu/

A search of records from 1950 to 2021 in the National Centers for Environmental Information (NCEI) Storm Events Database showed that between 2000 and 2021 there were seven frost/freeze events and 40 excessive heat and heat events in Stanislaus County. No records for either frost/freeze or heat hazards were found between 1950 and 1999 in the NCEI database. Since 1953, there have been two federally declared disasters in the County for freeze events (refer to Table 4-3). In 2007, California's San Joaquin Valley farming communities were hit with freezing temperatures that severely affected the region's crops and resulted in Presidential disaster declarations (2007). The declarations made federal funds available to supplement unemployment compensation for farm laborers and other farm industry workers put out of work as a direct result of lost seasonal crops. Moreover, in 2012 and 2016, the USDA designated Stanislaus County as a disaster area due to freeze and extreme cold (refer to Table 4-4). On the other hand, there have not been any federally declared disasters in the County for extreme heat (refer to Table 4-3), but the USDA has declared crop losses due to drought conditions often associated with consecutive extreme heat days or prolonged heat waves (refer to Table 4-4). During these events, California's San Joaquin Valley farming communities were severely affected, and the region's agricultural industry and the economy was impacted.

Probability of Future Occurrences

Highly Likely – Temperatures at or above 95°F are common most summer days throughout Stanislaus County, and it is highly likely that extreme heat will continue to occur on an annual basis in the future. In the past, extreme heat events have occurred every few years with four of the major excessive heat events occurring in 2021 over Memorial Day weekend with additional events in June and July. During the four-day excessive heat event in June, Modesto recorded a record daily high temperature of 107 degrees and over 22 cooling centers were available in Sacramento, Butte, Calaveras, Placer, San Joaquin, Tuolumne, Yolo, and Solano counties. Based on the NCEI data, 40 excessive heat and heat events incidents over a 22-year period equates to a major event every 1.8 years and a 55 percent chance (probability) of a major excessive heat event in any given year.

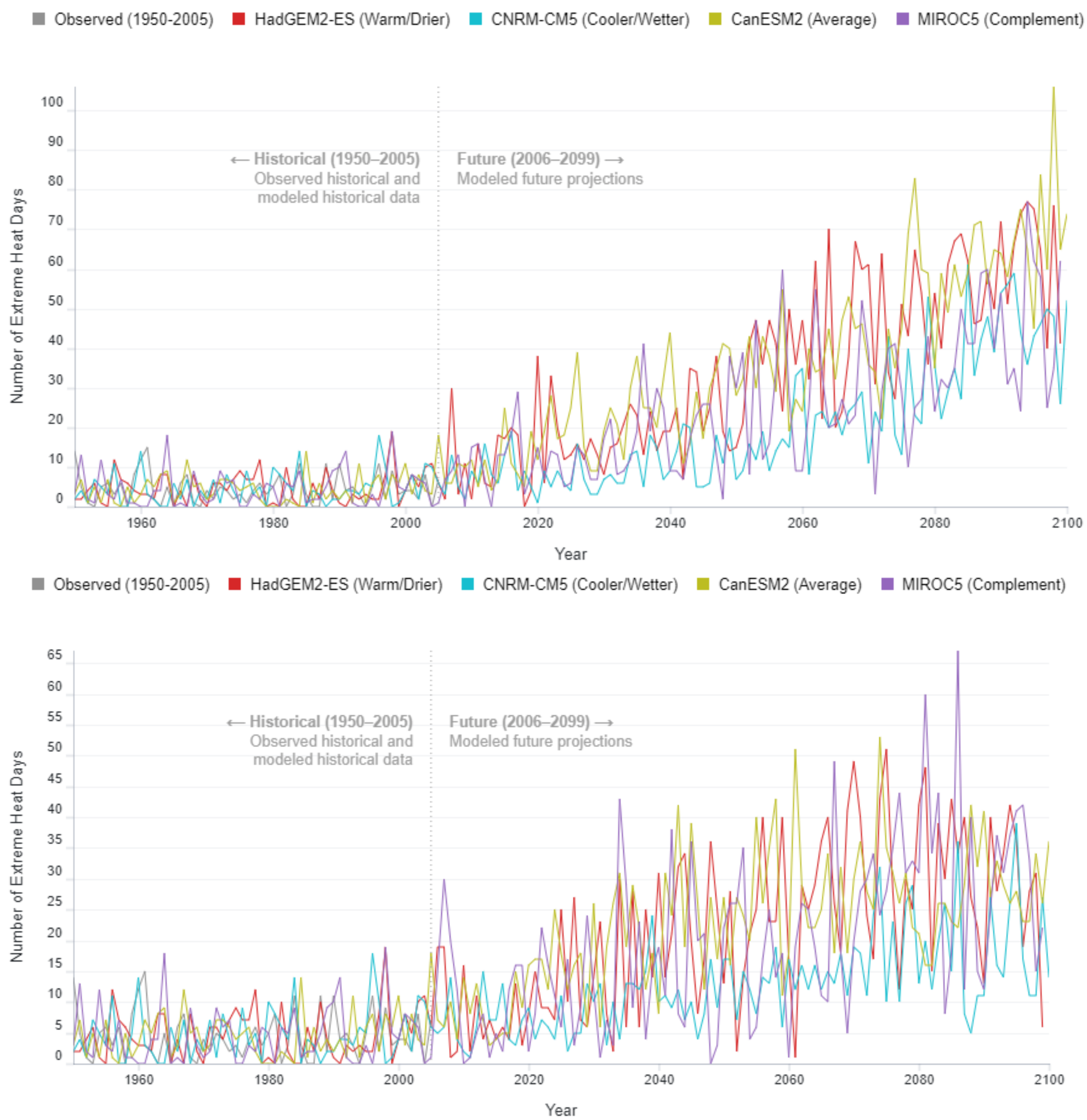
In the past, severe freezes have occurred every few years. Based on the NCEI data, seven frost and freeze events incidents occurred over a 22-year period, which equates to a major event every 3.1 years and a 32 percent chance of a major freeze event in any given year.

Climate Change Considerations

Heat waves will likely become more frequent, which will have a direct impact on human health in terms of heat-related illness. With the general trend of increased warming of average temperatures, extreme high temperatures will also increase. Cascading impacts include increased stress on water quantity and quality, degraded air quality, and increased potential for more severe or catastrophic natural events such as heavy rain, droughts, and wildfire. Another cascading impact includes increased duration and intensity of wildfires with warmer temperatures. According to the 2013 document, "*Preparing California for the Extreme Heat*", Cal-Adapt projects that throughout California urban and rural population centers will experience an average of 40 to 53 extreme heat days by 2050 and an average of 40 days by 2099; compared to a historical average of 4 per year (Cal-Adapt 2013). Cal-Adapt also projects that overall temperatures are expected to rise substantially throughout this century. Similarly, in the Draft Extreme Heat Action Plan, the daily maximum average temperature is expected to rise 4.4°F – 5.8°F by 2050 and 5.6°F – 8.8°F by 2100 (CNRA 2021).

Future temperature estimates from Cal-Adapt for the County under high and low emission scenarios are shown in Figure 4-21. The top graph shows the number of days per year when daily maximum temperature is above the extreme heat threshold of 101.2°F under the RCP 8.5 scenario (business as usual). The bottom graph shows the number of days per year when daily maximum temperature is above the extreme heat threshold of 101.2°F under the RCP 4.5 scenario.

Figure 4-21 Stanislaus County: Future Extreme Heat Days in High and Low Emission Scenarios



Source: Cal-Adapt 2021

A recent study on extreme heat released by the Union of Concern Scientists in July 2019 analyzed three global climate scenarios associated with different levels of heat-trapping emissions and future warming. The results of the analysis showed that with no actions taken to reduce heat-trapping emissions by mid-century (2036-2065) the average number of days per year in the United States with a heat index above 100°F will double, while the number of days per year above 105°F will quadruple.

Alternately, regarding extreme cold temperatures, a new study funded by NOAA Climate Program Office's Modeling, Analysis, Predictions and Projections (MAPP) program, used machine learning techniques and linked extreme cold weather in the United States to Arctic warming. Accelerated Arctic warming, known as Arctic amplification, has been evident since the 1990's as one of the more robust signs of global warming. MAPP program's researchers concluded that Arctic warming and climate change are likely contributing to the increasing frequency of Arctic polar vortex stretching events, which deliver extreme cold from the north pole to the United States and Canada, including one event that occurred before the winter 2021 in Texas when a cold wave caused the collapse of the state's infrastructure and resulted in approximately $80-130 billion in direct and indirect economic losses (Cohen et al 2021).)

Vulnerability Assessment

General Property

All property is vulnerable during severe weather events, but property and buildings are less likely to be vulnerable to extreme temperature events the same way as other severe weather events, like wind and hail can damage property. However, recent research indicates that the impact of extreme temperatures has been historically under-represented. The risks of extreme temperatures are often profiled as part of larger hazards, such as severe winter storms or drought. However, as temperature variances occur separate from larger hazards or outside of the expected seasons, it is important to examine them as stand-alone hazards. Extreme heat may overload demands for electricity due to the need to run air conditioners in homes and businesses during prolonged periods of exposure. Extreme heat may also be a secondary effect of droughts or may cause temporary drought-like conditions. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in vegetation, leading to higher wildland fire vulnerability for that time period even if the rest of the season is relatively moist.

Extreme cold temperatures impact structures when pipes or water mains freeze and burst, causing damage. Cold temperatures can also, in the most extreme of circumstances, make materials more fragile and breakable. Extreme cold temperatures may also lead to higher electricity and natural gas demands to maintain appropriate indoor heating levels combined with damages caused to the delivery infrastructure such as frozen lines and pipes. Cold temperatures may also impact transportation. Exposed populations may be at risk while waiting for public transportation, particularly when combined with wind chill, and some vehicles may not start which impacts the commute of the workforce and, in worst-case scenarios, the movement of emergency services personnel.

People

Recent research indicates that the impact of extreme temperatures, particularly on vulnerable populations has been historically under-represented. The risks of extreme temperatures are often profiled as part of larger hazards, such as drought, severe weather, or wildfire. Extreme temperatures may present health concerns to individuals that work outside in extreme temperatures. Extreme temperatures can also cause serious injury or death. During periods of extreme temperatures, inadequate protection from and exposure to harsh elements is especially dangerous. Moreover, elevated temperatures have the potential to increase the rate of ground-level ozone formation. Ground-level ozone can lead to urban smog which has adverse health effects including difficulty breathing, shortness of breath, coughing and sore or scratchy throat, aggravation of lung diseases such as asthma, emphysema, and chronic bronchitis, and increased susceptibility to vector-borne diseases

Social Vulnerability

Traditionally, the very young and very old are considered at higher risk to the effects of extreme temperatures, as are people in poor physical health; but any populations outdoors in the weather are exposed, including otherwise young and healthy adults and persons experiencing homelessness. Arguably, the young-and-otherwise-healthy demographic may be more exposed and experience a higher vulnerability because of the increased likelihood that they will be out in the extreme temperature, whether due to commuting for work or school, working outdoors such as construction, utilities, snow removal, or for recreational reasons. While everyone is vulnerable to extreme temperature incidents, some populations are more vulnerable than others. For example, extreme heat poses the greatest danger for Stanislaus County's outdoor laborers, who support the County's agriculture economy and are exposed to extreme temperatures and are at higher risk of heat-related illnesses than other populations of the County. In short, climate-vulnerable communities will experience the worst of these effects. Additionally, according to the Draft Extreme Heat Action Plan prepared by the State, heat risk is associated and correlated with physical, social, political, and economic factors (CNRA 2021). When combined with existing health inequities and poverty, linguistic isolation, and housing insecurities, this hazard puts individuals at a disproportionately high risk of heat-related illness.

Government Services

Extended power outages resulting from extreme temperature events affect the delivery of government services in the absence of backup power sources. Responders are as vulnerable to the effects of extreme temperature events as the general population and may receive increased calls during extended periods of such events. During an extended extreme temperature event, the public would expect alerts and warnings. For extreme heat events, the public would also expect the opening of cooling shelters by the government Similarly, the public should expect the opening of warming shelters by the government

Critical Facilities and Infrastructure

Extreme heat can affect road infrastructure, damaging and buckling road surfaces. Other direct impacts on critical infrastructure include power line sagging and power surges. Critical infrastructure such as water-pumping stations that rely on public utility systems that could be overloaded may result in impacts during extreme heat events. Extreme heat has also been shown to accelerate wear and tear on the natural gas system and electrical infrastructure (CNRA 2018a). Projected increases in summer demand associated with rising temperatures may increase risks to energy infrastructure and may exceed the capacity of existing substations and distribution line infrastructure and systems. Peak demand exceeding the local utility's capacity for supply can also lead to blackout or brownout conditions, or Public Safety Power Shutoffs (PSPS).

Similar to extreme heat events, the secondary impacts of extreme cold can also affect the supporting mechanisms or systems of a community's infrastructure. For example, when extreme cold is coupled with high winds or ice storms, power lines may be downed, resulting in an interruption in the transmission of that power and shutting down electric furnaces, which may lead to frozen pipes in homes and businesses.

Furthermore, the loss of utilities or power outages during extreme temperature events could result in adverse secondary impacts on sensitive populations. Electrical power outages may impact response capabilities or care capabilities for hospitals and clinics.

Economy

Extreme heat impacts on the economy may be more indirect compared to other hazards. Stanislaus County has a large agricultural economy. As noted previously outdoor laborers who are exposed to extreme heat and at a high risk of heat-related illnesses, and a long-term heat event could cause work interruptions. Crops are also impacted by heat events and could have an impact on the overall economy in the County. According to the USDA RMA Indemnity Report, since 2007 there have been 12,316 acres lost to heat resulting in $11,737,982 indemnity payment due to insured crop loss. There is an estimated $782,532 of annualized crop loss due to heat.

Prolonged freezing temperatures can also damage or destroy crops, affecting the economy and agricultural jobs in the County. According to the USDA RMA Indemnity Report, since 2007 there have been 28,830 acres lost to freeze/frost resulting in $22,429,754 indemnity payments due to insured crop loss. Annualized crop loss is estimated to be $1,602,125 due to freeze events.

Historic, Cultural and Natural Resources

Extreme heat may cause temporary drought-like conditions. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in vegetation, leading to higher wildfire vulnerability for that time period even if the rest of the season is relatively moist. Extreme cold can cause vegetation to freeze and cause high stress, leading to the decline and even disappearance of vegetation on or within landscapes.

Future Development

Since structures are not usually directly impacted by extreme temperature fluctuations, continued development is less impacted by this hazard than others in the plan. However, pre-emptive measures such as construction of green buildings that require less energy to heat and cool, use of good insulation on pipes and electric wirings, and smart construction of walkways, parking structures, and pedestrian zones that minimize exposure to severe temperatures may help increase the overall durability of the buildings and the community to temperature variations. Continued development also implies continued population growth, which raises the number of individuals potentially exposed to variations in temperature. Public education efforts should continue to help the population understand the risks and vulnerabilities of outdoor activities, property maintenance, and regular exposures during periods of extreme temperature events.

Risk Summary

- The average annual maximum temperature is 94.3°F and on average there are between 80 days per year above 90°F.
- The highest recorded temperature for the central portion of the County in Modesto is 113°F on July 23, 2006, while the lowest recorded temperature was 18°F on December 13, 1932.
- Extreme temperatures can have considerable impacts on human health, the natural environment, and the economy.
- 40 excessive heat and heat events incidents over a 23-year period equate to a major event every 1.8 years and a 55 percent chance of a major excessive heat event in any given year.
- Seven frost and freeze events incidents over a 22-year period equate to a major event every 3.14 years and a 32 percent chance of a major frost/freeze event in any given year.
- California's urban and rural population centers will experience an average of 40 to 53 extreme heat days by 2050 and an average of 40 days by 2099; compared to a historical average of 4 per year. Overall temperatures are also expected to rise substantially throughout this century. The daily maximum average temperature is expected to rise 4.4°F – 5.8°F by 2050 and 5.6°F – 8.8°F by 2100.
- Extreme temperatures can have considerable impacts on human health, the natural environment, and the economy.
- The County's agriculture economy is at risk of extreme temperatures from outdoor laborers being vulnerable to heat illnesses as well as crop losses due to heat and freeze and frost.
- Since 2007 there have been 41,146 acres of crop lost to extreme temperatures and a combined $34,167,736 indemnity payments made for insured crop loss to due freeze/frost and heat events.
- The very young, the very old, people with poor physical health and those experiencing homelessness are more susceptible to the impacts of extreme temperatures.
- Climate change is expected to result in higher average temperatures and more extreme heat events in the Central Valley and have a "*high*" influence on the number of extreme heat days; climate change is also expected to result in more extreme cold events in the US.
- The significance of extreme temperatures in the County is **Medium.**
- **Related hazards** – Agricultural Pest and Disease, Drought, Wildfire

Table 4-53 Hazard Risk Summary – Extreme Temperatures: Freeze and Extreme Heat

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Highly Likely	Critical	Medium	Yes
City of Ceres	Extensive	Highly Likely	Critical	Medium	No
City of Hughson	Extensive	Highly Likely	Limited	Medium	Yes
City of Modesto	Significant	Highly Likely	Critical	High	No
City of Newman	Extensive	Highly Likely	Critical	Medium	Yes
City of Oakdale	Extensive	Highly Likely	Critical	Medium	No
City of Patterson	Extensive	Highly Likely	Critical	Medium	Yes
City of Riverbank	Extensive	Highly Likely	Critical	Medium	No
City of Turlock	Significant	Highly Likely	Critical	High	Yes

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
City of Waterford	Extensive	Highly Likely	Critical	Medium	No
County Office of Education	Extensive	Highly Likely	Critical	Medium	No

4.3.8 Flood

Hazard Description

A flood is the temporary inundation of water or mud on normally dry land. Heavy or prolonged rain or dam collapse can cause inundation, as can flash floods. Urban flooding occurs in developed areas where the amount of water generated from rainfall and runoff exceeds the storm water systems' capacity. As land is converted from agricultural to urban uses, it often loses its ability to absorb rainfall. Rain flows over impervious surfaces such as concrete and asphalt and into nearby storm sewers and streams. This runoff can result in the rapid rise of floodwaters. During urban floods, streets can become inundated, and storm drains often back up because of the volume of water and become blocked by vegetative debris like yard waste, which can cause additional flooding. Development in or near the floodplain puts lives and property at risk. Flood damage can include structure inundation, erosion of stream banks, road embankments, foundations footings for bridges, impact damage from debris, blockage of infrastructure, cropland destruction, sewage releases from damaged tanks, and economic loss to agriculture.

Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. Certain health hazards are common to flood events. Standing water and wet materials in structures can become breeding grounds for microorganisms such as bacteria, mold, and viruses. This can cause disease, trigger allergic reactions, and damage materials long after the flood. When floodwaters contain sewage or decaying animal carcasses, infectious disease becomes a concern. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts.

Floodplains are defined as the areas immediately adjacent to a channel from a river, stream, or other waterway. Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage and based on FEMA guidelines, the floodplain most often refers to the area that is inundated by the 100-year flood, or the flood that has a one percent chance occurrence in any given year of being equaled or exceeded. The 1%-annual-chance flood is the national minimum standard to which communities regulate their floodplains through the FEMA National Flood Insurance Program (NFIP). The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. A 0.2%-annual-chance flood event would be slightly deeper and cover a greater area than a 1%-annual-chance flood event. The potential for flooding can change and increase through various land use changes and changes to land surface, which may result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

A levee is a raised area that runs along the banks of a river or canal. Levees reinforce the banks and help prevent flooding. By confining the flow, levees can also increase the speed of the water. Levees can be natural or manmade. A natural levee is formed when sediment settles on the riverbank, raising the level of the land around the river. To construct a manmade levee, workers pile dirt or concrete along the riverbanks, creating an embankment. This embankment is flat at the top, and slopes at an angle down to the water. For added strength, sandbags are sometimes placed over dirt embankments.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe flood events. Levees reduce, not eliminate, the risk to individuals and structure behind them. A levee system failure or overtopping can create severe flooding and high-water velocities. It is important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Riverine flooding – Riverine flooding, defined as the condition when a watercourse (e.g. river or channel) exceeds its "*bank-full*" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. Intense storms can overwhelm the local waterways as well as the integrity of any flood control structures. The warning time associated with slow rise floods assists in life and property protection.

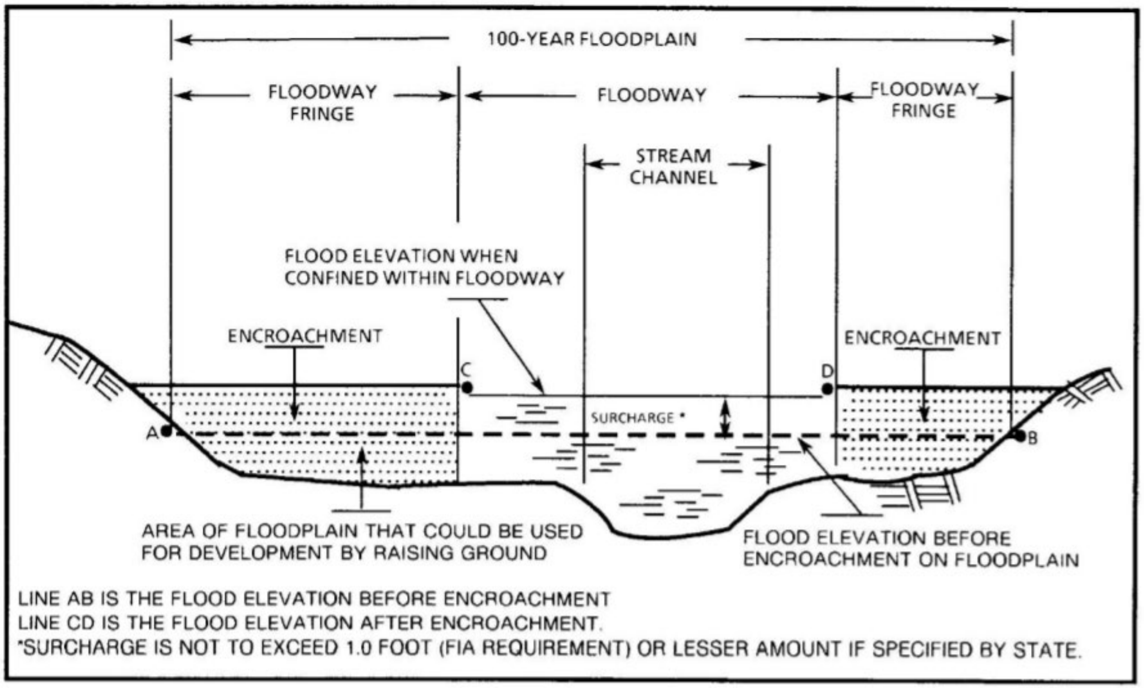
Localized flooding – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems.

Levee Failure – Flooding from the failure of levees throughout the County or upstream is also of concern, as there are levees along various waterways in Stanislaus, specifically along the San Joaquin River Flood Control System. A catastrophic flood control structural failure could easily overwhelm local response capabilities to save lives and require mass evacuations. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Loss of life could result, and there could be associated health concerns as well as negative effects to local buildings and infrastructure.

The potential for flooding can change and increase through various land use changes and changes to land surface, which result in changes to the floodplain. Environmental changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Encroachment into areas subject to inundation by floodwaters having rapid flows aggravates the risk of flood damage and heightens potential flood hazards by further increasing velocities. To reduce the risk of property damage in areas where the stream flows are high, the community may wish to restrict development in areas outside the floodway. FEMA defines a regulatory floodway as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water-surface elevation more than a designated height. The floodway is illustrated in Figure 4-22 below. The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in the following schematic.

Figure 4-22 Floodway Schematic



Source: Guidance for Flood Risk Analysis and Mapping – FEMA, 2019

Geographic Area

Significant – Stanislaus County is located within the San Joaquin River watershed. The San Joaquin River is one of the longest rivers in Central California after the Sacramento River. The 366-mile long river starts in the Sierra Nevada and flows through the agricultural region of the Northern San Joaquin Valley, where it meets up with the Sacramento River at the Sacramento-San Joaquin Delta, a 1,000-sqaure mile system of channels and islands that drains more than 40 percent of the State's lands. It eventually flows through to Suisun Bay, San Francisco Bay, and the Pacific Ocean.

An important source of irrigation water as well as a wildlife corridor, the San Joaquin is among the most heavily dammed and diverted of California's rivers. Over the length of the San Joaquin River is fed by many other rivers and streams, and most notably the Stanislaus and Tuolumne rivers in Stanislaus County. Surface water from the San Joaquin River is also stored and diverted within the watershed. Most of the surface water in the upper San Joaquin River is stored and diverted at Millerton Lakes Friant Dam near Fresno In the central portion of the watershed, many agricultural and municipal users received water from irrigation districts, such as the Modesto, Merced, Oakdale, South San Joaquin, and Turlock Irrigation Districts. These river system tributaries and surface water diversions are further described below.

Tuolumne River

The Tuolumne River flows for 149 miles through Central California, from the high Sierra Nevada and joins the San Joaquin River in the Central Valley. Originating at over 8,000 feet above sea level in Yosemite National Park, the Tuolumne drains a rugged watershed of 1,958 square miles, carving a series of canyons through the western slope of the Sierra.

There are various flood controls along the Tuolumne River, but flooding has happened in the past and is a risk for urban development in Stanislaus County. Due in large part to Don Pedro Dam, authorities have flood controls in place on the Tuolumne River. For example, TID can regulate the number of flows going through the river to mitigate possible floods, however additional flood storage space is needed. Along the Tuolumne River, it takes a lot of rain and snowmelt to impact the storage capacity of Don Pedro Reservoir to the point where it starts impacting downstream residents and property, however 100-year flood events and variability in snowpack and precipitation due to climate change can potentially impact these flood controls thereby limiting the protection of downstream communities. When flood events do occur, most of the impacts occur in the downtown Modesto area where there are some low-lying trailer parks along the

Tuolumne River, near 9th Street and according to the HMPC at the Sutter Wastewater Treatment Plant (WWTP) located downstream of Highway 99. (abc10 2019)

New Don Pedro Dam

New Don Pedro Dam is an earthen embankment dam across the Tuolumne River, about two miles northeast of La Grange, in Tuolumne County. The dam provides irrigation water storage, flood control and hydroelectricity production, and impounds Don Pedro Reservoir in the foothills of the Sierra Nevada. New Don Pedro Dam is owned and operated by the MID and TID.

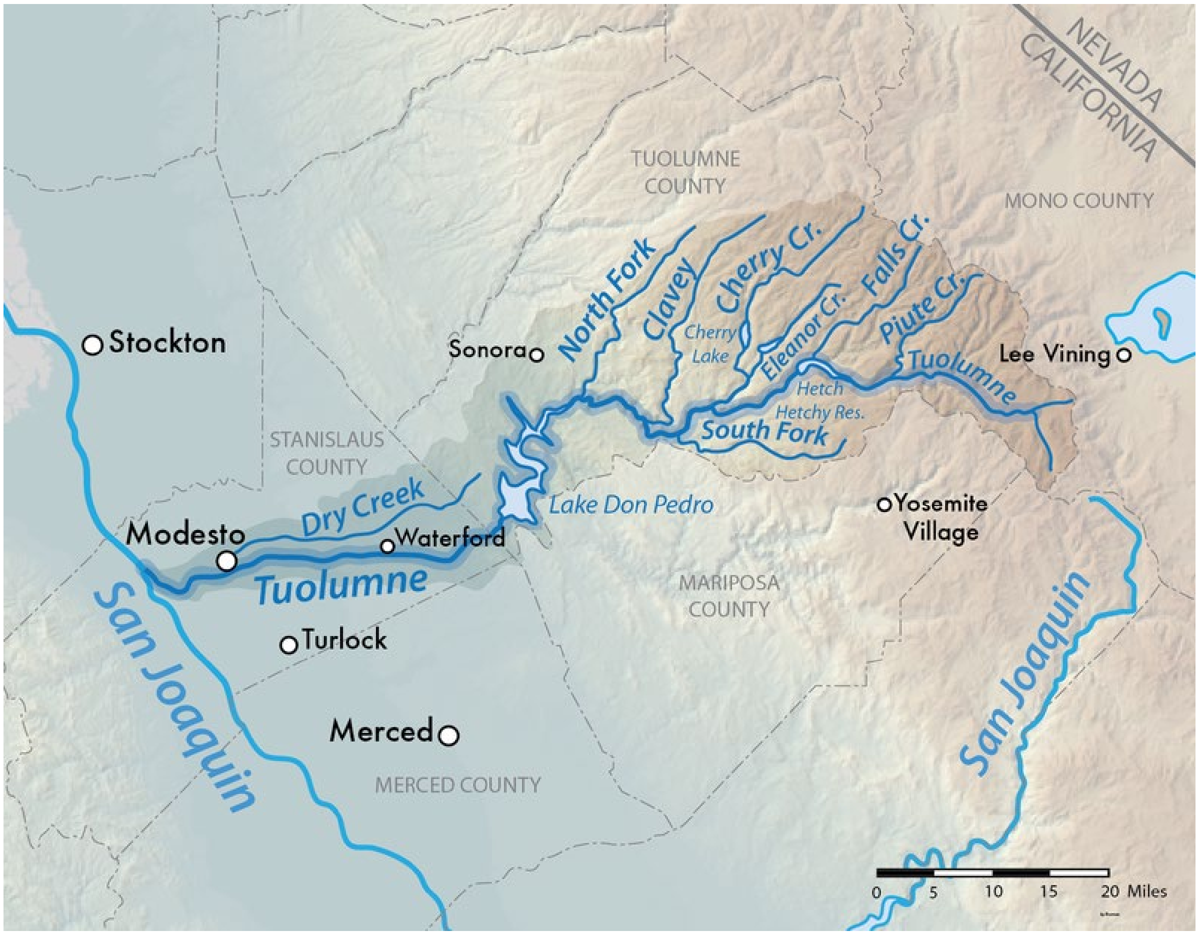
The Don Pedro Reservoir has a capacity of 2,030,000 acre-feet, of which 340,000 acre-feet is reserved for flood control and 1,381,000 acre-feet is available for irrigation, municipal water supply, and hydroelectric generation. The flood control reservation is one of the smallest among major California reservoirs because it allows for more water to be stored for power generation, but this has often resulted in inadequate flood protection such as in 1997 when the dam released more than 50,000 cubic feet per second (cfs) – almost six times the capacity of downstream levees.

In 2017, the Don Pedro spillway was opened for the first time in nearly 20 years. When the spillway opened, authorities were expecting flows between 18,000 and 30,000 cfs, but actual flow releases did not near 30,000 cfs and instead topped at a little above 19,000 cfs, but generally stayed at 15,000 cfs (TID 2017). Flooding did not pose much of an impact to some residential areas; however, several mobile home communities in the County were impacted. Before the spillway opened, TID, the area's provider for water and power, cut the power to some in the area homes because of the increasing water levels.

The 1997 January storms resulted in a 100-year flood. It set a record height for Tuolumne River at 71 feet above mean sea level (msl) and had flows around 60,000 cfs. Don Pedro Dam had filled up and began uncontrolled releases. The uncontrolled releases and the uncontrolled flows from Dry Creek stream overwhelmed levees and induced massive flooding directly into the Tuolumne and San Joaquin Rivers. Extensive flooding eventually impacted the City of Modesto (Stanislaus County 2019). As noted in the 2017 LHMP, regulation of the flows from Don Pedro limits flooding along the Tuolumne River but does not completely eliminate it (Stanislaus County 2017).

Figure 4-23 below shows Tuolumne River with relation to the Cities of Modesto, Turlock, and Waterford, as well as the Lake Don Pedro, also referred to as Don Pedro Reservoir.

Figure 4-23 Tuolumne River



Source: USGS

Stanislaus River

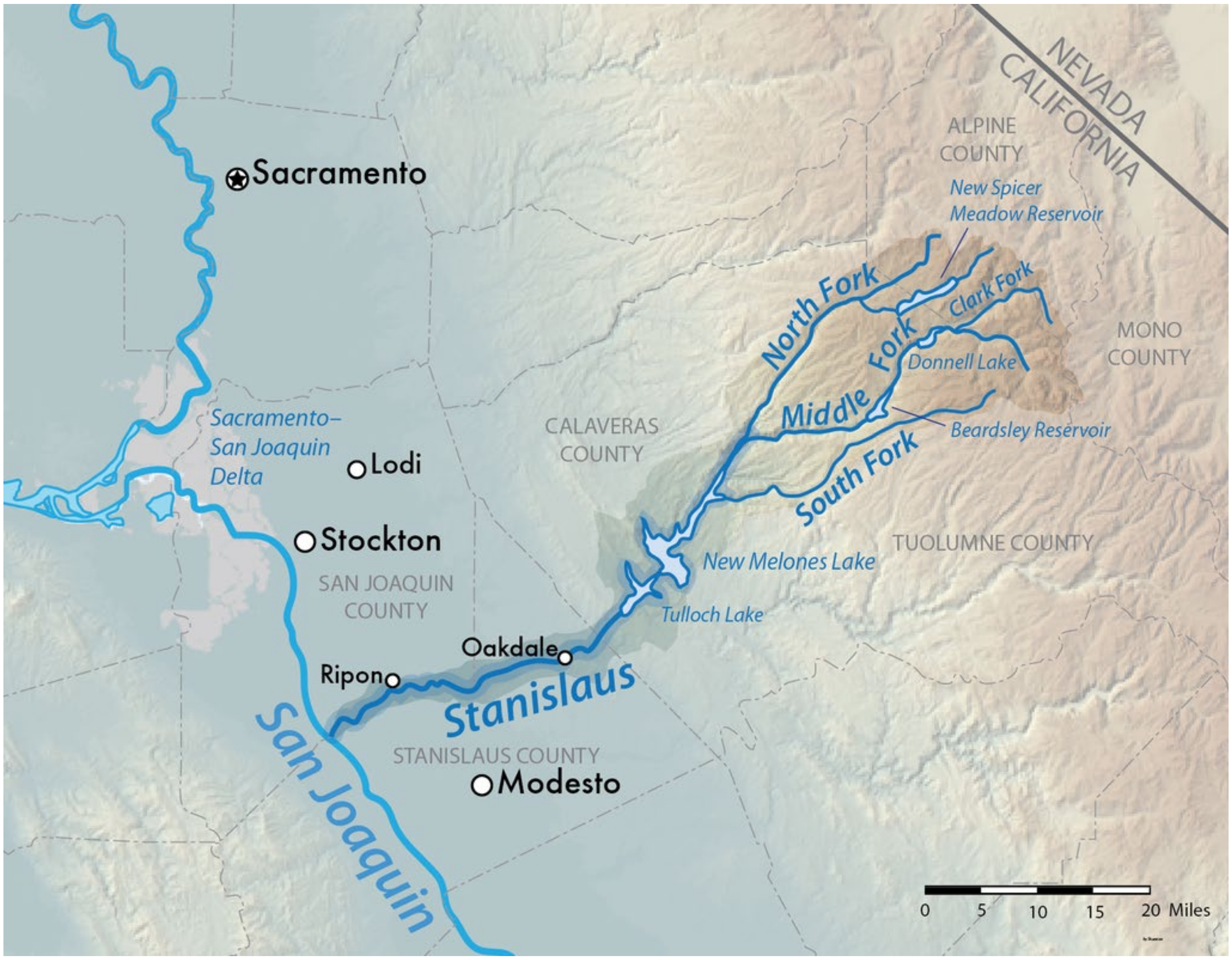
The Stanislaus River is a tributary of the San Joaquin River. The main stem of the river is 96 miles long and measured to its furthest headwaters it is about 150 miles long. Stanislaus River drains parts of five counties. The Stanislaus River is known for its swift rapids and scenic canyons in the upper reaches, and is heavily used for irrigation, hydroelectricity, and domestic water supply.

New Melones Dam

New Melones Dam is an earth and rock filled embankment dam on the Stanislaus River, about 5 miles west of Jamestown, on the border of Calaveras County and Tuolumne County. The water impounded by the 625-feet tall dam forms New Melones Lake, California's fourth largest reservoir in the foothills of the Sierra Nevada east of the San Joaquin Valley. The dam serves mainly for irrigation water supply, and also provides hydropower generation, flood control, and recreation benefits.

New Melones Lake, when at full pool of 1,088 ft above msl, encompasses 12,500 acres of surface water and a volume of 2,400,000 acre-feet. About 450,000 acre-feet, 19 percent of the reservoir's capacity, is reserved for flood control. During flooding events, the dam is operated to keep flows on the Stanislaus River below 8,000 cu ft/s, although this flow estimate may be lowered depending on flow conditions in the San Joaquin River. Between 1978 and 2010 the dam prevented a total of $505 million in flooding damages (adjusted for inflation), including $231 million during the New Year's flood of 1997 (US Bureau of Reclamation 2010). As a primary flood control structure, it would protect 35,000 acres (14,000 ha) of farmland as well as the towns of Oakdale, Riverbank and Ripon from flooding. Figure 4-24 below shows Stanislaus River with relation to Modesto and Oakdale, as well as the New Melones Lake.

Figure 4-24 Stanislaus River



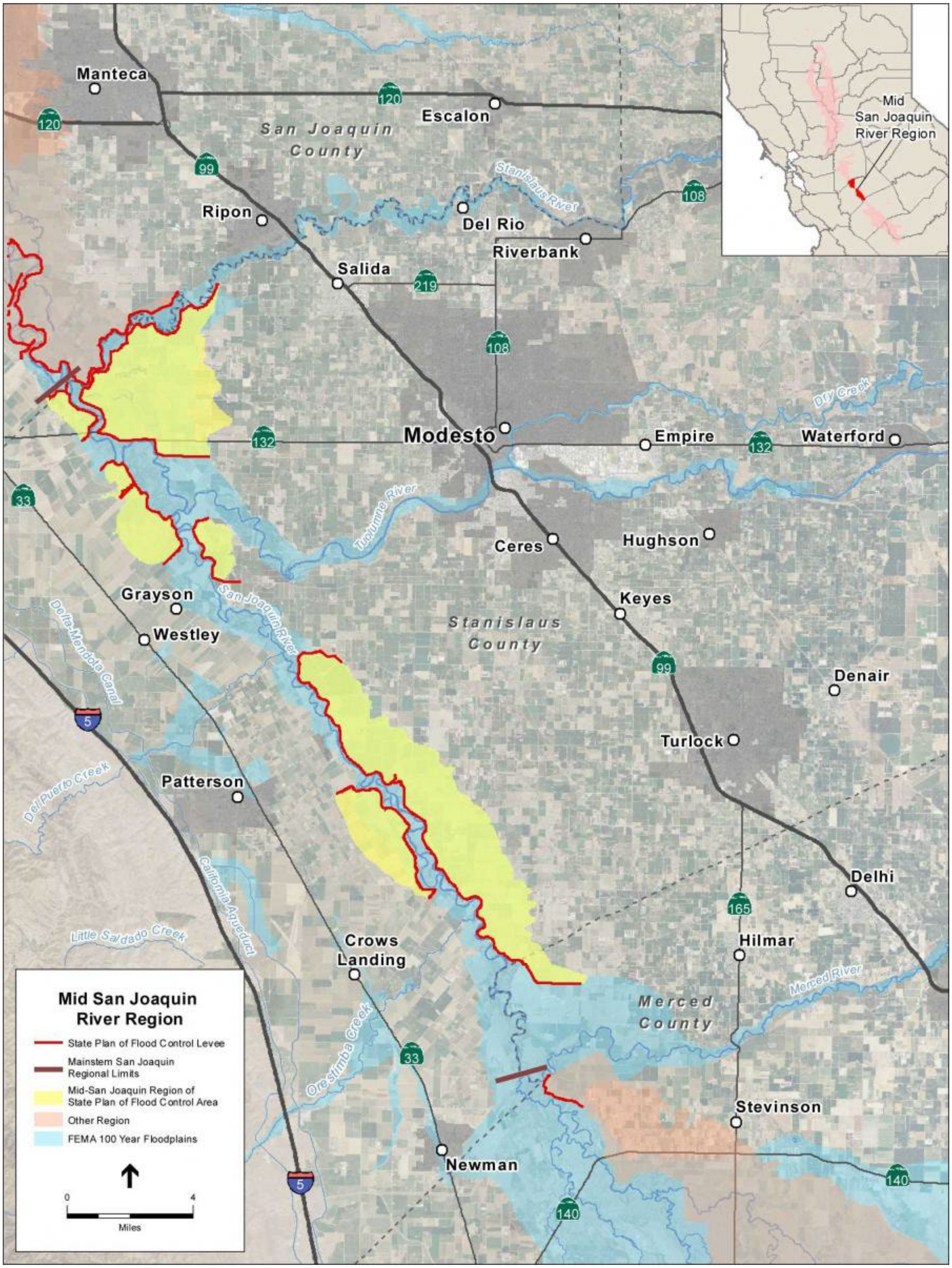
Source: USGS

Mid San Joaquin River

The Mid San Joaquin River region extends from the Merced-San Joaquin River confluence to the Stanislaus -San Joaquin River confluence. Any areas protected by the State Plan of flood control facilities, and other areas that experience flooding are connected to the State flood control facilities are included in the *Mid San Joaquin River Regional Flood Management Plan (MSJR RFMP).* The MSJR RFMP was first developed in 2013-2014, updated in 2017, and is currently being updated in 2022 through the participation of a range of stakeholders primarily from Stanislaus County. This regional planning effort was created to give stakeholders the opportunity to develop a plan to reduce flood risks in the area from the confluence of the Merced and the San Joaquin Rivers to the confluence of the Stanislaus and the San Joaquin Rivers. The result of these efforts is a vision for a safer and more flood-resilient region that identifies challenges and opportunities for flood management and a prioritized list of actions for DWR to consider in their Central Valley Flood Protection Plan (CVFPP). The MSJR RFMP also identifies priority flood protection projects to be carried out by local sponsors. The HMPC consisted of a stakeholder from the MSJR team, which consists of representation from the DWR, Reclamation District 2092, Stanislaus County, and consultant staff.

Millions of dollars have been raised by local sponsors from a variety of state, federal and other sources to implement the flood control projects. The major focuses of MSJR RFMP include identifying new projects consistent with regional flood management goals and state polices, ways to improve regional coordination of flood management and ways to improve regional resilience to evolving flood hazards. Figure 4-25 below shows the flood control area of MSJR RFMP.

Figure 4-25 Mid San Joaquin River Regional Flood Management Plan - Flood Control Area



Data source: MSJR RFMP

Dry Creek

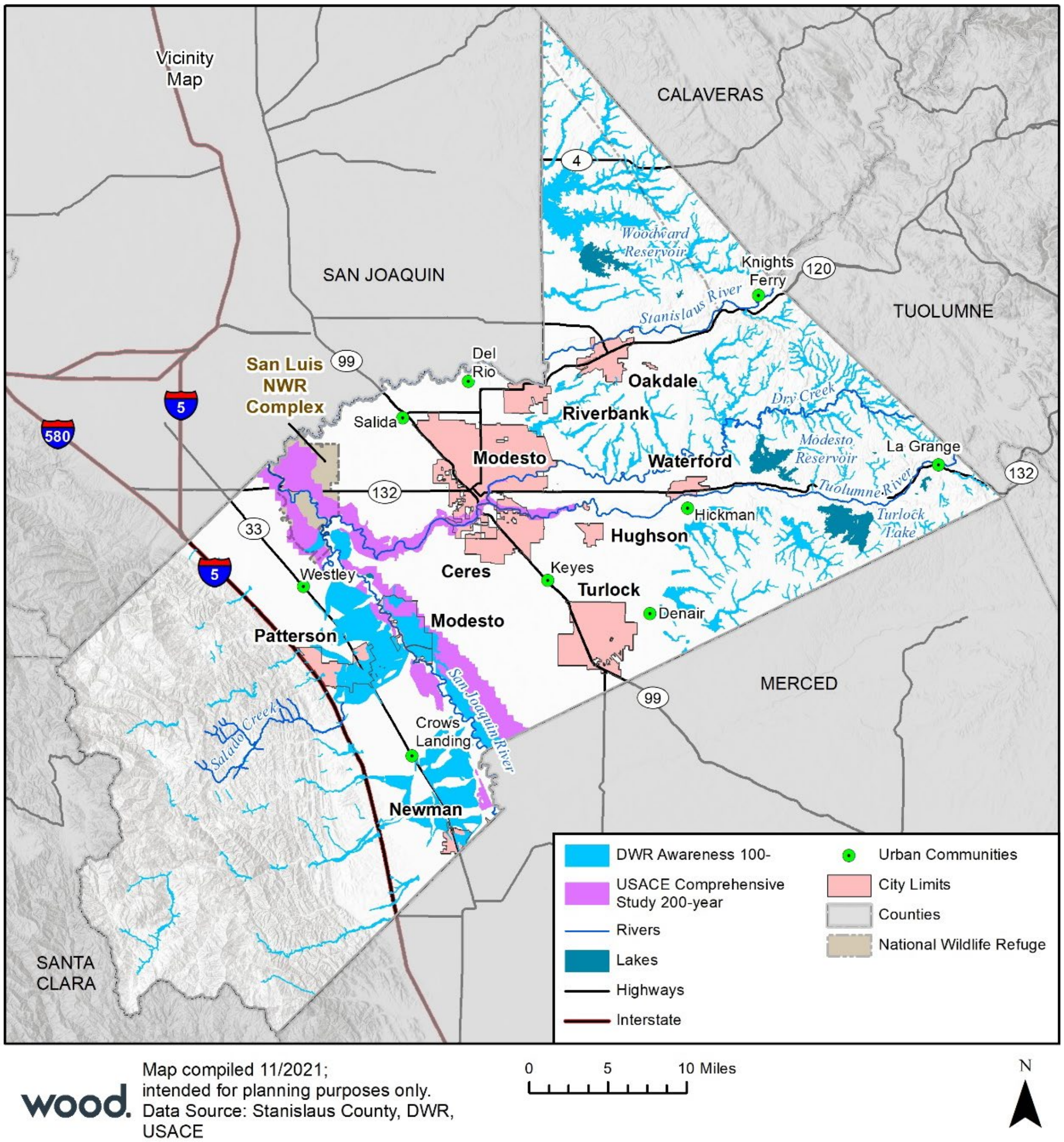
Dry Creek is a stream in Stanislaus County and is a tributary to the Tuolumne River. Dry Creek originates just north of the Modesto Reservoir. It then flows north of the City of Waterford. Continuing west, it flows through Modesto. Dry Creek has been historically subject to flooding the San Joaquin Valley in the vicinity of present-day Modesto. Dry Creek traverses the City of Modesto. Because there are no flood control structures along Dry Creek, such as a dam, this waterway has a higher probability of flooding than the other major rivers in the region (Modesto Bee 2021). The Stanislaus County 2017 LHMP also mentioned that Dry Creek exhibits seasonal flooding threat.

Central Valley Flood Protection Plan (CVFPP)

The physical risks associated with potential flooding and the regulatory requirements for floodplain management are important considerations when decisions are being made regarding future land use throughout the County. Those same risks guide the local and community-level emergency response needs. Economic growth and prosperity in Stanislaus County are dependent upon federal, state, and local agency involvement on regional and local flood management systems. Flood protection regulations within California have been increased over the past few years through legislation. This legislation included the requirement for the California DWR and Central Valley Flood Protection Board (CVFPB) to prepare and adopt the CVFPP by 2012 and update every 5 years. The legislation also established certain flood protection requirements for local land use decision-making based on the CVFPP. The law sets a higher standard for flood protection for the entire San Joaquin Valley. The standard was set for an urban level flood protection necessary to withstand a 1 in 200 chance of a flood event occurring in any given year (200-year flood) for areas developed or planned to have a population of at least 10,000. It also requires impacted counties to collaborate with cities to develop flood emergency response plans.

Figure 4-26 shows the extent of a 200-year flood event based on the Comprehensive Study compiled by USACE. This map includes a 100-year flood event layer compiled by DWR's Awareness Floodplain Mapping project. Both data layers come from the Best Available Maps (BAM) developed and compiled by DWR.

Figure 4-26 Stanislaus County DWR & Comprehensive Flood Hazards



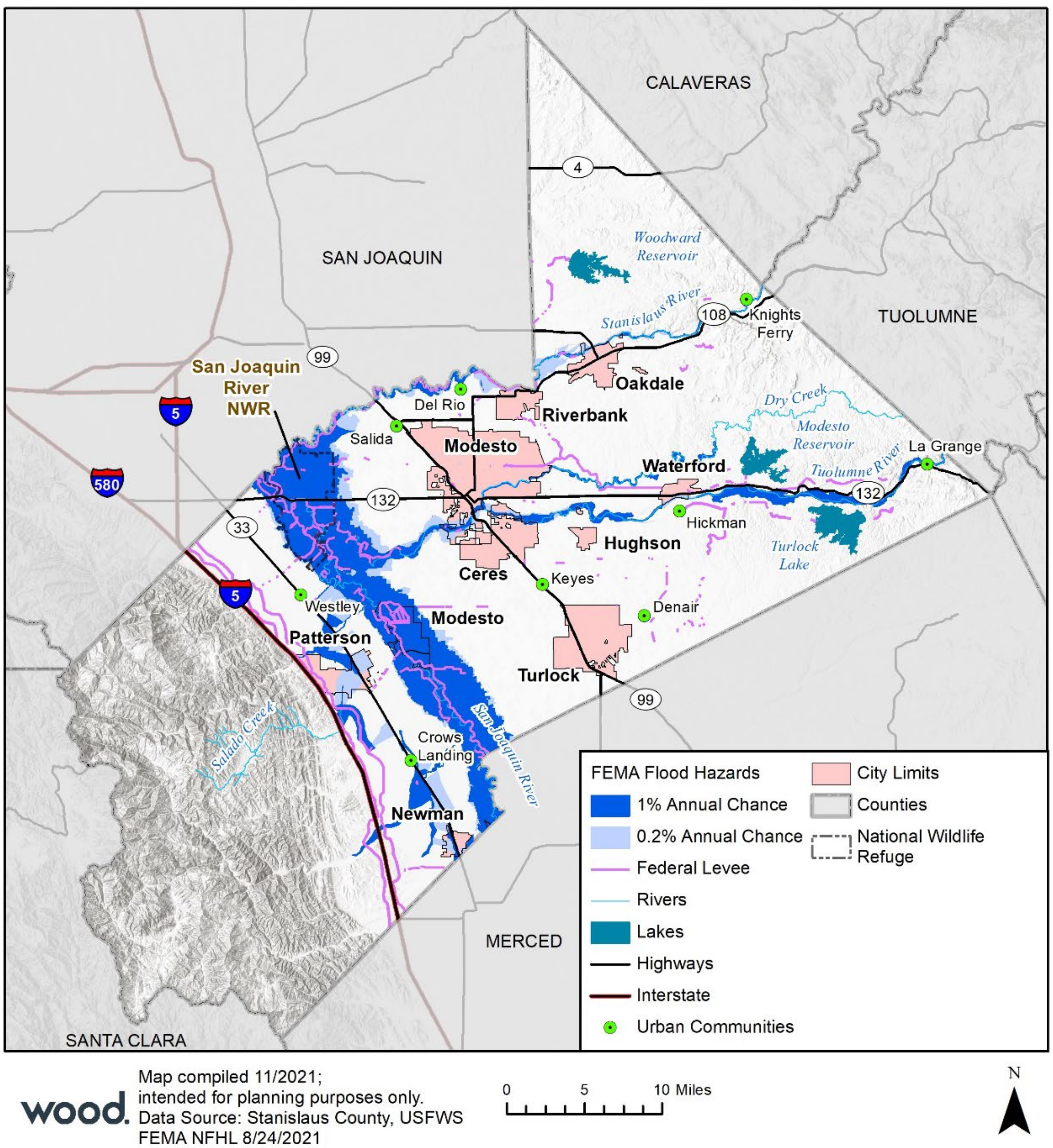
In 2009, FEMA completed their Digital Flood Insurance Rate Map (DFIRM) conversion and updated a number of flood zone areas using 2005 levee certification criteria. On July 27, 2020, FEMA released the updated FIRMs for Stanislaus County. In 2007, the California DWR completed their Awareness Floodplain Mapping of Stanislaus County to identify all pertinent flood hazard areas that are not mapped under FEMA's program, which provides an additional resource for identifying special flood hazard areas within the County.

Extent (Magnitude/Severity)

Critical – Flooding has been a major problem throughout the history of Stanislaus County, particularly with the encroachment of urban growth into flood plains. Major floods have occurred in 1861, 1938, 1950, 1955, 1969, 1983, 1995, 1997, and 1998. Minor flooding occurred in 2006 with limited impacts to County property. The Central Valley Flood Protection Board (known as the Reclamation Board prior to 2007) has identified and adopted designated floodways, defined in feet per second of flow, along the San Joaquin River, Stanislaus River, Tuolumne River, and portions of Dry Creek. Seasonal flooding along Dry Creek, San Joaquin River and Tuolumne River is common during very wet years or periods.

The FEMA Flood Insurance Rate Map (FIRM) provides information on flood risk in Stanislaus County using 100 and 500-year floodplain GIS mapping layers. Areas within the 100-year floodplain zone have a 1% annual exceedance probability of flood, meaning a flood has a 1% chance of being equaled or exceeded in any single year in those areas. Areas between the limits of the 100-year and 500-year floodplain zone have a 0.2% annual chance of flooding. A portion of Stanislaus County continues to be subject to inundation during flood events, as approximately 100,447 acres have been determined to be in the FEMA floodplain. The extent of the floodplain is shown in Figure 4-27. The 100-year and 500-year floodplains combined cover 10.3% of the County. Therefore, a potential flood hazard would threaten a significant geographic area (10% – 50%) of the County, and if a flood event would occur the damage associated with flooding could impact between 20% to 50% of the property.

Figure 4-27 Stanislaus County 100-year and 500-year Floodplain



The Department of Housing and Urban Development (HUD) has also developed flood hazard zones, which are referenced in the County's Flood Control Ordinance and used for insurance purposes. Any non-agricultural encroachment into these areas requires special permits that are difficult to obtain and often costly to implement. Permits for encroachment into the designated floodways must be obtained from the Central Valley Flood Protection Board. The County administers other permits. These measures still do not control flood hazards for existing development. Information regarding flood-prone areas as shown on the HUD maps is available in the Department of Public Works.

Life and property loss could occur as well as damage to agricultural land. Road and bridge closures, and communication systems may cause disruption to normal process. Population most vulnerable are those residents living in low-lying trailer parks along the rivers and those experiencing homelessness. There is usually sufficient time to alert and warn those that may be affected. There are no County buildings or historical buildings located in these areas. The Sutter WWTP in the City of Modesto could also experience problems should flood waters rise given its proximity to the floodplain.

As mentioned previously, the 1997 flood was one of the worst flood events that occurred in Stanislaus County and the Northern San Joaquin Valley. Precipitation in the Sierra Nevada Mountain range produced an above-normal snowpack and saturated soils during November and December 1996. A series of storms from December 29, 1996, through January 4, 1997, brought heavy and relatively warm precipitation across much of California. Precipitation totals of up to 24 inches were recorded for the week. Virtually all of this precipitation was rain because temperatures were above freezing at elevations as high as about 9,000 feet. Rainfall on snow and saturated soils caused rapid runoff and widespread flooding in the major drainage basins. Most flooding occurred near the tributaries and main channels of the Sacramento and San Joaquin Rivers. Localized flooding from intense rainfall was widespread throughout Northern California. Total flood damages in 1997, including damage to flood control structures, were estimated at nearly $2 billion dollars. This was the highest amount of flood damage in the State's history at the time. Disaster areas were declared in 48 of California's 58 counties (USGS 1999).

Previous Occurrences

Between 1992 and 2002, every county in California was declared a federal disaster area at least once for a flooding event. California has a repetitive and destructive flood history. Of the 336 federally declared disasters in California between 1950 and 2021, 37 were flood related. This makes flooding second only to fire in the number of federal disaster declarations in the State. Historically, floods have been the second most frequent cause of disaster in Stanislaus County.

According to the 2017 Stanislaus County LHMP, there have been clusters of flooding incidents within the County approximately every 14 years. Stanislaus County has had three flood events that were federally declared disasters, once in 1964, once in 1969 and again in 2017. FEMA's Flood Insurance Study also listed flooding events in 1938, 1950, 1955, 1958, 1969, 1973, and 1997. Additionally, NOAA's NCEI database lists 12 flood or flash flood events which have occurred in the County between 1950 and 2021. Table 4-54 below highlights several notable flood events in the County that resulted in significant damages or involved federal disaster declarations.

Table 4-54 Major Floods in Stanislaus County

Date of Event	Incident Description
December 1964 – January 1965	The Christmas flood of 1964 was a major flood in the United States' Pacific Northwest and some of Northern California between December 18, 1964, and January 7, 1965, spanning the Christmas holiday. Considered a 100-year flood, it was the worst flood in recorded history on nearly every major stream and river in Northern California. California Governor Pat Brown was quoted as saying that a flood of similar proportions could "*happen only once in 1,000 years*," and it was often referred to later as the Thousand Year Flood. Governor Brown declared 34 counties in the region disaster areas while Stanislaus County was one of them.
January and February 1969	The flood of 1969 was actually two distinct events – one the result of more than a week of rain in January 1969 and a subsequent flood from a second wave of rain the following month. The damage from these storms was a statewide event, with 35 of 58 California Counties being declared federal disaster areas. (The Press-Enterprise 2016)

Date of Event	Incident Description
December 22 – 23, 1996	Heavy rain, snow melt, and large reservoir releases in anticipation of more rain caused the Tuolumne River to rise about one foot above flood stage. According to NCEI, this event also resulted in $10,000 in property damage.
January 23 – 24, 2000	Persistent and heavy rain produced runoff which exceeded the capacity of a Salida neighborhood storm drain pond. The result flooded Doreen Court and a number of residences on the street. Four houses sustained interior flooding while an additional four homeowners sustained garage flooding. According to NCEI, this event also resulted in $20,000 in property damage.
January 1997	Several periods of rain (with snow to unusually low elevations in the mountains) beginning December 20, 1996, set up saturated conditions that finally gave way at the beginning of the month as subtropical air moved in and melted snow up to the 8000-foot level. The moist airmass also left huge amounts of additional rain in the valley, foothills, and mountains with its nearly ideal orographic enhancement conditions. A dry spell from the 3rd to the 11th allowed the flooding to subside in the Shasta-Cascades and the Sierra Nevada mountains, but flooding worsened in the valley below. As the runoff moved downstream and flood control dams operated at near maximum releases, stress on the Sacramento River and San Joaquin River levees resulted in numerous levee breaks, especially from the 4th to the 10th. The result was considerable inundation of the areas near the break. Heavy rains returned at the end of the month, beginning on the 22nd and lasting through the 27th. These storms were colder in nature, with flooding problems mainly in the foothills and valley floor. Levees continued to break in the Sacramento-San Joaquin River delta as the floodwaters headed out to San Francisco Bay. The variety and magnitude of the damage were huge. Besides five deaths in interior Northern California, at least 120,000 total people were evacuated. The flooding damaged or destroyed 20,000 homes and 1500 businesses, at a minimum, in the estimated 250 square miles that were inundated. Early estimates put the total bill for the State at $1.6 billion, much of it in interior Northern California. Infrastructure took the hardest hit, conservatively estimated at $400 million for roads and $300 million for flood control facilities. Agricultural damage is estimated at $250 million or more. Hardest hit included the artichoke and winter wheat crops, and the dairy industry, losing thousands of livestock drowned. The American Red Cross labeled the flooding a level 5 disaster--their highest rating.
January 1 – 3, 2006	A series of warm winter storms brought heavy rain, mudslides, flooding, and high winds to Northern California, resulting in levee overtopping and breaching as well as transportation being difficult throughout the area. A Stanislaus County woman died while crossing a flooding stream on foot. According to NCEI, this event also resulted in $100,000 in property damage.
April 14 – 15, 2006	Heavy rain from afternoon thunderstorms caused flooding in the Riverbend area of Modesto. Nearby areas had been flooded earlier in the week due to high river levels. Several houses and some local roads were flooded. According to NCEI, this event also resulted in $250,000 in property damage.
January and February 2017	During January and February 2017, three atmospheric river storm events swept across California, bringing high winds, substantial precipitation, and flooding, which has severely impacted counties throughout the State. On January 23, 2017, the Governor of the State of California proclaimed a state of emergency due to flood conditions in the State, specifically listing Stanislaus County one of the affected counties. At that time, rivers and creeks in Stanislaus County were at or near flood stage, and two residential communities adjacent to the San Joaquin River have been flooded and displaced numerous families. Numerous roads in Stanislaus County were flooded and were closed to traffic due to dangerous conditions. Stanislaus County also proclaimed local emergency.

Source: NCEI Storm Events Database, FEMA

Figure 4-28 shows past flooding in Stanislaus County from the 2017 floods.

Figure 4-28 Image of Past Flooding in Stanislaus County

Source: The Modesto Bee, Images of February 2017 flooding

Probability of Future Occurrences

Likely – Due to the history of past flooding events and the natural drainage pattern of the Planning Area, flooding in Stanislaus County is likely to continue to occur. The potential for failure of one of the many levees throughout the County could create more risk for flooding. The 100-year flood is the flood that has a one percent chance in any given year of being equaled or exceeded. Based on past events, flooding events less severe than a 100-year flood and those outside of the 100-year floodplain occur frequently during periods of heavy rains. According to the NCEI Storm Events Database, there have been 12 flood events recorded for Stanislaus County between 1950 and 2021. This means there is a 17% chance of a flood event occurring in a given year. Significant flooding occurs in Stanislaus County approximately every six years.

According to the 2017 Stanislaus County LHMP, flooding risks are present among several creeks and rivers, including Del Puerto Canyon, Dry Creek, Orestimba Creek, Salado Creek, San Joaquin River, Stanislaus River, and the Tuolumne River. The Dry Creek watershed is a major factor in flooding in eastern Stanislaus County and the east side of Modesto. The watershed was traditionally un-monitored and uncontrolled. To improve monitoring capabilities, in 2011 Stanislaus County purchased a Remote Automated Weather System (RAWS) to help monitor rainfall on the watershed near Crabtree Road. TID is now planning to install another weather station on the upper Dry Creek watershed to give further capabilities for managing this flood hazard. The MSJR planning group is also focused on increasing transitory storage on the San Joaquin River. Flooding on the San Joaquin generally impacts the west side of the County. Increased storage will help reduce seasonal flood threats as well as the impact of larger incidents.

Climate Change Considerations

California's Fourth Climate Assessment found that costs associated with direct climate change impacts by 2050 will be dominated by human mortality, coastal damage, and the potential for droughts and mega-floods (CNRA 2018). Scientific studies outlined in the same assessment indicated shifts in California's precipitation regime, which show more dry days, more dry years, a longer dry season, and increases in occasional heavy precipitation events and floods. Studies also project greater storm intensity with climate change, resulting in more direct runoff and flooding (CNRA 2018). As a result, high frequency flood events in conjunction with heavy precipitation events and extreme storm events will increase with climate change. Certain climate studies noted in the Fourth Climate Assessment also forecast that during periods with heavy rain and frequent storm events there is an increase in flood events, as well as landslide and debris flow (CNRA 2018). Storms have historically resulted in many secondary hazards, including numerous landslides and in some watersheds an increased sediment load. Also, with wildfires already being a problem in California, increasing periods of drought and lack of precipitation are expected to exacerbate conditions for fires to occur, and in turn worsen the potential for runoff and flooding associated with burned areas.

The Fourth Climate Assessment also includes nine reports for the nine regions in California. According to the preview for the San Joaquin Valley Region Summary Report, the frequency of catastrophic floods will increase in the coming years. This in turn will lead to increased stresses to agriculture, natural ecosystems, water resources, land use and community development, transportation, energy, public health, and climate justice. Further, the 2022 Central Valley Flood Protection Plan includes a technical analysis on climate change with new projects on climate-related flood risk in the San Joaquin Valley. Communities throughout the Central Valley are threatened by current and future effects of climate change on hydrology, such as increases in precipitation falling as rain instead of snow at higher elevations, extreme precipitation events influenced by atmospheric rivers, and runoff events that are expected to exceed the State's flood control system capacity (DWR 2022).

The 2022 CVFPP, which is the strategic blueprint for reducing Central Valley flood risk, highlights several impacts caused by climate change on flood risk in the Central Valley. Key risks summarized in the 2022 CVFPP included the number of people and structures at risk to flooding and economic damages in the Sacramento River Basin and the San Joaquin River Basin. For example, over a 50-year period (2022 through 2072) estimates of the annual lives lost more than doubles in the Sacramento River Basin and quadruples in the San Joaquin River Basin (DWR 2022). Also noted in the 2022 CVFPP is that socially vulnerable populations will bear a disproportionate share of adverse impacts of flooding, and research shows that recovery spending underserves these populations that need it the most. Poverty rates in Central Valley range from 10 percent to over 20 percent with higher poverty rates among children, seniors, Latinos, and less-educated adults (DWR 2022). This suggests that the socially vulnerable communities in the Central Valley face higher flood risk, particularly in the San Joaquin Valley. As mentioned in other sections of this plan, these communities often lack the resources to cope with and recovery from flood events without assistance.

The 2022 CVFPP integrates updated climate change analyses and a wider range of climate change projections to produce estimates of flood system performance at future points in time to provide flood managers with information on the potential impacts of climate change. Key findings from a technical analyses summary report that supports the 2022 CVFPP found that there will be increased warming across the planning area for all climate scenarios resulting in less below freezing temperatures, extreme precipitation is likely to intensify even with projections of overall drier conditions (this is the driver for most flood events and increase peak flows in winter and decrease flow in spring), and changes in flood magnitudes and frequencies of these events are projected to vary from the north to the south in the Central Valley (DWR 2022). Also, noted in the CVFPP is that watershed characteristics strongly influence the hydrological response to climate change, with the high-elevation San Joaquin watersheds showing the largest percentage increases in flood volumes because of a reduction in precipitation as snowfall and more rapid snowpack melting (DWR 2022). Additionally, during floods, reservoirs normally can release as much water as the downstream channels can safely accommodate. When inflows to a reservoir greatly exceed the reservoir storage capacity, dam safety concerns necessitate emergency operations to reduce storage and preserve the reservoir's structural integrity (DWR 2022). In turn, the emergency releases may exceed the downstream capacity. In summary, because climate change hydrology analysis indicates that peak flows may increase throughout the system and the majority of the increased runoff comes from the upstream portions of the reservoirs in the Sierra Nevada, there is a need to mitigate future flood risk above, at, and below reservoirs; improve forecasting; expand storage; modify outlets; and increase downstream floodplain capacity to improve the flexibility of overall floodplain management.

Vulnerability Assessment

While there are some benefits associated with flooding, such as the replenishment of sediments and nutrients to agricultural lands, it is considered a hazard to development in floodplains. Floods can cause many cascading effects. Fire can break out as a result of dysfunctional electrical equipment. Hazardous materials can also get into floodways, causing health concerns and polluted water supplies. In many instances during a flood, the drinking water supply will be contaminated.

General Property

Historically, Stanislaus County has been at risk to flooding primarily during the winter and spring months when river systems swell with heavier rainfall and runoff from winter snowmelt. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. But occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred in the past within the 100-year floodplain and in other localized areas in the County.

A flood vulnerability assessment was performed for Stanislaus County using the following GIS methodology. The County's parcel layer and associated assessor's building improvement valuation data were provided by the County and were used as the basis for the inventory. Stanislaus County's effective FEMA DFIRM dated August 24, 2021, was used as the hazard layer. A DFIRM is FEMA's flood risk data that depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events; this data is incorporated into the National Flood Hazard Layer (NFHL). Figure 4-28 summarizes the flood zones included on these maps.

Stanislaus County Assessor Parcel data was used to estimate flood hazard impacts to parcels with improvement values greater than zero. The parcels are then converted to centroid points. This method assumes that improved parcels have a structure of some type. FEMA's NFHL flood zones, with effective date August 24, 2021, were overlaid in GIS on the parcel centroid points to identify structures/parcels that would likely be inundated during a 1% annual chance and 0.2% annual chance flood event. This overlay is illustrated in Figure 4-28, and in more detail in the jurisdictional annexes.

Building improvement values and counts for those parcel centroid points were then extracted from the parcel/assessor's data and summed for the unincorporated county and jurisdictions. Results of the overlay analysis area shown in Table 4-55 for the 1% annual chance flood and Table 4-56 for 0.2% annual chance flood. The jurisdictional annexes provide more detailed information based on assessor property types. Property type refers to the land use of the parcel and includes Commercial, Industrial, Non-Assessable, Residential, Residential-Income, Rural Farm Agricultural, Unclassified, Vacant Commercial, and Vacant Residential. Contents values were estimated as a percentage of building values based on their occupancy type, using FEMA/Hazus estimated content replacement values. This includes 100% of the structure value for agricultural, commercial, non-assessable, and unclassified structures; 50% for residential structures; and 150% for industrial structures. Building and contents values were then totaled to obtain total exposure.

A loss estimate analysis was also performed based on depth damage functions developed by the Army Corp of Engineers and FEMA. The loss curves depict the expected flood losses associated with the depth of flooding at a structure. There are different depth damage curves for structure and content losses. For the purposes of this analysis, an average flood depth of two feet is assumed. A depth damage ratio of 25% was used for structural loss by multiplying it by the total values, based on the FEMA damage curves, assuming a 2-foot-deep flood. The results are shown in the loss estimate columns in Table 4-55 for the 1% annual chance flood and Table 4-56 for the 0.2% annual loss properties.

The result is an inventory of the number and types of improved parcels subject to flooding. Results are organized by unincorporated County and incorporated jurisdictions. Detailed tables show counts of parcels by jurisdictions and land use type (Commercial, Industrial, Non-Assessable, Residential, Residential-Income, Rural Farm Agricultural, Unclassified, Vacant Commercial, and Vacant Residential) within each flood zone. It is important to note that there could be more than one structure or building on an improved parcel (i.e., a condo complex occupies one parcel but might have several structures). The flood loss analysis does not account for business disruption, emergency services, environmental damages, or displacement costs, thus actual losses could exceed the estimate shown. Conversely, this analysis does not differentiate parcels that may have been developed since the County and cities adopted floodplain regulations, which would be mitigated to the 1% annual chance flood if developed in accordance with local floodplain regulations. Table 4-55 and Table 4-56 also do not include publicly-owned parcels that contain critical facilities and infrastructure; these vulnerable community lifelines are listed in Table 4-61 and Table 4-62.

Table 4-55 1% Annual Chance Floodplain Exposure and Loss by Jurisdiction

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Estimated Loss	Population
Ceres	Commercial	2	$339,418	$339,418	$678,836	$169,709	
	Residential	1	$74,277	$37,139	$111,416	$27,854	4
	Total	**3**	**$413,695**	**$376,557**	**$790,252**	**$197,563**	**4**
Modesto	Industrial	1	$3,453,683	$5,180,525	$8,634,208	$2,158,552	
	Residential	183	$30,649,630	$15,324,815	$45,974,445	$11,493,611	531
	Residential-Income	1	$230,847	$115,424	$346,271	$86,568	3
	Unclassified	2	$64,756	$64,756	$129,512	$32,378	
	Total	**187**	**$34,398,916**	**$20,685,519**	**$55,084,435**	**$13,771,109**	**534**
Newman	Commercial	92	$32,026,410	$32,026,410	$64,052,820	$16,013,205	
	Industrial	8	$5,700,420	$8,550,630	$14,251,050	$3,562,763	
	Residential	320	$33,974,723	$16,987,362	$50,962,085	$12,740,521	960
	Residential-Income	15	$1,371,815	$685,908	$2,057,723	$514,431	45
	Rural, Farm, Agricultural	1	$88,563	$88,563	$177,126	$44,282	
	Unclassified	16	$13,549,239	$13,549,239	$27,098,478	$6,774,620	
	Vacant Commercial	5	$22,113	$22,113	$44,226	$11,057	
	Vacant Residential	1	$75,308	$75,308	$150,616	$37,654	
	Total	**458**	**$86,808,591**	**$71,985,532**	**$158,794,123**	**$39,698,531**	**1,005**
Oakdale	Residential	4	$1,264,652	$632,326	$1,896,978	$474,245	15
	Total	**4**	**$1,264,652**	**$632,326**	**$1,896,978**	**$474,245**	**15**
Patterson	Commercial	15	$4,310,706	$4,310,706	$8,621,412	$2,155,353	
	Industrial	2	$469,751	$704,627	$1,174,378	$293,594	
	Residential	407	$54,926,055	$27,463,028	$82,389,083	$20,597,271	1,506
	Residential-Income	8	$1,372,588	$686,294	$2,058,882	$514,721	30
	Unclassified	10	$4,459,171	$4,459,171	$8,918,342	$2,229,586	
	Total	**442**	**$65,538,271**	**$37,623,825**	**$103,162,096**	**$25,790,524**	**1,536**
Unincorporated	Commercial	30	$10,183,097	$10,183,097	$20,366,194	$5,091,549	
	Industrial	20	$18,926,996	$28,390,494	$47,317,490	$11,829,373	
	Non-Assessable	2	$263,416	$263,416	$526,832	$131,708	
	Residential	586	$56,516,316	$28,258,158	$84,774,474	$21,193,619	1,811
	Residential-Income	16	$1,746,832	$873,416	$2,620,248	$655,062	49
	Rural, Farm, Agricultural	741	$153,219,040	$153,219,040	$306,438,080	$76,609,520	
	Unclassified	28	$5,042,104	$5,042,104	$10,084,208	$2,521,052	
	Vacant Commercial	2	$24,038	$24,038	$48,076	$12,019	
	Vacant Residential	3	$228,706	$228,706	$457,412	$114,353	
	Total	**1,428**	**$246,150,545**	**$226,482,469**	**$472,633,014**	**$118,158,254**	**1,860**
	Grand Total	**2,522**	**$434,574,670**	**$357,786,228**	**$792,360,898**	**$198,090,224**	**4,953**

Source: Stanislaus County Assessor’s Office; NFHL Effective date 8/24/2008, FEMA; GIS analysis

Significant areas of Stanislaus County are at risk of being inundated by a 100-year flood event. The City of Newman, City of Patterson, City of Modesto, and unincorporated areas of the County are predominantly inundated by the 100-year floodplain and have the greatest percentages of total loss from a 100-year flood event. While other jurisdictions are far less at risk during in a 100-year flood event, jurisdictions such as the City of Ceres and urban communities such as Westley and Crows Landing are at a great risk of inundation in the event of a 200-year flood.

Based on this analysis, the Stanislaus County Planning Area has 2,522 parcels valued at approximately $4.35 billion in the 100-year floodplain. An additional 7,610 parcels valued at over $1.55 billion within the 500-year floodplain. As a result, total structural exposure is approximately $5.9 billion. When factoring the content values within these areas in addition to the structures the total combined value of exposure is over $10.46 billion. Development in the 500-year floodplain is typically not regulated, thus a large flood event could be extremely damaging in the County. This information is summarized in Table 4-56 below.

Table 4-56 0.2% Annual Chance Floodplain Exposure and Loss by Jurisdiction

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Estimated Loss	Population
Ceres	Residential	78	$8,714,394	$4,357,197	$13,071,591	$3,267,898	285
	Total	**78**	**$8,714,394**	**$4,357,197**	**$13,071,591**	**$3,267,898**	**285**
Modesto	Commercial	16	$2,465,262	$2,465,262	$4,930,524	$1,232,631	
	Industrial	2	$589,725	$884,588	$1,474,313	$368,578	
	Residential	913	$121,250,154	$60,625,077	$181,875,231	$45,468,808	2,648
	Residential-Income	11	$1,530,478	$765,239	$2,295,717	$573,929	32
	Unclassified	92	$17,681,365	$17,681,365	$35,362,730	$8,840,683	
	Vacant Commercial	1	$17,288	$17,288	$34,576	$8,644	
	Total	**1,035**	**$143,534,272**	**$82,438,819**	**$225,973,091**	**$56,493,273**	**2,680**
Newman	Commercial	5	$1,519,026	$1,519,026	$3,038,052	$759,513	
	Industrial	11	$4,489,913	$6,734,870	$11,224,783	$2,806,196	
	Residential	514	$54,065,567	$27,032,784	$81,098,351	$20,274,588	1,753
	Residential-Income	8	$753,826	$376,913	$1,130,739	$282,685	27
	Unclassified	6	$1,093,880	$1,093,880	$2,187,760	$546,940	
	Vacant Commercial	2	$3,972	$3,972	$7,944	$1,986	
	Vacant Residential	1	$1,933	$967	$2,900	$725	
	Total	**547**	**$61,928,117**	**$36,762,411**	**$98,690,528**	**$24,672,632**	**1,780**
Oakdale	Commercial	8	$1,098,936	$1,098,936	$2,197,872	$549,468	
	Industrial	1	$143,252	$214,878	$358,130	$89,533	
	Residential	83	$18,463,874	$9,231,937	$27,695,811	$6,923,953	242
	Unclassified	6	$821,866	$821,866	$1,643,732	$410,933	
	Total	**98**	**$20,527,928**	**$11,367,617**	**$31,895,545**	**$7,973,886**	**242**
Patterson	Commercial	103	$57,997,592	$57,997,592	$115,995,184	$28,998,796	
	Industrial	16	$5,830,284	$8,745,426	$14,575,710	$3,643,928	
	Residential	4,227	$871,169,044	$435,584,522	$1,306,753,566	$326,688,392	15,640
	Residential-Income	47	$7,507,122	$3,753,561	$11,260,683	$2,815,171	174
	Rural, Farm, Agricultural	14	$1,716,867	$1,716,867	$3,433,734	$858,434	
	Unclassified	39	$40,898,545	$40,898,545	$81,797,090	$20,449,273	

Jurisdiction	Property Type	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Estimated Loss	Population
	Vacant Commercial	5	$118,338	$118,338	$236,676	$59,169	
	Vacant Residential	7	$13,847,070	$6,923,535	$20,770,605	$5,192,651	
	Total	**4,458**	**$999,084,862**	**$555,738,386**	**$1,554,823,248**	**$388,705,812**	**15,814**
Riverbank	Residential	210	$37,517,249	$18,758,625	$56,275,874	$14,068,968	722
	Total	**210**	**$37,517,249**	**$18,758,625**	**$56,275,874**	**$14,068,968**	**722**
Waterford	Industrial	1	$27,971	$41,957	$69,928	$17,482	
	Residential	91	$24,377,622	$12,188,811	$36,566,433	$9,141,608	325
	Residential-Income	1	$510,594	$255,297	$765,891	$191,473	4
	Total	**93**	**$24,916,187**	**$12,486,065**	**$37,402,252**	**$9,350,563**	**328**
Unincorporated	Commercial	18	$5,279,230	$5,279,230	$10,558,460	$2,639,615	
	Industrial	28	$95,788,986	$143,683,479	$239,472,465	$59,868,116	
	Residential	637	$57,992,306	$28,996,153	$86,988,459	$21,747,115	1,968
	Residential-Income	24	$2,116,727	$1,058,364	$3,175,091	$793,773	74
	Rural, Farm, Agricultural	352	$86,047,521	$86,047,521	$172,095,042	$43,023,761	
	Unclassified	26	$6,586,064	$6,586,064	$13,172,128	$3,293,032	
	Vacant Commercial	3	$23,764	$23,764	$47,528	$11,882	
	Vacant Residential	3	$45,617	$22,809	$68,426	$17,106	
	Total	**1,091**	**$253,880,215**	**$271,697,383**	**$525,577,598**	**$131,394,400**	**2,042**
	Grand Total	**7,610**	**$1,550,103,224**	**$993,606,501**	**$2,543,709,725**	**$635,927,431**	**23,894**

Source: Stanislaus County Assessor’s Office; NFHL Effective date 12/02/2008, FEMA; GIS analysis

As mentioned in previous sections, in addition to FEMA 100-year and 500-year floodplains, a 200-year flood event based on the Comprehensive Study compiled by the USACE as well as a 100-year flood event layer compiled by DWR's Awareness Floodplain Mapping project were acquired to assess flood vulnerability. Analyzing these floodplain data in the same way as described above revealed an estimate of 2,087 parcels with a total combined value of exposure at $603 million using the USACE 200-year flood event layer, and an estimate of 7,300 parcels with a total combined value of exposure at $2.49 billion, using the DWR 100-year flood event layer.

It is important to note that BAMs, which include the Comprehensive Study compiled by the USACE and DWR's Awareness Floodplain Mapping project, do not replace existing FEMA regulatory floodplains, but rather identify potential flood risks that may warrant further studies or analysis.

Insurance Coverage, Claims Paid, and Repetitive Losses

Stanislaus County joined the NFIP in 1980; each jurisdiction also participates in the NFIP. Table 4-57 below shows the NFIP entry dates of Stanislaus County and its jurisdictions. Moreover, The City of Newman and City of Patterson currently participate in the Community Rating System (CRS). Both cities have a Class 9 and received 5% discount. The other jurisdictions and the County currently do not participate in the CRS.

Table 4-57 NFIP Entry Dates of Stanislaus County and Its Jurisdictions

Jurisdiction	NFIP Entry Date
Ceres	March 7, 1997
Hughson	April 21, 2020
Modesto	August 15, 1980
Newman	September 29, 1978
Oakdale	September 5, 1979
Patterson	August 1, 1979
Riverbank	February 3, 1997
Stanislaus County	August 1, 1980
Turlock	May 14, 1981
Waterford	July 16, 1979

In the unincorporated County, there are 303 flood insurance policies in force, of which there are 241 single-family units, 3 2-4 family units, zero in all other residential, and 59 non-residential. The number of policies in force by jurisdiction and flood zone are shown in Table 4-58.

Table 4-58 Community Information System Policies in Force by Flood Zone and Jurisdiction

Flood Zone	Stanislaus County	City of Ceres	City of Hughson	City of Modesto	City of Newman	City of Oakdale	City of Patterson	City of Riverbank	City of Turlock	City of Waterford
A01-30 & AE Zones	102	0	0	56	0	0	0	1	0	56
A Zones	52	0	0	0	1	0	0	0	0	0
AO Zones	26	0	0	0	52	0	5	0	0	0
AH Zones	7	0	0	0	2	0	92	0	0	0
atmospheric river (AR) Zones	0	0	0	0	0	0	0	0	0	0
A99 Zones	0	0	0	0	0	0	0	0	0	0
V01-30 & VE Zones	0	0	0	0	0	0	0	0	0	0
V Zones	0	0	0	0	0	0	0	0	0	0
D Zones	0	0	0	0	0	0	0	0	0	0
B, C & X Zone	0	0	0	0	0	0	0	0	0	0
Standard	30	0	0	20	2	0	17	0	1	0
Preferred	75	7	1	102	13	18	7	19	24	5
Total	**292**	**7**	**1**	**178**	**70**	**18**	**121**	**20**	**25**	**61**

Source: FEMA NFIP Community Information System

NFIP data indicates that there are 890 insurance policies in Stanislaus County representing $223,896,900 of insurance coverage in force. Since 1978 there have been 230 paid losses, totaling $4,424,635. This results in approximately $102,898 in annualized losses. Most of the losses have been in the City of Modesto and the unincorporated County. Table 4-59 provides details on flood insurance policies for each individual jurisdiction.

FEMA insures properties against flooding losses through the NFIP. As part of the process to reduce or eliminate repetitive flooding to structures across the United States, FEMA has developed an official Repetitive Loss Strategy. The purpose behind the national strategy is to identify, catalog, and propose mitigation measure to reduce flood losses to the relatively few numbers of structures that absorb the majority of the premium dollars from the national flood insurance fund.

A repetitive loss property is defined by FEMA as "*a property for which two or more NFIP losses of at least $1,000 each have been paid within any 10-year period since 1978*". A repetitive loss property may or may not be currently insured by the NFIP. There are eight repetitive loss buildings in the unincorporated County, one of which is insured and a total of $431,960 was paid out. Besides, there are also 18, 6 and 9 repetitive loss buildings in the Cities of Modesto, Newman, and Patterson. There are no Severe Repetitive Loss properties, as defined by FEMA, anywhere in the County.

Table 4-59 Stanislaus County Flood Insurance Policy Information

Jurisdiction	Policies	Insurance in Force	No. of Paid Losses	Total Losses Paid
Ceres	7	$2,025,000	0	$0
Hughson	1	$350,000	0	$0
Modesto	178	$50,016,000	50	$1,654,264
Newman	142	$35,034,400	27	$329,075
Oakdale	18	$6,300,000	0	$0
Patterson	191	$46,011,900	32	$274,891
Riverbank	20	$6,655,000	0	$0
Unincorporated Stanislaus County	303	$67,423,800	106	$2,121,232
Turlock	25	$8,330,800	14	$45,173
Waterford	5	$1,750,000	1	$0
Total	890	$223,896,900	230	$4,424,635

Source: FEMA NFIP Community Information System

People

The total people at risk were estimated by multiplying the average number of persons per household in Stanislaus County (3.09) and each applicable incorporated jurisdiction (Ceres 3.66, Hughson 3, Modesto 2.9, Newman 3.41, Oakdale 2.91, Patterson 3.7, Riverbank 3.44, Turlock 2.87, and Waterford 3.57) times the number of residential parcels in each floodplain to estimate the population residing in flood hazard areas.

Based on this analysis, which accounts for residents only and not workers, there are 4,953 residents living in the 100-year flood zone throughout the County. Of all study areas, the unincorporated County has the most residents living in the 1% annual chance flood area, followed by the City of Patterson. Table 4-60 below details population estimates by jurisdiction, followed a table for the 500-year floodplain.

Table 4-60 Population Living in the 1% Annual Chance Flood Hazard Zone

Jurisdiction	Population
Ceres	4
Modesto	534
Newman	1,005
Oakdale	15
Patterson	1,536
Unincorporated County	1,860
Total	**4,953**

Source: Wood GIS analysis on Stanislaus County Assessor's Office data and FEMA NFHL, ACS Census Estimates

The same analysis was conducted for the 500-year floodplain, indicating that there are 23,894 residents living in the 500-year flood zone throughout Stanislaus County. The majority of people living in this floodplain are residents of the City of Patterson, with 15,814 people in the 500-year floodplain. This population distribution is shown in the table below.

Table 4-61 Population Living in the 0.2% Annual Chance Flood Hazard Zone

Jurisdiction	Population
Ceres	285
Modesto	2,680
Newman	1,780
Oakdale	242
Patterson	15,814
Riverbank	722
Waterford	328
Unincorporated County	2,042
Total	**23,894**

Source: Wood GIS analysis on Stanislaus County Assessor's Office data and FEMA NFHL, ACS Census Estimates

Government Services

Publicly owned facilities are a key component of daily life for all citizens of the County. Public buildings are of particular importance during flood events because they house critical assets for government response and recovery activities. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Loss of power and communications can be expected. Drinking water and wastewater treatment facilities may be temporarily out of operation. Flooding can have various impacts to responders in terms of response time and the personal safety of first responders. Flooded roadways are a common occurrence throughout the Planning Area and can block emergency vehicles from crossing certain areas, delaying response times. Flood events can often result in motorists needing to be rescued from stalled vehicles in flooded roadways. These types of challenges can often be dangerous for the first responders due to potentially polluted waters as well as swift currents.

Public confidence in government may be hindered if warnings and alerts prior to the flood event are not communicated effectively. Local governments' ability to respond and recover may be questioned and challenged by the public if planning, response, and recovery is not timely and effective, particularly in areas that have repeated flooding.

Critical Facilities and Infrastructure

Key support facilities and structures most necessary to withstand the impacts of, and respond to, natural disasters are referred to as critical facilities. Examples of these critical facility types include utilities, transportation infrastructure, and emergency response and services facilities, given failures of components along major lifelines or even closures or inaccessibility to key emergency facilities could limit if not completely cut off transmission of commodities, essential services, and other potentially catastrophic repercussions. Floods and levee failure have the ability to disrupt, damage, or destroy these critical facilities, which in turn can impede the ability of Stanislaus County to respond to and recover from a major flood event.

A GIS analysis of exposed critical facilities was conducted, similar to the parcel analysis, using HIFLD. The results of critical facilities throughout the County which are exposed to the various flood hazards are shown in Table 4-62 and Table 4-63 below and organized by the jurisdiction they are located in and the FEMA Lifeline category into which they are classified.

Table 4-62 Critical Facilities Within the 1% Annual Chance Flood Hazard by FEMA Lifeline and Jurisdiction

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	1	1
Hughson	-	-	-	-	-	-	-	-
Modesto	-	-	-	1	-	1	2	4
Newman	-	-	-	-	-	-	-	-
Oakdale	-	-	-	-	-	-	-	-
Patterson	-	-	-	-	1	-	3	4
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	-	-
Unincorporated	5	2	1	1	-	-	38	47
Other Counties	-	-	-	-	-	-	-	-
Total	5	2	1	2	1	1	44	56

Source: HFILD, Stanislaus County, Cities of Newman, and Hughson

Table 4-63 Critical Facilities Within the 0.2% Annual Chance Flood Hazard by FEMA Lifeline and Jurisdiction

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	-	-
Hughson	-	-	-	-	-	-	-	-
Modesto	1	-	-	-	1	3	2	7
Newman	2	-	3	-	-	2	-	7
Oakdale	-	-	-	-	1	-	-	1
Patterson	-	-	3	-	4	10	4	21
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	-	-
Unincorporated	1	1	1	1	-	-	5	9
Other Counties	-	-	-	-	-	-	-	-
Total	4	1	7	1	6	15	11	45

Source: HFILD, Stanislaus County, Cities of Newman, and Hughson

Economy

Flooding can have a major economic impact on the economy. Based on the flood loss analysis, there are 2,397 commercial structures worth an estimated $771 million in total value directly at risk to flooding in the 1% annual chance zone. Based on the loss analysis this could result in approximately $193 million in direct losses. This does not account for other indirect losses such as business interruption, lost wages, and other downtime costs.

Effects on the agriculture economy can be devastating, and a large amount of area at risk to flooding in the County is agricultural. Flooding can damage crops and livestock. In addition to the obvious impacts on crops and animals, flooding can have deleterious effects on soil and the ability to reinvigorate the agricultural activities impacted once the flood waters recede. Damage to water resources such as underground irrigation systems, water storage reservoirs, springs and other natural water bodies could have a serious effect upon agriculture operations.

Historic, Cultural, and Natural Resources

There are 28 properties throughout the County on the California Office of Historic Preservation Registry. Seven of these places are located in the City of Modesto, while the southwestern portion of the Modesto has medium risk and exposure to flood hazards.

Natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. A large percentage of flood-prone area in the County are wetlands that are part of the San Joaquin River National Wildlife Refuge. These areas provide natural and beneficial functions to hold and absorb floodwaters. Areas recently suffering from wildfire damage may erode because of flooding, which can temporarily alter an ecological system.

Future Development

Flooding and floodplain management are significant issues for Stanislaus County. The potential or likelihood of a flood event in the County increases with the annual onset of heavy rains in winter and spring months. Much of the historical growth in the problem areas connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards. For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances should mitigate the flood risk to new development in the 100-year floodplains. As noted previously, a large amount of development has occurred in the 500-year floodplain and these areas are not regulated or require flood mitigation, thus flood risk is increasing to a degree, although to the less frequent flood events.

The development trend in the Stanislaus County Planning Area consists of steady growth. Much of this growth is occurring in the urban and SOI areas; such growth can result in more impervious surfaces due buildings and infrastructure and increase stormwater runoff.

The California DOF projects that Stanislaus County's population will increase by 3.4% by the year 2025 when compared to the year of 2021. The County's population will also continue to grow through the year 2060. Such growth may consume previously undeveloped acres, and the increase in impervious surfaces could affect existing drainage and flood control facilities.

Changes in municipal boundaries such as annexations into the SOI may change the flood risk profile for certain communities. A GIS analysis of 1% and 0.2% annual chance flood exposure within SOI boundaries is summarized in the tables below. These parcels are also included in Table 4-55 and Table 4-56, and they fall under "*Unincorporated*" in terms of their jurisdiction. Parcels shown below in Table 4-64 and Table 4-65 are those that fall within each jurisdiction's SOI and are exposed to potential flood hazard events.

Table 4-64 Sphere of Influence Risk to FEMA 1% Annual Chance Flood Hazard

	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	69	$16,701,108	$11,609,955	$28,311,063	209
Modesto	517	$53,218,689	$43,100,018	$96,318,707	1,351
Newman	20	$2,728,480	$2,399,329	$5,127,809	31
Patterson	19	$3,106,544	$1,929,618	$5,036,162	56
Total	**625**	**$75,754,821**	**$59,038,920**	**$134,793,741**	1,646

Source: Stanislaus County; Wood Analysis 2022

Table 4-65 Sphere of Influence Risk to FEMA 0.2% Annual Chance Flood Hazard

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	88	$20,524,430	$22,163,605	$42,688,035	271
Modesto	586	$136,459,520	$156,944,643	$293,404,163	1,491
Newman	39	$3,779,406	$2,226,945	$6,006,351	109
Oakdale	4	$257,958	$257,958	$515,916	-
Patterson	20	$1,920,068	$1,572,480	$3,492,548	19
Waterford	1	$7,664	$7,664	$15,328	-
Total	**738**	**$162,949,046**	**$183,173,294**	**$346,122,340**	1,889

Source: Stanislaus County; Wood Analysis 2022

Risk Summary

- The overall significance of the flood hazard in the County is Medium.
- 12 flood events were recorded for Stanislaus County between 1950 and 2021, which means there is a 17% chance of a flood event occurring in a given year. Significant flooding also occurs in the County approximately every six years.
- Flooding risks are present among several creeks and rivers, including Del Puerto Canyon, Dry Creek, Orestimba Creek, Salado Creek, San Joaquin River, Stanislaus River, and the Tuolumne River. The Dry Creek watershed is a major factor in flooding in eastern Stanislaus County and the east side of Modesto.
- Scientific studies indicate shifts in California's precipitation regime, which show more dry days, more dry years, a longer dry season, and increases in occasional heavy precipitation events and floods. These same studies project greater storm intensity with climate change, resulting in more direct runoff and flooding and as a result, high frequency flood events in conjunction with heavy precipitation and extreme storm events.
- Key findings from the 2022 CVFPP included increased warming across the planning area for all climate scenarios, an intensification of extreme precipitation even with projections of overall drier conditions, and changes in flood magnitudes and frequencies that are projected to vary from the north to the south in the Central Valley.
- When inflows to reservoirs exceed the reservoir storage capacity, dam safety concerns necessitate emergency operations to reduce storage and preserve reservoirs structural integrity. This means that emergency releases may exceed the downstream capacity and the need to mitigate future flood risk above and below reservoirs; improve forecasting; and increase downstream floodplain capacity to improve the flexibility of overall floodplain management.
- Countywide there are 10,132 structures at risk within the limits of the 100-year and 500-year floodplain zones worth over $3.33 billion, with a loss estimate of over $0.83 billion.
- The unincorporated County accounts for 59.6% of the total estimated losses in the 100-year floodplain; City of Patterson accounts for 61.1% of the total losses in the 500-year floodplain.
- Commercial structures account for 34.5% of total losses in the 100-year floodplain, with a loss estimate of $68.3M.
- Countywide approximately 4,953 persons live in the 100-year floodplain, of which the vast majority (1,860) are in the unincorporated County.
- There are 23,894 persons within the 500-year floodplain and a flood of this magnitude would have severe consequences.
- Levees and flood control dam infrastructure provide some protection, but also pose potential levee and dam failure risks.
- A total of 56 critical facilities are found in 1% annual chance and 55 critical facilities are in the 0.2% annual chance flood zones in the County.
- **Related hazards** – Severe weather: Heavy Rain, Wildfire, Landslide and Debris Flow.

Table 4-66 Hazard Risk Summary – Flood

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Significant	Likely	Critical	Medium	Yes
City of Ceres	Limited	Likely	Negligible	Low	No
City of Hughson	Limited	Likely	Negligible	Medium	No
City of Modesto	Significant	Likely	Limited	Medium	Yes
City of Newman	Significant	Likely	Critical	Medium	Yes
City of Oakdale	Limited	Likely	Negligible	Medium	Yes
City of Patterson	Significant	Likely	Catastrophic	High	Yes
City of Riverbank	Limited	Likely	Negligible	Low	Yes
City of Turlock	Limited	Likely	Negligible	Low	No
City of Waterford	Limited	Likely	Negligible	Low	No
County Office of Education	Significant	Likely	Negligible	Low	Yes

4.3.9 Landslide

Hazard Problem/Description

According to the USGS National Landslide Information Center (NLIC), the term "*landslide*" is defined as the movement of a mass of rock, debris, or earth down a slope. The force of gravity acting upon a steep (or sometimes, even a moderately steep) slope is the primary cause of a landslide. Slope failure occurs when the force of gravity pulling the slope downward exceeds the strength of the earth materials that comprise the slope to hold it in place. In addition to the force of gravity, other contributing factors to landslides can include rainfall, earthquakes, changes in groundwater, and human-induced modifications to existing slopes. The potential for a landslide to occur exists in every state wherever very weak or fractured materials are resting on a moderate to steep slope.

The severity of a landslide depends in large part on the degree of development in the area in which it occurs and the geographic area of slide itself. Generally speaking, landslides often result in devastating consequences, but in very localized areas. A landslide occurring in an undeveloped area would be less severe because lives and property would not be affected; the only impacts would be to land, vegetation, and possibly some wildlife. On the contrary, a landslide occurring in a developed area could have devastating effects, ranging from structure and infrastructure damage to injury and/or loss of life. Structures or infrastructure built on susceptible land would likely collapse as their footings slide downhill, while those below the land failure would likely be crushed. Landslides around roadways could have the potential to fall and damage or destroy vehicles and force other drivers to have accidents.

Mudslides are a mass of water and fine-grained earth that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains (rocks, stones, boulders), the event is called a debris flow. A debris fan is a conical landform produced by successive mud and debris flow deposits, and the likely spot for a future event. Mud and debris flow problems can be exacerbated by wildfires that remove vegetation that serves to stabilize soil from erosion. Heavy rains on the denuded landscape can lead to rapid development of destructive mudflows.

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting, and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfalls can threaten human life, impact transportation corridors and communication systems and result in other property damage. Rockfalls and landslides are influenced by seasonal patterns, precipitation, and temperature patterns. Earthquakes could trigger rockfalls and landslides too.

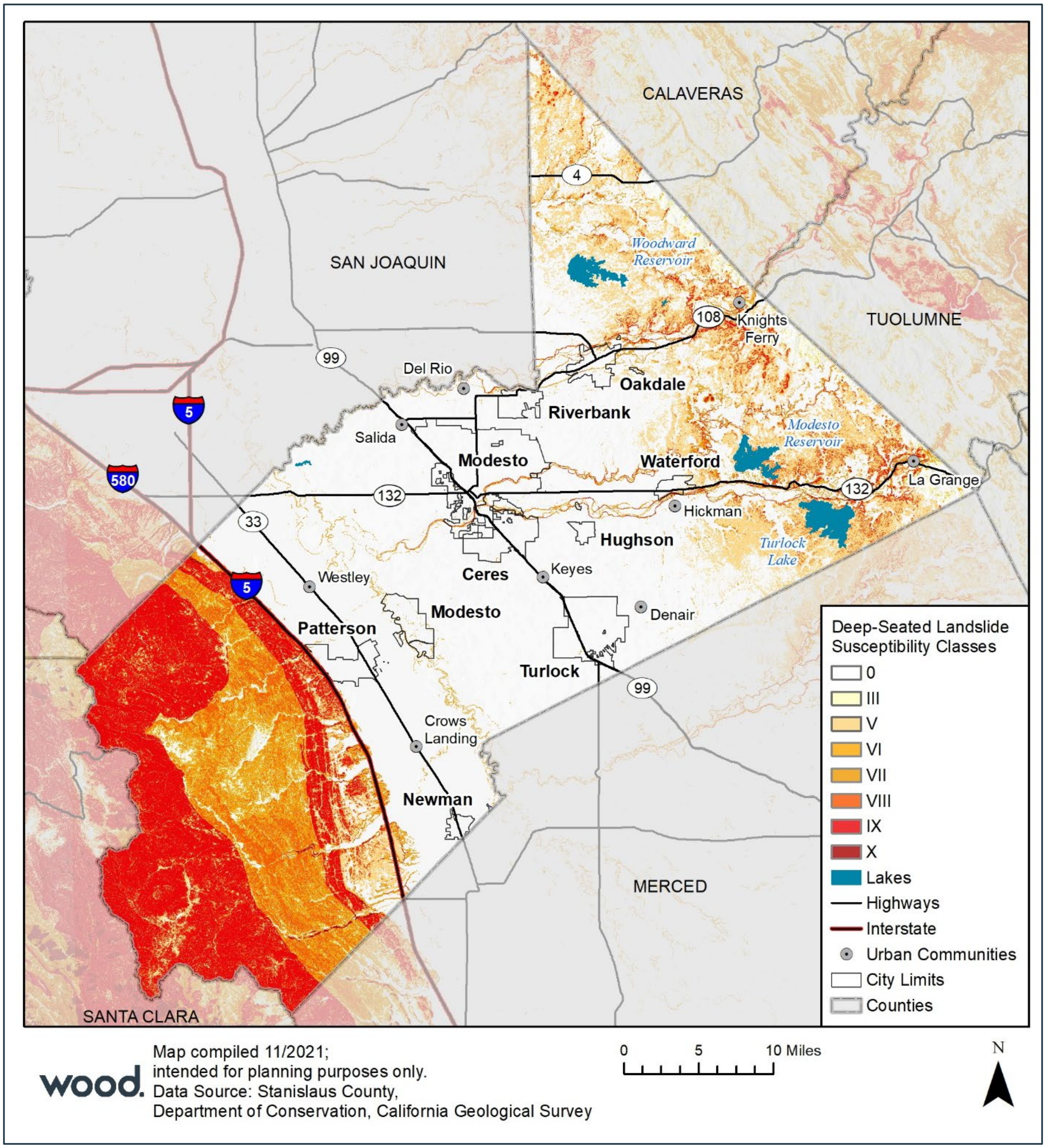
There are predictable relationships between local geology and landslides, rockslides, and debris flows. The downslope movement of earth material, either as a landslide, debris flow, mudslide, or rockslide, is part of the continuous, natural process of erosion. This process, however, can be influenced by a variety of causes that change the stability of the slope. Slope instability may result from natural processes, such as the erosion of the toe of a slope by a stream, or by ground shaking caused by an earthquake. Slopes can also be modified artificially by grading, or by the addition of water or structures to a slope. Development that occurs on a slope can substantially increase the frequency and extent of potential slope stability hazards. Knowledge of these relationships can improve planning and reduce vulnerability. Slope stability is dependent on many factors and their interrelationships, including rock type, moisture content, slope steepness, and natural or manmade undercutting.

Geographic Area

Significant – Hazards due to landslide events are mostly limited to areas within the foothills at the western and eastern edges of Stanislaus County. The western edge of the County is part of the Diablo Range which stretches almost 200 miles along the west side of the Central Valley, running parallel to the Pacific Ocean. Virtually the entire area located west of Interstate 5 is composed of geological formations that, due to structure, slope, runoff, lack of vegetation, earthquake, and human activity, are considered extremely susceptible to failure and sliding. This is also mentioned in the County's General Plan's Safety Element.

The eastern edge of the runs parallel to the Sierra Nevada Mountain range. The west-facing slope of the Sierra Nevada range has a series of streams whose waters ultimately reach the Pacific Ocean. It is along these areas and other locally identified specific river bluff regions near rivers and streams that are susceptible to landslide, though there are few past occurrences. The areas near rivers and streams are also subject to natural erosion, although erosion activity may be increased during flood events. Deep-seated landslide susceptibility in the County is depicted in Figure 4-29.

Figure 4-29 Stanislaus County Deep-Seated Landslide Susceptibility



Extent (Magnitude/Severity)

Negligible – Figure 4-30 shows the relative extent of deep land sliding based on regional estimates of rock strength and steepness of slopes. The data used for the map utilizes detailed information on the location of past landslides, the location and relative strength of rock units, and steepness of slope in a methodology developed by Wilson and Keefer (1985) as implemented by Ponti et al (2008) to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. The convergence of factors suggests limited landslide potential in most of Stanislaus County due to the very low slopes. There are areas on the west side where the potential increases due to increase in slope and topography along the Diablo Range to the west and the Sierra Nevada range to the east these areas are shown in red in Figure 4-30.

Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, flood, or wildfires. Landslide frequency is often related to the frequency of these other hazards. In Stanislaus County, landslides typically occur during and after major storms so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. In the winter of 1982-1983, saturation of the soil in the Diablo Range area resulted in a considerable amount of damage to Del Puerto Canyon Road. During the winter storms of 1997, Del Puerto Canyon Road experienced an approximately 10-mile landslide consisting of mud, rocks and boulders. One lane was closed for repair for 2 to 3 months while the other lane stayed open to traffic. This caused minor traffic delays since the road is not a major thoroughfare. These types of landslides are typical for this area following storms due to vertical cuts for roadways without sufficient sloping for runoff.

Previous Occurrences

There have not been any disaster declarations associated with landslides in Stanislaus County. According to records from the California Geological Survey (CGS), there has been one recent record of landslide that occurred in 2017.

January 10, 2017 – Highway 132 was covered in rock, which resulted in road closure. The location is just under one mile west of the intersection of Highway 132 and La Grange Road. According to Stanislaus Count 2017 LHMP, this landslide event was one of the two landslides occurred at the location. This landslide consisted of rocks and boulders and closed one lane for about 3 hours while Caltrans removed the debris. The slides were 10 to 15 feet on the roadway. and boulders and caused minor traffic delays. Cleanup was completed within 1 to 2 hours and the road was fully open for traffic.

Highway 132 covered in rock during the January 10, 2017 landslide event.
Photo credit: Caltrans District 10

Moreover, the County's 2017 LHMP noted that the storms of January 2017 created landslides across Del Puerto Canyon Road ranging from 3 feet to 40 feet in size. These slides consist of mud, rocks and boulders and caused minor traffic delays. In addition, a significant rain event in January 2016 required one lane closure of Del Puerto Canyon Road, which caused minimum impact to traffic.

Probability of Future Occurrences

Occasional – It is evident that the steep slopes and undesirable geology of the area on the west side of the County, even without considering the possibility of an earthquake, present risks in certain conditions. It is common for minor incidents requiring some debris clearing of Del Puerto Canyon Road to occur on average of 5 to 12 times a year. On the east side of the County there are frequent landslides on Highway 132 along the river bluffs. These landslides are usually due to rain and occur during or within days after a storm. Based on these past events, landslides are high frequency events and highly likely to continue to impact the Diablo Range and areas on Hwy 132 but are limited to occasional events in the central portion of the County.

The CGS uses three factors that most determine susceptibility of landslide: prior failure, rock or soil strength, and steepness of slope. Landslides can also be triggered by rainfall, earthquake shaking, or other factors. The unstable formation comprising the underlying geologic structure of the Diablo Range then makes this area of Stanislaus County more vulnerable to landslides and its effects. The few structures and population within the Diablo Range are most vulnerable to damage due to landslides.

Impacts in the Diablo Range, specifically Del Puerto Canyon Road, are limited. Del Puerto Canyon Road is not a major thoroughfare, and the area is sparsely populated. There are no critical buildings in the area. Stanislaus County Public Works maintains the road and within 1-2 hours, debris is cleared with little to no impact to traffic. The staffing and equipment needed to clear the landslide are minimal. Therefore, the impacts of landslides on the population have been minimal due to the short duration of road closure during debris removal. Moreover, the landslides experienced on Highway 132 are also limited occurring due to rain and during or within days after a storm. These happen along the river bluff and there are no critical structures in the area. Roadways may be blocked causing traffic delays.

Climate Change Considerations

Landslides can result from intense rainfall and runoff events. Projected climate change-associated variance in rainfall events may result in more high-intensity events, which may increase landslide frequency. In addition, the increased potential of wildfire occurrence also escalates the risk of landslide and debris flows in the period following a fire, when slopes lack vegetation to stabilize soils and burned soil surfaces create more rainfall runoff. As climate change affects the length of the wildfire season, it is possible that a higher frequency of large fires may occur into late fall, when conditions remain dry. The wildfires can be followed by intense rains early in the winter, as occurred with the Thomas Fire in December 2017 and subsequent Montecito and Carpinteria debris flows in January 2018 that occurred in Santa Barbara County (CA SHMP 2018). Moreover, tree mortality resulting from drought, pests or any other threat could also pose an increase to landslides. Currently, Stanislaus County is not experiencing tree mortality as severe as other areas of California due to the drought and bark beetle. However, any future loss of trees would reduce the protection of steep slopes and thereby increase the probability for landslide occurrences.

Vulnerability Assessment

General Property

Landslides directly damage engineered structures in two general ways: 1) disruption of structural foundations caused by differential movement and deformation of the ground upon which the structure sits, and 2) physical impact of debris moving downslope against structures located in the travel path.

During the 2021 update of this plan, a GIS analysis of exposure to landslide hazard areas was performed. GIS analysis indicates approximately $63.4 billion of property improvements are exposed, which takes into account improved values of properties. Table 4-67 summarizes landslide exposure by jurisdiction. GIS was used to intersect the parcel boundaries with a master address point layer to obtain the number of buildings per parcel. Only parcels with improvement values greater than zero were used in the analysis, this method assumes that improved parcels have a structure of some type.

Based on this analysis there is a total of 2,864 improved parcels potentially within landslide hazard areas. The majority of this exposure is in the western unincorporated County. There is a high level of uncertainty as to the actual risk to these exposed parcels, thus a more specific loss estimation is not provided. A more detailed, site specific analysis would be needed to assess actual risk within the identified parcels.

Table 4-67 Stanislaus County Improved Properties at Risk to Landslide

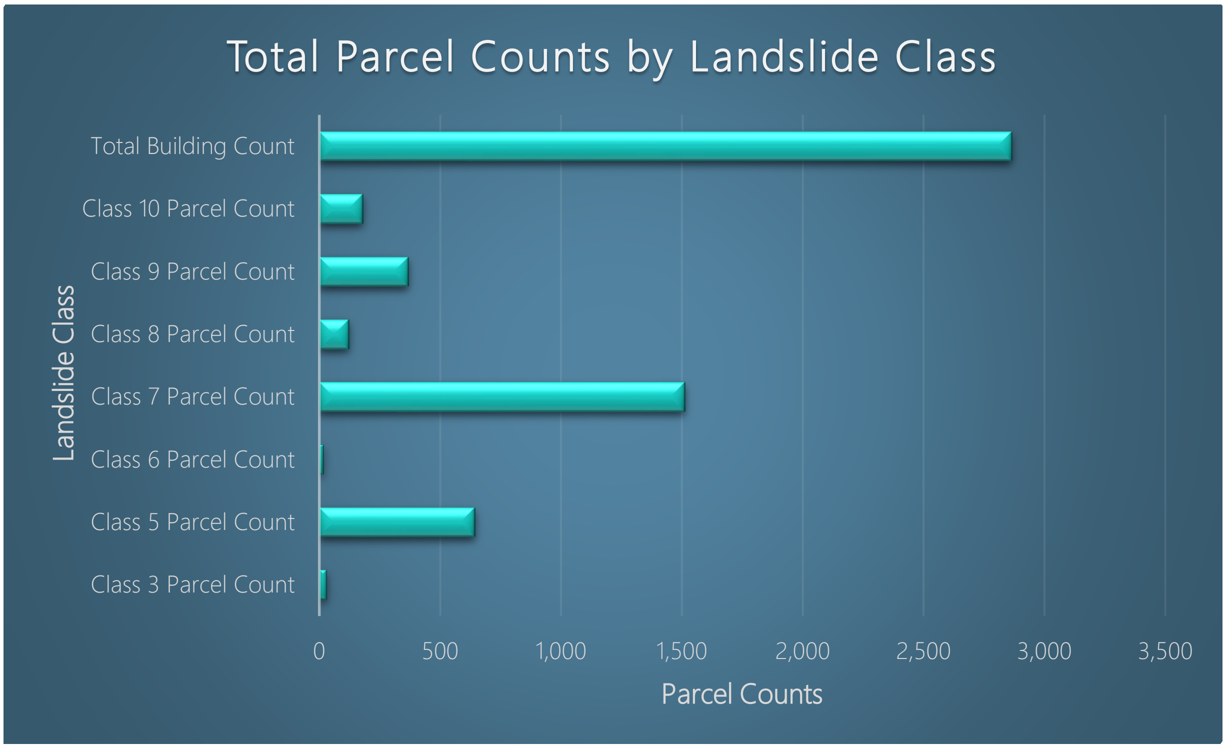
Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	23	$11,571,650	$12,087,387	$23,659,037	77
Hughson	-	-	-	-	-
Modesto	369	$96,766,751	$54,390,827	$151,157,578	1,032
Newman	8	$1,834,671	$917,336	$2,752,007	27
Oakdale	429	$104,345,400	$69,518,643	$173,864,043	1,190
Patterson	2	$87,037	$87,037	$174,074	0
Riverbank	77	$18,661,965	$11,728,810	$30,390,775	241

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Turlock	-	-	-	-	-
Waterford	149	$31,727,856	$17,491,408	$49,219,264	464
Unincorporated	1,807	$547,149,003	$457,888,713	$1,005,037,716	1,687
Total	**2,864**	**$812,144,333**	**$624,110,159**	**$1,436,254,492**	**4,719**

Source: Department of Conservation, CGS, Stanislaus County Assessor, Wood GIS Analysis

Figure 4-30 below further breaks down the numbers of exposed parcels by landslide class, as shown previously in Figure 4-29; the higher the class the greater the susceptibility.

Figure 4-30 Total Parcel Counts by Landslide Class



Source: Dept. of Conservation, CGS, Stanislaus County Assessor, Wood GIS Analysis

People

People could be susceptible if they are caught in a landslide or debris flow, potentially leading to injury or death. There is also a danger to drivers operating vehicles, as rocks and debris can strike vehicles passing through the hazard area or cause dangerous shifts in roadways. The parcel analysis described previously estimated there are approximately 4,719 people potentially residing in landslide susceptible areas, but it is not likely that landslides will occur without warning and direct impacts to people are suspected to be minimal.

Government Services

Aside from possible damage to government facilities, the impact of landslides and rockslides on government services or public confidence in government is minimal. The vulnerability of responders to landslide and rockslide events is similar to that of the general public.

Critical Facilities and Infrastructure

In addition to buildings, utilities and transportation structures are vulnerable to the impact and ground deformation caused by slope failures. They present a particular vulnerability because of their geographic extent and susceptibility to physical distress. Lifelines are generally linear structures that, because of their geographic extent, have a greater chance of being affected by ground failure due to greater hazard exposure.

Extension, bending, and compression caused by ground deformation can break lifelines. Failure of any component along the lifeline can result in failure to deliver service over a large region. Once broken, transmission of the commodity through the lifeline ceases, which can have catastrophic repercussions including loss of power to critical facilities such as hospitals, impaired disposal of sewage, contamination of water supplies, disruption of all forms of transportation, and release of flammable fuels. Therefore, the overall impact of lifeline failures, including secondary failure of systems that depend on lifelines, can be much greater than the impact of individual building failures.

Table 4-68 below summarizes the results of the critical facilities analysis, highlighting the exposure of critical facilities throughout the County to landslide hazards. Many exposed critical facilities are located in unincorporated areas of the County, largely to the west of Interstate 5.

Table 4-68 Critical Facilities Within the Class 9 Landslide Hazard by FEMA Lifeline

Jurisdiction	Landslide Class	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	10							1	**1**
	7							2	**2**
Modesto	10							3	**3**
	9	1	-	-	-	-		5	**6**
	7	1	-	-	-	-		5	**6**
Patterson	8	-	1	-	-	-			**1**
	10			1					**1**
Riverbank	9							1	**1**
	7					1		1	**2**
Turlock	7			1	1				**2**
Unincorporated	10	3	1	-	-	-		10	**14**
	9	-	-	1	-	-	-	10	**11**
	8	2	2	-	-	-	-	3	**7**
	7	-	1	1	1	-	2	39	**44**
	6	-	2	-	-	-	-	-	**2**
	5	12	1	-	-	-	2	10	**25**
	3	-	-	-	1	-	-	1	**2**
	Total	**19**	**8**	**4**	**3**	**1**	**4**	**91**	**130**

Source: CGS, HIFLD, Wood GIS Analysis

Moreover, as noted in the County's 2017 HMP, several State highways traverse cuts through hillsides or along river bluffs where landslide hazards may pose a risk, including State Routes (SRs) 4, 108, 120, 132, 219 and Interstate 5. County roads at risk are shown in Table 4-69 below:

Table 4-69 County Roads Susceptible to Landslide Hazards

County Roads at Risk
Del Puerto Canyon Road
Crows Landing Road (at San Joaquin River)
Grayson Road (at San Joaquin River)
Lake Road
Mitchell Road (at Tuolumne River)
River Road (Ceres Area)
Shiloh Road (at Tuolumne River)
Diablo Grande Parkway
Cooperstown Road

County Roads at Risk
Geer/Albers Roads
La Grange Road
Orestimba Road
Roberts Ferry Road
South Carpenter Road
Crabtree Road
Hills Ferry Road
Ingram Creek Road
Los Cerritos Road
Paradise Road (at San Joaquin River)
Santa Fe Avenue
Warnerville Road

Source: Stanislaus Count 2017 HMP

Economy

Economic impacts typically center around transportation routes temporarily closed by debris flow or landslide activity. These roads may be used to transport goods across the County or provide access by visitors and tourists. Depending on the amount of damage, the road may simply need to be cleaned off, or may require some level of reconstruction.

Historic, Cultural, and Natural Resources

As primarily a natural process, landslides and debris flows can have varying impacts to the natural environment; debris flows have the potential to permanently alter the natural landscape. The impacts of landslides and debris flows on historical and cultural structures would be similar to the impacts on general property.

Future Development

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Future development should take place carefully to prevent landslide damage to property or people. Adverse effects can be mitigated by early recognition and avoiding incompatible land uses in these areas or by corrective engineering. Improving mapping and information on landslide hazards and incorporating this information into the development review process could prevent siting of structures and infrastructure in identified hazard areas.

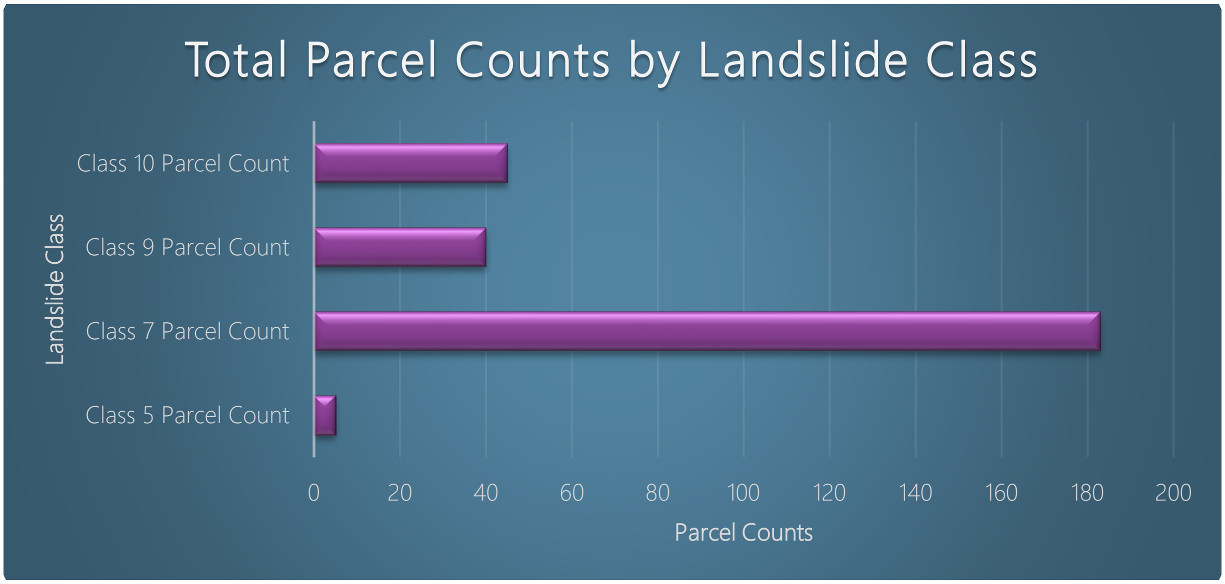
A GIS analysis of exposure to landslide hazard within SOI boundaries is summarized in the tables below. These parcels are also included in Table 4-67, and they fall under "*Unincorporated*" in terms of their jurisdiction. Parcels shown below in Table 4-70 are those that fall within each jurisdiction's SOI and are exposed to potential landslide hazard events.

Table 4-70 Sphere of Influence Risk to Landslide Hazard

Jurisdiction	Improved Parcel Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	81	$17,105,613	$9,848,189	$26,953,802	260
Modesto	62	$7,173,488	$5,785,965	$12,959,453	157
Oakdale	76	$13,383,107	$8,886,713	$22,269,820	160
Riverbank	49	$13,373,065	$6,713,824	$20,086,889	165
Waterford	5	$915,670	$915,670	$1,831,340	0
Total	**273**	**$51,950,943**	**$32,150,360**	**$84,101,303**	**742**

Figure 4-31 below further breaks down the numbers of exposed parcels within SOI areas by landslide class.

Figure 4-31 Total Parcel Counts within SOI areas by Landslide Class



There has been limited development in the Diablo Grande area, which is located seven miles west of I-5. The development was approved by the Board of Supervisors in 1993 for 5,000 residences. However, because of the economic turn down in 2008, build out of the residential area was stalled. There are currently 425 occupied residences while building development is projected to continue over the next few years. Aside from the limited development in the Diablo Grande area, there has been no significant change in development in the unincorporated areas impacted by landslide within Stanislaus County since the last LHMP update.

Construction is possible west of Interstate 5, but any proposals for significant development (anything other than the currently permitted two dwellings for every 160 acres), should include a geological report identifying potential problems and mitigation measures to be incorporated into the development plan. The County also complies with the CEQA process to ensure that development does not occur that would be especially susceptible to landslides. Most discretionary projects require review for compliance with CEQA. As part of this environmental review, potential impacts must be identified and mitigated or a statement of overriding concerns adopted. Further, the routes of new public roads in areas subject to landslides shall be designed to minimize landslide risks. Engineered benchmarks will be utilized to monitor movement of slopes to stabilize and mitigate the hazard before it occurs, if possible. Also, road-clearing and debris equipment must be pre-staged to make response time faster to maintain accessibility to roads and infrastructure. Improved mapping and data collection will assist in identifying needed mitigation strategies for the future.

Risk Summary

- The overall significance of landslides in Stanislaus County is Low.
- The geologic formations commonly associated with slope stability problems in Stanislaus County, are largely concentrated in the far western and eastern edges of the County, which are also the least populated.
- On the west side of the County minor landslide incidents and debris clearing occurs along Del Puerto Canyon Road on average of 5 to 12 times a year. On the east side there are frequent landslides on Highway 132 along the river bluffs. These landslides are due to rain and occur during or within days after a storm. Based on these past events, landslides are high frequency events and highly likely to continue to impact the Diablo Range and areas along Hwy 132 but are only occasional events in the central portion of the County.
- **Effects on people** – People are most commonly at risk if they are caught in a landslide or debris flow, including when driving through a hazard area.
- **Effects on property** – Property loss is rare, but GIS analysis shows there is some property which could be exposed to landslides.

- **Effects on economy** – Landslides in adjacent counties can disrupt major transportation corridors, possibly affecting the local tourist economy and shipment of goods.
- **Effects on critical facilities and infrastructure** – Landslides and debris flows can result in the destruction of infrastructure such as water and sewer lines, electrical and telecommunications utilities and drainage. Disrupted transportation routes occur occasionally, usually during heavy rainstorms, and cause considerable inconvenience.
- **Related Hazards** – Earthquake, Adverse Weather, Wildfire.

Table 4-71 Hazard Risk Summary – Landslides

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Significant	Occasional	Negligible	Low	No
City of Ceres	Limited	Occasional	Negligible	Low	No
City of Hughson	Limited	Occasional	Negligible	Low	No
City of Modesto	Limited	Occasional	Negligible	Low	No
City of Newman	Limited	Occasional	Negligible	Low	No
City of Oakdale	Limited	Occasional	Negligible	Low	No
City of Patterson	Limited	Occasional	Negligible	Low	No
City of Riverbank	Limited	Occasional	Negligible	Medium	Yes
City of Turlock	Limited	Occasional	Negligible	Low	No
City of Waterford	Limited	Occasional	Negligible	Low	No
County Office of Education	Significant	Occasional	Negligible	Low	No

4.3.10 Public Health Hazards: Pandemics/Epidemics

Hazard/Problem Description

A pandemic can be defined as a disease that attacks a large population across great geographic distances. Pandemics are larger than epidemics in terms of geographic area and the number of people affected. Epidemics tend to occur seasonally and affect much smaller areas. Pandemics, on the other hand, are most often caused by new subtypes of viruses or bacteria for which humans have little or no natural resistance. Consequently, pandemics typically result in more deaths, social disruption, and economic loss than epidemics.

Three conditions trigger a pandemic declaration:

1. A new virus subtype must emerge that has not previously circulated in humans (and therefore there is no pre-existing immunity),
2. This new subtype must be able to cause disease in humans, and
3. The virus must be easily transmissible from human-to-human.

Since March 2020, Stanislaus County, the nation, and the world are dealing with the public health hazards, specifically the COVID-19 pandemic (caused by the SARS-CoV-2 virus). The COVID-19 pandemic confirms that pandemic is a key public health hazard in the Planning Area. This hazard risk assessment includes an analysis of pandemic and infectious disease risk across Stanislaus County and an analysis of the impacts of the hazards profiled in this plan on public health.

COVID-19

Unlike seasonal flu, a pandemic has much greater potential for loss of life and significant social disruption due to higher rates of transmission and more severe health impacts. The SARS-CoV-2 virus has a much higher rate of transmission than the seasonal flu, primarily by airborne transmission of droplets/bodily fluid. Common symptoms include fever, cough, fatigue, shortness of breath or breathing difficulties, and loss of smell and taste. While most people have mild symptoms, some people develop acute respiratory distress syndrome with roughly one in five requiring hospitalization in the United States and a fatality rate between 1 to 2 percent. Because the virus can be transmitted by people who are asymptomatic, and due to the presence of several variants of SARS-CoV-2, the Delta and Omicron Variant, for example, containing the spread has been a significant challenge across the globe.

Valley Fever

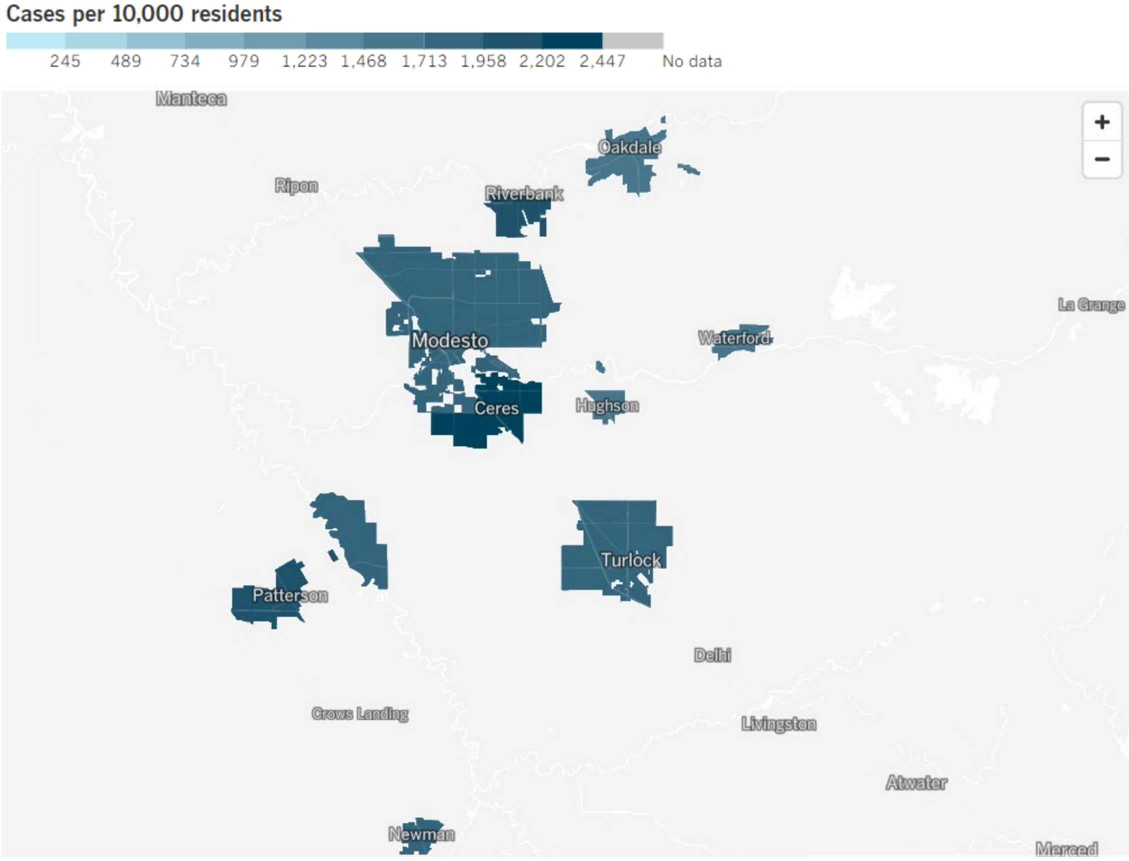
Another example of a human health hazard that is endemic to Stanislaus County is Valley Fever, or "*cocci*" which is a known but poorly understood secondary effect of drought conditions, and possibly a combination of wind and drought events followed by a rainy season. Valley Fever is an infection caused by a fungus (*Coccidioides immitis*) that lives in soil and dirt and areas with low rainfall, high summer temperatures, and moderate winter temperatures. Valley Fever is primarily a disease of the lungs and the infection can occur year-round. In California, it has been reported from most counties, but especially from the San Joaquin Valley and Central Coast. Anyone who lives in, works in, or visits a place with Valley Fever can be infected. Figure 4-34 below shows Valley Fever Annual Incidence among California Counties in the year 2012 – 2016 and 2017. People can get sick by breathing in a form of the Valley Fever fungus called spores. Spores are too small to be seen and they can get into the air with dust when it is windy or when dirt is distributed. Fortunately, Valley Fever cannot be spread from one person to another. About 60% of infected people will not get sick. People who do get sick can have symptoms such as fever, tiredness, and weight loss that last a month or more. Valley Fever can also infect the brain, joints, bone, skin, or other organs. This type of infection is rare; however, it can be serious and sometimes fatal. Most people who get Valley Fever fully recover and are usually protected from getting Valley Fever again (CDPH 2021).

Geographic Area

Extensive – Pandemics occur not only on a county or state level but on a national and global scale. It is likely that most communities in Stanislaus County would be affected, either directly or by secondary impacts. Some indirect consequences may be the diversion of resources that may be otherwise available.

Stanislaus County has reported 84,433 cases and 1,302 deaths from COVID-19 as of October 12, 2021. According to the Los Angeles Times "*Tracking the coronavirus in Stanislaus County*" dashboard, the major cities of Stanislaus have the highest number of cases, which is around 1,038 to 1730 cases per 10,000 residents, among which the City of Ceres currently has the highest concentration of cases (approximately 1,557 – 1,730 cases per 10,000 residents), as of October 12, 2021. These major cities like Ceres and Modesto have higher populations and municipal areas relative to other urban communities within the County, and COVID-19 is transmitted primarily from human-to-human contact. Figure 4-32 below shows the cases per 10,000 residents map for the cities in Stanislaus County, prepared by Los Angeles Times.

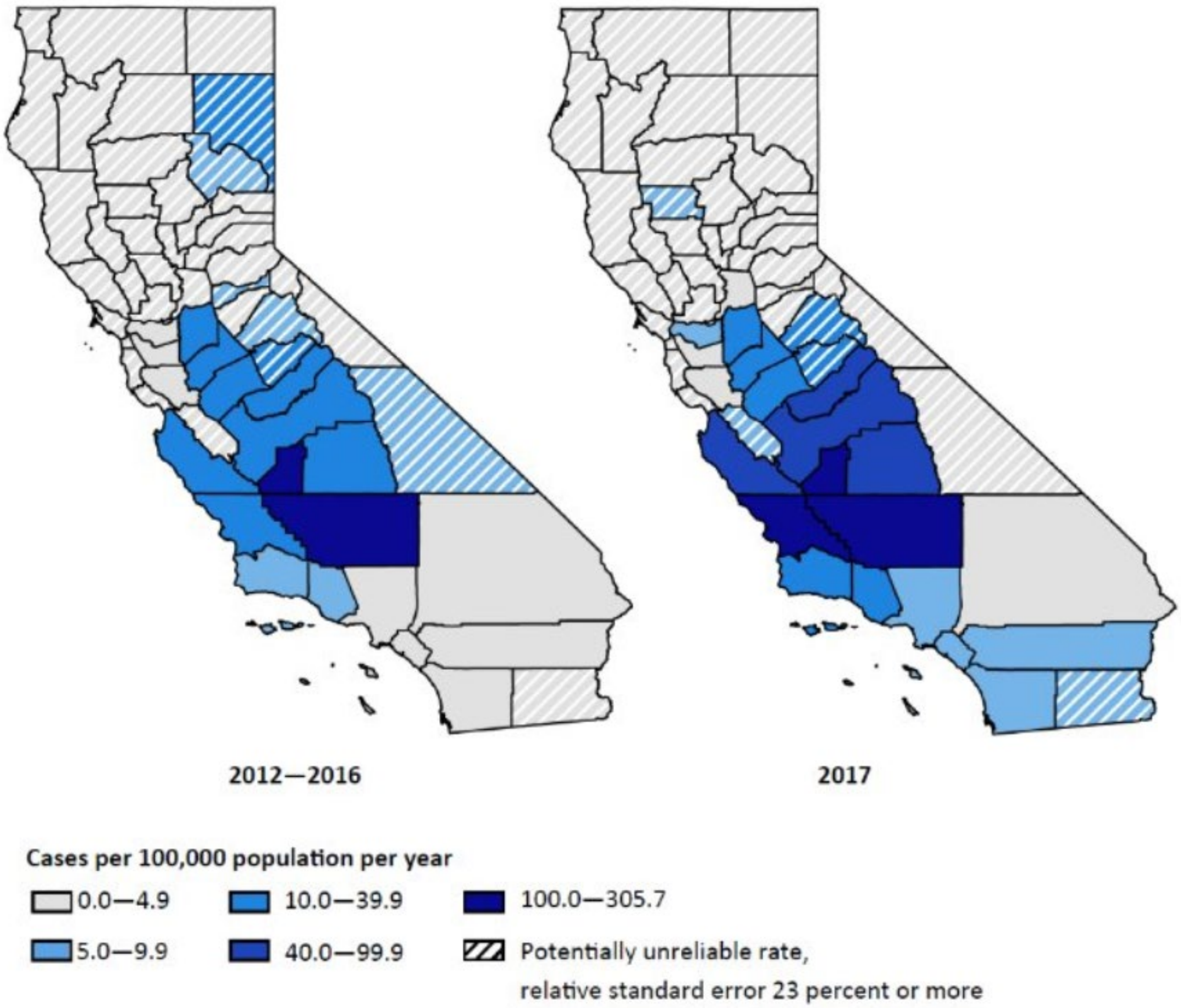
Figure 4-32 Coronavirus cases per 10,000 residents for cities in Stanislaus County



Data source: Los Angeles Time, October 12, 2021

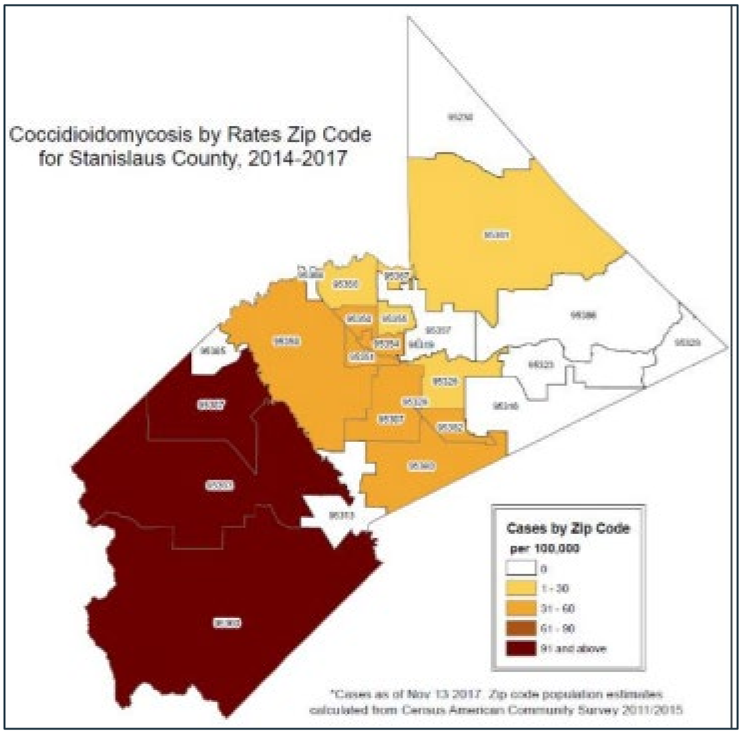
Figure 4-33 shows Valley Fever rates by California county. Figure 4-34 shows Valley Fever (coccidioidomycosis) cases by zip code per 100,000 population for Stanislaus County between 2014 and 2017. Figure 4-35 shows the reported cases of Valley Fever by year in Stanislaus County from 2011 – 2017.

Figure 4-33 Valley Fever Rates in California Counties, 2012 – 2016 & 2017



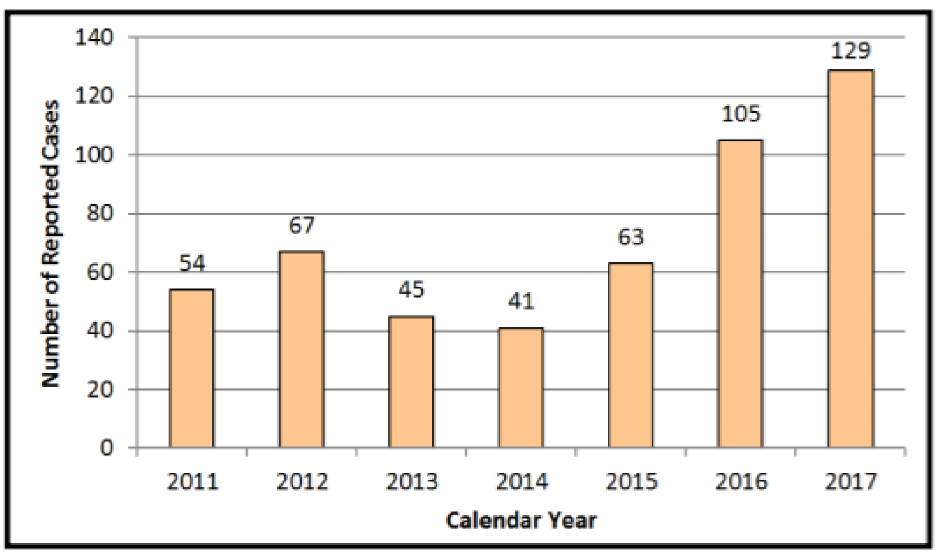
Source: CDPH, November 2018.

Figure 4-34 Valley Fever Cases by Zip Code per 100,000 population, Stanislaus County, 2014 and 2017



Source: CDPH, Stanislaus County Health Services Agency, December 2017.

Figure 4-35 Reported cases of Valley Fever by year, Stanislaus County from 2011 – 2017



Source: 2018 Stanislaus County Public Health Annual Report

Extent (Magnitude/Severity)

Critical – The magnitude of a public health emergency will range significantly depending on the transmissivity and mortality rate of the virus. For example, pandemic influenza is easily transmitted from person-to-person, however, advances in medical technologies have greatly reduced the number of deaths caused by influenza over time.

Today, a much larger percentage of the world's population is clustered in cities, making them ideal breeding grounds for epidemics. Additionally, the explosive growth in air travel means the virus could spread around the globe within hours. Under such conditions, there may be very warning little time for counties, states, and countries to prepare. Most experts believe we will have just one to six months between the time that a dangerous new influenza strain is identified and the time that outbreaks begin to occur in the United States. Outbreaks are expected to occur simultaneously throughout much of the nation, preventing shifts in human and material resources that normally occur with other natural disasters. These and many other aspects make pandemics unlike any other public health emergency or community disaster. Pandemics typically last for several months to 1-2 years and have even longer-lasting effects on the economy and communities.

As described by the World Health Organization (WHO), the Pandemic Intervals Framework (PIF) is a six-phased approach to defining the progression of a pandemic. This framework is used to guide pandemic planning and provides recommendations for risk assessment, decision-making, and action. These intervals provide a common method to describe a pandemic activity that can inform public health actions. The duration of each pandemic interval might vary depending on the characteristics of the virus and the public health response.

The six-phase approach was designed for the easy incorporation of recommendations into existing national and local preparedness and response plans. Phases 1 through 3 correlates with preparedness in the pre-pandemic interval, including capacity development and response planning activities, while Phases 4 through 6 signal the need for response and mitigation efforts during the pandemic interval. Phase 6 was reached in the County during the 2020 COVID-19 outbreak.

Pre-Pandemic Interval
Phase 1 is the natural state in which influenza viruses circulate continuously among animals but do not affect humans.

Phase 2 involves cases of animal influenza that have circulated among domesticated or wild animals and have caused specific cases of infection among humans.

Phase 3 represents the mutation of the animal influenza virus in humans so that it can be transmitted to other humans under certain circumstances (usually very close contact between individuals). At this point, small clusters of infection have occurred.

Pandemic Interval
Phase 4 involves community-wide outbreaks as the virus continues to mutate and become more easily transmitted between people (for example, transmission through the air).

Phase 5 represents human-to-human transmission of the virus in at least two countries.

Phase 6 is the pandemic phase, characterized by community-level influenza outbreaks.

Past Occurrences

Since the early 1900s, five lethal pandemics have swept the globe:

- **1918-1919 Spanish Flu** – The Spanish Flu was the most severe pandemic in recent history. The number of deaths was estimated to be 50-100 million worldwide and 675,000 in the United States. Its primary victims were mostly young, healthy adults. At one point, more than 10 percent of the American workforce was bedridden.
- **1957-1958 Asian Flu** – The 1957 Asian Flu pandemic killed 1 to 2 million people worldwide, including about 70,000 people in the United States, mostly the elderly and chronically ill. Fortunately, the virus was quickly identified, and vaccine production began in May 1957.
- **1968-1969 H3N2 Hong Kong Flu** – The 1968 Hong Kong Flu pandemic killed 34,000 Americans. Again, the elderly were more severely affected. This pandemic peaked during school holidays in December, limiting student-related infections, which may have kept the number of infections down. Also, people infected by the Asian Flu ten years earlier may have gained some resistance to the new virus.
- **2003 SARS Outbreak** – Severe acute respiratory syndrome (SARS) is a viral respiratory illness caused by a coronavirus, called SARS-associated coronavirus (SARS-CoV). SARS was first reported in Asia

in February 2003. Over the next few months, the illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained. According to the WHO, a total of 8,098 people worldwide became sick with SARS during the 2003 outbreak. Of these, 774 died. In the United States, only eight people had laboratory evidence of SARS-CoV infection. All of these people had traveled to other parts of the world where SARS was spreading. SARS did not spread more widely in the community in the United States. The main way that SARS seems to spread is by close person-to-person contact.

- **2009-2010 H1N1 Swine Flu** – This influenza pandemic emerged from Mexico in early 2009 and was declared a public health emergency in the U.S. on April 26, 2009. By June, approximately 18,000 cases had been reported in the U.S. and the virus had spread to 74 countries. Most cases were fairly mild, with symptoms similar to the seasonal flu, but there were cases of severe disease requiring hospitalization and a number of deaths. The CDC estimates that 43-89 million people were infected worldwide, with an estimated 8,870 to 18,300 H1N1-related deaths, including 12,469 deaths in the United States.
- **2020-Ongoing COVID-19** – The COVID-19 or novel coronavirus outbreak began in December 2019 and was declared a pandemic in March of 2020. As of October 12, 2021, over 219 million cases and more than 4.5 million deaths have been reported globally, according to the WHO. Within the U.S. as of October 12, 2021, around 44.5 million cases and around 716,662 deaths have been reported. Stanislaus County has reported 84,433 cases so far resulting in 1,302 deaths. COVID-19 vaccines are currently being administered and thus far 48.2% of Stanislaus County's total population has been fully vaccinated (CDC 2021). It will take several months for the entire population to receive a vaccine and achieve herd immunity; additionally, due to the uncertainty in the transmission of several variants of the SARS-CoV-2 virus, the pandemic is expected to continue through 2021 and even 2022.

Furthermore, the opioid epidemic, which is already a problem in the Stanislaus County region, was made worse over the previous year, with the County recording an increase of overdose deaths from opioids. In 2020, Stanislaus County recorded 132 total deaths from overdose, which is an increase of 59 percent from 2019, according to the Stanislaus County Health Services Agency (SCHSA). Of the 132 overdose deaths, 78 were opioid-related. White residents continue to experience the highest opioid death rate, but the largest increase was seen in 18- to 24-year-olds in the Latinx community. This segment of the population saw an increase of 150 percent from 2019 to 2020, the SCHSA reported. The Centers for Disease Control and Prevention stated drug overdoses "*surged during the pandemic*" with more than 87,000 people dying from drug overdoses in the 12 months ending in September 2020. That is the highest number of overdose deaths ever recorded in a year since the opioid epidemic began in the 1990s (Turlock Journal 2021).

The CDC points to several factors unique to the pandemic has having a direct role in the increase in overdose deaths. Disruptions to daily life during the pandemic caused individual isolation, economic fragility, and fear, while disrupting the treatment and support systems that were in space to support those most vulnerable to the disruptions and social connections in place prior to the pandemic. Another driver of the increase in overdose deaths is counterfeit pills that contain fentanyl, a highly potent painkiller reported as impacting various communities in Stanislaus County.

Probability of Future Occurrences

Occasional – Even before the COVID-19 pandemic began, most public health experts considered another major pandemic to be inevitable. However, there is no definite way to predict when the next pandemic might occur. Some indicators will be present, but not every new virus turns into a pandemic. Based on the five pandemics that have affected the United States in roughly the last 100 years, a pandemic occurs on average roughly every 20 years.

Climate Change Considerations

Additional research is needed to determine the effects of climate change on the frequency and duration of epidemics and pandemics. Climate change may influence vector-borne disease transmission, although the direction of the effects (increased or decreased incidence) will be location- and disease-specific. The intensity and extent of certain diseases are projected to increase. According to the WHO, there has been research development into the linkages between climate and infectious disease transmission that examine the associations between climate variability and infectious disease occurrence, early indicators of emerging infectious disease impacts of climate change and using predictive models to estimate the future burden of infectious disease under different climate change scenarios (WHO 2003). In summary, future risks associated with climate change are difficult to predict, but changes in infectious disease transmission patterns are likely consequences of climate change. Climate change can impact when and where pathogens appear, particularly related to temperature and rainfall patterns.

Ongoing efforts to reduce greenhouse gas emissions, building climate resiliency, and creating robust public health campaigns to prevent or prepare for possible increased vector-borne diseases may help to reduce the impacts of climate change on pandemics.

Vulnerability Assessment

Preparing for, responding to, and recovering from a pandemic requires a strategy that includes a holistic suite of public health activities designed to lessen the impact on morbidity and mortality. These activities include education, vaccination, prophylaxis, isolation/quarantine, robust contact tracing programs, and the closure of public facilities. In addition, clear, concise communication with the public and with other agencies remains a critical component, as does the ability of the involved agencies to achieve collaboration and coordination. By their very nature, most pandemics, once started, will not be stopped until they have run their course. This course can be shortened and weakened by a number of factors, with vaccination being the most effective method for protecting the population. Pandemic plans describe strategies of preparedness, response, and recovery to attempt to decrease illnesses and deaths during the pandemic period to manageable levels (i.e., that do not overwhelm the critical infrastructure) and to promote community resiliency and rapid recovery.

General Property

For the most part, property itself is not impacted by a human disease epidemic or pandemic. However, as concerns about contamination increase, property may be quarantined or destroyed as a precaution against spreading illness. Additionally, traditional sheltering facilities including homeless shelters or temporary facilities set up to support displaced persons due to an evacuation or other reason due to a simultaneous disaster occurring cannot be done in a congregate setting. This requires additional planning considerations or the use of facilities that allow for non-congregate shelter settings, which may require approval of a request to FEMA for non-congregate sheltering and may have an increased cost (such as the use of individual hotel rooms) as opposed to traditional congregate sheltering facilities.

People

Pandemics can affect large segments of the population for long periods. The number of hospitalizations and deaths will depend on the virulence of the virus. Risk groups cannot be predicted with certainty; the elderly, people with underlying medical conditions, and young children are usually at higher risk due to their higher exposure rates from schools, but as discussed above this is not always true for all infectious agents. People without health coverage or access to good medical care are also likely to be more adversely affected. The mental health of the public could also be impacted depending on the length of the event and public health guidance on prevention.

As previously described, the COVID-19 pandemic has resulted in over 716,662 deaths in the U.S. alone (1,302 in Stanislaus County). In addition to the direct impacts, the pandemic has disrupted life for many people. Most large gatherings have had to be cancelled, and many schools have closed. Sheltering in place and social distancing have been highly encouraged and, in some places, mandated, leaving some individuals isolated for months.

Government Services

Medical staff can become overburdened with hundreds of additional cases on top of their normal workload. All other responders will be impacted in similar proportions to the general public, thereby reducing available responders. Adverse impacts are expected to be severe for unprotected personnel and uncertain for trained and protected personnel, depending on the nature of the incident.

The COVID-19 pandemic has had severe impacts on healthcare workers and other responders. The difficulty of trying to protect themselves and their families while still doing their jobs was exacerbated initially by shortages of personal protective equipment (PPE). The mental health impacts on responders and healthcare workers have not been fully quantified but are likely to have impacts for months if not years to come. Other responders will be impacted similarly to the general public, although the nature of their jobs may make social distancing more difficult, which could potentially lead to higher infection rates, thereby reducing available responders.

Unscheduled sick leave from a large portion of the workforce could result in loss of productivity and delivery of services. Even without large numbers of infected workers, social distancing requirements and workplace closures can have a major impact on the government's ability to deliver services, as seen during the COVID-19 pandemic. As residents are quarantined, as seen during the COVID-19 pandemic the demand for deliveries of essential goods will also increase.

The ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective. Help from the federal government and other states would likely be limited, as all personnel would be deployed throughout the country already. While the federal government would do what they can, communities would have to rely on their own resources for a much longer period of time as compared to other disasters. It is expected that the government will work towards a solution that will end the pandemic, typically by helping to distribute vaccines and antiviral agents. Continual public messaging and outreach are vital.

Critical Facilities and Infrastructure
In the event of a pandemic, especially one with high transmission rates and mortality rates such as COVID-19, community lifelines, such as healthcare facilities will be heavily affected and may be overwhelmed due to the limited number of beds, doctor and medical staff, laboratory testing capacity, and possible PPE shortages. Indirect impacts can also result in these facilities being temporarily offline due to testing or other precautionary monitoring and downed systems. Further, outbreaks in small cities and counties may cause medical facilities to reach capacity very quickly. Other critical facilities and infrastructure are not directly affected by a pandemic but may have difficulty maintaining operations and maintenance activities due to a significantly decreased workforce. Schools may also be forced to close due to faculty and staffing shortages.

Economy
Pandemics can have extensive economic impacts, as evidenced by the COVID-19 pandemic and associated restrictions on social gatherings. Social distancing requirements have affected nearly every segment of the local and national economy, most notably the restaurant and hospitality industries. Additionally, tourism may be impacted in affected areas. As a result, the unemployment rate can increase, which also occurred in 2020 due to the COVID-19 pandemic. Other economic impacts including varying disruptions in the food supply chains and other essential medical services.

Historic, Cultural and Natural Resources
Impacts on these resources are typically minimal.

Future Development

Population growth and development contribute to pandemic exposure. Future development in and around Stanislaus County has the potential to change how infectious diseases spread through the community and impact human health in both the short- and long-term. New development may increase the number of people and facilities exposed to public health hazards and greater population concentrations (often found in special needs facilities, businesses, and school campuses) put more people at risk. During a disease outbreak those in the immediate isolation area would have little to no warning, whereas, the population further away in the dispersion path may have some time to prepare and mitigate against disease depending on the hazard, its transmission, and public notification.

Risk Summary

- Pandemics affecting the U.S. occur roughly once every 20 years but cannot be reliably predicted.
- Valley Fever is especially prevalent in California's Central Valley, including Stanislaus County; people and animals can catch Valley Fever and get sick when they breathe in dust that contains the Valley Fever fungus, which usually infects the lungs and can cause respiratory symptoms.
- Effects on people will vary, but a significant portion of the population could become ill and may need to be hospitalized.

- Effects on property are typically minimal, although quarantines could result in short-term closures.
- Community lifelines, such as healthcare facilities, like hospitals will be impacted and may be overwhelmed and have difficulty maintaining operations due to bed availability, medical staffing shortages, and lack of PPE and other supplies.
- Lost productivity due to illness and potential business closures could potentially have severe economic impacts, such as increased unemployment rates in the County. Social distancing requirements and fear of public gatherings could also significantly reduce in-person commerce.
- The hazard is considered high significance across all participating jurisdictions.
- Ongoing mitigation activities should focus on disease prevention, especially during flu season. This includes, but is not limited to, pre-season community outreach campaigns to educate the public about risks and available support; establishing convenient vaccination centers; reaching out to vulnerable populations and care givers; and issuing advisories and warnings.

Table 4-72 Hazard Risk Summary – Public Health Hazards

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Occasional	Critical	High	Yes
City of Ceres	Extensive	Occasional	Critical	High	Yes
City of Hughson	Extensive	Occasional	Critical	High	Yes
City of Modesto	Extensive	Occasional	Critical	High	No
City of Newman	Extensive	Occasional	Critical	High	No
City of Oakdale	Extensive	Occasional	Critical	High	No
City of Patterson	Extensive	Occasional	Critical	High	No
City of Riverbank	Extensive	Occasional	Critical	High	Yes
City of Turlock	Extensive	Occasional	Critical	High	Yes
City of Waterford	Extensive	Occasional	Critical	High	No
County Office of Education	Extensive	Occasional	Critical	High	Yes

4.3.11 Severe Weather: General

The climate in the Central Valley is defined generally by hot, dry summers and foggy, rainy winters. Severe weather is generally any destructive weather event, but usually occurs in Stanislaus County as localized thunderstorms that bring heavy rain and strong winds that occur most often during the winter and spring months. The agricultural industry is among the most vulnerable asset to severe weather. Agricultural losses resulting from natural hazards can have dramatic impacts on the economic health of Stanislaus County.

For this plan, adverse weather is broken down as follows:

- Dense Fog
- Heavy Rain, Thunderstorm, Hail, Lightning
- High Wind/Tornado

NOAA's NCEI has been tracking adverse weather since 1950. Their Storm Events Database contains data on the following: all weather events from 1993 to 2017 (except from 6/1993-7/1993); and additional data from the Storm Prediction Center, which includes tornadoes (1950-1992), thunderstorm winds (1955-1992), and hail (1955-1992). This database contains 254 storm events that occurred in Stanislaus County between January 1, 1950, and December 2021. Table 4-73 summarizes these events.

Table 4-73 NCEI Hazard Event Reports for Stanislaus County, 1950-2021

Hazard	# of Events	Property Loss ($)	Crop Loss ($)	Deaths	Injuries	USDA RMA Losses***
Cold/wind Chill	11	$0	$0	1	0	$0
Dense Fog*	9	$890,000	$0	3	6	$0
Dense Smoke	1	$0	$0	0	0	$0
Drought	27	$0	$1,500,000,000****	0	0	$90,695
Excessive Heat	3	$0	$0	0	0	$0

Hazard	# of Events	Property Loss ($)	Crop Loss ($)	Deaths	Injuries	USDA RMA Losses***
Extreme Cold/Wind Chill	2	$0	$0	0	0	$0
Flood	12	$380,000	$0	2	1	$1,028,578
Frost/Freeze*	7	$500,000	$20,000,000	0	0	$11,581,182
Funnel Cloud	12	$0	$0	0	0	
Hail	5	$5,110	$300,000	0	5	$2,500,684
Heat	35	$0	$0	2	0	$25,530,144
Heavy Rain	45	$750,000	$10,450,000	0	0	$32,037,565
High Wind	19	$4,913,000	$0	0	3	$1,721,079*
Lightning	3	$220,000	$0	0	0	$0
Heat*	13	$0	$0	0	0	$0
Strong Wind	6	$150,500	$0	2	2	$0
Thunderstorm Wind	9	$150,000	$0	1	0	$0
Tornado	12	$1,351,000	$200,000	0	1	$0
Wildfire	4	$0	$0	0	0	$0
Winter Storm	1	$0	$0	0	0	$0
Winter Weather	1	$0	$0	0	0	$0
Total	**284**	**$11,334,610**	**$1,534,293,000**	**11**	**27**	**$74,489,927**

Source: National Center for Environmental Information Storm Events Database, www.ncdc.noaa.gov/stormevents/
*Hazards with wide extents reflect larger zones that extend beyond Stanislaus County.
** Value based on “Wind/Excess Wind” category of the USDA RMA database.
*** USDA RMA data is for the year 2007 – 2020.
**** This value represents the overall crop loss caused by drought in California during the year 2014. NCEI database does not have a specific crop loss value for Stanislaus County during the year 2014 and shows no crop loss during other years.

The NCEI table above summarizes adverse weather events that have occurred in Stanislaus County from 1950 to 2021. Only a few of the events actually resulted in state and federal disaster declarations. It is interesting to note that different data sources capture different events during the same time period, and often different information specific to the same events. While the HMPC recognizes these inconsistencies, this data provides value in depicting the County’s “*big picture*” hazard environment as it relates to severe weather.

Due to size of the County and changes in elevation and climate, weather conditions can vary greatly across the County. The profiles that follow provide information from two weather stations in different parts of the County: Newman weather station in the southern and southwestern part of the County (1902-2016) and the Modesto City CO AP Weather Station in the central of the County (1906-2016). The temperature data from these two weather stations are displayed in Subsection 4.3.12 below.

4.3.12 Severe Weather: Dense Fog

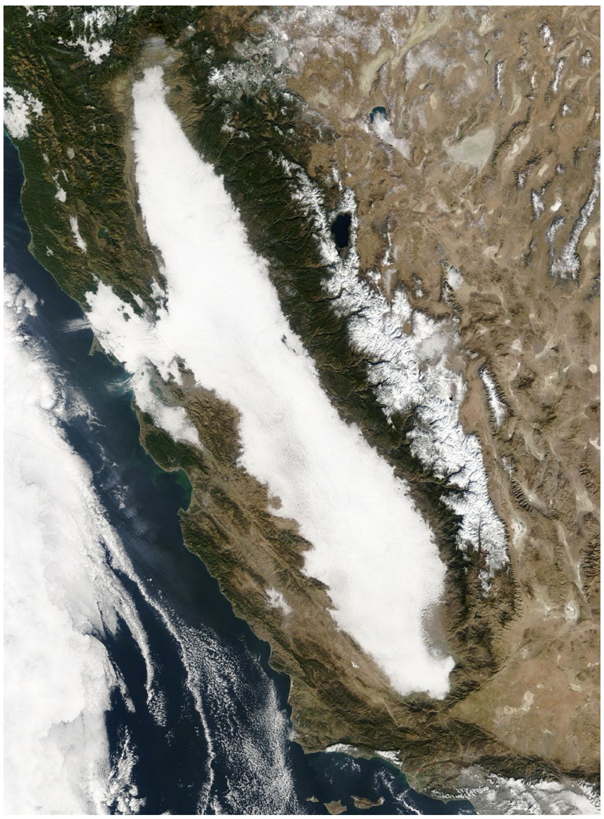
Hazard/Problem Description

Fog results from air being cooled to the point where it can no longer hold all of the water vapor it contains. For example, rain can cool and moisten the air near the surface until fog forms. A cloud-free, humid air mass at night can lead to fog formation, where land and water surfaces that have warmed up during the summer are still evaporating water into the atmosphere. This is called radiation fog. A warm moist air mass blowing over a cold surface also can cause fog to form, which is called advection fog.

The interior California valleys have a unique fog problem called the tule fogs. The tule fog is a radiation fog, which condenses when there is a high relative humidity, typically after a heavy rain, calm winds, and rapid cooling during the night. The longer nights during the winter months create this rapid ground cooling and results in a pronounced temperature inversion at a low altitude, creating a thick ground fog. Above the cold, foggy layer, the air is typically warm and dry. Once the fog has formed, turbulent air is necessary to break through the inversion. Daytime heating can also work to evaporate the fog in some areas. The tule fogs get their name from the tule reeds, which grew around the swamps and deltas of the great Tulare Lake that once covered the southern end of the San Joaquin Valley.

The tule fog season in Stanislaus County is typically in the late fall and winter (November through March) but can occur as late as May. Fog typically forms rapidly in the early morning hours. Tule fogs can last for days, sometimes weeks. Fog can have devastating effects on transportation corridors in the County. Nighttime driving in the fog is dangerous and multi-car pileups have resulted from drivers using excessive speed for the conditions and visibility. Tule fog has also been found to be connected to air pollution and exacerbates the naturally occurring fog. A study published in the Journal of Geophysical Research in 2019 found that air pollution is a key contributor to the seasonal fog, and due to the passage of the Clean Air Act in 1970, it has declined about 75 percent since 1980 (Gray 2019). Figure 4-36 illustrates the extent of tule fog over the Central Valley.

Figure 4-36 Tule Fog over Central Valley



Source: NASA, Jeff Schmaltz, January 5, 2005

Geographic Area

Extensive – The San Joaquin Valley is hemmed in on three sides by mountain ranges, with resulting inversion layers trapping cooler air on the valley floor. This predisposes the Planning Area to severe episodes of fog in winter months, when barometric pressures are high, humidity is increased, and ambient temperatures are low. All areas of the County are vulnerable to dense fog events.

Extent (Magnitude/Severity)

Critical – Tule fog forms on clear nights when the ground is moist, and the wind is near calm and can be widespread throughout the San Joaquin Valley. On nights like this, the ground cools rapidly. In turn, the moist air above it cools and causes water vapor to condense. Once it has formed, the air must be heated enough to either evaporate the fog or lift it above the surface so that visibilities improve. Common areas for tule fog to form include foothills and valleys. Visibility in tule fog is usually less than an eighth of a mile (about 600 ft or 200 m) but can be much lower. Visibility can vary rapidly; in only a few feet, visibility can go from 10 feet (3.0 m) to near zero.

Fog contributes to transportation accidents and is a significant life safety hazard. These accidents can cause multiple injuries and deaths and could have serious implications for human health and the environment if a hazardous or nuclear waste shipment were involved. Other disruptions from fog include delayed emergency response vehicles and school closures.

In 2018 the NWS in Hanford, California developed the Experimental Fog Severity Index in conjunction with the NWS issues fog advisories to help give motorists advance warning of fog events. A dense fog advisory is issued when widespread dense fog develops, and visibilities drop to one-quarter of a mile or less. The Fog Severity Index has five levels with level 5 being the most severe. Figure 4-37 describes each level of the Index.

Figure 4-37 National Weather Service Experimental Fog Severity Index

Level 5	Very High Risk For Transportation Visibilities 200 Feet To Zero Stopped Traffic Ahead Highest Risk For Chain Reaction Accidents
Level 4	High Risk For Transportation Visiblity 800 Feet Or Less Very Slow Or Stopped Traffic Ahead Higher Risk For Chain Reaction Accidents
Level 3	Moderate Risk For Transportation Visibility Half Mile Or Less Slow Traffic Ahead Moderate Risk For Fog Related Accidents
Level 2	Low Risk For Transportation Visibility One Mile Or Less Traffic May Slow Below Speed Limit Low Risk For Fog Related Accidents
Level 1	No Transportation Risks

Source: NWS

Past Occurrences

The NCEI records nine dense fog events in the Northern San Joaquin Valley between 1950 and 2021 (refer to Table 4-73 above). Although only one of these nine events happened within Stanislaus County, Tule Fog is prevalent all over San Joaquin Valley and accidents have happened in adjacent and other nearby counties. Also, according to other sources, a few accidents caused by dense fog have happened in Stanislaus County. The following is the description of this one event of record in the NCEI Storm Events Database as well as other two incidents from additional media sources:

- **December 16, 1996** – In the City of Modesto a man died when his pick-up collided with a double tractor-trailer in the poor visibility.
- **January 13, 2015** – two cars collided at 7:15 am on Fulkerth Road west of Faith Home Road near Turlock. One driver was severely injured. California Highway Patrol (CHP) arrived at the scene on time and the injured received medical support immediately, however, the dense fog prevented a medical helicopter from flying in. American Medical Response's responders mentioned that dense fog can create serious problems for responders, and the fog in rural locations such as Turlock tends to be even denser, which causes more trouble to responders. (Modesto Bee 2015).

- **December 21, 2021** – In the City of Turlock a woman was driving an SUV southbound on Highway 99 at a high rate of speed when she ran into the back of a slower big rig. The crash happened just after midnight on 99 north of Linwood Avenue, in dense fog conditions. The crash caused the woman to lose control onto the shoulder and then crashed into a fence and a tree. The crash caused major damage to her SUV, which then burst into flames, and the woman died at the scene. The driver of the big rig was not injured. (KMPH 2020).

Probability of Future Occurrences

Likely – According to Table 4-73, nine dense fogs impacted Stanislaus County during a 72-year period, which equates to a major dense fog event every 8 years and a 12.5 percent chance of a major fog event in any given year. Therefore, based on NCEI data and other reported accidents caused by fog according to media sources, together with the fact that the tule fog prevails in the San Joaquin Valley, it is likely that fog events will continue to occur regularly in Stanislaus County.

Climate Change Considerations

California's winter tule fog has declined dramatically over the past three decades, raising a red flag for the state's multibillion-dollar agricultural industry, according to researchers at UC Berkeley. Crops such as almonds, pistachios, cherries, apricots and peaches go through a necessary winter dormant period brought on and maintained by colder temperatures. Tule fog that descends upon the State's Central Valley between late fall and early spring, helps contribute to this winter chill.

When there is an insufficient rest period (or lack of dormant time for crops) it impairs the ability of farmers to achieve high quality fruit yields. The UC Berkeley findings have implications for the entire country since many of these California crops account for 95 percent of U.S. production. The researchers also paired NASA and NOAA satellite records with data from a network of University of California weather stations, covering 32 consecutive winters. Based on the data, there was a great deal of variability from year to year, but on average, the researchers found a 46 percent drop in the number of fog days between the first of November and the end of February. Climate forecasts suggest that the accumulation of winter chill will continue to decrease in the Central Valley. Tule fog was also less prevalent in recent years in part due to the multi-year drought.

While the short-term fog variability is dominantly driven by climate fluctuations, the longer-term temporal and spatial changes in fog have been driven by changes in air pollution. The Clean Air Act has also greatly reduced the air pollution that would form fogs.

Vulnerability Assessment

General Property

Based on historic information, the primary effect of fog has not resulted in significant damages to property, and the losses are typically covered by insurance. Dense fog does result in substantial vehicle damage during transportation-related accidents.

People

Reduced visibility is the greatest risk to people when heavy fog is prevalent. Particularly when fog is dense, it can be hazardous to drivers, mariners and aviators and contributes to numerous accidents each year. To reduce injury and harm, people should avoid driving when dense fog is prevalent, if possible. If driving is pertinent, emergency services advise driving with lights on low beam, watching for CHP pace vehicles to guide through fog, avoiding stopping on highways, and avoiding crossing traffic lanes.

Government Services

The impact of fog on government services structures and buildings should be similar to the impacts on general property. Dense fog can create serious problems for responders by slowing down the speed of responders and preventing them from arriving at accident scenes on time. The impact of dense fog on public confidence in government is minimal.

Critical Facilities
Fog can have devastating effects on transportation corridors in the County. Multi-car pileups have resulted from drivers using excessive speed for the conditions and visibility. These accidents can cause multiple injuries and deaths and could have serious implications for human health and the environment if a hazardous or nuclear waste shipment were involved. Other disruptions from tule or dense fog include delayed emergency response vehicles and school closures.

Economy
Economic impacts due to dense fog are generally related to road closures leading to a decrease in travel to businesses. Other economic impacts relate to property damages to vehicles from accidents. As shown in Table 4-73 above there is a recorded $890,000 of property damages as a result of dense fog all of which are from traffic accidents in the Central Valley and San Joaquin Valley. Based on that amount, this region including Stanislaus County has an estimated average loss expectancy of $12,361 due to dense fog events.

Historic, Cultural and Natural Resources
As referred to in the Climate Change Considerations section, California's winter tule fog has declined dramatically over the past three decades, raising a red flag for the State's multibillion-dollar agricultural industry. Crops such as almonds, pistachios, cherries, apricots and peaches go through a necessary winter dormant period brought on and maintained by colder temperatures and tule fog that descends upon the State's Central Valley between late fall and early spring, helps contribute to this winter chill.

Future Development

Population and commercial growth both within and outside the County will increase the potential for complications with traffic accidents and commerce interruptions associated with dense fog.

Risk Summary

- Tule fog season begins in late fall and lasts from winter (November – March).
- Between 1950 and 2021 there were nine dense fog events that impacted Stanislaus County during a 72-year period, which equates to a major dense fog event every 8 years and a 12.5 percent chance of a major fog event in any given year.
- Dense fog events in the Central Valley and north San Joaquin Valley have resulted in $890,000 in property damages, largely due to traffic accidents.
- Fog can have devastating effects on transportation corridors and result in casualties; fog can prevent responders to arrive on scene timely.
- Major fog events in the County are estimated to occur every 8 years or a 12.5% chance in any given year.

  Related Hazards – Hazardous Materials Incidents

Table 4-74 Hazard Risk Summary – Dense Fog

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Likely	Critical	Medium	Yes
City of Ceres	Extensive	Likely	Critical	Medium	No
City of Hughson	Extensive	Likely	Critical	Medium	No
City of Modesto	Extensive	Likely	Critical	Medium	No
City of Newman	Extensive	Likely	Critical	Medium	Yes
City of Oakdale	Extensive	Likely	Critical	Medium	No
City of Patterson	Extensive	Likely	Critical	Medium	No
City of Riverbank	Extensive	Likely	Critical	Medium	Yes
City of Turlock	Extensive	Likely	Critical	Medium	No
City of Waterford	Extensive	Likely	Critical	Medium	No
County Office of Education	Extensive	Likely	Critical	Medium	No

4.3.13 Severe Weather: Heavy Rain, Thunderstorms, Hail, and Lightning

Hazard/ Problem Description

Hail

Hail forms on condensation nuclei such as dust or ice crystals, when supercooled water freezes on contact. In clouds containing large numbers of supercooled water droplets, these ice nuclei grow quickly at the expense of the liquid droplets. The hail grows increasingly larger. Once a hailstone becomes too heavy to be supported by the storm's updraft it falls out of the cloud. Hailstones are usually from the size of a pea to the size of a golf ball.

Heavy Rain

A majority of adverse weather experienced in Stanislaus takes place in the winter months as heavy rain and thunderstorm events that are sometimes accompanied by high winds, dense fog events.

Stanislaus's weather is influenced by the Pacific Ocean and routine climate patterns such as El Niño. El Niño is the warm phase of the El Niño-Southern Oscillation, a pattern found in the tropical Pacific when there are fluctuations in temperatures between the ocean and atmosphere. During El Niño, the surface winds across the entire tropical Pacific are weaker than normal and the ocean surface is at above-average temperatures in the central and eastern tropical Pacific Ocean (Leisure 2014). El Niño typically develops over North America during the winter season, causing the severe winter storms the County often experiences. This climate pattern occurs every few years and brings with it above-average rain and snow across the southern region of the United States, especially in California.

Atmospheric rivers, another climate pattern that leads to adverse weather in the County, are responsible for up to 50 percent of California's precipitation annually and 65 percent seasonally (Arcuni 2019). An atmospheric river (AR) is a long, narrow region of the atmosphere, like a river in the sky, that transports most of the water vapor outside of the tropics. ARs can be 300 miles wide, a mile deep and more than 1,000 miles long and carry an amount of water vapor roughly the same as the average flow of water at the mouth of the Mississippi River (NOAA 2015). Warm water storms over the Pacific Ocean lead to evaporation and create a high concentration of moisture in the air while prevailing winds create the distinctive river shape, which is often compared "to a fire hose pointed at California" (Arcuni 2019). When an AR reaches land, it releases water vapor in the form of rain or snow. ARs play an important role in the global water cycle and are closely tied to both water supply and flooding risk.

Research suggests that atmospheric rivers contributed to the collapse of both Oroville Dam spillways in February 2017 (NASA Global Hydrology Resource Center), as well as the winter flooding in 1861-1862, which completely inundated Sacramento and is considered the worst flood event in California's history (Ingram 2013). When an atmospheric river forms in the tropical regions of the Pacific near Hawaii it is known as a "Pineapple Express". This type of atmospheric river can produce as much as five inches in one day (NOAA 2018). In 2018 two Pineapple Express ARs hit California, causing significant heavy precipitation events throughout the State.

Thunderstorms

Thunderstorms are formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as warm and cold fronts or a mountain. Thunderstorms may occur alone, in clusters, or in lines. As a result, several thunderstorms can affect one location in the course of a few hours. A thunderstorm can produce lightning, thunder, and rainfall and may also lead to the formation of tornadoes, hail, downbursts, and microbursts of wind. Electricity can be interrupted by lightning strikes and property damage can occur if hailstones reach a large diameter. As a result, recreational activities can also be interrupted. During the summer, climatic factors combine to promote the development of thunderstorms.

Lightning

Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four strokes per flash. The length and duration of each lightning stroke vary but typically average about 30 microseconds.

Geographic Area

Extensive – Heavy rain is generally expansive in size. The entire County is susceptible to any of the effects of heavy rain and thunderstorms. Hail and lightning events are also common in the County, which can impact any area of the County during any month of the year.

Extent (Magnitude/Severity)

Critical – The extent for heavy rain, thunderstorms, hail, and lightning weather events can affect up to 50 percent of property in the County. These weather events can also shutdown of facilities and result in severe injuries.

Hail

The NWS classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-75 indicates the hailstone measurements utilized by the NWS.

Table 4-75 Hail Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: NWS

There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms probably produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short so there is not much time for the growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, hail two inches (5 cm) or larger in diameter is associated with supercells (a little larger than golf ball size which the NWS considers to be 1.75 inches.). Non-supercell storms are capable of producing golf ball-size hail.

In all cases, the hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft the larger the hailstone can grow. When viewed from the air, it is evident that hail falls in paths known as hail swaths. They can range in size from a few acres to areas 10 miles wide and 100 miles long. In some instances, piles of hail have been so deep that snowplows were required to remove them, and occasionally hail drifts have been reported. Severe hailstorms can be destructive to property. Vehicles, roofs of buildings and homes, and landscaping are the most commonly damaged by hail. Hail has been known to cause injury to humans and occasionally has been fatal.

Heavy Rain

The heavy precipitation events that Stanislaus County and all of California experience are often the results of an atmospheric river. Atmospheric rivers are categorized by a unit of measurement known as the Integrated Water Vapor Transport (IVT), which takes into account the amount of water vapor in the system and the wind that moves it around. For a storm to be classified as an AR it has to reach an IVT threshold of 250 units; 1,000 IVT or more is considered to be "extreme" (Arcuni 2019). In 2019 a system for categorizing the strength and impacts of atmospheric rivers was developed by the Center for Western

Weather and Water Extremes (CW3E), out of the Scripps Institution of Oceanography at UC San Diego. The newly developed scale ranks ARs into five categories from weak to exceptional. Unlike the Fujita Scale for tornadoes that focuses on potential damages, the AR scale accounts for both storms that may be hazardous and storms that can provide benefits to the local water supply. A category one AR is considered to be primarily beneficial, generally lasting only 24 hours and producing modest rainfall. While a category five AR is considered “exceptional” and primarily hazardous, lasting for several days and associated with heavy rainfall and runoff that may cause significant damages. Table 4-76 below describes the scale further. The CW3E developed the scale as a tool for officials with an operational need to assess flooding potential in their jurisdictions before the storms make landfall.

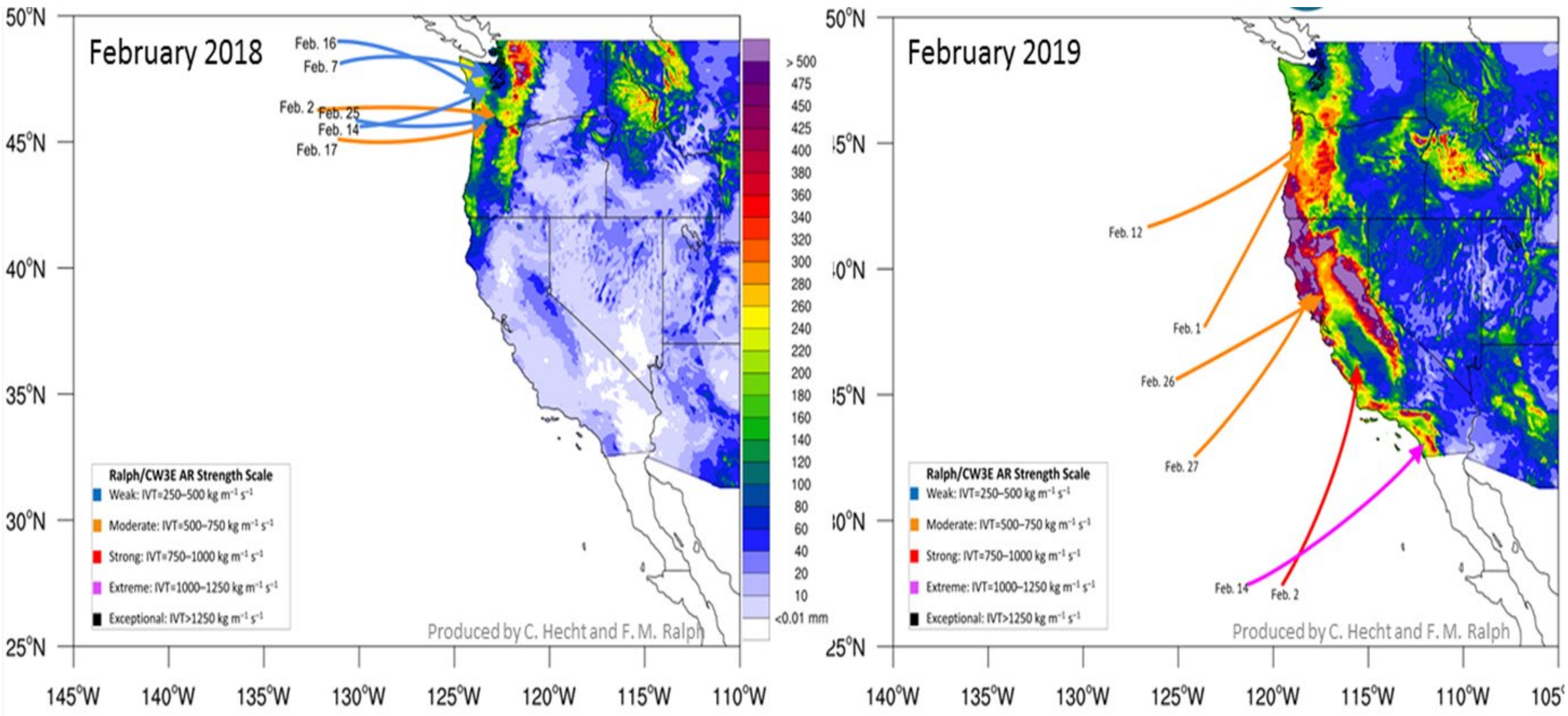
Table 4-76 Atmospheric River Categories

Category	Potential Impacts
AR Cat 1: Weak	Primarily beneficial. For example, a Feb. 2, 2017 AR hit California, lasted 24 hours at the coast, and produced modest rainfall.
AR Cat 2: Moderate	Mostly beneficial, but also somewhat hazardous. An atmospheric river on Nov. 19-20, 2016 hit Northern California, lasted 42 hours at the coast, and produced several inches of rain that helped replenish low reservoirs after a drought.
AR Cat 3: Strong	Balance of beneficial and hazardous. An atmospheric river on Oct. 14-15, 2016 lasted 36 hours at the coast, produced 5-10 inches of rain that helped refill reservoirs after a drought, but also caused some rivers to rise to just below flood stage.
AR Cat 4: Extreme	Mostly hazardous, but also beneficial. For example, an atmospheric river on Jan. 8-9, 2017 that persisted for 36 hours produced up to 14 inches of rain in the Sierra Nevada and caused at least a dozen rivers to reach flood stage.
AR Cat 5: Exceptional	Primarily hazardous. For example, a Dec. 29, 1996 to Jan. 2, 1997 atmospheric river lasted over 100 hours at the Central California coast. The associated heavy precipitation and runoff caused more than $1 billion in damages.

Source: Center for Western Weather and Water Extremes, Scripps Institution of Oceanography at UC San Diego. Scale was developed by F. Martin Ralph Director of CW3E in collaboration with Jonathan Rutz of NWS

In both February 2018 and 2019 the West Coast experienced six ARs. But as shown in Figure 4-38 from the Center for Western Weather and Water Extremes shows, California experienced vastly different precipitation totals due to the location of where the atmospheric river made landfall as well as each atmospheric river’s IVT. Using the AR scale developed by CW3E, the ARs in February 2019 were all considered to be moderate to extreme and concentrated more on California, resulting in heavy precipitation, whereas the ARs in February 2018 did not really impact California.

Figure 4-38 Atmospheric River Strength and Land Distribution, February 2018 vs. February 2019



Source: Center for Western Weather and Water Extremes, Scripps Institution of Oceanography at UC San Diego

Thunderstorms

Although thunderstorm events by themselves may not create significant damage or danger to the County, hail, lightning and high winds events that happen together with thunderstorm events can all have damaging effects.

Lightning

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the NWS to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. The County is at risk to experience lightning in any of these categories. The LAL is reproduced in Table 4-77.

Table 4-77 Lightning Activity Level Scale

LAL 1	No thunderstorms.
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: NWS

Lightning is a common factor in new wildfire starts in the Sierra Nevada, though no specific information is available for Stanislaus County. The relationship of lightning to wildfire ignitions in the County increases the significance of this hazard. Lightning strikes are more likely at higher elevations, such as mountain peaks, and may pose a threat to hikers, climbers, and other recreational users.

Past Occurrences

Hail

Hail events are common in the County. Figure 4-41 shows that different areas within the Planning Area, SOI, and other areas in the vicinity have historically experienced hail events. Several hail events during which quarter and even golf ball-sized hailstones fell happened in recent years. As shown in Table 4-78, since 1950, there have been five reports of hail events that caused around $5,110 property loss and $300,000 crop loss in combination with five injuries in Stanislaus County. (NOAA NCEI 2021). The following table shows the records collected from the NCEI Strom Events Database for hail.

Table 4-78 Hail Events in Stanislaus County, 1950-2021

Location	Date	Property Damages ($)	Crop Damages ($)
Oakdale	3/11/1996	$0	$0
Multi-County	3/28/1998	$0	$300,000
Turlock	5/9/2005	$5,000	$0
Denair	5/9/2005	$10	$0
Oakdale	4/27/2016	$100	$0
	Total:	$5,110	$300,000

Source: NCEI Database

Heavy Rain

Heavy rains and adverse storms occur in Stanislaus County primarily during the late fall and winter but have a chance of occurring in every month of the year. According to information obtained from the WRCC, the majority of precipitation is produced by storms during January and other winter months. Precipitation during the summer months is in the form of rain showers and is rare.

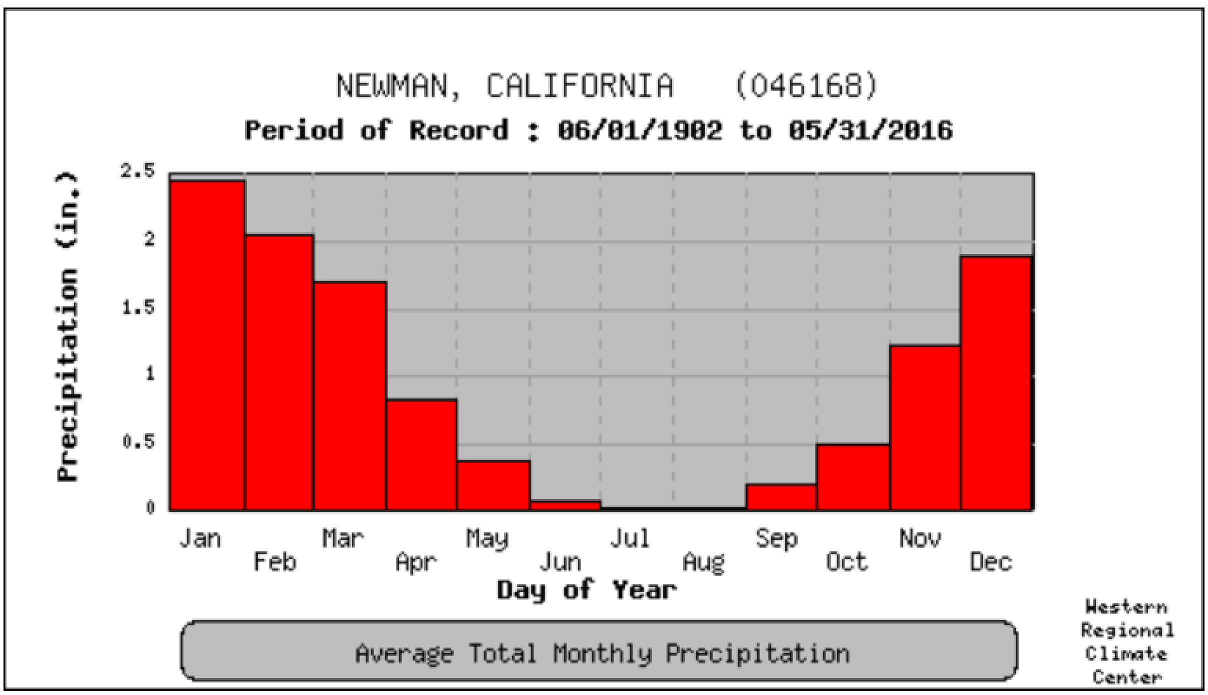
The NCEI records show heavy rainstorms can cause widespread flooding, which can lead to extensive localized drainage issues. In addition to the flooding that often occurs during these storms, strong winds, when combined with saturated ground conditions, can down very mature trees. Refer to the Flood section for more information related to flooding events in the County. There have been eight federal and state disaster declarations (1964, 1969, 1983, 1995, 1997, 1998, 2006 and 2017) for heavy rain, severe storm and flooding in Stanislaus County. In addition, there have four USDA disaster designations (2012, 2016, 2017 and 2019) for excessive rainfall and also one for hailstorm in Stanislaus County (refer to Table 4-3 and Table 4-4 for details).

Information from the two representative weather stations introduced in Subsection 4.3.11 Severe Weather: General are summarized below and in Figure 4-39 through Figure 4-42.

Newman Weather Station (1902-2016)

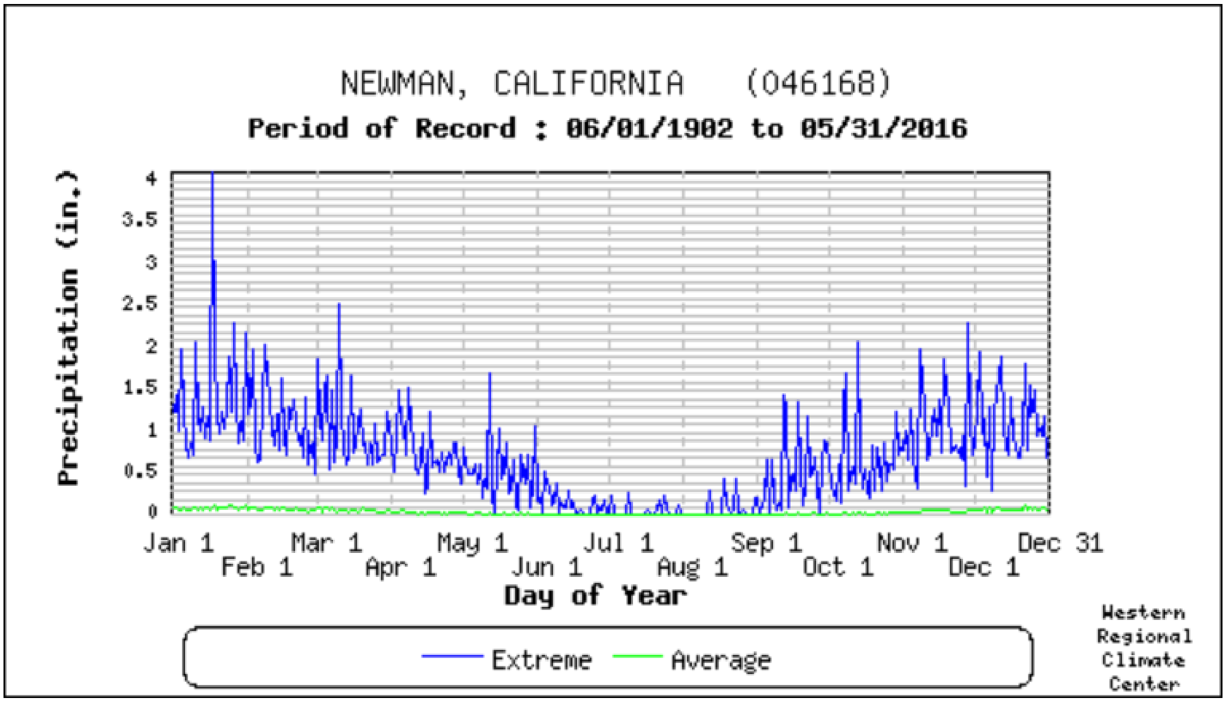
Information from the Newman weather station is summarized below in Figure 4-39 and Figure 4-40. This station covers the southern and southwestern portion of the County. The average annual precipitation recorded at this weather station is 10.69 inches per year. The highest recorded annual precipitation was 22.56 inches in 1998; the highest recorded precipitation for a 24-hour period is 4.1 inches on January 17, 1988. The lowest recorded annual precipitation was 3.34 inches in 1953.

Figure 4-39 Newman Weather Station Monthly Average Total Precipitation (Period of Record 1902-2016)



Source: WRCC, www.wrcc.dri.edu/

Figure 4-40 Newman Weather Station Daily Precipitation Average and Extreme (Period of Record 1902-2016)

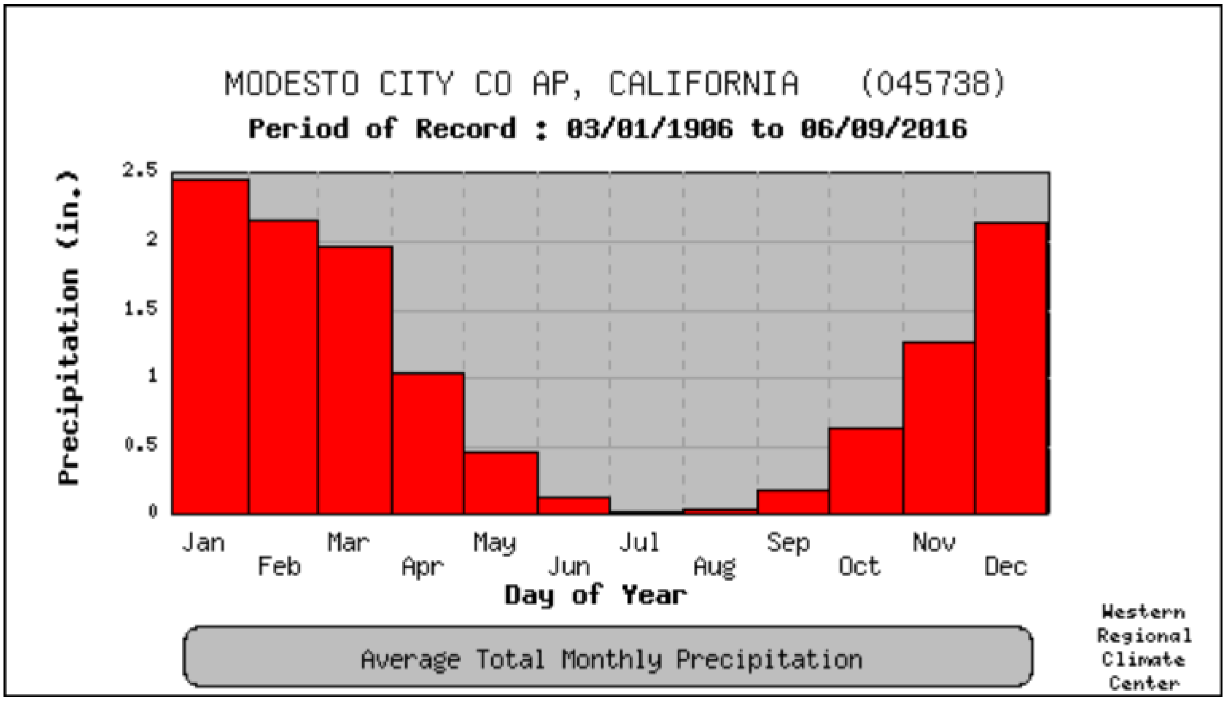


Source: WRCC, www.wrcc.dri.edu/

Modesto City CO AP Weather Station (1906-2016)

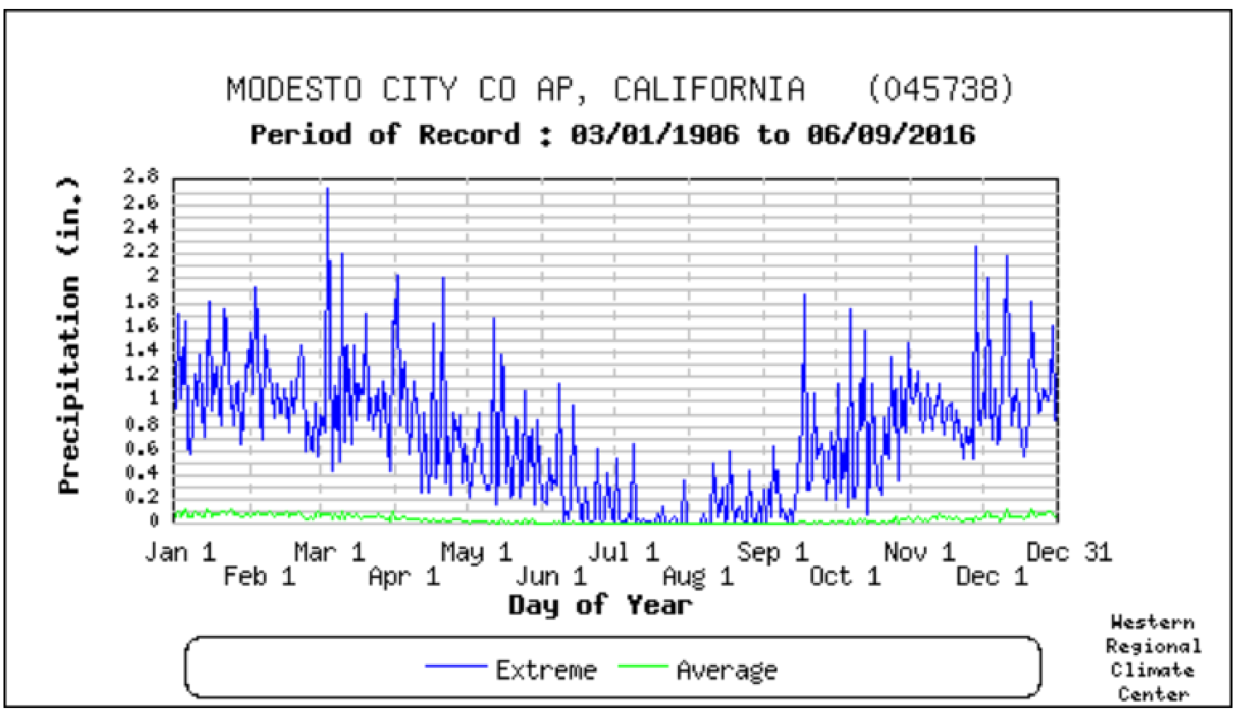
Information from the Modesto City CO AP Weather Station is summarized below in Figure 4-41 and Figure 4-42. The Modesto City CO AP weather stations covers the central portion of the County. The average annual precipitation recorded at this weather station is 12.21 inches per year. The highest recorded annual precipitation was 27.39 inches in 1983; the highest recorded precipitation for a 24-hour period is 2.72 inches on March 4, 1978. The lowest recorded annual precipitation was 5.7 inches in 1929.

Figure 4-41 Modesto City CO AP Weather Station Monthly Average Total Precipitation (Period of Record 1906-2016)



Source: WRCC, www.wrcc.dri.edu/

Figure 4-42 Modesto City CO AP Weather Station Daily Precipitation Average and Extreme (Period of Record 1906-2016)



Source: WRCC, www.wrcc.dri.edu/

The NCEI Storm Events Database records 45 heavy rain events in Stanislaus County between 1950 and 2021. No casualties are recorded for any of the events. As noted above there is a connection between heavy rain events and flooding and is it assumed that the property damages listed in the NCEI database are the results of flooding caused by heavy rain events. Table 4-79 shows the records collected from the NCEI Strom Events Database for heavy rain.

Table 4-79 Heavy Rain Events in Stanislaus County, 1950-2021

Location	Date	Property Damages ($)	Crop Damages ($)
Countywide	11/23/1996	$25,000	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Multi-County	11/10/1997	$0	$0
Countywide	1/12/1998	$0	$0
Countywide	1/18/1998	$0	$0
Multi-County	9/4/1998	$0	$5,000,000
Multi-County	9/9/1998	$0	$0
Multi-County	9/22/1999	$0	$5,000,000
Multi-County	2/1/2000	$0	$0
Multi-County	2/13/2000	$0	$0
Multi-County	9/1/2000	$0	$250,000
Multi-County	7/2/2001	$0	$0
Multi-County	7/5/2001	$0	$0
Multi-County	9/3/2001	$0	$0
Multi-County	9/3/2001	$0	$0
Multi-County	9/3/2001	$0	$0
Multi-County	9/3/2001	$0	$0
Multi-County	9/3/2001	$0	$0
Countywide	3/22/2005	$25,000	$0
Countywide	9/20/2005	$0	$0
Countywide	12/17/2005	$0	$0
Countywide	4/2/2006	$600,000	$200,000
Countywide	12/12/2006	$0	$0
Countywide	4/22/2007	$0	$0
Countywide	7/24/2007	$0	$0
Countywide	10/12/2007	$0	$0
Countywide	1/4/2008	$0	$0
Countywide	10/4/2008	$0	$0
Countywide	10/13/2009	$0	$0
Countywide	1/27/2021	$100,000	$0
	Total	**$750,000**	**$10,450,000**

Source: NCEI

Thunderstorms

It is important to note that county-level thunderstorm data is not available, however, as noted above, thunderstorm events are not uncommon in the County, especially during summer months.

Lightning

As noted above, lightning events are not uncommon in the County. As shown in, since 1950, there have been 3 reports of lightning events that caused around $220,000 property loss in Stanislaus County. (NOAA NCEI 2021). The following table shows the records collected from the NCEI Strom Events Database for lightning.

Table 4-80 Lightning Events in Stanislaus County, 1950-2021

Location	Date	Property Damages ($)	Crop Damages ($)
Westley	9/22/1999	$0	$0
Oakdale	3/21/2017	$200,000	$0
Oakdale	5/25/2018	$20,000	$0
	Total:	**$220,000**	**$0**

Source: NCEI

Probability of Future Occurrences

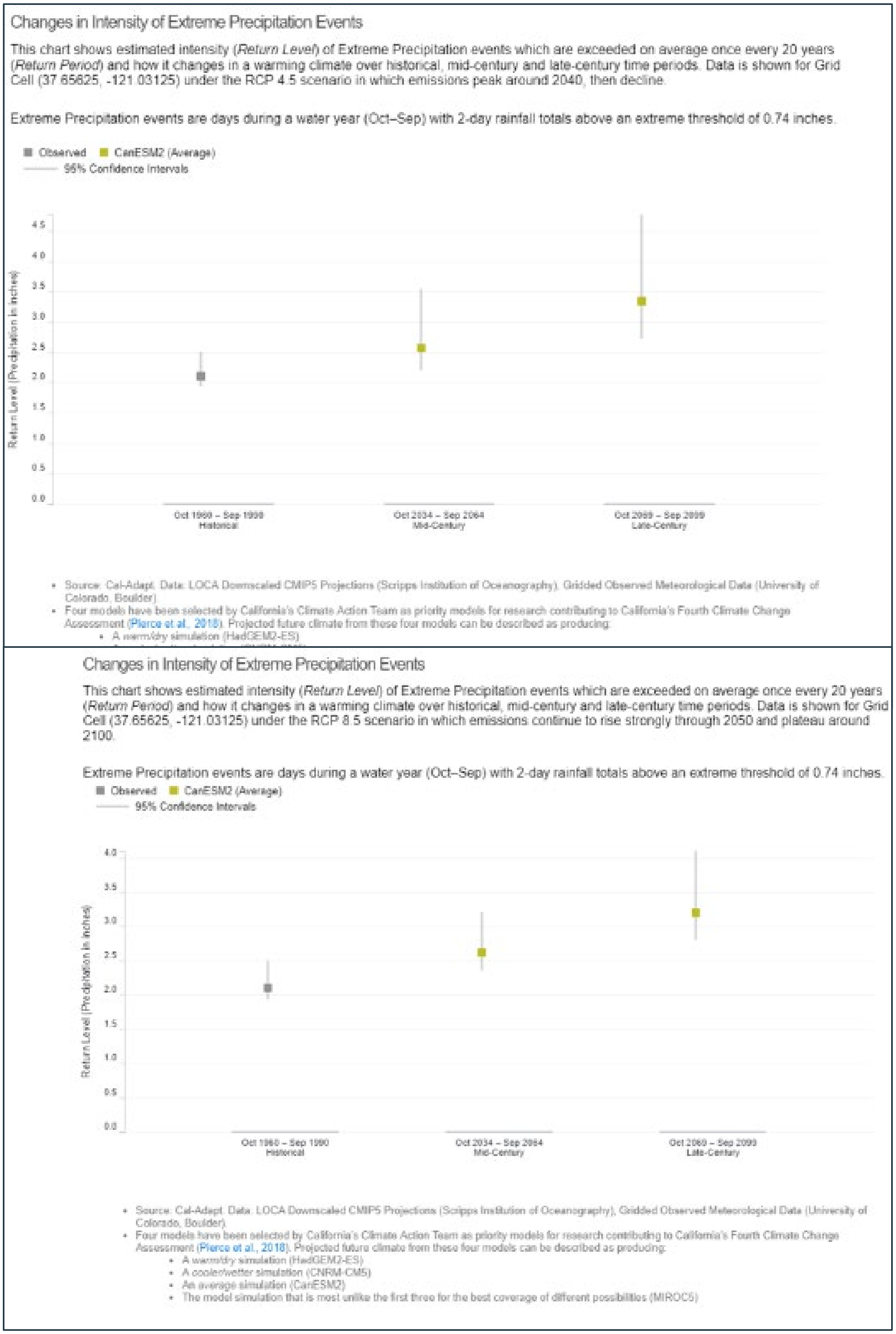
Highly Likely – Based on the NCEI data, 5 hail events, 45 heavy rain events and three lightning events have occurred in Stanislaus County over 72 years of recordkeeping, which equates to one hail event every 14.4 years, one heavy rain event every 1.6 years and one lightning event every 24 years. When combined, there is a 73.6 percent chance that a major hail, heavy rain, or lightning event will happen in any given year. Moreover, given that climatic factors will continue influencing the weather and climate at the County and based on historical data, these severe weather events are highly likely to occur in the future. The actual risk to the County is dependent on the nature and location of any given hazard event.

Climate Change Considerations

As average temperatures increase over time, this generally will result in higher extreme temperatures and more warming in the atmosphere can trigger climate changes, which could result in more frequent extreme weather events. Pacific Northwest National Laboratory researchers have also found that ARs will reach the West Coast more frequently (Gao 2015). Currently, the West receives rain or snow from these ARs between 25 and 40 days each year. By the end of this century, days on which the atmospheric rivers reach the coast could increase by a third, or between 35 and 55 days a year.

Figure 4-43 shows the estimated intensity (return level) of extreme precipitations events which are exceeded on average once every 20 years (return period) and how it changes in a warming climate over historical, mid-century and late-century time periods, based on the Cal-Adapt webtool mentioned in 4.1.4 Climate Change Considerations. Under both RCP 4.5 (low-emissions scenario) and RCP 8.5 (high-emissions scenario), precipitation level will increase throughout the century. When using the average simulation, precipitation will increase from around 2 inches to almost 3.4 inches by 2099 under the low-emissions scenario and will increase from around 2 inches to around 3.2 inches by 2099 under the high-emissions scenario. For these graphs that were exported from Cal-Adapt, extreme precipitation events are defined as days during a water year (Oct–Sep) with 2-day rainfall totals above an extreme threshold of 0.74 inches.

Figure 4-43 Predicted Future Changes in Intensity of Extreme Precipitation Events – Under Low-emissions and High-emissions Scenarios for Stanislaus County



Source: Cal-Adapt 2021

Vulnerability Assessment

General Property

The Stanislaus County Planning Area experiences a rainy season in the winter months through early spring. These winter storms can include significant precipitation. The primary effect of these storms has not resulted in significant injury or damages to people and property, or the losses are typically covered by insurance. It is the secondary hazards caused by weather, such as floods, that have had the greatest impact on the County. Damage and disaster declarations related to adverse weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Utility outages, downing of trees, debris blocking streets and property damage can be a direct result of these storm events. Properties in poor condition may risk the most damage given the nature of these types of storms, the entire County is potentially at risk.

People

Exposure is the greatest danger to people from heavy rain events. People can be caught in rising waters and need to be rescued. Populations living at higher elevations in the eastern and western portions of the County with large stands of trees or power lines may be more susceptible to power outages, while populations in low-lying areas are at risk for possible flooding.

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life-threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during hail, heavy rain, lightning, and thunderstorms events, and could suffer the secondary effects of the hazard. Hikers and climbers in the area may also be more vulnerable to severe weather events.

Critical Facilities

Transportation infrastructure can be affected by hail, heavy rain, and lightning events, mostly associated with secondary hazards. Landslides caused by heavy prolonged rains can block roads. Of particular concern are roads providing access to isolated areas and the elderly, especially given that limited local roads and highways are available to move people and supplies throughout the region. Prolonged obstruction of major routes due to landslides, debris, or floodwaters can disrupt the shipment of goods and other commerce.

Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance. Lightning events can have similarly destructive effects on power and information systems. Failure of these systems would have cascading effects throughout the County and could disrupt critical facility functions. Downed power lines can cause blackouts, leaving large areas isolated.

Economy

The economic impact of heavy rain and hail events is typically short-term. Lightning events can cause power outages and fires. Generally, long-term economic impacts center more around hazards that cascade from a heavy rain event such as flooding. In general, all severe weather poses a risk to the agriculture economy in the County. Table 4-81 and Table 4-82 below describe the crops losses related to hail and heavy rain lightning events and associated indemnity amounts or loss payments from the USDA, RMA in the past 14 years. Please note that RMA does not keep lightning-related data. Stanislaus County experiences an estimated $2,467,018 annualized loss due to crop damages from hail and heavy rain events.

Table 4-81 Crops Loss Due to Hail, RMA Crop Indemnity Reports, 2007-2020

Year	Net Determined Acres	Indemnity Amount
2007	51.90	$33,096
2009	117.00	$89,396
2010	6.10	$2,366
2011	20.19	$15,347
2012	437.93	$520,669
2013	688.10	$427,219
2014	259.91	$527,474
2015	216.40	$264,890
2016	55.24	$67,210
2017	15.85	$26,437
2018	73.10	$171,158
2019	403.53	$186,877
2020	113.45	$168,545
Total	**2,458.7**	**$2,500,684**

Source: USDA RMA

Table 4-82 Crops Loss Due to Heavy Rain, RMA Crop Indemnity Reports, 2007-2020

Year	Net Determined Acres	Indemnity Amount
2007	159	$66,027
2008	13	$28,130
2009	3,123	$3,068,360
2010	4,769	$2,866,463
2011	1,777	$1,752,690
2012	660	$690,067
2013	146	$75,778
2014	3,349	$3,232,043
2015	3,064	$2,963,512
2016	2,806	$4,681,825
2017	7,375	$5,520,654
2018	837	$1,040,027
2019	4,210.62	$4,687,789
2020	1,182.33	$1,364,201
Total	**33,472.8**	**$32,037,565**

Source: USDA RMA

Governmental Services

Hail, heavy rain and lightning can have limited impacts on the continuity of operations throughout the Planning Area. However, events such as power loss that is caused by severe lighting and poor road conditions that result from heavy rain and flooding-induced landslides and mudflows can interrupt daily services such as delivery services and staff being able to perform their normal job functions.

The impact on responders would be similar to the impact on the general public. can be extensive during a severe winter storm. During these extreme weather events, the public will expect notifications as early as possible and updated frequently as events unfold. The local government agencies are expected to enact severe weather operations timely and accordingly.

Historic, Cultural and Natural Resources

As a natural process, the impacts of most heavy rain events by themselves are part of the overall natural cycle and do not cause long-term consequential damage. However, natural habitats such as streams and trees risk major damage. Prolonged rains can saturate soils and lead to slope failure and potentially landslide events. Flooding events can produce river channel migration or damage riparian habitat.

Future Development

New critical facilities, such as communication towers should be built to withstand heavy rain damage. Future development projects should consider adverse weather hazards at the planning, engineering and architectural design stage to reduce vulnerability. Stormwater master planning and site review should account for buildings to withstand heavy rain events considered for all new development. Thus, development trends in the County are not expected to increase overall vulnerability to the hazard but all development will be affected by adverse weather and storm events.

Meanwhile, continued development implies continued population growth, which raises the number of individuals potentially exposed to severe weather. Individual citizens, families, and businesses of the County need to be prepared to address severe weather events when they occur. It is recommended that citizens, families, and businesses have an emergency preparedness plan, such as storing extra supplies of food and water, as well as other related supplies such as flashlights, batteries, firewood and have a battery-operated radio within their home or business. In addition, public education efforts should continue to help the population understand the risks and vulnerabilities of outdoor activities, property maintenance, and regular exposures during periods of severe weather.

Risk Summary

- During the 72-year period from 1950 to 2021, five hail events, 45 heavy rain events and three lightning events occurred in Stanislaus County.
- Average annual precipitation ranges from 10.69 inches in the southern and southwestern portions of the County to 12.61 inches in the central portion.
- The County experiences an estimated $2,467,018 annualized crop loss due to hail and heavy rain events.
- **Related Hazards** – Flooding, Landslide

Table 4-83 Hazard Risk Summary – Heavy Rain, Thunderstorms, Hail, and Lightning

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Extensive	Highly Likely	Critical	High	Yes
City of Ceres	Extensive	Highly Likely	Critical	High	No
City of Hughson	Extensive	Highly Likely	Critical	High	No
City of Modesto	Extensive	Highly Likely	Critical	High	No
City of Newman	Extensive	Highly Likely	Critical	High	Yes
City of Oakdale	Extensive	Highly Likely	Critical	High	No
City of Patterson	Extensive	Highly Likely	Critical	High	No
City of Riverbank	Extensive	Highly Likely	Critical	High	No
City of Turlock	Extensive	Highly Likely	Critical	High	No
City of Waterford	Extensive	Highly Likely	Critical	High	No
County Office of Education	Extensive	Highly Likely	Critical	High	Yes

4.3.14 Severe Weather: High Wind/Tornado

Hazard/ Problem Description

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Windstorms in Stanislaus County are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph that represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. These winds can overturn mobile homes, tear roofs off houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

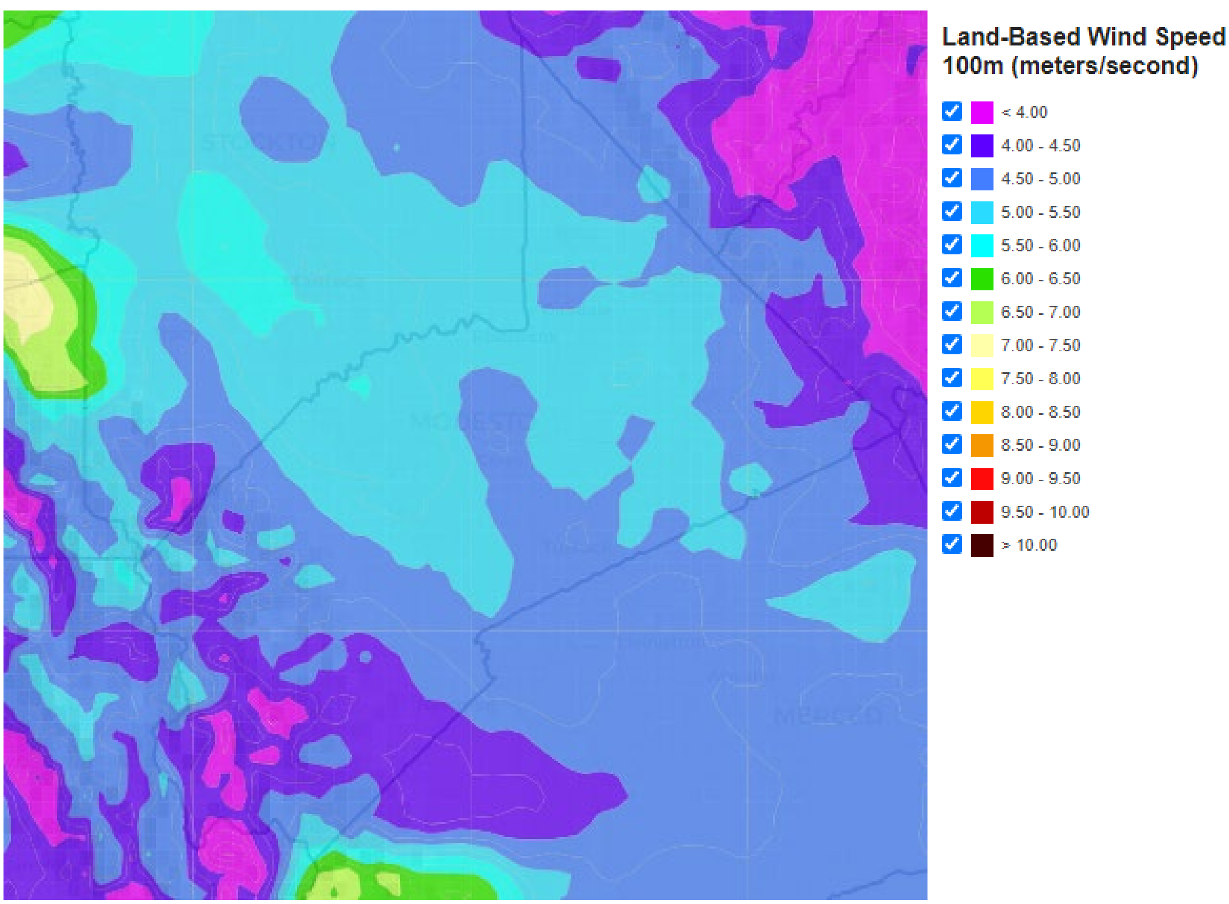
Tornadoes are another severe weather hazard that can affect the Stanislaus County Planning Area. Tornadoes form when cool, dry air sits on top of warm, moist air. Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential that fuels 300-mile-wide hurricanes across a path only 300-yards wide or less.

Geographic Area

Extensive – Wind and tornadoes have the potential to happen anywhere in the County. The resulting damage from wind and tornado events may be most severe in the downtown areas of incorporate communities where there are more large trees, infrastructure, and higher density development.

The National Renewable Energy Laboratory (NREL) collects data on wind resources in the U.S. to help determine the location of new wind energy sites. Figure 4-44 from the NREL Wind Prospector Web viewer shows the average annual wind speed in Stanislaus County at the height of 100 meters. The central portions of the County have average wind speeds between 5.00 meters/second (11.18 mph) and 6.00 meters/second (13.42 mph). The wind speeds in the southwestern portion of the County vary greater than in the eastern portions. The wind speeds in southwestern Stanislaus County could be as low as 4.00 meters/second (8.95 mph) to 4.50 meters/second (10.07 mph) or lower than 4.00 meters/second, however, only a small portion of the eastern county would have wind speeds that are around 4.00 meters/second to 4.50 meters/second, while the majority of the eastern County's wind speeds are between 5.00 meters/second and 6.00 meters/second.

Figure 4-44 Stanislaus County Average Annual Wind Speed at 100 meters



Source: NREL Wind Prospector

Extent (Magnitude/Severity)

Critical – High winds and tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, most injuries and deaths result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying the necessary emergency response.

In 2007, the NWS began rating tornadoes using the Enhanced Fujita Scale (EF-scale). The EF-scale is a set of wind estimates (not measurements) based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures. Table 4-84 describes the EF-scale ratings versus the previous Fujita Scale used prior to 2007 (NOAA 2007).

Table 4-84 The Fujita Scale and Enhanced Fujita Scale

Fujita Scale			Derived		Operational EF-Scale	
F Number	Fastest ¼ Mile (mph)	3-Second Gust (mph)	EF Number	3-Second Gust (mph)	EF Number	3-Second Gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Source: NWS. Notes: EF - Enhanced Fujita F – Fujita mph - Miles per Hour

Figure 4-45 illustrates the potential impact and damage from a tornado.

Figure 4-45 Potential Impact and Damage from a Tornado

Source: NOAA NWS, Storm Prediction Center

The damaging effects of wind speed are measured using the Beaufort Wind Scale as shown in Table 4-85 below. This scale only reflects land-based effects and does not take into consideration the effects of wind over water.

Table 4-85 Beaufort Wind Scale

Wind Speed (mph)	Description – Visible Condition
0	Calm; smoke rises vertically
1-4	Light air; direction of wind shown by smoke but not by wind vanes
4-7	Light breeze; wind felt on face; leaves rustle; ordinary wind vane moved by wind
8-12	Gentle breeze; leaves and small twigs in constant motion; wind extends light flag
13-18	Moderate breeze; raises dust and loose paper; small branches are moved
19-24	Fresh breeze; small trees in leaf begin to sway; crested wavelets form on inland water
25-31	Strong breeze; large branches in motion; telephone wires whistle; umbrellas used with difficulty
32-38	Moderate gale whole trees in motion; inconvenience in walking against wind
39-46	Fresh gale breaks twigs off trees; generally, impedes progress
47-54	Strong gale slight structural damage occurs; chimney pots and slates removed
55-63	Whole gale trees uprooted; considerable structural damage occurs
64-72	Storm very rarely experienced; accompanied by widespread damage
73+	Hurricane devastation occurs

Source: NWS

Based on NCEI records between 1955 and 2021 there have been a combined 34 strong wind/high wind/thunderstorm winds and 30 tornado/funnel cloud events in Stanislaus County, which have resulted in a total of $6,564,500 in property damage. The most damaging event took place on January 4, 2008. A powerful Pacific storm brought widespread winds gusting to 60 mph and in some areas to more than 80 mph across interior Northern California, causing extensive damage and numerous power outages. A 60-mph gust was recorded at Stockton Airport and a 44-mph gust was recorded in Modesto. Numerous homes and business facilities were damaged due directly to the wind and/or by flying debris and falling trees and branches. This wind event resulted in $4,408,000 in property damages (NCEI n.d.). Overall, high wind event impacts would likely be limited, with a majority of impacts being related to property damages caused by downed trees as well as power outages.

In the past 65 years all the tornado events that have taken place in Stanislaus County have been between F0-F1 or EF0 tornadoes. There was only one F2 tornado incident that happened in the year of 1953. However, it should be noted that, although unlikely, larger tornadoes could occur. Should the County be hit by an EF-3 or higher tornado, it can be extrapolated that because of its relative size and the potential size and length of a tornado's path, a significant portion of the County could be impacted, resulting in property and crop damage and loss of life. An EF1 tornado event that happened on November 15, 2015 resulted in $1,000,000 property damage and $200,000 crop damage. A worse tornado event could result in more severe damage.

Tornado impacts to the County would likely be negligible, with less than 10 percent of the Planning Area affected by events in the EF0-2 range, though stronger tornadoes are possible. The impact on quality of life or critical facilities and functions in the affected area would depend on where the tornado occurred. Injuries or deaths are possible due to wind thrown trees or property damage caused by wind events. Overall, impacts from high wind and tornado events would likely be negligible, with less than 10 percent of property severely damaged and shutdown of facilities due to loss of power for 24 hours or less.

Past Occurrences

During the rainy season, the Stanislaus Planning Area is prone to relatively strong thunderstorms, sometimes accompanied by high winds and tornadoes. While tornadoes do occur occasionally, most often they are of F0/EF0 intensity. The NCEI Storm Events Database does not record any tornado events that had a magnitude higher than F2 or EF1 in the Planning Area in the past. Table 4-86 Past High Wind and Tornado Events contains incident descriptions for significant historic events. In addition to the events listed in the NCEI database, there was a USDA disaster designation declared for Stanislaus County in 2016 for "severe weather including excessive rainfall and high winds" (refer to Table 4-4).

Table 4-86 Past High Wind and Tornado Events in Stanislaus County, 1950-2021

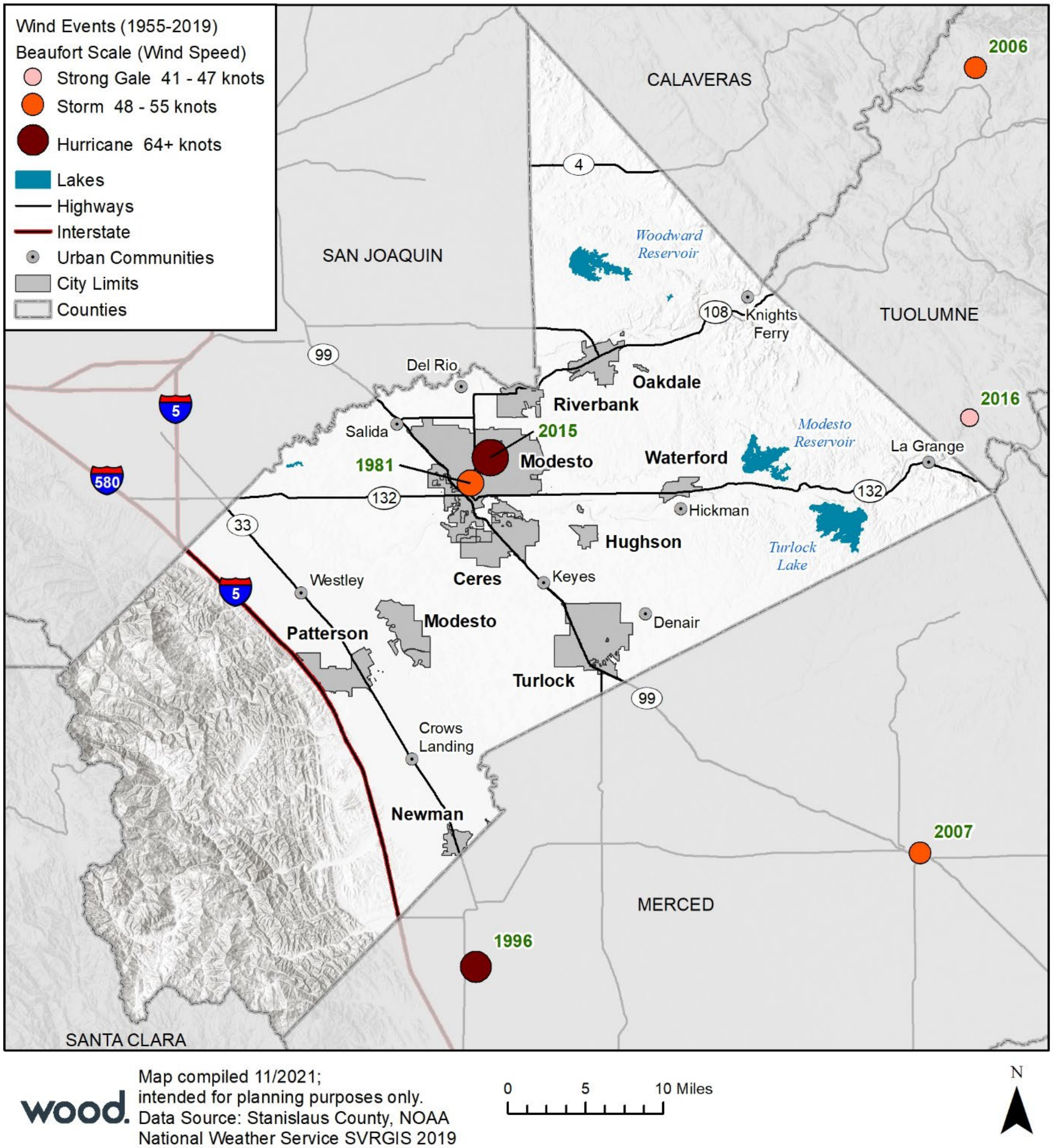
Hazard Type	Date	Location	Magnitude	Property Damages ($)	Crop Damages ($)	Deaths	Injuries
Tornado	4/27/1953	Countywide	F2	$2,500	$0	0	0
Tornado	4/1/1958	Countywide	F1	$2,500	$0	0	0
Tornado	3/1/1978	Countywide	Unknown	$25,000	$0	0	0
Tornado	3/4/1978	Countywide	Unknown	$25,000	$0	0	0
Tornado	1/14/1980	Countywide	F1	$250,000	$0	0	1
Thunderstorm Wind	5/23/1980	Countywide	Unknown	$0	$0	0	0
Thunderstorm Wind	3/19/1981	Countywide	52	$0	$0	0	0
High Wind	1/16/1996	Countywide	Unknown	$10,000	$0	0	0
Funnel Cloud	2/5/1996	Patterson	Unknown	$0	$0	0	0
Funnel Cloud	3/12/1996	Turlock	Unknown	$0	$0	0	0
Tornado	4/1/1996	Newman	F0	$0	$0	0	0
High Wind	4/11/1996	Countywide	66	$150,000	$0	0	0
Tornado	12/12/1996	Oakdale	F1	$10,000	$0	0	0
High Wind	4/2/1997	Countywide	50	$0	$0	0	1
High Wind	12/21/1997	Countywide	40	$0	$0	0	0
High Wind	2/6/1998	Countywide	47	$0	$0	0	0
High Wind	2/7/1998	Countywide	35	$0	$0	0	0
Funnel Cloud	5/5/1998	Ceres	Unknown	$0	$0	0	0
Funnel Cloud	5/5/1998	Modesto	Unknown	$0	$0	0	0
Funnel Cloud	5/5/1998	Salida	Unknown	$0	$0	0	0
High Wind	6/16/1998	Countywide	Unknown	$25,000	$0	0	2
High Wind	10/16/1998	Countywide	38	$100,000	$0	0	0
High Wind	11/7/1998	Countywide	40	$0	$0	0	0
High Wind	4/3/1999	Countywide	35	$0	$0	0	0
High Wind	4/22/1999	Countywide	34	$20,000	$0	0	0
High Wind	2/11/2000	Countywide	37	$0	$0	0	0
High Wind	10/21/2000	Countywide	35	$0	$0	0	0
High Wind	2/24/2001	Countywide	41	$0	$0	0	0
High Wind	3/4/2001	Countywide	36	$0	$0	0	0
Funnel Cloud	3/19/2005	Ceres	Unknown	$0	$0	0	0
Tornado	3/20/2005	Modesto	F0	$0	$0	0	0
Funnel Cloud	5/9/2005	Modesto	Unknown	$0	$0	0	0
Tornado	4/14/2006	Modesto	F1	$15,000	$0	0	0
High Wind	1/4/2008	Countywide	52	$4,408,000	$0	0	0
High Wind	1/20/2010	Countywide	44	$0	$0	0	0
Strong Wind	4/8/2013	Countywide	39	$500	$0	0	0
Strong Wind	10/27/2013	Countywide	43	$0	$0	2	2
Tornado	11/15/2015	Denair	EF1	$1,000,000	$200,000	0	0
Thunderstorm Wind	12/24/2015	Northeast Modesto	87	$150,000	$0	0	0
Tornado	12/24/2015	Modesto Airport	EF0	$20,000	$0	0	0
Tornado	4/27/2016	Waterford	EF0	$500	$0	0	0
Funnel Cloud	1/11/2017	Turlock (Chemurgic tributary)	Unknown	$0	$0	0	0
High Wind	1/18/2017	Countywide	53	$0	$0	0	0
Strong Wind	2/17/2017	Countywide	45	$100,000	$0	0	0
Strong Wind	2/17/2017	Countywide	45	$10,000	$0	0	0
Funnel Cloud	3/21/2017	Denair	Unknown	$0	$0	0	0

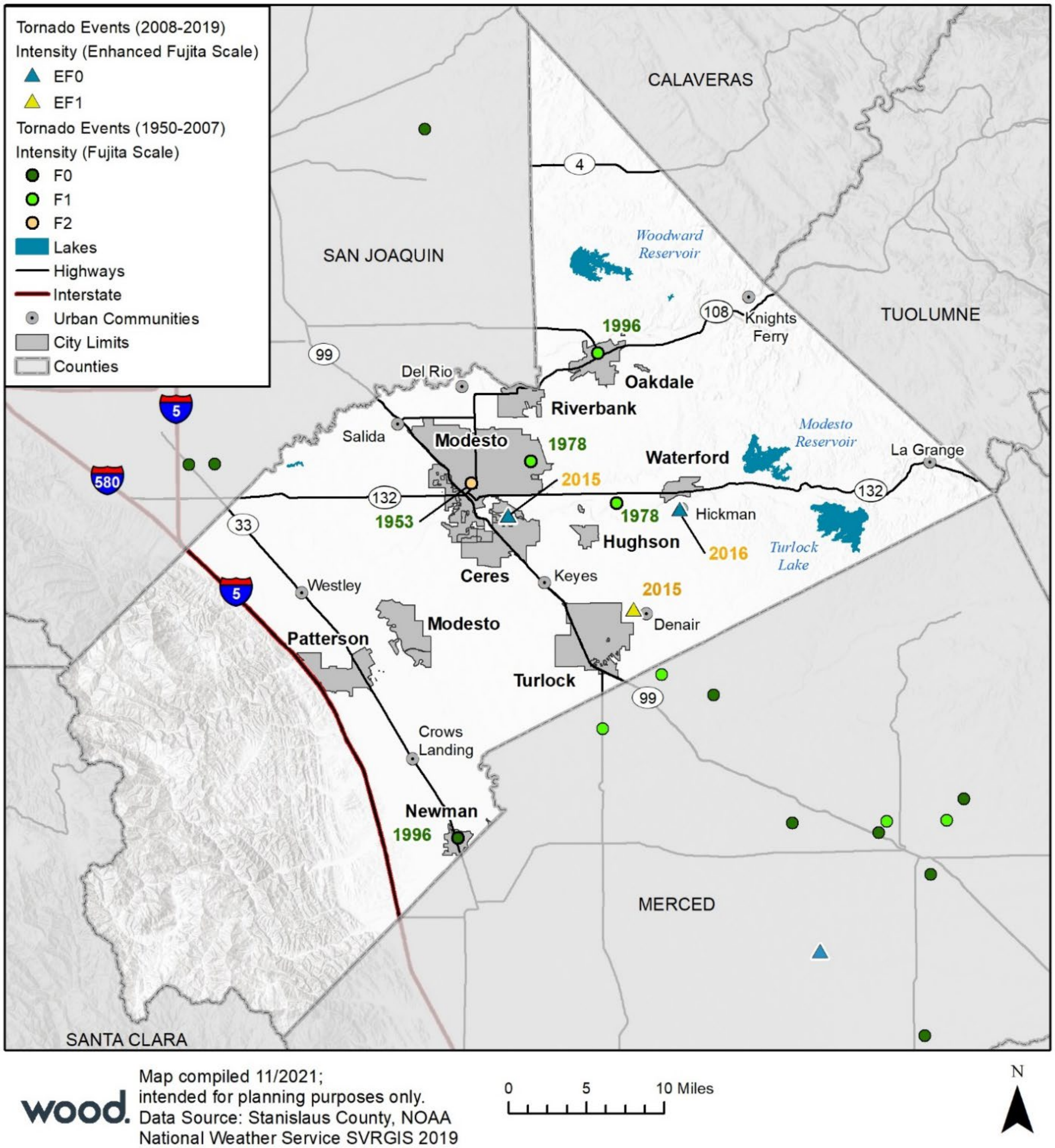
Hazard Type	Date	Location	Magnitude	Property Damages ($)	Crop Damages ($)	Deaths	Injuries
Funnel Cloud	3/21/2017	Turlock	Unknown	$0	$0	0	0
Funnel Cloud	5/16/2019	(NRC)NAF Crows Landing	Unknown	$0	$0	0	0
Funnel Cloud	5/16/2019	Oakdale	Unknown	$0	$0	0	0
Strong Wind	2/9/2020	Countywide	46	$35,000	$0	0	0
Strong Wind	1/18/2021	Countywide	45	$5,000	$0	0	0
High Wind	1/26/2021	Countywide	50	$200,000	$0	0	0
			Total	**$6,564,000**	**$200,000**	**2**	**6**

Source: NCEI Storm Events Database, Notes: mph – Miles per Hour, ARPT – Airport, AFB – Airforce Base, (NRC)NAF CROWS LANDI – NASA Crows Landing Airport and Test Facility

Figure 4-46 and Figure 4-47 show the location of the past wind and tornado events in Stanislaus County based on data from NOAA's NWS Storm Prediction Center.

Figure 4-46 Tornado Events in Stanislaus County, 1950 -2019




Tornado Events (2008-2019)
Intensity (Enhanced Fujita Scale)
EF0
EF1
Tornado Events (1950-2007)
Intensity (Fujita Scale)
F0
F1
F2
Lakes
Highways
Interstate
Urban Communities
City Limits
Counties
CALAVERAS
SAN JOAQUIN
TUOLUMNE
MERCED
SANTA CLARA
Woodward Reservoir
Modesto Reservoir
Turlock Lake
Knights Ferry
Oakdale
Riverbank
Del Rio
Salida
Modesto
Waterford
La Grange
Hickman
Hughson
Ceres
Keyes
Denair
Westley
Patterson
Turlock
Crows Landing
Newman
1996
1978
2015
1953
1978
2016
2015
1996
4
108
99
132
33
5
580
Map compiled 11/2021;
intended for planning purposes only.
Data Source: Stanislaus County, NOAA
National Weather Service SVRGIS 2019
0 5 10 Miles
N

Probability of Future Occurrences

Highly Likely – Sixty-four high wind and tornado events have occurred in Stanislaus County over 72 years of recordkeeping, which equates to one high wind or tornado event every 1.13 years, on average, and an 89 percent chance of a high wind or tornado event occurring in any given year. Historical wind activity within the Planning Area indicates the County will likely continue to experience high wind during thunderstorm events with the potential of the formation of funnel clouds and low-intensity tornadoes during adverse weather conditions. The actual risk to the County is dependent on the nature and location of any given thunderstorm or tornado event.

Climate Change Considerations

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity. NASA's Earth Observatory has conducted studies that aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others do not, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. Because of uncertainty with the influence of climate change on tornadoes, future updates to the mitigation plan should include the latest research on how the tornado hazard frequency and severity could change. An article published on National Geographic also agrees that there is still a lot to learn about how climate change might affect tornadoes. As one of nature's most violent storms, climate change's effect on tornadoes remains unclear (National Geography 2019). The level of significance of this hazard should be revisited over time.

As for wind, studies referenced in California's Fourth Climate Assessment indicated that extreme fire weather, particularly in the form of hot and dry winds, can strongly influence shrub-land fire regimes. Strong winds have also been now associated with severe forest fires in California meaning climate change impacts on wind patterns may also affect forest health and wildfire susceptibility. Lastly, other ongoing research compiled in the recent climate assessment has resulted in different conclusions on the effect of climate change on wind regimes, particularly extreme wind events, such as the Santa Ana and Diablo winds that created some of the most devastating wildfires (California Natural Resources Agency 2018a). At this time, these changing factors are not well understood and are still being incorporated into state and regional research and risk analysis.

Vulnerability Assessment

General Property

General damages are both direct (what the wind event physically destroys) and indirect, which focuses on additional costs, damages and losses attributed to secondary hazards spawned by the event, or due to the damages caused by the wind event. Depending on the magnitude of the wind events as well as the size of the tornado and its path, a tornado is capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize the resistance of the structures to damage.

Secondary impacts of damage caused by wind events often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation infrastructure, create difficulties in reporting and responding to emergencies. These indirect impacts of a wind event put tremendous strain on a community. In the immediate aftermath, the focus is on emergency services.

Downed trees caused by a wind event are a common occurrence in the County. Falling trees can cause significant damage to property and put people at risk. Due to multiple years of drought in the County, many trees in the area have been impacted making them more susceptible to blow-down during wind events.

People

Community members are the most vulnerable to high wind and tornado events. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. However, there are also segments of the population that are especially exposed to the indirect impacts of high winds and tornadoes, particularly the loss of electrical power. According to the data obtained from emPOWER.com, a website maintained by the U.S. Department of Health and Human Services, 4%, or 3,482 of the 88,934 of the Medicare beneficiaries in the County rely on medical equipment that is dependent on electricity in order to live independently. These populations include the elderly or disabled, especially those with medical needs and treatments dependent on electricity. Nursing homes, community-based residential facilities, special needs housing facilities, and isolated communities are also vulnerable. Life support needs can be threatened when electrical outages are prolonged since backup power generally operates only minimal functions for a short period of time.

PUBLIC SAFETY POWER SHUTOFF

High winds can cause trees or debris to damage electric lines and cause wildfires. As a result, utility providers may need to turn off power during severe weather events – high wind & other events that could increase wildfire risk. This is called a Public Safety Power Shutoff. In 2020, state-funded PSPS grant program was changed to “Community Power Resiliency”, which will continue to support critical services vulnerable to power outage events, including schools, county election offices, and food storage reserves.

Following the unprecedented 2018 wildfire season in California, Pacific Gas & Electric (PG&E) announced it will be conducting PSPS when there are high winds and dry conditions and generally a heightened fire risk forecasted. The outages could last several days, and PG&E has suggested customers be prepared for outages that could last longer than 48 hours. A majority of Stanislaus County could be affected by the power outages. In addition to PG&E, both MID and TID provide power to Stanislaus County residents. According to MID and TID’s official websites, both of their service territories are either not designated as high fire threat area or have a very low wildfire risk. Despite the low risk, both irrigation districts have been implementing their own Wildfire Mitigation Plans, which outline a range of activities and actions to help both irrigation districts prevent and respond to the increasing risk of wildfires. PSPS is mentioned on both irrigation districts websites. Both irrigation districts also have 24-hour hotlines for customers to call and report power outage events. TID also keeps an online platform where customers can check out current outage information, including the estimate on when the power will return.

Government Services

Most structures, including the County’s critical facilities, should be able to withstand and provide adequate protection from severe wind and tornadoes. Those facilities with backup generators should be fully equipped to handle severe wind and tornado events should the power go out. The impact of high wind on responders is similar to that of the general public. In the event of a tornado, there may be localized impacts to response personnel. Impacts on transportation corridors and communications lines affect first responders’ ability to respond effectively. To maintain public confidence, jurisdictions must continue to adhere to building codes and to facilitate new development that is built to the highest design standards to account for heavy winds and tornado winds.

Critical Facilities and Infrastructure

Both winds and tornadoes may impact exposed critical infrastructure such as power lines; depending on the impact and the function, this could cause a short-term economic disruption. The most common problems associated with tornadoes and high winds are loss of utilities. Downed power lines can cause power outages, leaving large parts of the County isolated, and without electricity, water, and communication. Damage may also limit timely emergency response and the number of evacuation routes. Downed electrical lines following a storm can also increase the potential for lethal electrical shock. Damaging winds can also cause wildfires.

On June 26, 2020, California Governor Gavin Newsom and the State Legislature approved the Fiscal Year 2020-2021 State Budget, which included a $50 million onetime General Fund appropriation to support State and local government efforts to mitigate the impacts of the investment-owned utility use of PSPS. In 2020, the name of the PSPS program was changed to “Community Power Resiliency”. Building on the previous year’s investments, the resiliency program will support critical services vulnerable to power outage events, including schools, county election offices, and food storage reserves.

In 2019, the Stanislaus County OES received an initial award of $494,197 for PSPS resiliency initiatives. The OES awarded Public Works Department $220,000 in PSPS resiliency funding to purchase four trailermounted generators that supply backup power to support essential water and sewer system services during power disruptions. The OES also awarded the Parks and Recreation Department $100,000 in resiliency funding to purchase two portable generators that provide backup power to support the reservoir that supplies over 200,000 customers with drinking water. Additionally, the OES awarded $130,425 in resiliency funding to the West Stanislaus Fire Agencies to purchase Community Resource Center (CRC) equipment that will support the communities of Grayson, Westley, Vernalis, Patterson, and Newman during a PSPS event.

The Stanislaus County OES received an additional PSPS resiliency award of $247,098 on October 2, 2020, that requires OES to allocate at least 50% percent of the award to support one or more of the resiliency areas: schools, election offices, food storage reserves, and/or COVID-19 testing sites. Of the total amount, $197,678, or 80%, is expected to be spent in the community to support resiliency efforts. The remaining $49,420, or 20%, is expected to be used within the County on other resiliency efforts.

Economy

Winds typically do not have long-term impacts on the economy, although wind does have an impact on the agriculture economy in the County. As shown in Table 4-87, wind events have been a leading cause of crop loss in the past 15 years (2007 – 2021), resulting in over $1.7 million in loss payments from the USDA and more than 3,500 acres lost to high wind events. Stanislaus County experiences an estimated $113,333 annualized loss due to crop damages from excessive wind events.

Table 4-87 Crops Loss Due to High Wind, RMA Crop Indemnity Reports, 2007-2021

Year	Net Determined Acres	Indemnity Amount
2007	168.83	$6,6302
2008	581.5	$540,125
2009	36.95	$125,915
2010	5.7	$2,641
2011	20.8	$78,962
2012	130	$7,644
2013	721.06	$398,954
2014	39.15	$19,646
2015	89.17	$74,225
2016	141.29	$76,638
2017	253.86	$244,427
2019	134.03	$60,623.55
2020	4.08	$18,287.6
Total	**3,539**	**$1,721,079**

Source: USDA RMA

Historic, Cultural and Natural Resources

High winds and tornadoes can cause massive damage to the natural environment, uprooting trees and other debris. This is part of a natural process, however, and the environment will return to its original state in time.

Future Development

As the County continues to increase in population, the number of people and housing developments exposed to the hazard increases. Adherence to current building codes, coupled with proper education on building techniques and the use of sturdy building materials, attached foundations, and other structural techniques may minimize the property vulnerabilities. Public shelters at parks and open spaces may help reduce the impacts of tornadoes and high wind events on the recreational populations exposed to storms.

Risk Summary

- Between 1950 and 2021 there were a combined 64 high wind (34) and tornado (30) events in the County.

- Wind and tornado events have resulted in $6,564,500 in property damages. The most damaging event took place on January 4, 2008, with wind ranging from 44 to 60 mph causing $4,408,000 in property damages.
- Excessive wind has caused 3,539 acres to be lost and $1,721,079 crop loss payment made by the USDA to farmers in the County.
- PSPS poses a risk to individuals in the County who depend on electricity to live independently. Four percent of Medicare Beneficiaries in the County are electricity dependent.
- **Related Hazards** – Extreme heat, Heavy Rain, Agriculture/Pest and Crop Disease, Wildfire

Table 4-88 Hazard Risk Summary – High Wind/Tornado

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Hazard Priority?
Stanislaus County	Extensive	Highly Likely	Critical	High	Yes
City of Ceres	Extensive	Highly Likely	Critical	High	No
City of Hughson	Extensive	Highly Likely	Critical	High	No
City of Modesto	Extensive	Highly Likely	Critical	High	No
City of Newman	Extensive	Highly Likely	Critical	High	No
City of Oakdale	Extensive	Highly Likely	Critical	High	No
City of Patterson	Extensive	Highly Likely	Critical	High	No
City of Riverbank	Extensive	Highly Likely	Critical	High	No
City of Turlock	Extensive	Highly Likely	Critical	High	No
City of Waterford	Extensive	Highly Likely	Critical	High	No
County Office of Education	Extensive	Highly Likely	Critical	High	No

4.3.15 Wildfire

Hazard/Problem Description

A wildfire is an uncontrolled fire spreading through vegetative fuels, such as grasslands, brush, or woodlands and posing danger and destruction to property and watersheds. Wildfires can occur in areas essentially void of development, or in areas where development intermingles with the natural area known as the wildland-urban interface (WUI), a general term that applies to development adjacent to landscapes that support wildfire. Many wildfires occur in locations that abound in grasslands and brush. Heavier fuels with high temperatures, low humidity, low rainfall, and high winds all work to increase wildfire risk.

While wildfires are often the direct result of lightning strikes, they can be caused by downed powerlines or mechanical equipment or are the result of human activities like landscape debris burns, carelessness, or arson. Wildfires often start in undeveloped areas and public land areas, such as state and federal lands, but can spread to urban areas where structures and other human development are more concentrated. The predominant dangers from wildfires are:

- Injury or loss of life to people in the affected area; and
- The destruction of vegetation, property, wildlife.

Communities throughout California are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Wildfire risk is predominantly associated with WUI areas. However, significant wildfires can also occur in heavily populated areas, although urbanized and developed areas that are not contiguous with vast areas of wildlands are typically considered safer from wildfires.

Stanislaus County is exposed to a variety of wildfire hazard conditions that vary based on fuels, topography, weather, and human behavior. Cal FIRE, as required by Government Code Section 51181, has undertaken a statewide program to map areas of potential wildfire severity, and to describe the potential for wildfires to occur in a given area; the resulting Fire Hazard Severity Zones (FHSZs) adopted in November 2007 for the State Responsibility Areas (SRA) and adopted in September 2007 for the Local Responsibility Area (LRA) are shown in Figure 4-47 below. Cal FIRE determined Stanislaus County had no Very High FHSZs

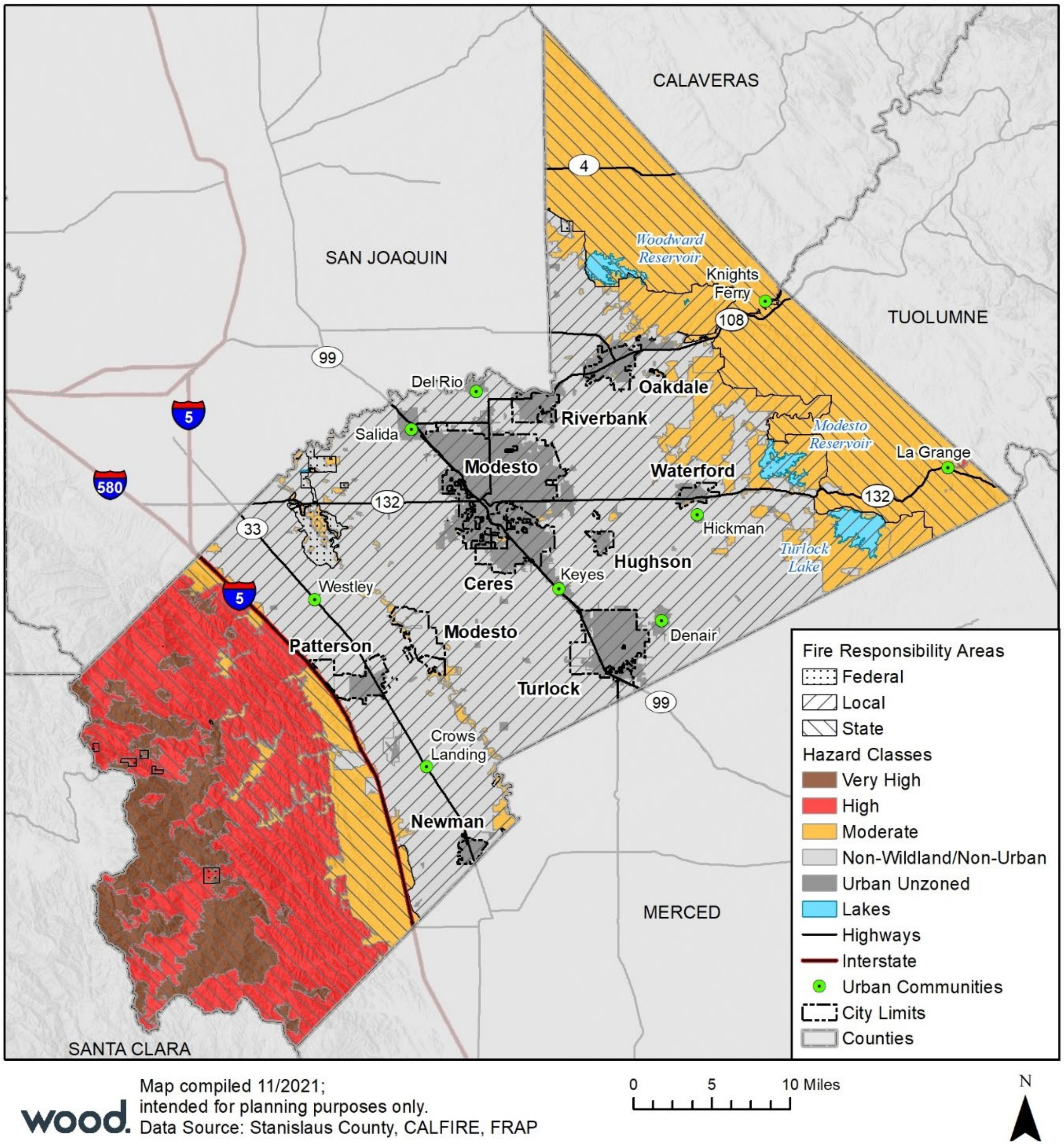
(VHFHSZs) in the LRA. Therefore, Figure 4-47 does not have a specific map or zone of recommended VHFHSZ in the LRA.

Wildfires are an important natural component of Stanislaus County's ecosystem. Wildlands need to burn periodically to naturally maintain viable environments. Fuel maintenance (controlled burns, mowing, cattle grazing, and other means) is a necessary replacement to uncontrolled wildland fires because of threats to human habitation. Development patterns in rural lands can reduce the ability to manage fuel and defend "values at risk".

Generally, there are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather.

- **Fuel** – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source are manmade structures, such as homes and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that can be modified by humans. The main fuel types in Stanislaus County are crops and grasses, while there are also brush and pine fuels present in some areas in the western portion of the County.
- **Topography** – An area's terrain and slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement and types of vegetation throughout a hillside can also contribute to increased fire activity on slopes.
- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will more readily ignite and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most influential weather factor of the three and its influence can increase rates of spread regardless of temperature and relative humidity.

Figure 4-47 Stanislaus County Federal, State, and Local Responsibility Severity Zones



Geographic Area

Significant – Both urban and wildland fires conditions exist in Stanislaus County, which increases the chances for damage to property, loss of life and/or injury. In the WUI, where development has expanded into rural, higher-risk areas, wildfires can result in major losses of property and structures. In most of Stanislaus County, Cal FIRE ranks fuel loading as low. Fuels are mainly crops and grasses. In the far western and eastern portions of the County in areas identified by Cal FIRE as SRAs, there is undeveloped and rugged terrain that contains highly flammable grass, brush, and some pine fuels, which are ranked as moderate fuel hazards, primarily in the area west of Interstate 5 (I-5). The far western portion of the County includes the Diablo Range, located west of I-5. The far eastern portion of the County includes the Sierra Nevada foothills. These two areas are managed by Santa Clara Unit (SCU) and Tuolumne Calaveras Unit (TCU), respectively and are the two areas in the County that are rated as having the highest possible critical fire weather frequency on an annual basis. Risk information for the SRAs are summarized in Cal FIRE's Strategic Fire Plan for the SCU and TCU.

Generally, fire season in Stanislaus County extends from early spring to late fall (May to October) of each year, but wildfires can now occur at any time of the year during the warmer and dryer months. Onset can happen suddenly due to lightning or human-caused factors and wildfires can last from a few hours to a few months, but the likely hood of a large and damaging fire lasting for months in Stanislaus County is not likely. Secondary effects from wildfire include increased erosion, destabilized slopes, degraded air and water quality, and economic impacts from burned landscapes. Urban fires primarily involve the uncontrolled burning of residential, commercial and/or industrial structures generally caused by human activities.

Cal FIRE's Fire and Resource Assessment Program (FRAP) assesses the amount and extent of California's forests and rangelands, analyzes their conditions, and identifies alternative management and policy guidelines. Cal FIRE identifies areas that are at high risk of damage from wildfire based primarily on three factors:

- **Ranking Fuel Hazards** – ranking vegetation types by their potential fire behavior during a wildfire.
- **Assessing the Probability of Fire** – annual likelihood that a large damaging wildfire would occur in a particular vegetation type.
- **Defining Areas of Suitable Housing Density that would Create WUI Fire Protection Strategy Situations** – areas of intermingled wildland fuels and urban environments that are in the vicinity of fire threats.

Population density and the presence of structures are not currently used to determine the FHSZ for a particular region, although they do have a significant impact on fire behavior. Based on the above criteria, Cal FIRE maps FHSZs for each county as "Very High," "High," or "Moderate". As shown below in Figure 4-49, the areas ranked Very High and High are primarily located west of I-5 County. These areas exhibit the combination of vegetative fuel and topography that contribute to an increased fire hazard potential. The fact that an area is in a "Moderate" hazard designation does not mean it cannot experience a damaging fire. It only means that the probability is reduced, generally because the number of days a year that the area has "fire weather" is less.

The FHSZ spatial dataset was explicitly developed for adopting new ignition-resistant building code standards mandated by the California Building Standards Commission in 2007 (California Code of Regulations [CCR], Title 24, Part 2, known as the California Building Code [CBC] Chapter 7A). The dataset is used to implement WUI building standards for new construction, defensible space requirements, and property development standards such as road width, water supply, and signage. For example, beginning on July 1, 2021 Assembly Bill 38 required all homes sales in "High" or "Very High" FHSZs to be compliant following a Defensible Space Inspection. The FHSZ spatial datasets were also developed to describe the nature and probability of fire exposure to structures, including those lands that are highly urbanized, but in close proximity to open wildlands. It is broken into Federal Responsibility Areas (FRA), SRA, and LRA shown below.

Cal FIRE has also designated the following Stanislaus County communities as being at increased risk from wildfires (https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/fire-plan/communities-at-risk/):

- Knights Ferry
- La Grange
- Oakdale
- Riverbank

Some unincorporated communities located within the County are not confronted with a high wildfire risk, due primarily to the dominant type of vegetation in those areas. The low-growing native grasses and shrubs found in these communities present a minimal vegetative fuel source and a corresponding low wildfire risk. In addition, the topography of those areas is mainly level and well developed in both residential and agricultural land uses.

Extent (Magnitude/Severity)

Negligible – Vegetation (or fuel) plays a major role in fire behavior and shaping fire hazard potential. Vegetation distribution throughout the County varies by location and topography, with dramatic differences observed between the western, central, and eastern portions of the County. For instance, fire behavior in brush fuel types, such as chapparal produces higher flame lengths than that in grassland, although spread rates are typically slower. Fire behavior in forests is variable, depending on surface fuel conditions and the presence of ladder fuels.

Fuel loading in developed areas susceptible to wildfire becomes even more complex. The introduction of some ornamental plantings as landscaping and groundcover can dramatically increase the fire loading of a neighborhood. Gazebos, fencing, patios, decks and even the structures themselves add even more fuel. Once structures become involved in fire, the problem compounds as embers cast out thousands of feet onto combustible roofs well removed from the wildland area.

Steep terrain also plays a key role in the rate at which wildfires spread, as fires will normally burn much faster uphill. Generally, when the gradient of a slope doubles, the rate of spread of a fire will also double. Steep topography also channels air flow, thereby creating erratic wind patterns. Fire suppression in steep areas is also complicated by limited accessibility, and the effectiveness of firefighters and equipment are hampered by lack of access roads. Another factor that can increase the severity of wildfires in the County is areas with high percentages of dead trees, as discussed in Subsection 4.3.1 Agricultural Pests and Disease and Subsection 4.3.5 Drought.

The Fire Rating System defined in Table 4-89 describes the characteristics and potential intensity of fires, including the effect on the ability to manage and suppress fires. Fire conditions up through Class 5 are possible in Stanislaus County, primarily in the unincorporated areas in the far east and west of the County, whereas fire threat is generally moderate to low or none within urban areas.

Table 4-89 Fire Danger Rating System

Rating	Basic Description	Detailed Description
CLASS 1: Low Danger (L) COLOR CODE: **Green**	fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) COLOR CODE: **Blue**	fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel -- may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) COLOR CODE: **Yellow**	fires start easily and spread at a rapid rate	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly, and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) COLOR CODE: **Orange**	fires start very easily and spread at a very fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.

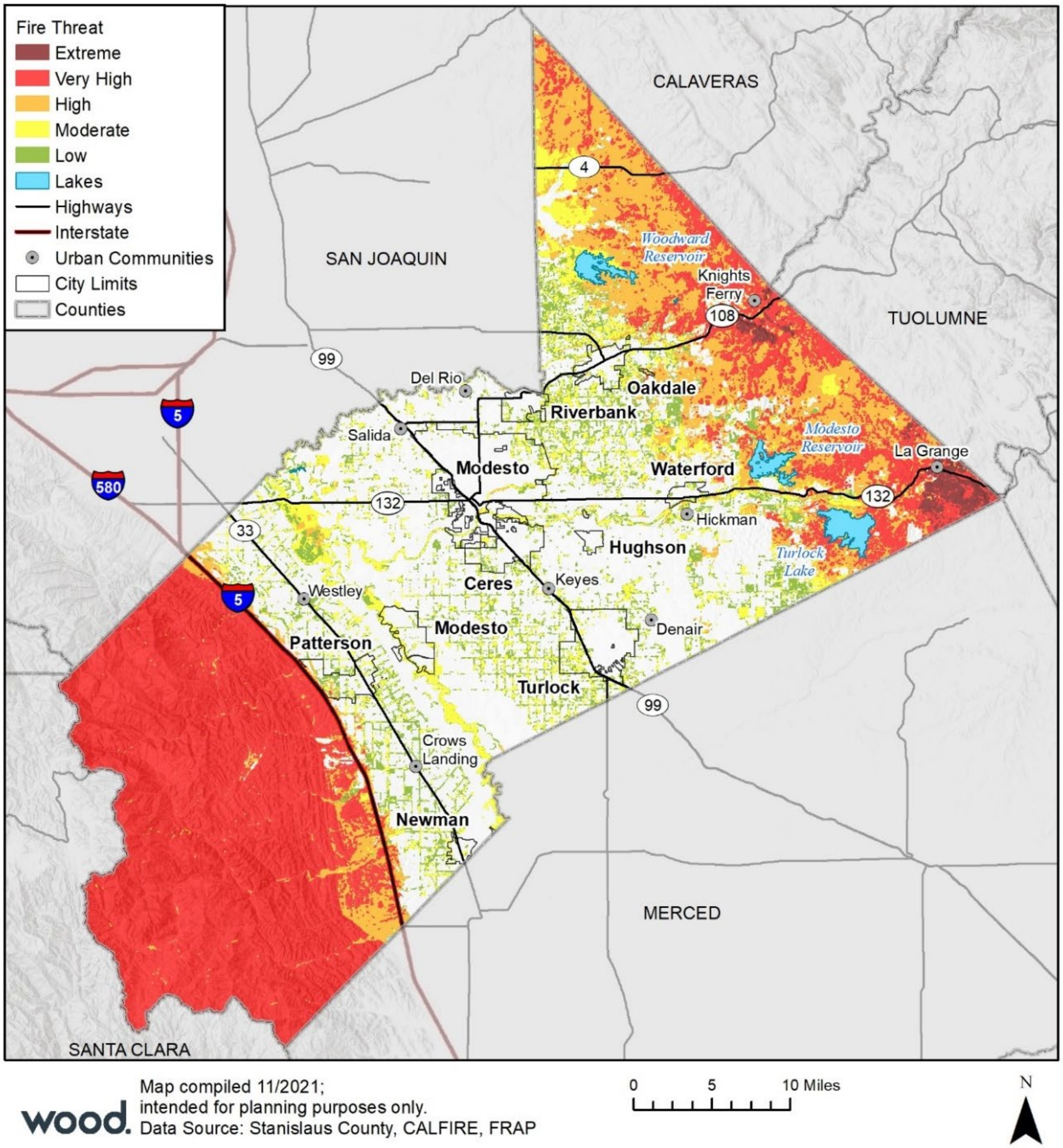
Rating	Basic Description	Detailed Description
CLASS 5: Extreme (E) COLOR CODE: **Red**	fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger Class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.

Source: http://www.wfas.net

Major wildland fires can completely destroy ground cover. If heavy rains follow a major fire, flash floods, heavy erosion, land subsidence and mudflows can occur. After a wildland fire passes through an area, the land is laid bare of its protective vegetation cover and is susceptible to excessive runoff and erosion from winter storms. The intense heat from the fire can also cause a chemical reaction in the soil that makes it less porous, and the fire can destroy the root systems of shrubs and grasses that aid in stabilizing slope material. These cascading effects can have ruinous impacts on people, structures, infrastructure, and agriculture.

Fire threat provides a measure of fuel conditions and fire potential in the ecosystem, representing the relative likelihood of “damaging” or difficult to control wildfire occurring for a given area. Fire Threat is not a risk assessment by itself but can be used to assess the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severity for the higher threat classes. Fire threat is a combination of two factors: 1) fire probability, or the likelihood of a given area burning, and 2) potential fire behavior (hazard). These two factors are combined to create five threat classes ranging from low to extreme. Figure 4-48 below shows the wildfire threat areas throughout Stanislaus County.

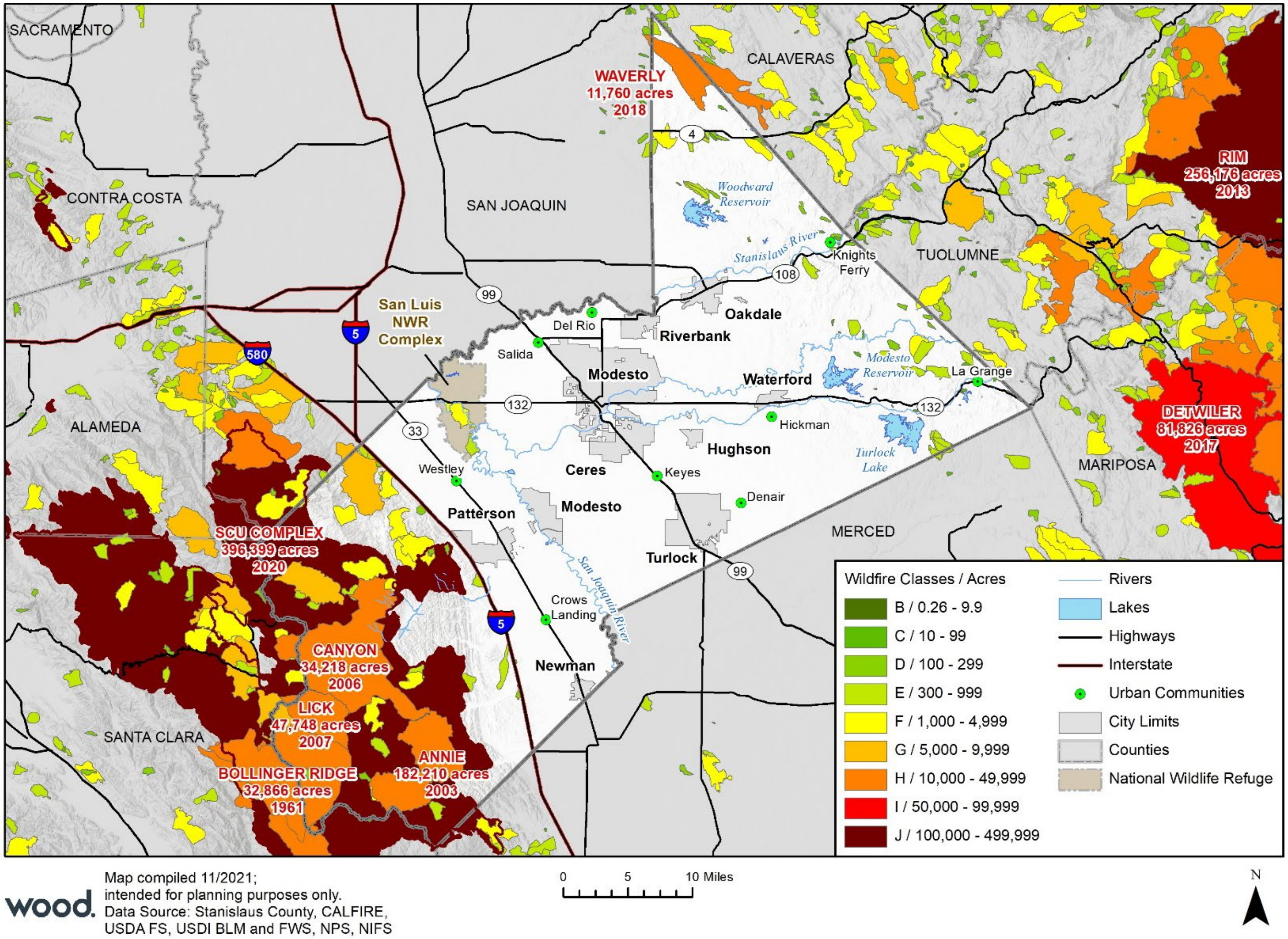
Figure 4-48 Stanislaus County Wildfire Threat Areas



Previous Occurrences

There has been one state and federal disaster declaration in Stanislaus County related to wildfire that occurred in 2020. There have been 119 wildfires recorded in the County from 1950-2020 totaling 620,582 acres burned in the region (some of the wildfires spread across the County border). This is an average of over 31,029 acres burned every year (this estimate is high based on the recent SCU Lightning Complex Fire in 2020). In August 2020, a portion of the SCU Lightning Complex Fire, which is the 4th largest fire by acres burned (396,624 acres) in state history, extended into Stanislaus County, burning approximately 175,812 acres in the Planning Area. As stated above, most fires are relatively small compared to the state as a whole, the highest number of acres burned in the County not including the SCU Lightning Complex Fire was 47,748 during the 2007 Lick fire. The County's fire history from 1911-2020 is illustrated in Figure 4-49.

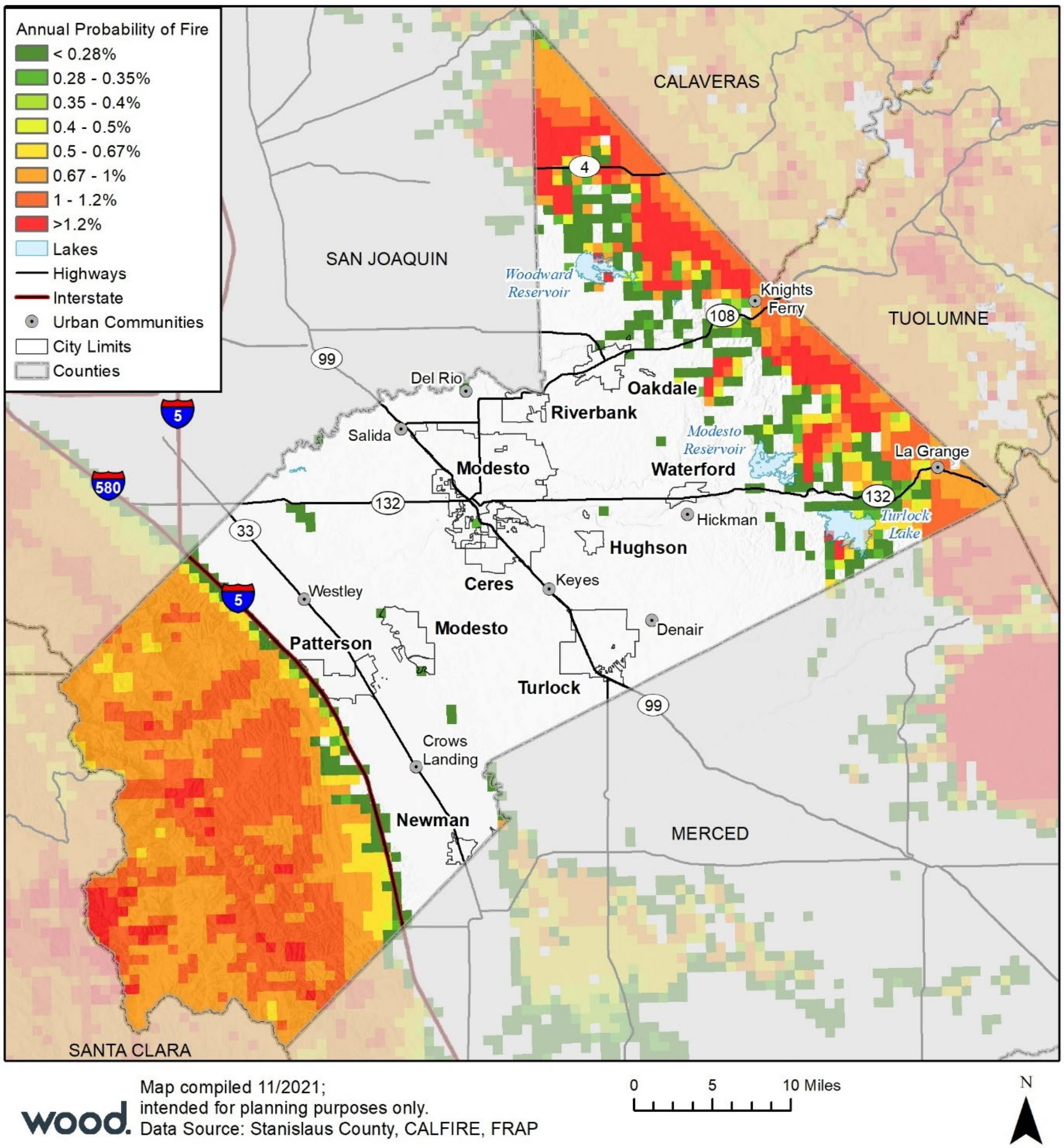
Figure 4-49 Stanislaus County Fire History, 1911-2020



Probability of Future Occurrences

Occasional – Fire starts are highly likely during each fire season; though, they rarely result in large-scale wildfires in Stanislaus County. Information obtained from the Cal FIRE Redbook lists multiple fires, the largest in the most recent past consumed approximately 175,812 acres. Based on climate and weather in Stanislaus County and the fuels, topography, and a past fire history which indicates an average of 1.7 wildfires per year, it is likely that fires will continue to occur in the future. Figure 4-50 below shows the annual probability for wildfire in Stanislaus County from 2026-2040, based on Cal FIRE GIS mapping.

Figure 4-50 Stanislaus County Annual Probability of Fire, 2026-2050



Climate Change Considerations

According to the 2018 California SHMP, climate change has the potential to impact the frequency, size, and severity of the wildfire hazard statewide. Increasing temperatures may intensify wildfire threat and susceptibility to more frequent wildfires in the County.

Exactly how climate change will affect total precipitation is not clear, but models suggest that there is a tendency for wetter conditions in the northern part of the State and drier conditions in the south (CNRA 2018a). Forests are also sensitive to variable precipitation events, as the 2012-2017 drought contributed to widespread tree mortality as warmer temperatures stressed trees and made them more susceptible to pests and pathogens (CNRA 2018). Studies noted in California's Fourth Assessment report note climate change impacts on wind patterns may strongly affect forests, potentially serving as a trigger mechanism for conversion of forest to other types of vegetation (CNRA 2018).

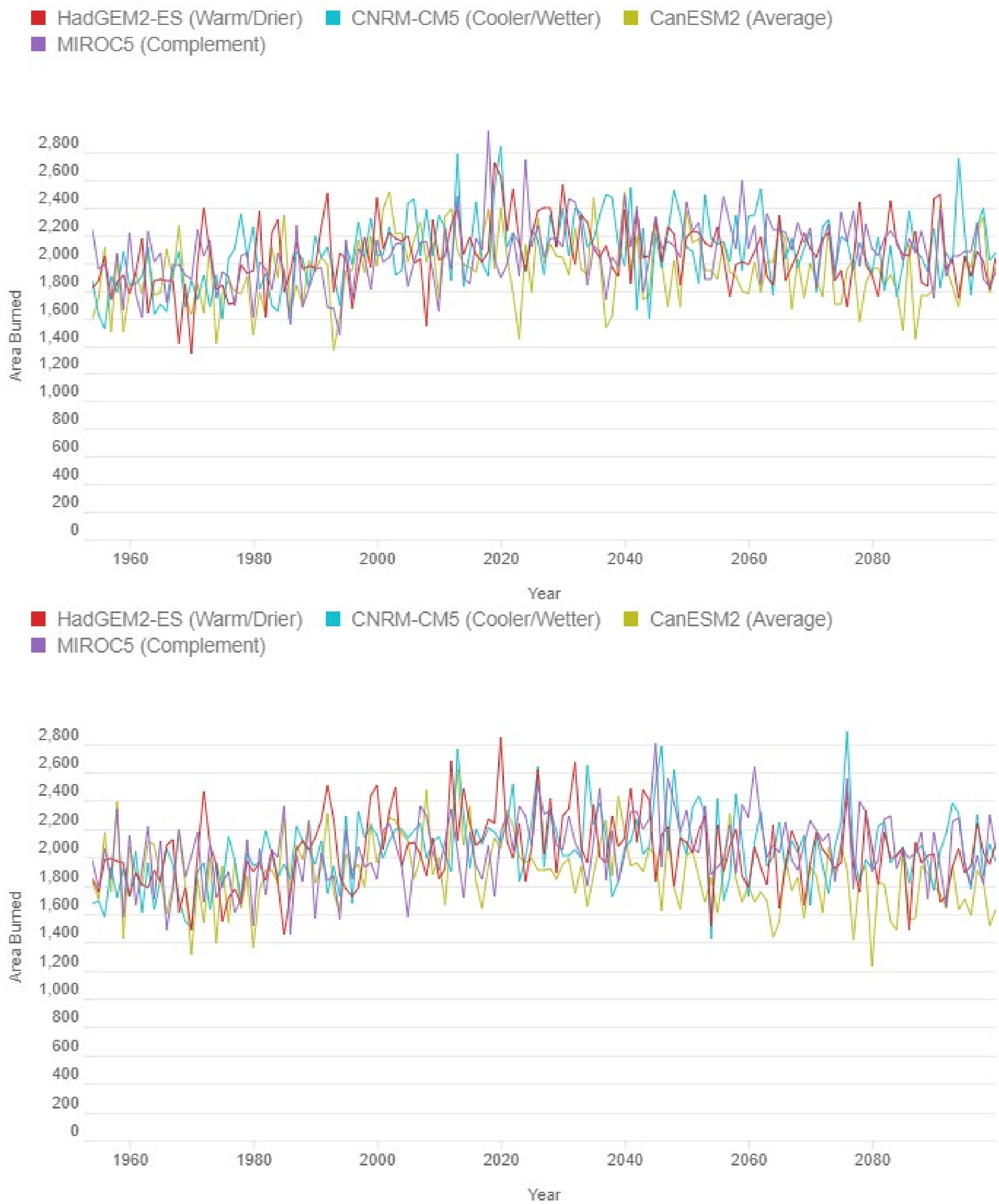
Current scientific models expect all of California will be affected by increased numbers of forest fires with added intensity due to longer warmer seasons, reduced distribution of biodiversity, lack of moisture, changes in ecosystems, drought impacts (e.g. pest diseases and continued spread of invasive species), and other impacts in coming years. The extending of the wildfire season into winter months, coinciding with seasonal high wind patterns, has contributed to severe fires in recent years. Southern California experienced 29 wildfires in December of 2017 alone, and the deadliest and most destructive fire in California history, the Camp Fire, happened in November of 2018 and resulted in 153,336 acres burned, 18,804 structures damaged, and 85 deaths.

Projected wildfire occurrence (annual area burned) estimates based on different potential climate futures and GHG emission scenarios is summarized from Westerling (2018) and presented in Figure 4-51. This figure shows the modeled projections of annual area burned for a mid-century projection (2035 to 2064) under a medium and high GHG emissions scenario with a central population growth scenario. Projected future climate from these four models can be described as producing:

- **HadGEM2-ES** – A *warm/dry* future climate simulation
- **CNRM-CM5** – A *cooler/wetter* future climate simulation
- **CanESM2** – An *average* future climate simulation
- **MIROC5** – The model simulation that is most unlike the first three for the best coverage of different possibilities.

Each of the climate models responds to variations in GHG emission levels, where greater GHG emissions result in more extreme weather phenomenon. Under a "medium" GHG emission scenario, projections across all future climate scenarios predict that annual area burned in Stanislaus County could range from 1,538 to 2,599 acres for the mid-century projections between the years 2035 and 2064. Under a "high" GHG emission scenario, projections across all future climate scenarios predict that annual area burned in Stanislaus County could range from 1,426 to 2,070 acres for the mid-century projections between the years 2035 to 2064 (see Figure 4-52).

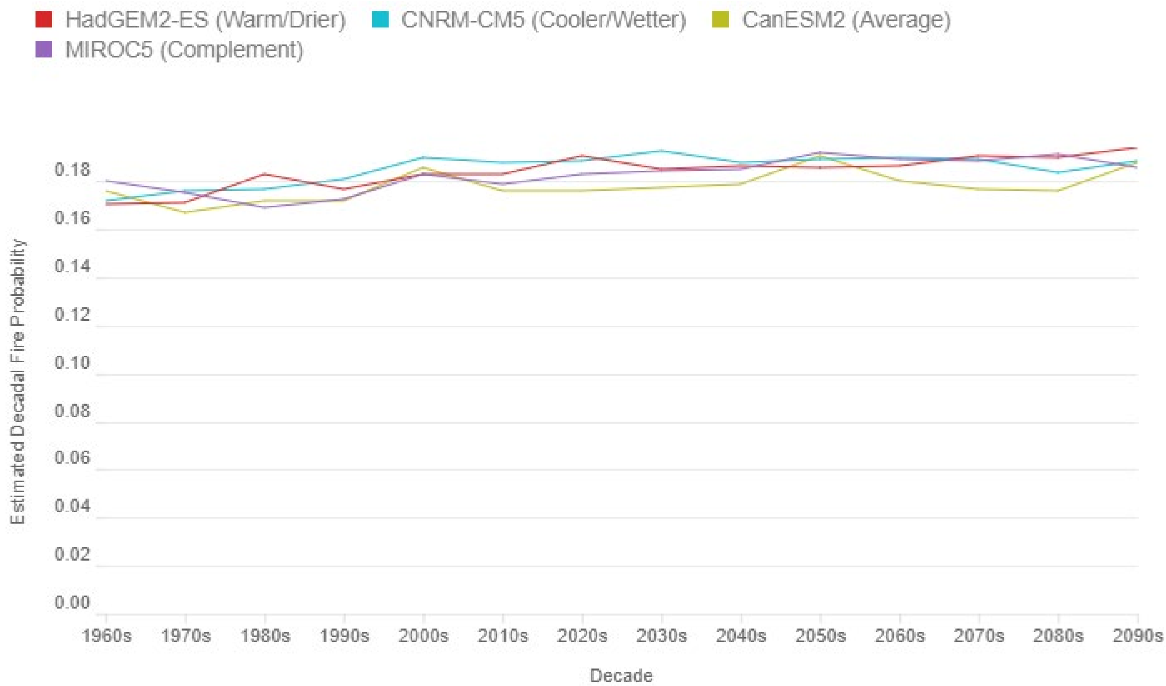
Figure 4-51 Modeled Projections of Annual Area Burned for Stanislaus County: 2020 to 2099 under Medium Emissions (RCP 4.5) Scenario and High-Emissions Scenario (RCP 8.5)

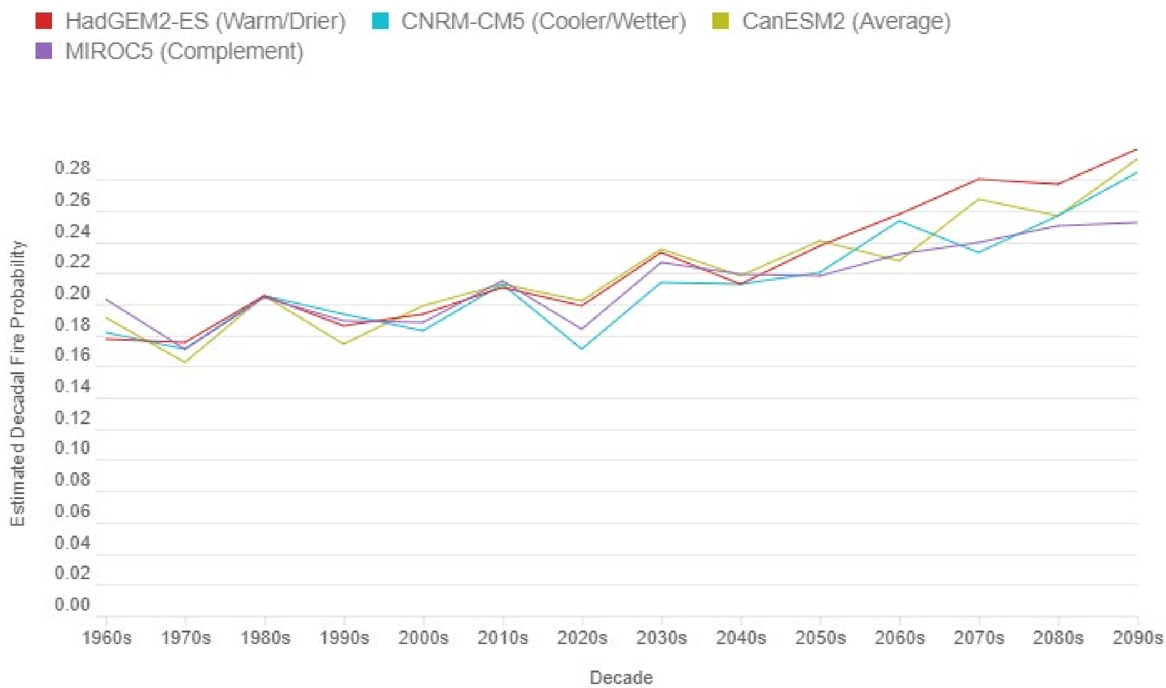


Source: Cal-Adapt 2021

The modeled historical (1961 to 1990) and mid-century projections (2035 to 2064) for estimated decadal fire probability for a medium GHG emissions scenario (RCP 4.5) with a central population growth scenario shows a range between 0.2 to 0.2 for estimated probability. In comparison, the modeled historical (1961 to 1990) and mid-century projections (2035 to 2064) for estimated decadal fire probability for a high GHG emissions scenario (RCP 8.5) with a central population growth scenario was slightly higher with a range between 0.2 to 0.3 for estimated probability. These two GHG emissions scenarios are shown in Figure 4-52.

Figure 4-52 Estimated Decadal Fire Probability for Stanislaus County from 1960 to 2099 under Medium Emissions (RCP 4.5) Scenario and High-Emissions Scenario (RCP 8.5)





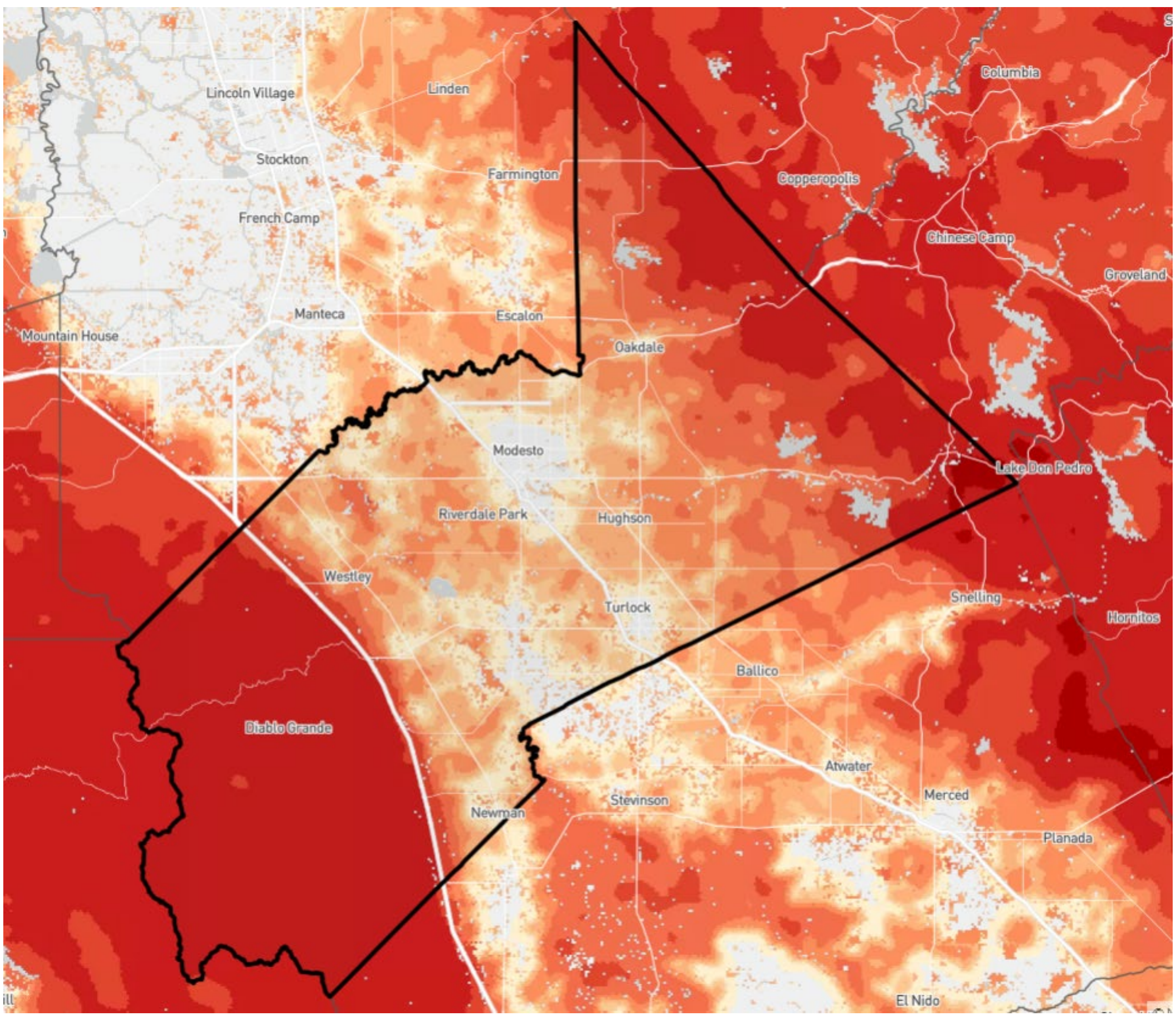
Source: Cal-Adapt 2021

Vulnerability Assessment

Stanislaus County vulnerability to wildfires varies, with some areas of the Planning Area along the far western and eastern portions being at greater risk than the central and more urbanized portion of the County. Generally, this hazard is a medium concern given the increasing frequency and severity of wildfires in California. High fuel loads in some areas of the Planning Area along with geographical and topographical features near the Diablo Range create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. Even the relatively flat central parts of the County are not immune to fire; hot and sometimes windy weather combined with dry vegetation and a denser population can result in an increase in the number of ignitions.

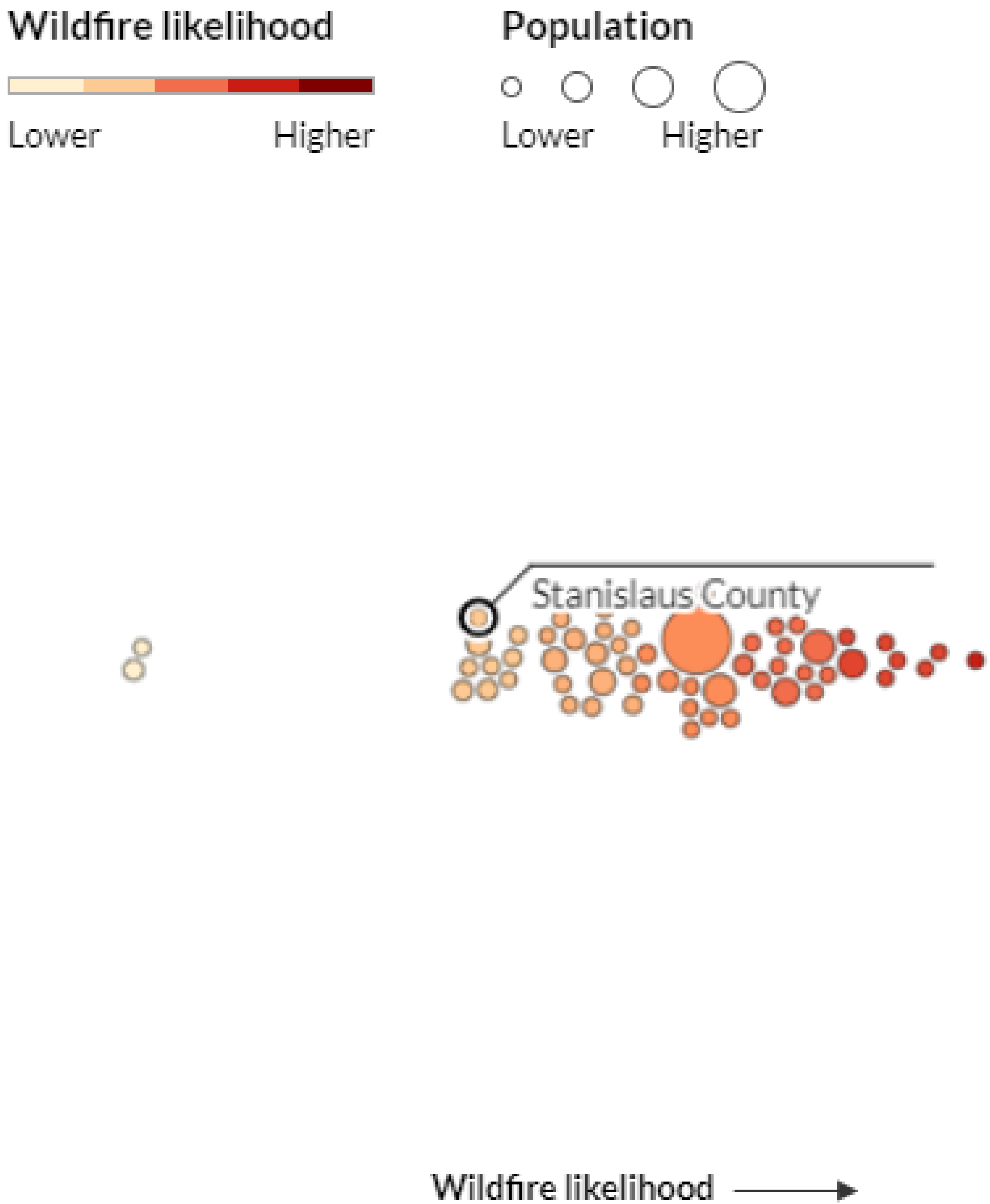
Figure 4-53 through Figure 4-56 below are the result of a nationwide risk study referred to as *Wildfire Risk to Communities* from the United States Forest Service that was designed to help communities understand, explore and reduce wildfire risk (USFS 2021). These figures provide a perspective of wildfire risk and vulnerability compared to other California Counties. Populated areas in Stanislaus County have, on average, greater risk to homes than 7% of counties in California. Populated areas in Stanislaus County have, on average, greater wildfire likelihood than 18% of counties in California.

Figure 4-53 Stanislaus County Wildfire Likelihood



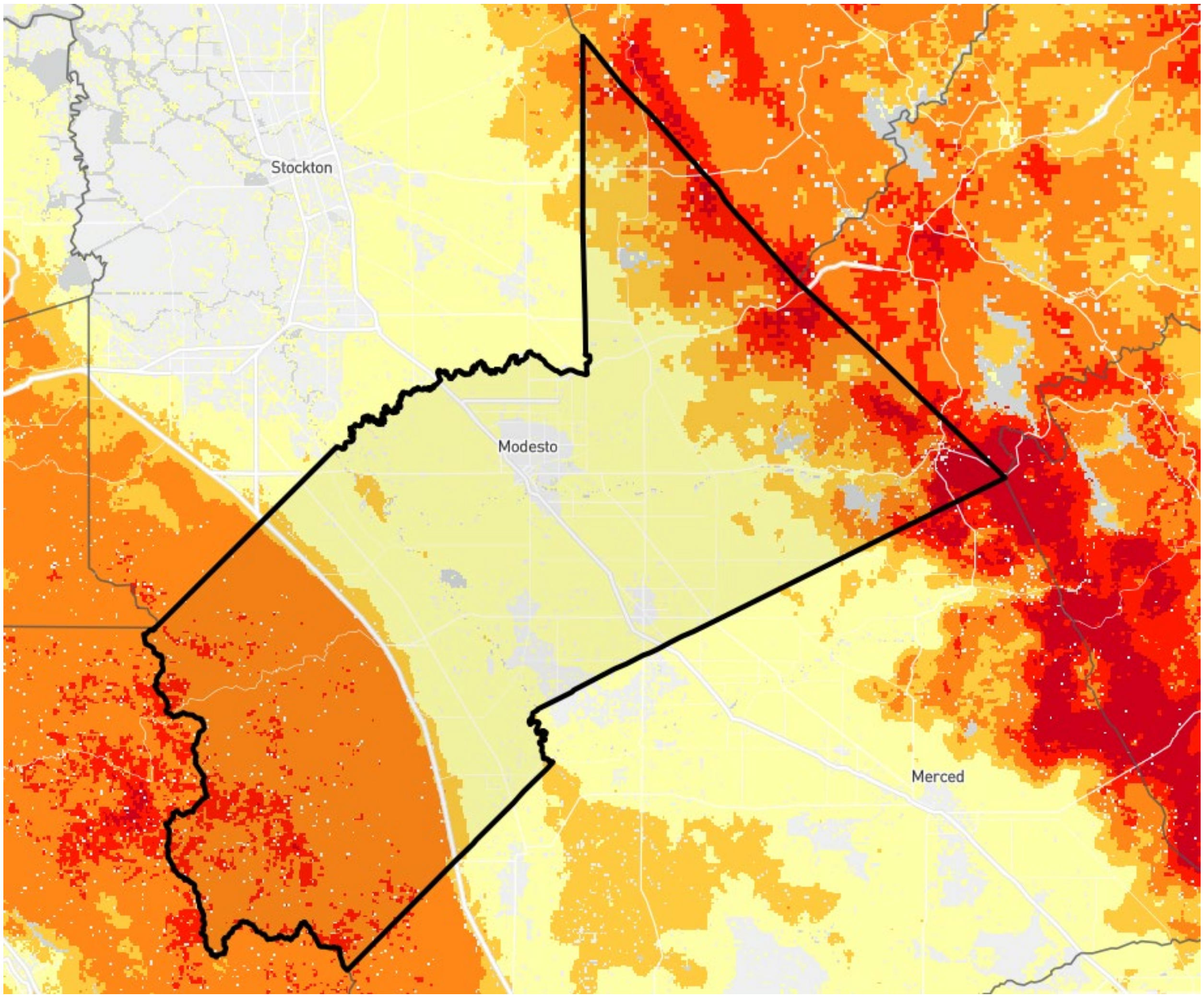
Source: USFS 2021

Figure 4-54 Stanislaus County Wildfire Likelihood Compared to California Counties



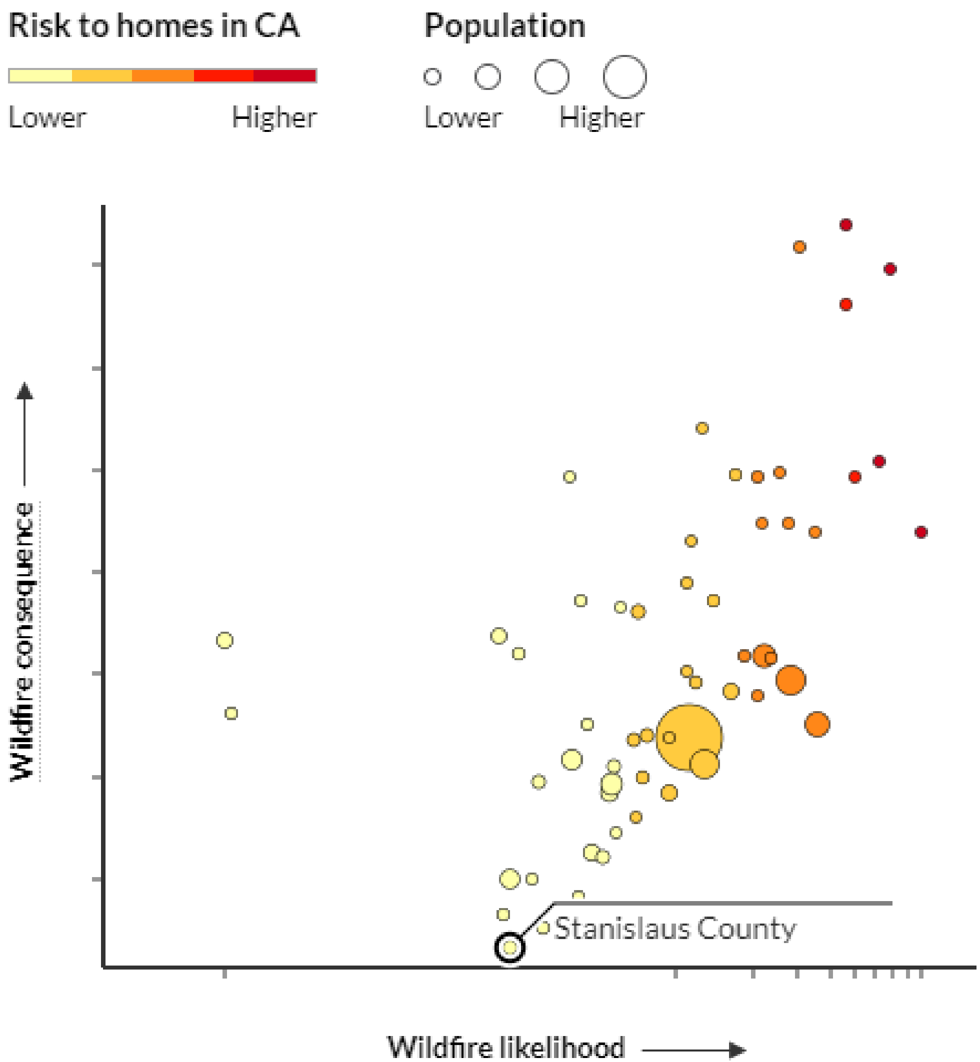
Source: USFS 2021

Figure 4-55 Stanislaus County Wildfire Risk to Homes



Source: USFS 2021

Figure 4-56 Stanislaus County Wildfire Risk to Homes Compared to California Counties



Source: USFS 2021

General Property

The potential impacts of wildfire on property include crop loss, injury and death of livestock and pets, and damage to infrastructure, homes and other buildings located throughout the wildfire risk area.

A wildfire threat assessment was performed for Stanislaus County using the following GIS methodology. Assessor's parcels are converted to centroid points. This data was then overlaid on the Fire Threat Layer. For the purposes of this analysis, the wildfire hazard zone that intersected the centroid points was assigned as the hazard zone for the entire parcel. It was assumed that every parcel with an improved value greater than zero was developed in some way, thus only improved parcels and their values were analyzed.

An analysis of the value of those parcels – the improvement value plus estimated value of building contents – quantifies the potential losses from wildfires by severity zone. The results show that $3.73 billion worth of property and approximately 8,596 structures are exposed to fire risk countywide. The majority of these buildings are in high to moderate hazard areas. The unincorporated areas and the City of Newman make up the majority of this risk. Residential and agricultural properties constitute the majority of the number of parcels and the projected losses. The total values shown in these tables include both structure value and contents and can be used as an estimate of potential losses since wildfires typically result in a total loss.

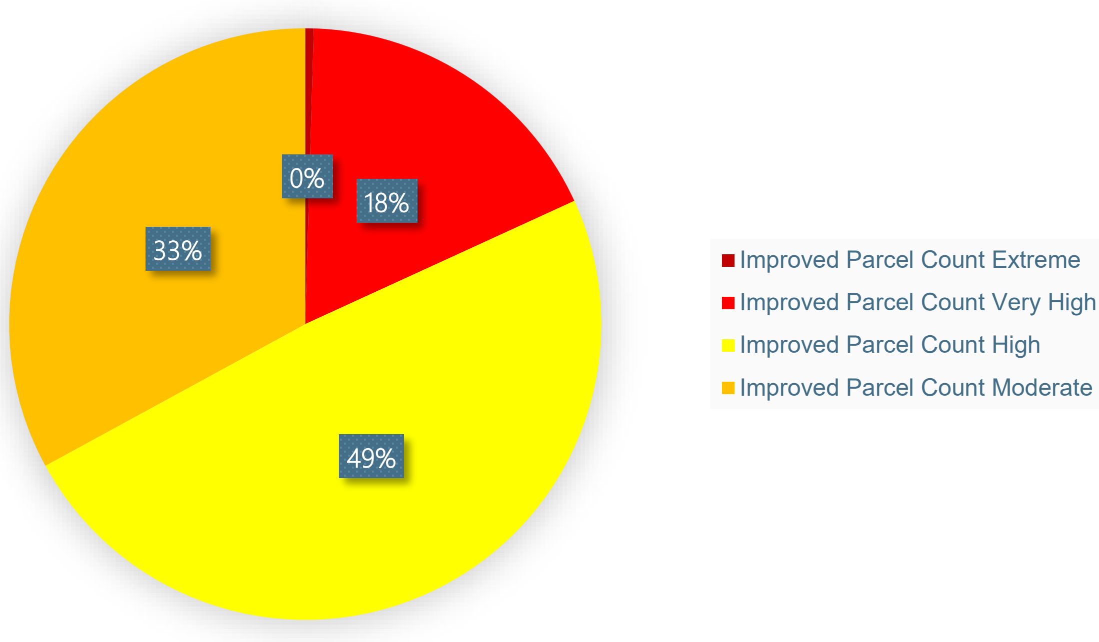
Table 4-90 Wildfire Hazard Exposure –Property Summary by Jurisdiction and Fire Threat Zone

Jurisdiction	Building Count Extreme	Building Count Very High	Building Count High	Building Count Moderate	Total Building Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	0	1	276	303	580	$158,646,509	$82,890,947	$241,537,456	18
Hughson	0	0	57	97	154	$26,104,098	$13,904,591	$40,008,689	-
Modesto	0	0	59	171	230	$91,308,401	$67,612,796	$158,921,197	656
Newman	0	2	198	976	1,176	$328,297,798	$178,953,729	$507,251,527	95
Oakdale	0	1	257	364	622	$156,504,212	$99,657,587	$256,161,799	70
Patterson	0	0	5	114	120	$46,298,879	$33,552,414	$79,851,293	407
Riverbank	0	0	0	46	46	$12,166,220	$8,061,240	$20,286,882	134
Turlock	0	0	1	179	180	$73,109,917	$61,486,333	$135,201,707	390
Waterford	0	0	0	8	8	$2,064,374	$1,252,199	$3,316,573	25
Unincorporated	108	462	1,605	3,659	5,834	$1,373,680,176	$1,148,731,537	$2,522,411,713	2,095
Total	**108**	**467**	**2,458**	**5,917**	**8,950**	**$2,268,180,584**	**$1,696,103,373**	**$3,964,948,836**	**3,890**

Source: Cal FIRE, Stanislaus County Assessor, Wood GIS analysis

Figure 4-57 shows the composition of improved parcels that are exposed to fire threats within the unincorporated County, categorized by fire threat zone.

Figure 4-57 Unincorporated County Parcels in Fire Threat Classes



Source: Cal FIRE, Stanislaus County Assessor, Wood GIS analysis

People

Wildland fires result in a high risk for personal injury, loss of life to inhabitants of the fire area and firefighters, and losses of structures and personal property. Wildfires in or near the WUI frequently require emergency evacuation and sheltering, often for many days. As is shown in Table 4-91 below, approximately 3,891 people in Stanislaus County reside in FHSZs. This figure was derived by taking the total number of residential structures identified in the FHSZs and multiplying them by the average household size in the County based on 2019 U.S. Census Bureau estimates.

Table 4-91 Population at Risk to Fire Threat

Jurisdiction	Population
Ceres	18
Hughson	-
Modesto	656
Newman	95
Oakdale	70
Patterson	407
Riverbank	134
Turlock	390
Waterford	25
Unincorporated	2,095
Total	**3,891**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, U.S. Census Bureau, Wood GIS Analysis

Other indirect impacts from wildfires on people are related to dense smoke from fires within the region. Wildfires in the past three years have decreased the air quality throughout Stanislaus County, and many of the wildfires located over 150 miles from the County have resulted in poor air quality in the Central Valley (e.g. Dixie Fire in 2021 resulted in poor air quality across portions of Northern California). Dense smoke poses a risk to both people with compromised health as well as those considered healthy. A study from the

University of California San Diego found that wildfire smoke is more harmful to respiratory health in humans than pollution from cars (NPR 2021). Studies have also shown an increase in ambulance calls, hospital visits and an increase of people experiencing respiratory or cardiac emergencies (NPR 2020).

Critical Facilities and Infrastructure

Critical facilities are those community components that are most needed to withstand the impacts of disaster, as previously described in the Assets section. Wildfire impacts to critical facilities can include structural damage or destruction, risk to persons located within facilities, disruption of transportation, shipping, and evacuation operations, and interruption of facility operations and critical functions.

Critical facilities and infrastructure also create an increased risk for the occurrence of wildfires. Overhead electric transmission lines have been known to spark wildfires. According to data from the California Public Utilities Commission, the State's three largest utility companies collectively reported 2,009 ignitions statewide between 2014-2017. Most of these instances were small, less than one acre in size, however these fires can grow rapidly under the right fire conditions. One such example is California's deadliest wildfire, the 2018 Camp Fire in Northern California. Identifying critical facilities and infrastructure and mitigating their potential risks is important both for maintaining the County's resilience and for reducing the potential impacts of wildfire. The locations of critical facilities identified by HIFLD throughout the County are summarized by their exposure to the various wildfire threat levels in Table 4-92 through Table 4-96 below.

Table 4-92 Critical Facilities Within the Low Wildfire Threat by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	1	-	-	-	1	1	3	6
Hughson	-	-	-	-	-	-	-	-
Modesto	2	-	-	-	2	1	1	6
Newman	-	-	-	1	-	-	-	1
Oakdale	-	-	-	-	1	1	-	2
Patterson	-	-	-	-	-	1	-	1
Riverbank	-	-	-	-	-	-	1	1
Turlock	-	-	-	-	-	-	1	1
Waterford	-	-	-	-	-	-	-	-
Unincorporated	19	17	1	3	-	8	74	122
Other Counties	-	-	-	-	-	-	-	-
Total	**22**	**17**	**1**	**4**	**4**	**12**	**80**	**140**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

Table 4-93 Critical Facilities Within the Moderate Wildfire Threat by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	-	-
Hughton	-	-	-	-	-	-	-	-

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Modesto	1	-	-	-	1	-	-	2
Newman	-	-	-	-	1	1	-	2
Oakdale	-	-	-	-	-	-	-	-
Patterson	1	-	-	-	-	-	-	1
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	1	-	-	1
Waterford	-	-	-	-	-	-	-	-
Unincorporated	13	2	-	-	-	3	19	37
Other Counties	-	-	-	-	-	-	-	-
Total	**15**	**2**	**-**	**-**	**3**	**4**	**19**	**43**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

Table 4-94 Critical Facilities Within the High Wildfire Threat by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	-	-
Hughson	-	-	-	-	-	-	-	-
Modesto	-	-	-	-	-	-	-	-
Newman	-	-	-	-	-	-	-	-
Oakdale	-	-	-	-	-	-	-	-
Patterson	-	-	-	-	-	-	-	-
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	-	-
Unincorporated	17	5	1	-	-	1	26	50
Other Counties	-	-	-	-	-	-	-	-
Total	**17**	**5**	**1**	**-**	**-**	**1**	**26**	**50**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

Table 4-95 Stanislaus County Critical Facilities Within the Very High Wildfire Threat by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	-	-
Hughton	-	-	-	-	-	-	-	-

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Modesto	-	-	-	-	-	-	-	-
Newman	-	-	-	-	-	-	-	-
Oakdale	-	-	-	-	-	-	-	-
Patterson	-	1	-	-	-	-	-	1
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	-	-
Unincorporated	4	4	1	1	-	-	16	26
Other Counties	-	-	-	-	-	-	-	-
Total	**4**	**5**	**1**	**1**	**-**	**-**	**16**	**27**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

Table 4-96 Stanislaus County Critical Facilities Within the Extreme Wildfire Threat by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Ceres	-	-	-	-	-	-	-	-
Hughson	-	-	-	-	-	-	-	-
Modesto	-	-	-	-	-	-	-	-
Newman	-	-	-	-	-	-	-	-
Oakdale	-	-	-	-	-	-	-	-
Patterson	-	-	-	-	-	-	-	-
Riverbank	-	-	-	-	-	-	-	-
Turlock	-	-	-	-	-	-	-	-
Waterford	-	-	-	-	-	-	-	-
Unincorporated	1	-	1	-	-	1	-	3
Other Counties	-	-	-	-	-	-	-	-
Total	**1**	**-**	**1**	**-**	**-**	**1**	**-**	**3**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

According to the analysis conducted, there are 123 critical facilities exposed to at least a moderate wildfire threat area. The highest rates of exposure to wildfire threat areas are facilities in the Communication and Transportation Lifeline categories, both of which are crucial for response and evacuations in the event of a significant fire.

Economy

The economic impacts of wildfire include loss of property, direct agricultural sector job loss, secondary economic losses to businesses in or near wildland resources like parks and national forests, and loss of public access to recreational resources. Fire suppression may also require increased cost to local and state government for water acquisition and delivery, especially during periods of drought when water resources are scarce. Effects on agriculture can be significant, which makes up a large portion of Stanislaus County's economy. In addition to the obvious impacts on crops and animals, wildland fire can have damaging effects on soil and water that will impact agriculture for an extended period of time.

Historic, Cultural, and Natural Resources

The County has 26 sites according to California Office of Historic Preservation (refer to Subsection 4.2.1). Since these structures are sensitive in nature and may not have been built according to the latest building codes due to their age, it is expected that they might be at risk of wildfires (e.g., because of their potential inability to withstand significant heat). Most of these structures are located in the Cities of Modesto and Turlock, and the community of LaGrange, which are at lower risk to wildfire than unincorporated areas of the County. However, parks and open spaces, particularly in the foothills in the eastern edge of the County, could also be at risk of a wildfire.

Future Development

A fire threat GIS analysis within SOI boundaries is summarized in the table below. The methodology resembles what was used for the General Property subsection above. These parcels are also included in Table 4-90, and they fall under "Unincorporated" in terms of their jurisdiction. Parcels shown below in Table 4-97 are those that fall within each jurisdiction's SOI and are exposed to potential flood hazard events.

Table 4-97 Sphere of Influence Fire Threat Analysis

Jurisdiction	Building Count High	Building Count Moderate	Total Building Count	Improved Value	Estimated Content Value	Total Value	Population
Ceres	1	15	16	$6,643,798	$7,544,435	$14,188,233	26
Modesto	1	14	15	$9,131,525	$11,421,828	$20,553,353	26
Newman	-	13	13	$1,645,529	$1,219,848	$2,865,377	20
Oakdale	-	28	28	$4,986,202	$4,381,180	$9,367,382	12
Patterson	-	11	11	$1,597,840	$1,521,806	$3,119,646	4
Riverbank	-	6	6	$931,010	$859,100	$1,790,110	7
Turlock	1	6	7	$1,018,903	$591,124	$1,610,027	17
Waterford	-	1	1	$316,696	$316,696	$633,392	-
Total	**3**	**94**	**97**	**$26,271,503**	**$27,856,015**	**$54,127,518**	**112**

Source: Stanislaus County, HIFLD, Cal FIRE, FRAP, Wood GIS Analysis

Any population increases in the Planning Area will continue to make wildfire vulnerability a growing issue, especially as future development expands into higher fire risk areas. These risks can however be managed with strong land use regulations and building code requirements, and with policies established in the Safety Element of the 2030 General Plan. For example, policies requiring fire-resistant vegetation, clustered development, and vegetation clear zones in areas with high and extreme fire hazard.

Risk Summary

- The overall significance of wildfire in Stanislaus County is **Medium**. These events are recurring in nature and can cause significant damage, loss of life, and disruption to critical infrastructure.
- The County experiences an average of one wildfire every 1.7 years and an average of 30,000 acres burned per year. As impacts of climate change such as increased temperatures and prolonged drought conditions continue in coming years, this frequency and intensity may increase.
- Powerlines and vehicle or equipment use present a significant source of ignitions.
- **Effects on people** – Past wildfires in the County have not resulted in a large number of fatalities; however, significant evacuations and sheltering have been required in past events.
- **Effects on property** – Wildfires can destroy homes, businesses, and critical infrastructure. $3.73 billion worth of property in the County is located in a Fire Threat Zone.
- **Effects on critical facilities and infrastructure** – Wildfires can disrupt access to, or even destroy critical facilities and infrastructure; 43 critical facilities are in the Moderate Fire Threat Zone, 50 critical facilities are in the High Fire Threat Zone, 27 critical facilities are in the Very High Fire Threat Zone, and three critical facilities are in the Extreme Fire Threat Zone.
- **Effects on economy** – Wildfires impacts can include loss of property, direct agricultural sector job loss, secondary economic losses to businesses, and loss of public access to recreational resources.

- **Effects on Historic, Cultural, and Natural Resources** – Wildfire can significantly impact water and air quality, even at great distances from the area burning. Damage to agriculture, natural resource areas, and habitats are very likely during a wildfire.
- **Related Hazards** – Drought, Agricultural Pest Infestation and Disease, Landslide and Debris Flow.

Table 4-98 Hazard Summary – Wildfire

Jurisdiction	Geographic Area	Probability of Future Occurrence	Magnitude/ Severity	Overall Significance	Priority Hazard?
Stanislaus County	Significant	Occasional	Negligible	Medium	Yes
City of Ceres	Limited	Occasional	Negligible	Low	No
City of Hughson	Limited	Occasional	Negligible	Low	No
City of Modesto	Limited	Occasional	Negligible	Low	No
City of Newman	Limited	Occasional	Negligible	Medium	No
City of Oakdale	Significant	Likely	Negligible	Medium	Yes
City of Patterson	Significant	Likely	Negligible	Medium	No
City of Riverbank	Limited	Occasional	Negligible	Low	No
City of Turlock	Limited	Occasional	Negligible	Low	No
City of Waterford	Limited	Occasional	Negligible	Low	No
County Office of Education	Limited	Occasional	Negligible	Low	No

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5 Mitigation Strategy

Requirement §201.6(c)(3):
[The plan shall include the following:] A mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the Stanislaus County Multi-Jurisdictional Hazard Mitigation Plan. It describes how the County and participating jurisdictions met the requirements for the following from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The mitigation strategy reflects the results of the collaborative work of the HMPC. Subsection 5.3 Mitigation Action Plan is based on the updated planning process, risk assessment, capability assessment, consequence analysis, goal setting, and the identification of mitigation actions. Taking all of these into consideration, the HMPC developed the following overall mitigation strategy, which build upon the 2017 LHMP strategy:

- **Communicate** the hazard information collected and analyzed through this planning process as well as HMPC success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- **Implement** the action plan recommendations of this plan to reduce the County's vulnerability to hazards.
- **Use** existing rules, regulations, policies, and procedures already in existence. Given the flood hazard in the planning area, an emphasis should be placed on continued compliance with the NFIP.
- **Lessen** the impact of disasters and the speed of the response and recovery process.
- **Build** awareness to help the community become more sustainable and reliant to disasters.
- **Monitor** multi-objective management opportunities so that funding opportunities may be shared and packaged, and broader constituent support may be garnered.

5.1 Mitigation Goals and Objectives

§201.6(c)(3)(i)
[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals, objectives, and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative, updated mitigation strategy as described further throughout this section.

Over a series of meetings during the 2021 – 2022 update process, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment update. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to update planning goals and objectives and the ultimate mitigation strategy for the Stanislaus County planning area.

Mitigation goals are defined as general guidelines that explain what the County wants to achieve in terms of hazard and loss prevention. Goals are typically long-range statements representing community-wide visions. The HMPC reviewed the goals from the 2017 LHMP which focused on minimizing future loss of life, reducing property damage, avoiding long-term vulnerabilities to the identified hazards, and increased planning and mitigation efforts for dam and flood along with increased preparedness in participating in ShakeOut for earthquakes. The goals were developed to be compatible with the goals of the community as expressed in the Safety Element of the General Plan, and the 2021 EOP. The County's Mitigation Strategy is guided by the vision of a safe and resilient County. Our mission is to integrate existing laws and programs into a mitigation strategy that will serve the citizens by reducing and preventing injury and damage from natural hazards.

Stanislaus County routinely performs activities such as issuing building permits, approving development plans, and repairing roads. The County is conscious that these activities should reflect our vision and goals by using the most current building code, restricting development in hazard-prone areas, or making infrastructure decisions based on our risk assessment findings. As a result, goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

During the 2021 – 2022 plan update process, HMPC members reviewed the existing goals and objectives from the 2017 LHMP Hazard Mitigation Plan. Through a brainstorming process at the third HMPC meeting, the HMPC consolidated the mitigation goals designed in the 2017 LHMP, which were previously categorized by specific hazards, and then came to a consensus on five main goals that apply to all hazards. The mitigation objectives were also categorized by specific hazards in the 2017 LHMP. The HMPC decided to keep that format but update them to be more comprehensive, inclusive, and specific. Goals and objectives are listed below, but are not prioritized:

5.1.1 Mitigation Goals:

- **Goal 1:** Minimize the loss of life and reduce property damage as a result of natural, human-health, and human-caused hazards to support the health and safety of the whole community.
- **Goal 2:** Reduce economic impacts and promote a sustainable economy.
- **Goal 3:** Improve community resilience to disasters through increased outreach and awareness and better resources.
- **Goal 4:** Protect climate and socially vulnerable communities in the County, including individuals with access and functional needs and those that may suffer from economic, health, and environmental burdens.
- **Goal 5:** Build resilient infrastructure and communities that withstand climate-related impacts.

5.1.2 Mitigation Objectives by Hazard

The County's corresponding objectives are listed below and organized by hazard. The objectives were revised using the risk assessment and consequence analysis. The mitigation strategy objectives have been organized by hazard in the past three HMPs.

Agricultural Pests and Disease

- **Objective ADP01:** The County shall continue to administer, enforce and enhance federal, state and local-level pest management and detection programs to prevent, detect, and respond to agricultural pests and disease when they occur, and prevent the spread of pests and disease that have become established.
- **Objective ADP02:** Enable the public to prepare for, respond to, and recover from disasters by improving hazard information.

- **Objective ADP03:** Integrate mitigation plan and related mitigation strategy with other local government plans and programs.

Aquatic Invasive Species (AIS)

- **Objective AIS01:** The County shall continue to administer and enforce federal, state and local-level invasive species programs to prevent, detect, and respond to species introductions when they occur and prevent the spread of species that have become established.
- **Objective AIS02:** Raise the public's awareness of AIS, which helps prevent the unintentional introduction of AIS.
- **Objective AIS03:** Integrate mitigation plan and related mitigation strategy with other local government plans and programs.

Cyber Attack

- **Objective CA01:** The County shall continue to administer, enforce, and enhance County IT Security Policy to monitor, prevent, detect, and respond to cyber-attack hazard.
- **Objective CA02:** Promote necessary education to enable County staff to prepare for, respond to, and recover from potential cyber-attack hazard.
- **Objective CA03:** Integrate mitigation plan and related mitigation strategy, as well as state-level cyber attack mitigation efforts, with other local government plans and programs.

Dam Incidents

- **Objective DI01:** Continue critical business operations.
- **Objective DI02:** Train emergency responders.
- **Objective DI03:** Enable the public to prepare for, respond to, and recover from disasters by improving hazard information.
- **Objective DI04:** Integrate mitigation plan with other local government plans.
- **Objective DI05:** Coordinate with partner agencies, specifically dam owners and operators to limit impacts to public, infrastructure and environment.

Drought

- **Objective D01:** Minimize the threat to property posed by the possibility of drought within the County by collaborating and partnering with water utilities, water, and irrigation districts, GSAs, and other relevant stakeholders.
- **Objective D02:** The County shall continue to enforce the Water Conservation Code to mitigate drought hazard's impact.
- **Objective D03:** Promote the development of drought mitigation plan(s), groundwater sustainability plan(s), drought contingency plans, and other local and regional plans to prepare for and respond to drought hazard.
- **Objective D04:** Integrate mitigation plan and related mitigation strategy with other local government plans and programs.

Earthquake

- **Objective E01:** Encourage and comply with higher development standards in hazard-prone areas.
- **Objective E02:** Limit urban development in hazard areas unless regulations, standards, or measures to mitigate the problems are included as part of the application.
- **Objective E03:** All new public and private development shall be designed to increase safety.
- **Objective E04:** The County shall continue to enforce State mandated Health and Safety Codes, which include but are not limited to the California Code of Regulations Title 24 and International Property and Maintenance Code. Specifically, for Seismically designed structures that meet or exceed the requirements stated in the California Building Code Volumes 1 and 2.
- **Objective E05:** Continue critical business operations and minimize public service and utility disruptions related to climate hazards.
- **Objective E06:** Maximize training opportunities for emergency responders.

- **Objective E07:** Enable the public to prepare for, respond to, and recover from disasters by improving hazard information and increasing awareness.
- **Objective E08:** Support efforts to identify and rehabilitate structures that are not earthquake resistant.
- **Objective E09:** Integrate mitigation plan with other local government plans.

Extreme Temperatures: Freeze and Extreme Heat

- **Objective ET01:** Minimize the threat to County's property posed by extreme heat hazard and prepare for and respond to potential power outage/shutoff by collaborating and partnering with utility companies and revisiting extreme heat contingency plans.
- **Objective ET02:** Enable the public to prepare for, respond to, and recover from disasters by improving hazard information.
- **Objective ET03: I**ntegrate mitigation plan and related mitigation strategy with other local government plans and programs.

Flood

- **Objective FL01:** Provide ordinances to ensure that flood insurance can be made available to qualified property owners through state and federal programs.
- **Objective FL02:** Support programs and activities that increase CRS premium discounts through NFIP.
- **Objective FL03:** Development should not be allowed in areas that are within the designated floodway.
- **Objective FL04:** New developments shall be designed to increase safety.
- **Objective FL05:** Discourage development in areas susceptible to floods.
- **Objective FL06:** Continue critical business operations.
- **Objective FL07: I**ntegrate mitigation plan with other local government plans.
- **Objective FL08:** Train emergency responders.
- **Objective FL09:** Coordinate with partner agencies to limit impacts to public, infrastructure and environment.
- **Objective FL10:** Take actions in floodways to reduce or remove impediments to safe passage of high flows and improve reservoir management flexibility.

Landslide

- **Objective LS01:** Development west of Highway 5 in areas susceptible to landslides shall be permitted only when a geological soils report has been completed with (a) documented evidence that no such potential exists on the site, or (b) identifying the extent of the problem and the mitigation measures necessary to correct the identified problem.
- **Objective LS02:** Development west of Highway 5 in areas susceptible to landslides shall be permitted only when a geological soils report has been completed with (a) documented evidence that no such potential exists on the site, or (b) identifying the extent of the problem and the mitigation measures necessary to correct the identified problem.
- **Objective LS03:** All new development, including near river bluffs shall be designed to increase safety and reduce health hazards.
- **Objective LS04:** Discourage development on lands that are subject to landslides.
- **Objective LS05:** Implement engineering benchmarks to monitor landslide susceptibility to prevent impacts to roadways.
- **Objective LS06:** Manage landslide hazard areas by pre-staging road-clearing equipment.
- **Objective LS07:** Continue critical business operations.
- **Objective LS08:** Train emergency responders.
- **Objective LS09:** Integrate mitigation plan with other local government plans.

Public Health Hazards

- **Objective PH01:** Lessen the threat to County's population posed by public health hazards by collaborating and partnering with public health agencies and other relevant stakeholders. and revisiting drought contingency actions.

- **Objective PH02:** Promote the development of pandemic plan(s) to prepare for and respond to public health hazards.
- **Objective PH03:** Develop public health and safety strategies to reduce risks on vulnerable populations.
- **Objective PH04:** Integrate mitigation plan and related mitigation strategy with other local government plans and programs.

Severe Weather

- **Objective SW01:** Lessen severe weather hazards-related damages for all types of severe weather hazards that impact the County.
- **Objective SW02:** Support efforts to identify and rehabilitate structures that are not severe weather hazards (high wind, tornado, etc.) resistant.
- **Objective SW03:** Maximize training opportunities for emergency responders.
- **Objective SW04:** Encourage and comply with higher development standards in hazard-prone areas.
- **Objective SW05:** All new public and private development shall be designed to increase safety.
- **Objective SW06:** Enable the public to prepare for, respond to, and recover from disasters by improving hazard information and increasing awareness.
- **Objective SW07:** Continue critical business operations and minimize public service and utility disruptions related to severe weather hazards.
- **Objective SW08:** Integrate mitigation plan and related mitigation strategy with other local government plans and programs.

Wildfire

- **Objective WF01:** All new development shall be designed to increase protection from wildfire.
- **Objective WF02:** Adequate fire protection shall be provided.
- **Objective WF03:** Roads shall be maintained for the safety of travelers for wildfire.
- **Objective WF04:** Future growth shall not exceed the capacity to provide services such as water and public safety.
- **Objective WF05:** The County will continue to enforce the State Mandated Health and Safety Code, the **Objective WF06:** Public Resources Code and the California Code of Regulations, Title 24.
- **Objective WF07:** The County to adopt an ordinance that meets or exceeds the regulations in 14 CCR 1270 et seq to be used in lieu of the minimum State Standards in the State responsibility Areas.
- **Objective WF08:** The County shall continue to support the training of emergency responders.
- **Objective WF09:** Integrate mitigation plan with other local government plans.
- **Objective WF10:** Continue critical business operations.

5.2 Identification and Analysis of Mitigation Actions

§201.6(c)(3)(ii):
[The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

In order to identify and select mitigation measures to support the mitigation goals, each hazard identified in Section 4: Hazard Identification and Risk Assessment and Consequence Analysis was evaluated. The HMPC analyzed a comprehensive set of viable mitigation alternatives for both new and existing buildings and infrastructure that would support identified goals and objectives and reduce or eliminate risks to persons or property or to lessen the actual or potential effects or consequences of a disaster. Each HMPC member was provided with the following list of categories of mitigation measures, which originate from the NFIP CRS:

- **Prevention**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural**: Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness**: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

At the HMPC Meeting #3, the HMPC was provided with a matrix showing examples of potential mitigation action alternatives for each of the above categories, for each of the identified hazards. The HMPC was also provided a handout that explains the categories and provided further examples. Another reference document titled "*Mitigation Ideas*" developed by FEMA in 2013 and FEMA's 2020 *Mitigation Action Portfolio* were distributed to the HMPC via emails and an online link. These documents list the common alternatives for mitigation by hazard and actions funded by FEMA. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. This reference provides four categories of mitigation actions that were discussed at the HMPC meeting in addition to the NFIP/CRS categories. These include:

- Plans and Regulations
- Structure and Infrastructure Projects
- Education and Awareness
- Natural systems protection

Other alternatives discussed in the webinar include the four 'A's' of mitigation:

- **Alter** the physical nature of the hazard
  - Such as wildfire defensible space and fuels treatments, snow fences etc.
- **Avert** the hazard away from people, buildings, and infrastructure
  - Can include engineered solutions, drainage, and channel improvements, floodproofing, fuel breaks
- **Adapt** to the hazard
  - Through land use planning, building codes and design standards, warning systems etc.
- **Avoid** the hazard
  - Natural systems protection, open space, acquisition, or relocation of properties out of hazardous areas

As part of the review of mitigation options, long-term climate change adaptation strategies were also discussed. HMPC members were encouraged to incorporate climate change adaptation measures into the mitigation strategy of their respective jurisdictions utilizing resources and guidance available on the Cal-Adapt website and California Adaptation Planning Guide.

To facilitate the brainstorming process, the HMPC referred to a matrix of typical mitigation alternatives organized by CRS category for the hazards identified in the plan, in addition to a handout that explains the categories and provided examples. These materials are included in Appendix B. HMPC members were encouraged to develop mitigation alternatives that would protect future, as well as existing, development from hazards per the DMA 2000 regulations. A facilitated discussion then took place to examine the existing actions in the 2017 LHMP and analyze the other possible mitigation alternatives. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions. The result was new and updated project ideas with the intent of meeting the identified goals and mitigating identified hazards. These new and updated project actions were expanded on during numerous follow-up meetings with County OES staff and participating jurisdictions to focus on the refinement and prioritization of new mitigation activities. Once new mitigation actions were defined, the HMPC selected and prioritized the mitigation actions by ranking them using an electronic survey form that asked the participants to rank actions as either low, medium, or high-priority projects; additional information on this process is described below. Wood also discussed remaining information or mitigation gaps that needed to be addressed during the final follow-up meetings. These meetings were more focused stakeholder group sessions intended to wrap up mitigation gaps, discuss opportunities for plan integration, and review the plan implementation and maintenance procedures.

5.2.1 Prioritization Process

Once the mitigation actions were identified, the HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations) Does it consider social equity, disadvantaged communities, or vulnerable populations?
- Technical: Will it work? (Is the action technically feasible? Does it solve the problem?)
- Administrative: Is there capacity to implement and manage the project? (adequate staffing, funding, and other capabilities to implement the project?)
- Political: Who are the stakeholders? Did they get to participate? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal? Are there liability implications?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

In accordance with the Disaster Mitigation Act requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. Other criteria used to assist in evaluating the benefit-cost of a mitigation action included:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives (Multiple Objective Management)?
- What will the action cost?
- What is the timing of available funding?

The mitigation categories, multi-hazard actions, and criteria are included in Appendix D.

At the HMPC Meeting #3: mitigation strategy meeting, the HMPC reviewed and discussed the STAPLEE considerations to determine which of the identified actions were most likely to be implemented and effective. Prioritization of previous mitigation actions identified in the 2017 LHMP that were carried forward in the updated plan. New actions identified in 2021 also were prioritized based on the group discussion. With the STAPLEE criteria in mind, HMPC participants were completed an online survey to select and rank the existing and new mitigation actions. The team was asked to prioritize projects with the above criteria in mind, essentially voting on the projects. The projects with the most "high" points or votes became the higher priority projects. This process provided both consensus and priority for the recommendations.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to collectively prioritize recommended mitigation actions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis.

Cost-Benefit Review

A cost-benefit review was applied in order to prioritize the mitigation recommendations for implementation. The priority for implementing mitigation recommendations depends upon the overall cost-effectiveness of the recommendation, when taking into account monetary and non-monetary costs and benefits associated with each action. The cost-benefit table for each hazard provides an analysis of the benefit, cost, and a relative priority rank (High, Medium, and Low) for each mitigation activity. The guidelines are listed below.

- **High** – Benefits are perceived to exceed costs without further study or evaluation.
- **Medium** – Benefits are perceived to exceed costs but may require further study or evaluation prior to implementation.
- **Low** – Benefits and cost evaluations requires additional evaluation prior to implementation.

Funding projects that will help to mitigate imminent hazards are cost-effective and assist in efforts to help communities recover from disasters. Most of the projects are already funded through general fund, application fees or state/federal funds. The majority of the projects are ongoing to ensure mitigation measures are implemented within the County. It is not anticipated that all future projects will be identified in 2021-2022 MJHMP. The County's MJHMP will also help guide local government to prioritize, be flexible, and identify critical mitigation strategy needs that may arise from a disaster when there is no time to update the local plan.

Benefit-cost was considered in greater detail in the development of the Mitigation Action Plan. For example, parameters were established for assigning the subjective ratings (high, medium, low) to the benefits and costs of each mitigation action. Specifically, each action developed for this plan contains a description of the problem and proposed project, the entity with primary responsibility for implementation, any other alternatives considered, a cost estimate, expected project benefits, potential funding sources, and a schedule for implementation. Development of these project details for each action led to the determination of an overall high, medium, or low priority for each action.

Recognizing the limitations in prioritizing actions from multiple departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to pursue mitigation action strategy development and implementation according to the nature and extent of damages, the level of protection and benefits each action provides, political support, project cost, available funding, and jurisdiction and department priority. This process guided the development of a prioritized action plan for Stanislaus County and the participating jurisdictions, as well as the Office of Education.

Cost-effectiveness will be considered in greater detail through a formal benefit-cost analysis when seeking FEMA mitigation grant eligibility and funding (e.g. HMGP, BRIC grant programs) for eligible actions associated with this plan. It is also important for the County to protect critical facilities and infrastructure; this is current implemented by the County's Capital Projects Team through the CIP. Areas of repetitive loss are high priorities for mitigation funding as they can drain County coffers.

5.2.2 Continued Compliance with the National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1% annual chance flood (or 100-year flood) and the 0.2% annual chance flood (or 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRM), which are the principal tools for identifying the extent and location of the riverine flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Stanislaus County and all the nine jurisdictions participate in the NFIP. Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these flood-prone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

Table 5-1 below shows the dates when Stanislaus County and the jurisdictions joined the NFIP.

Table 5-1 Stanislaus County and Its Jurisdictions' NFIP Entry Date

County/Jurisdiction	NFIP Entry Date
Stanislaus County	August 1, 1980
City of Ceres	March 7, 1997
City of Hughson	April 21, 2020
City of Modesto	August 15, 1980
City of Newman	September 29, 1978
City of Oakdale	September 5, 1979
City of Patterson	August 1, 1979
City of Riverbank	February 3, 1997
City of Turlock	May 14, 1981
City of Waterford	July 16, 1979

Post-FIRM structures built in compliance with the floodplain regulations are mitigated to withstand floods up through the 100-year event. The insurance rate is different for the two types of structures, as pre-FIRM structures are at higher risk of flooding. The effective date for the current countywide FIRM is August 24, 2021. The County and participating jurisdictions are currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff. Maintaining compliance with the NFIP is an important component of flood mitigation and risk reduction. Furthermore, both City of Newman and City of Patterson currently participate in the CRS.

Given the flood hazard and risk in the planning area and recognizing the importance of the NFIP in mitigating flood losses, an emphasis is placed on continued compliance with the NFIP by Stanislaus County and all participating jurisdictions. As NFIP participants, these communities have and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's requirements for adopting official FEMA floodplain maps and maintaining, enforcing, and updating local floodplain regulations.

5.3 Mitigation Strategy Action Plan

§201.6(c)(3)(iii)
[The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost-benefit review of the proposed projects and their associated costs.
§201.6(c)(3)(iv)
For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

This action plan was developed to present the recommendations developed by the HMPC for how the Stanislaus County planning area can reduce the vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.3.1 Progress on Previous Mitigation Actions

A review of 2017 mitigation actions progress reports indicates that Stanislaus County has been successful in implementing actions identified in the 2017 LHMP Mitigation Strategy, thus, working diligently towards meeting the 2017 plan goals. The 2017 mitigation strategy contained 38 separate mitigation actions. Given that the 2017 LHMP is not a multi-jurisdictional, all the mitigation actions identified were for the County to implement. There was no jurisdiction-specific mitigation action.

As of March 2022, one of these actions have been completed and 37 actions are continuing. The table below summarizes progress implementing mitigation actions. The total continuing actions row summarizes the actions from 2017 that are either still in-progress, have annual implementation, or are continuing but not completed. The new actions in 2021 summarizes the number of actions that were identified during the 2021- 2022 plan update process.

Table 5-2 Mitigation Action Progress Summary for County

Progress Category	# Of Mitigation Actions
Completed	1
Deleted	N/A
Continue In-Progress	36
Continue Not Started	1
Total Continuing Actions	37
New Actions in 2021	5
Grand Total	42

Table 5-3 indicates the details for each of the 2017 mitigation action items that have been completed or deleted.

Table 5-3 Completed and Deleted Mitigation Actions

ID	Corresponding Hazard(s)	Mitigation Action	Lead Agency	Goals	Priority	Action Status Notes
HMP.01	Earthquake	Ensure all Development and Building Permit Applications in areas with geological faults shall include measures to mitigate the impacts based on the Seismic Design Category associated with Soil Classification, liquefaction, and seismic activity, in accordance with California Code of Regulations Title 24.	County Department of Planning and Community Development	1	High	**Completed.** This action was fully implemented since the 2010 plan but continues to be included in the HMP to ensure building structural safety.

5.3.2 Updated Action Plan

The results of the project identification and prioritization exercise from the third HMPC meeting is summarized in Table 5-4. These projects detail specific actions for reducing future hazard-related losses within Stanislaus County. The projects are organized by jurisdictions and include notes about the department and partners necessary to implement the project. Table 5-4 provides more details on the mitigation actions, including the mitigation action description estimated cost, potential funding sources, timeline, indication of the goal(s) that the projects primarily align with and are marked with their relative level of priority high, medium, and low. The following table also provides status/implementation notes that describe progress made on the actions so far, using the following categories, and, where applicable, notes if there were changes in the priority level from the previous plan:

- **Continue In-Progress:** work has begun on the project and is ongoing.
- **Continue not Completed:** Not completed: little or no work has been done on the project to date and the HMPC agreed to carry over the action into the updated plan.
- **New in 2022:** The action is new to this plan update; little to no work has been completed.

Many of these mitigation actions are intended to reduce impacts to existing development. Those that protect future development from hazards, as required per the DMA 2000 regulations, are indicated by an asterisk '*' in the action identification number. These actions include those that promote wise development and hazard avoidance, such as building code, mapping, and zoning improvements, and continued enforcement of floodplain development regulations.

Table 5-5 provides a summary of the individual mitigation actions by jurisdiction specific to the municipalities that participated in the 2021 plan update. Together with the County goals, objectives, and actions the tables provide an overview of all the mitigation actions proposed. More details can be found in the respective jurisdictional annexes.

Table 5-4 Stanislaus County Mitigation Actions

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
1*	Goal 1, Objectives EQ01, EQ02, EQ03	Earthquake	Proposed Residential development may not be approved at the maximum density if it is in a geological fault area or if it does not meet the requirements of Ordinance 1182(Building Code adoption), Title 24 and 16, Stanislaus County Code unless mitigation measures are approved at application.	County Department of Planning and Community Development	$10,000 – $100,000	General Funds, State Earthquake Hazard Mitigation Funding	Safety and Security	High	Ongoing	Continue In-Progress.
2*	Goal 1, Objectives EQ01, EQ02, EQ03	Earthquake	The County shall enforce provisions of the Alquist-Priolo Earthquake Fault Zoning Act.	County Department of Planning and Community Development	$10,000 – $100,000	General Funds, State Earthquake Hazard Mitigation Funding	Safety and Security	High	Ongoing	Continue In-Progress.
3	Goal 1, Objective EQ07	Earthquake	Conduct public outreach about earthquake risk and mitigation activities through participation in and publicizing The Great California Shake Out.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress. Outreach for the Great Shake Out program is completed annually. County OES executed outreach for this program each year since 2017.
4*	Goals 1-5, Objectives EQ09, LS08, DI04, FL07, WF08	Multi-Hazard: Earthquake, Landslide, Dam Incidents, Flood, Wildfire	Continue to integrate MJHMP priorities with policies included in the EOP, General Plan Safety Element, and Capital Improvement Plan and other local plans.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress. The County recently updated the EOP in 2021. The EOP references the 2017 LHMP.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
										Likewise, the Safety Element also incorporates by reference the 2017 LHMP. Continued incorporation of MJHMP into other planning mechanisms is expected.
5	Goals 1-5, Objectives EQ05, LS06, DI01, FL06, FL07, WF09	Multi-Hazard, Earthquake, Landslide, Dam Incidents, Flood, Wildfire	Develop, adopt, maintain, and update a Continuity of Operations Plan (COOP). Provide disaster management to assist and support County departments to maintain their critical functions and emergency responders.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress. This action is updated annually, or as needed. The County has six workshops scheduled for 2022 to maintain the COOP.
6	Goal 1-5, Objectives EQ06, LS07, DI02, FL08, WF07	Multi-Hazard: Earthquake, Landslide, Flood, Dam Incidents, Wildfire	Provide NIMS training to all County employees who may be called upon during an emergency. NIMS was developed so that responders from different jurisdictions and disciplines can work together to provide a unified approach to incident management.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress. The County OES provides NIMS training to all County employees. All new employees must complete NIMS training.
7	Goals 1-5, Objectives CT01, CT02,	Cyber Attack	Establish a Cyber Security Risk Management Program to identify cyber security risks, understand the likelihood and impact, and	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Not Started	New in 2022.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
	CT03, and CT04		put security controls in place that mitigate the risk to a level considered acceptable. The risk management program will also include ongoing evaluation and assessment of cyber security risk and controls throughout the life cycle of the software programs in place.							
8*	Goal 1, Objective EQ03	Earthquake	New public roads and bridges in areas subject to significant seismic hazard shall be designed to minimize seismic risk.	County Department of Public Works	$100,000 – $1,000,000	General Funds, State Earthquake Hazard Mitigation Funding	Transportation	Medium	Ongoing	Continue In-Progress. All new roads and bridges shall be designed to current standards to withstand seismic forces.
9*	Goal 1, Objective EQ03	Earthquake	Additional width shall be required if right-of-way widths greater than those specified in the Circulation Element are necessary to provide added safety in geologically unstable areas.	County Department of Public Works	$100,000 – $1,000,000	General Funds, State Earthquake Hazard Mitigation Funding	Transportation	Low	Ongoing	Continue In-Progress. Additional width shall be required to provide added safety in geologically unstable areas.
10	Goal 1, Objectives EQ04 and EQ08	Earthquake	Take advantage of programs that would provide funds to identify and rehabilitate structures that do not currently meet building standard minimums for earthquake resistance.	County Department of Planning and Community Development	$10,000 – $100,000	General Funds, State Earthquake Hazard Mitigation Funding	Safety and Security; Food, Water, Shelter; Health and Medical; Communications	Low	Ongoing	Continue In-Progress.
11*	Goals 2 and 5;	Landslide	All building permit applications shall be	County Department of	$10,000 – $100,000	General Funds,	Safety and Security;	High	Ongoing	Continue In-Progress.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
	Objectives LS01, LS02, LS03, WF01, WF04, and WF06		reviewed to ensure compliance with the California Code of Regulations Title 24 and Subdivision Ordinance in areas of unstable soils.	Planning and Community Development		Application Fees	Transportation; Health and Medical; Communications			Mitigation Actions 10 and 31 from the 2017 LHMP were combined.
12*	Goal 2, Objective LS01	Landslide	Development west of Highway 5 located in Seismic Design Category D shall submit a geological soils report unless the Chief Building Official and Planning Director are satisfied that no need for the report is present.	County Department of Planning and Community Development	$10,000 – $100,000	General Funds and Application Fees	Safety and Security; Transportation	High	Ongoing	Continue In-Progress.
13*	Goals 2 and 4 Objectives LS03, FL01 and FL07	Multi-Hazard, Landslide, Flooding	The County shall utilize the CEQA process to ensure that development does not occur that would be prone to flooding or susceptible to landslides. Most discretionary projects require review for compliance with CEQA. As part of this review, potential impacts must be identified and mitigated or a statement of overriding concerns added.	County Department of Planning and Community Development	<$10,000	General Funds and Application Fees	Safety and Security	High	Ongoing	Continue In-Progress. Mitigation Actions 12 and 28 from the 2017 LHMP were combined.
14*	Goal 2, Objective LS03	Landslide	The routes of new public roads in areas subject to landslides shall be designed to minimize landslide risks.	County Department of Public Works	$10,000 – $100,000	General Funds, Bonds, Tax Measures	Transportation	High	Ongoing	Continue In-Progress. All new roads shall be designed to minimize landslide risks.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
15*	Goal 2, Objective LS04	Landslide	Engineering benchmarks will be utilized to survey slope differences over time and monitor for changes in topography to prevent roadway damage and traffic disruptions.	County Department of Public Works	$10,000 – $100,000	General Funds, Bonds, Tax Measures	Transportation	High	Ongoing	Continue In-Progress. Engineering benchmarks will be used to monitor any changes in topography to prevent roadway damage.
16	Goal 2, Objective LS05	Landslide	Manage landslide hazard areas by staging road-clearing equipment in known landslide prone areas for faster stabilization.	County Department of Public Works	$10,000 – $100,000	General Funds	Transportation	High	Ongoing	Continue In-Progress. Road-clearing equipment will continue to be staged.
17*	Goal 2, Objective LS03	Landslide	Development proposals in an area identified as having unstable soils and subject to landslides such as areas in the foothills and river bluffs shall include an engineered design with emphasis on soil, degree of slope measures for mitigating possible hazards.	County Department of Planning and Community Development	$10,000 – $100,000	General Funds, Bonds, Tax Measures	Safety and Security	High	Ongoing	Continue In-Progress.
18	Goals 1-4, Objective DI05	Dam Incidents	Continue to partner with dam operators to identify projected flood path of travel as if total loss of dam occurs.	Chief Executive Officer/Office of Emergency Services, Army Corps of Engineers, California DSOD, PG&E, MID, TID,	$10,000 – $100,000	General Funds, HMGP	Safety and Security; Food, Water, Shelter	High	Ongoing	Continue In-Progress. The County works with the TID Flood Working Group to identify the projected flood paths of certain dams. The County aims

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
				SSJID, OID, Merced Irrigation District, Other Dam Owners and Operators						to work with this group on an annual basis.
19	Goal 3, Objectives DI02, DI04, and DI05	Dam Incidents	Participate in the Stanislaus County /TID Flood Working Group to develop and approve plans specific to public notification and evacuation.	Chief Executive Officer/Office of Emergency Services, TID	<$10,000	General Funds, HMGP	Safety and Security; Communications	High	Ongoing	Continue In-Progress. A siren will be installed in the community of LaGrange for notification and evacuation procedures. Workshops will be scheduled once the siren and related evacuation procedures are in place for the community.
20	Goals 3 and 4, Objectives DI05, FL09, and FL10	Dam Incidents, Flood	Participate in the Mid San Joaquin Regional Flood Management Plan (RFMP) Updates. The RFMP identifies flood management strategies and projects to reduce flood risks and advance ecosystem restoration in the Mid San Joaquin Region, which includes Stanislaus County.	Stanislaus County Department of Public Works, Army Corps of Engineers, California DSOD, PG&E, MID, TID, SSJID, OID, Merced Irrigation District, Other Dam Owners and Operators	<$10,000	General Funds, HMGP	Safety and Security	Medium	Ongoing	Continue In-Progress. County OES has been working with the Mid San Joaquin Regional Flood Management Working Group. Mitigation Actions 20 and 30 from the 2017 LHMP were combined.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
21	Goal 3, Objective DI05	Dam Incidents	Identify structures within the flood path of travel and note impacted properties in data base.	County Department of Planning and Community Development	<$10,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress. As part of the 2021-2022 MJHMP update risk assessment, critical facilities were identified that are within dam inundation areas.
22	Goal 3, Objectives DI04 and DI05	Dam Incidents	The County will continue to participate in Emergency Action Plan (EAP) training and exercises. Lessons learned will be reflected in plans developed for dam inundation.	Chief Executive Officer/Office of Emergency Services	<$10,000	General Funds, HMGP	Safety and Security; Communications	High	Ongoing	Continue In-Progress. The County staff takes Cal OES courses for EAP planning and training. The County also works with TID related to dam inundation. TID owns and/or operates several of the dams in the County.
23	Goal 3, Objectives DI-4 and DI05	Dam Incidents	Promote dam safety awareness each year on May 31 as part of the National Dam Safety Awareness Day campaign, using FEMA templates and background materials coupled with information from the risk assessment.	Chief Executive Officer/Office of Emergency Services	<$10,000	General Funds	Safety and Security	High	Not Started	New in 2022.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
24	Goals 2-5, Objectives DR01, DR02, DR03, and DR04	Drought	Develop a Public Awareness Campaign to advertise and promote on the StanEmergency webpage to encourage water conservation during drought conditions.	Office of Emergency Services	<$10,000	General Funds	Safety and Security; Food, Water, Shelter	High	Not Started	New in 2022.
25	Goal 1, 2,3 and 4, Objectives ET01, ET02	Extreme Temperatures : Freeze and Extreme Heat	The County will regularly update the Extreme Heat Contingency Plan, as an annex to the County's EOP.	Chief Executive Officer/Office of Emergency Services	<$10,000	General Funds, HMGP	Safety and Security	High	Ongoing	New in 2022. The County's most recent Extreme Heat Contingency Plan was produced in 2019.
26	Goal 4, Objectives FL09	Flood	GIS layers will be maintained and kept current of the probability and extent of flooding based on various models, primarily data about historical flooding. Capturing real-time flood reporting and monitoring for integration into flood maps is a key focus for GIS mitigation efforts.	County Strategic Business Technology	<$10,000	General Funds, HMGP, State Flood Hazard Mitigation Funding	Safety and Security	High	Ongoing	Continue In-Progress.
27*	Goal 4, Objectives FL01, FL02, and FL04	Flood	Through enforcement of Title 16, require that structures in a flood plain will have the Lowest Flood Elevation constructed at a minimum level of one foot above Base Flood Elevation and to adopt FEMA section 11-01 and provide clarity on basement definition.	County Department of Planning and Community Development	<$10,000	General Funds & Application Fees	Safety and Security	High	Ongoing	Continue not Started. The County needs to update Title 16 – Floodplain Management Ordinance to provide clarify on the basement definition.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
28	Goal 4, Objectives FL02	Flood	Elevate existing homes out of the flood plain due to repetitive loss and provide flood mitigation resources on methods to reduce flood risk to residents in neighborhoods most vulnerable to flooding.	County Department of Planning and Community Development	$100,000 – $1,000,000	General Funds, State Flood Hazard Mitigation Funding	Safety and Security	Medium	Ongoing	Continue In-Progress
29	Goal 4, Objectives FL01, FL02, FL04, and FL05	Flood	Coordinate participation in the NFIP for Stanislaus County and ensure compliance with the requirements.	County Department of Planning and Community Development	<$10,000	General Funds	Safety and Security	High	Ongoing	Continue In-Progress.
30*	Goals 4, Objectives FL03	Flood	Enforce Chapter 16.50 Floodplain Management Ordinance of the County Code and within the designated floodway shall obtain State Floodway Agency and Reclamation District Board approval.	County Department of Planning and Community Development	<$10,000	General Funds, HMGP	Safety and Security	High	Ongoing	Continue In-Progress.
31	Goal 4, Objectives FL04 and FL05	Flood	The Public Works Department will provide information and resources to landowners in areas subject to flooding.	Department of Public Works	<$10,000	General Funds	Safety and Security	High	Ongoing	Continue In-Progress. Public Works will continue to provide flood information. The efforts related to establishing flood control districts in communities subject to repetitive flooding impacts was split into a separate action.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
32	Goal 4, Objectives FL04 and FL05	Flood	The Public Works Department will work with communities subject to repetitive flood impacts to help them form flood control districts.	Department of Public Works	<$10,000	General Funds	Safety and Security	High	Ongoing	Continue In-Progress. This is an existing action that was added as a separate action focused on establishing flood control districts.
33	Goal 4, Objective FL09	Flood	Increase monitoring capabilities for the Dry Creek watershed.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP, State Flood Hazard Mitigation Funding	Safety and Security	Medium	Ongoing	Continue In-Progress. This activity/action was new to the 2017 LHMP and was identified in the DWR Flood Plan. It involves the installation of a water level gauge on Dry Creek.
34	Goal 5, Objective FL10	Flood	Participate in FEMA Direct Technical Assistance awarded to City of Modesto to perform benefit-cost analyses for risk mitigation actions on the Tuolumne River floodway.	Stanislaus County Department of Public Works, City of Modesto	$10,000 – $100,000	General Funds	Safety and Security; Transportation; Health and Medical	High	Ongoing	New in 2022.
35	Goal 5, Objective FL10	Flood	Remove impediments to passage of increased flow releases from New Don Pedro Dam on the Tuolumne River to improve	Stanislaus County Department of Public Works, City of Modesto	$100,000 – $1,000,000	General Funds, State Flood Hazard Mitigation Funding, BRIC, HMGP	Safety and Security; Transportation; Health and Medical	High	Ongoing	New in 2022.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
			management flexibility for high-flow events.							
36	Goal 5, Objective FL10	Flood	Support regional flood management strategies through continued participation with the Mid San Joaquin Regional Flood Management Plan update process and by accounting for the projected impacts of climate change on flood risk in Stanislaus County in order to protect vulnerable communities and infrastructure and to restore floodplains along the San Joaquin River and its tributaries.	Stanislaus County Department of Public Works, City of Modesto, Mid San Joaquin Regional Flood Management Plan Working Group	<$10,000	General Funds, State Flood Hazard Mitigation Funding, BRIC, HMGP	Safety and Security; Transportation; Health and Medical	High	Ongoing	New in 2022.
37	Goal 5, Objective FL10	Flood	Improve engagement with and flood protection for socially vulnerable and disadvantaged communities as part of an effort to understand how management actions can increase adaptation capacity, reduce flood risk, and provide benefits to these communities.	Chief Executive Officer/OES, Environmental Justice Program of Catholic Charities of Stockton, City of Modesto	<$10,000	General Funds	Safety and Security; Transportation; Health and Medical	High	Not Started	New in 2022.
38	Goals 1, 2, 3, 4, and 5, Objectives PH01, PH02,	Public Health Hazards	Conduct a COVID-19 After Action Review Plan that involves working with County Hospitals and Medical Providers to	Health Services Agency	$100,000 – $1,000,000	General Fund, Coronavirus (COVID-19) Aid, Relief,	Safety and Security; Health and Medical	High	Not Started	New in 2022.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
	PH03, and PH04		increase bed capacity of existing hospitals.			and Economic Security (CARES) Act Relief Funding				
39	Goal 1, 2, 3 and 4, Objectives SW 01, 02, 06 and 07	Severe Weather: Dense Fog, Heavy Rain, Thunderstorms, Hail, Lightning, High Wind, Tornado	Champion a Severe Weather Preparedness Campaign with participating jurisdictions and neighboring counties to enhance existing weather-related campaigns that share information on severe weather hazards, including all hazards preparedness information.	Chief Executive Officer/Office of Emergency Services/NWS/ DWR	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Not Started	New in 2022.
40	Goal 1, 2, 3 and 4, Objectives SW 01, 02, 06 and 07	Severe Weather: Dense Fog, Heavy Rain, Thunderstorms, Hail, Lightning, High Wind, Tornado	Organize targeted outreach plans for socially vulnerable populations in the County; including accessibility to shelters; multi-lingual pamphlets to increase awareness; and long-term engagement with under-represented groups, farm worker organizations, and other Community-Based Organizations (CBOs) to improve community's adaptive capacity to respond to natural and climate-related hazards.	Chief Executive Officer/OES and Environmental Justice Program of Catholic Charities of Stockton	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Not Started	New in 2022.
41	Goal 1, 2, 3 and 4, Objectives SW 01, 02, 06 and 07	Severe Weather: Dense Fog, Heavy Rain, Thunderstorms,	Obtain back-up power generation at EOCs, Critical Facilities, and Shelters.	Chief Executive Officer/Office of Emergency Services	$10,000 – $100,000	General Funds, HMGP	Safety and Security	High	Not Started	New in 2022.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
		Hail, Lightning, High Wind, Tornado								
42	Goal 5, Objectives WF01, WF04, and WF06	Wildfire	All building permit applications shall be reviewed to ensure compliance with the California Code of Regulations, Title 24, County Ordinances and California PRC.	County Department of Planning and Community Development	<$10,000	General Funds & Fees	Safety and Security	High	Ongoing	Continue In-Progress.
43	Goal 5, Objectives WF01, WF04, and WF06	Wildfire	The California Fire Code shall be enforced during inspections and maintenance of structures regulated under that code.	Fire Warden/Fire Prevention Bureau	<$10,000	General Funds & Application Fees	Safety and Security	High	Ongoing	Continue In-Progress. The California Fire Code will continue to be enforced.
44*	Goals 5, Objectives WF01, WF04, and WF05	Wildfire	All discretionary projects in the County shall be referred to the County Fire Prevention Bureau and to the appropriate Fire District for comment. The comments of these agencies will be used to condition or recommend modifications of the project as it relates to fire safety and rescue issues.	Fire Warden/Fire Prevention Bureau	<$10,000	General Funds & Fees	Safety and Security	High	Ongoing	Continue In-Progress. Stanislaus County Fire Prevention and the appropriate Fire District will continue to review discretionary projects.
45	Goal 5, Objectives WF02, WF03, WF05, and WF06	Wildfire	The County Fire Prevention Bureau shall work with the California Department of Forestry and Fire Protection and with local fire districts to minimize the danger from wildfires and the related	Fire Warden/Fire Prevention Bureau	<$10,000	General Funds & Fees, State Wildfire Hazard Mitigation Funding	Safety and Security; Energy	High	Ongoing	Continue In-Progress. Project applicants are advised to reach out to CALFIRE for input into their project.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
			impacts of post fire conditions.							
46*	Goal 5, Objectives WF02, WF04, WF05, and WF06	Wildfire	All new development shall have adequate fire flow water supply that meets or exceeds the requirement specific to the project as required by the California Fire Code-appendix B, NFPA 1142, County-District Ordinance or the California Code of Regulations Title 14 1270 in the State Responsibility Areas (SRA).	Fire Warden/Fire Prevention Bureau	$10,000 – $100,000	General Funds & Fees, State Wildfire Hazard Mitigation Funding	Safety and Security; Food, Water, Shelter; Energy	High	Ongoing	Continue In-Progress.
47*	Goal 5, Objectives WF02, WF04, WF05, and WF06	Wildfire	All building permits and discretionary projects within the SRAs, as identified by the California Department of Forestry and Fire Protection, shall meet the minimum development standards outlined in the California Code of Regulations Title 14 1270 (SRA Fire Safe Regulations) and Title 14 Section 1299.01 (Fire Hazard Reduction Around Buildings and Structures Regulations) for SRAs and/or VHFHSZs.	County Department of Planning and Community Development	<$10,000	General Funds & Fees, State Wildfire Hazard Mitigation Funding	Safety and Security	High	Ongoing	Continue In-Progress. Fire flows will continue to be evaluated as new projects are submitted. The only VHFHSZs are in the western portion of County. This area has little development.
48*	Goal 5, Objectives WF05, WF06, and WF08	Wildfire	Adopt a County Ordinance as requested by the State Board of Forestry to be enforced in the SRA within Stanislaus County that meets or exceeds the regulations of 14 CCR 1270.	Fire Warden/Fire Prevention Bureau	<$10,000	General Funds & Fees, State Wildfire Hazard Mitigation Funding	Safety and Security	High	Not Started	Continue not Started.

ID	Links to Goals & Objectives	Hazard(s) Mitigated	Description/Background/ Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	FEMA Lifeline	Priority	Timeline	Implementation Status
49*	Goal 5, Objectives WF05, WF06, and WF08	Wildfire	Identify and construct secondary ingress/egress transportation and circulation improvements for wildfire emergencies in WUI areas in the eastern and western portions of the County.	Fire Warden/Fire Prevention Bureau	$100,000 – $1,000,000	General Funds & Fees, HMGP	Safety and Security	High	Ongoing	New in 2022.
50	Goal 5, Objectives WF05, WF06, and WF08	Wildfire	Work with cities and local fire districts to develop evacuation plans and develop education and outreach materials to populations most vulnerable to wildfire risk.	Fire Warden/Fire Prevention Bureau	$10,000 – $100,000	General Funds & Fees, HMGP	Safety and Security	High	Ongoing	New in 2022.

Table 5-5 Jurisdictional Mitigation Action Summary

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
City of Ceres					
1	Dam Incidents	Develop a Public Awareness Campaign on Dam Safety	City of Ceres Executive Team, USACE, DSOD, MID, TID	Medium	Develop a Public Awareness Campaign on Dam Safety – The City will organize a Social Media Campaign that will run quarterly on City of Ceres platforms to advertise and promote evacuation routes or pre-incident preparation related to dam incidents that can be done by the public.
2	Dam Incidents	Prepare/Update the Emergency Action Plan, Emergency Operations Plan and Emergency Response Plan	City of Ceres Executive Team, USACE, DSOD, MID, TID	Medium	Prepare/Update the Emergency Action Plan, Emergency Operations Plan and Emergency Response Plan to reduce risks associated with dam failure; build partnerships and coordinate with neighboring agencies if necessary to update these plans.
3	Drought	Further restrict outdoor water use during drought events beyond the already established requirements	City of Ceres Executive Team	Medium	Further restrict outdoor water use during drought events beyond the already established requirements in the City's Urban Water Management Plan, Water Shortage Contingency Plan and Water Conservation Plan.
4	Drought	Enhance the City's Water Conservation Program and further encourage water conservation	City of Ceres Executive Team	Medium	Enhance the City's Water Conservation Program and further encourage water conservation by providing additional rebate options for appliance replacement to promote water-efficient models.
City of Hughson					
1	Dam Incidents	Prepare/Update the Emergency Action Plan (EAP) and the Emergency Operations Plan (EOP) to reduce risks associated with dam failure.	City of Hughson, Public Works Department, USACE, DSOD, MID, TID	High	Prepare/Update the Emergency Action Plan (EAP) and the Emergency Operations Plan (EOP) to reduce risks associated with dam failure.
2	Dam Incidents	Build partnerships and mutual aid agreements with neighboring agencies in order to quickly respond in the event of a dam incident.	City of Hughson, Public Works Department, USACE, DSOD, MID, TID	High	Build partnerships and mutual aid agreements with neighboring agencies in order to quickly respond in the event of a dam incident.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
3	Dam Incidents	Implement an alert system capable of notifying residents of emergencies through landlines, cell phones, and emails.	City of Hughson Public Works Department, Fire Department, Stanislaus County, USACE, DSOD, MID, TID	High	Implement an alert system capable of notifying residents of emergencies through landlines, cell phones, and emails.
4	Drought	The City enforces all Water Board regulations restricting potable water use in drought years.	City of Hughson Public Works Department, Stanislaus County	Medium	The City enforces all Water Board regulations restricting potable water use in drought years.
5	Flood	Drainage Systems for Flood Prevention	City of Hughson, Public Works Department	High	Drainage Systems for Flood Prevention – The City will provide and improve existing water drainage systems because the existing drainage systems need pumping capacity upgrades. Alternatives may involve adding capacity to existing drainage basins in the City. This action would benefit the City's existing drainage system and pump stations would prevent emergency flooding. This action would also prevent property damage and potential safety concerns.
6	Extreme Temperature: Extreme Heat and Freeze	Senior Center HVAC Replacement	City of Hughson, Public Works Department	High	Senior Center HVAC Replacement – This project would require replacing two of the three HVAC units that supply heating and air conditioning to the Senior Center. Currently the Senior Center is used as a cooling zone and only has two working units with one of the units being older than fifteen years old. Updating the current HVAC system will allow the continuing use of Senior Center as a cooling zone and also as facility to be used during pandemic/epidemic for public services.
7	Public Health Hazards	The City will enhance existing public health programs they partner on with the Stanislaus County Public Health Officer.	City of Hughson, Stanislaus County Health Services Agency	Medium	The City will enhance existing public health programs they partner on with the Stanislaus County Public Health Officer. This includes following Public Health orders by the State of California and the County of Stanislaus Public Health Officer. This includes advertising vaccination and testing clinics at the City's Senior Center and distributing masks at City Hall during incidents when there are higher incidents of public health concerns in the community.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
City of Modesto					
1	Flood	Relocation of Sutter Treatment Primary Facilities	City of Modesto	High	The Sutter Treatment Primary Facilities are located along the Tuolumne River within the FEMA designated floodplain. It experienced repeated flooding several times previously. The “Sutter Treatment Facility Feasibility Study” that was finalized in April 2015 concluded that flood protection of the Sutter Plant was not feasible. To avoid future flooding, the Sutter Treatment Primary Facilities will be demolished. New facilities will be constructed 6.5 miles away at the Jennings Treatment Plant Facilities, which are outside the 100-year FEMA floodplain along the San Joaquin River. The footprint of the old primary facilities will be incorporated into the Tuolumne River Regional Park Master Plan and regraded to further reduce flood risk by removing levees around the sludge drying beds and by relocating the emergency holding pond.
2	Flood	Tuolumne River & Carpenter Road Bridge River Restoration Project	City of Modesto	High	A 1999 FEMA Flood Hazard Mitigation Study identified that the constriction at Carpenter Road on the Tuolumne River was caused by the bridge and roadway embankment on the north side of the river. The embankment could be replaced by a “causeway” (lengthened bridge). Additionally, the remaining elevated land east of Carpenter roadway embankment (former Carpenter Eastern Landfill) and the elevated land to the west (existing Carpenter Western Landfill) would have to be removed and regraded to increase the cross-sectional flow area, to eliminate the constriction on the river and lower flood elevations and reduce the repeated flooding of the neighborhood adjacent and upstream of these flood flow obstacles. Homes in the adjacent neighborhood “Robertson Road Neighborhood” have experienced flooding in 1950, 1955, 1969, and 1997. A hydraulic analysis to determine the boundary of the new 100-year floodplain as if the project had been completed, is underway to determine how many fewer homes would flood in a 100-year event.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
3	Multi-Hazard: Dam Incidents, Flood	Tuolumne River Floodway Capacity Increase	City of Modesto, USACE, DWR, MID, TID, City of Ceres, Central Valley Flood Protection Board, Tuolumne River Regional Park JPA	High	The problem with the floodway capacity downstream of Don Pedro is that the current operation objective releases of 9,000 cfs (or non-damaging flow) limit the preemptive releases needed to minimize a massive uncontrolled spill from the reservoir, which in the past has resulted in repeated flooding of disadvantaged communities that line the edges of the Tuolumne River as well as the City of Modesto Sutter Avenue Wastewater Treatment Plant. Some of these communities have experienced repeated flooding in 1950,1955, 1969 and 1997. The project aims to increase the floodway capacity downstream of Don Pedro to match or exceed the maximum-controlled release level of approximately 15,000 cfs upstream of Modesto, and 25,000 cfs below the Dry Creek confluence, in order to grant Don Pedro Reservoir operators more flexibilities to reduce flood risk, increase water supply and address impacts caused by climate change in the San Joaquin Valley.
City of Newman					
1	Drought	Low-Water Use Landscape Conversion Program – Lawn to Garden Program	City of Newman Public Works Department	Low	Low-Water Use Landscape Conversion Program – Lawn to Garden Program Grant that allows residential customers in the City to replace lawn and other water-intensive landscaping with water-efficient and drought-tolerant landscaping.
2	Earthquake	Establish procedures and standards for the structural evaluation of existing unreinforced masonry buildings	City of Newman Building Department & Planning Department	Medium	Establish procedures and standards for the structural evaluation of existing unreinforced masonry buildings located in the downtown area; carry out a study to identify other unreinforced masonry buildings and other structures within the City that would be at risk during seismic events.
3	Earthquake	Repair one of Newman Police Department's exterior walls that is at risk of earthquake hazard	City of Newman Building Department & Police Department	High	Repair one of Newman Police Department's exterior walls that is at risk of earthquake hazard
4	Flood	Orestimba Creek Overflow Flood Reduction Project	City of Newman, Southern Pacific	High	Orestimba Creek Overflow Flood Reduction Project

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
			Railroad, Stanislaus County Public Works Department		
5	Flood	Orestimba Creek Debris Maintenance and Channel Conveyance Enhancement Program	City of Newman, Stanislaus County Public Works Department	High	Orestimba Creek Debris Maintenance and Channel Conveyance Enhancement Program
6	Extreme Temperatures: Freeze and Extreme Heat	Cooling Zone Permanent Solar Back-up Generator	City Manager's Office	High	Cooling Zone Permanent Solar Back-up Generator
7	Severe Weather, Multi-Hazard	City Hall Emergency Operations Center (EOC) Back-up Power	City of Newman Fire Department	Medium	City Hall Emergency Operations Center (EOC) Back-up Power
8	Severe Weather, Multi-Hazard	Transfer Switch to Connect to Critical Pump Stations in City	City of Newman Public Works Department, Stanislaus County Public Works Department	Medium	City Hall Emergency Operations Center (EOC) Back-up Power
9	Earthquake, Multi-Hazard	Continue to implement policies established in the City's General Plan Safety Element	City of Newman	Medium	Continue to implement policies established in the City's General Plan Safety Element
City of Oakdale					
1	Dam Incidents	Develop a Public Awareness Campaign on Dam Safety	City of Oakdale Executive Team, USACE, DSOD, ConAgra Grocery Products Company,	Medium	Develop a Public Awareness Campaign on Dam Safety – The City will organize a Social Media Campaign that will run quarterly on City of Oakdale platforms to advertise and promote evacuation routes or pre-incident preparation related to dam incidents that can be done by the public.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
			LLC, MID, TID, OID, SSJID		
2	Drought	Develop a Public Awareness Campaign on Water Conservation	City of Oakdale Executive Team	Medium	Develop a Public Awareness Campaign on Water Conservation – The City will organize a Social Media Campaign that will run quarterly on City of Oakdale platforms to advertise and promote conservation and water saving ideas that can be performed by the public.
3	Flood	Develop a Public Awareness Campaign on Flood Preparedness	City of Oakdale Executive Team	Medium	Develop a Public Awareness Campaign on Flood Preparedness – The City will organize a Social Media Campaign that will run quarterly on City of Oakdale platforms to advertise and promote evacuation routes or pre-incident preparation for flood hazards that can be done by the public.
4	Wildfire	Develop a Public Awareness Campaign on Preventing Wildfire Hazards	City of Oakdale Executive Team	Medium	Develop a Public Awareness Campaign on Wildfire Hazards – The City will organize a Social Media Campaign that will run quarterly on City of Oakdale platforms to advertise and promote evacuation routes, fire prevention, and pre-incident preparation that can be done by the public.
City of Patterson					
1	Dam Incidents	The City shall establish and maintain cooperative working relationships among various stakeholders to ensure that dam incident and flood inundation impacts to essential public facilities are minimized.	City of Patterson Public Works Department, Dam Operators, DSOD, DPWD, San Joaquin River Exchange Contractors Authority, Stanislaus County	High	The City shall establish and maintain cooperative working relationships among public agencies, dam operators, DSOD, DPWD, San Joaquin River Exchange Contractors Authority, and the County of Stanislaus to ensure that dam incident and flood inundation impacts to existing essential public facilities, such as Fire Station 52 (City's EOC) are minimized. This action is intended to focus on dam safety concerns related to the Del Puerto Canyon Reservoir in Del Puerto Canyon in the Coast Range foothills west of the City of Patterson and south of the Sacramento-San Joaquin Delta.
2	Drought	Develop a Public Awareness Campaign on Water Conservation	City of Patterson Executive Team, Community Development Department,	High	Develop a Public Awareness Campaign on Water Conservation – The City will organize a Social Media Campaign that will run quarterly on City of Patterson platforms to advertise and promote conservation and water saving ideas that can be performed by the public.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
			Public Works Department		
3	Drought	Further restrict outdoor water use during drought events beyond the already established requirements	City of Patterson Executive Team	Medium	Further restrict outdoor water use during drought events beyond the already established requirements in the City's Urban Water Management Plan and Drought Contingency Plan.
4	Earthquake	Conduct public outreach about earthquake risk and mitigation activities	City of Patterson Executive Team, Community Development Department	Medium	Conduct public outreach about earthquake risk and mitigation activities
5	Earthquake	Continue to implement policies established in the City's General Plan Health and Safety Element	City of Patterson, Public Works Department	Medium	Continue to implement policies established in the City's General Plan Health and Safety Element, such as requiring the preparation of geotechnical reports to impose appropriate mitigation measures to ensure, within the limits of technical and economic feasibility, that new structures are able to withstand the effects of seismic activity, including liquefaction, slope instability, expansive soils or other geologic hazards.
6	Extreme Temperature: Freeze and Extreme Heat	Work on finding multiple cooling centers at different locations to cover the entire geographic extent of the City.	City of Patterson Executive Team, Community Development Department, Public Works Department	High	Work on finding multiple cooling centers at different locations to cover the entire geographic extent of the City; pay additional attention to disadvantaged communities and vulnerable populations that do not have adequate transportation to arrive at the City's downtown area.
7	Flood	Develop a Public Awareness Campaign on Flood Preparedness	City of Patterson Executive Team, Community Development Department, Public Works Department	High	Develop a Public Awareness Campaign on Flood Preparedness – The City will organize a Social Media Campaign that will run quarterly on City of Patterson platforms to advertise and promote evacuation routes or pre-incident preparation for flood hazards that can be done by the public.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
8	Flood	The City shall prepare and adopt Flood Management Plans and practices aimed at protecting life and property from the harmful effects of flooding	City of Patterson Executive Team, Community Development Department, Public Works Department	High	The City shall prepare and adopt Flood Management Plans and practices aimed at protecting life and property from the harmful effects of flooding. The effort includes establishing criteria for evaluating whether new development should be located in flood hazard zones, identifying construction methods or other methods to minimize damage if new development is located in flood hazard zones, and maintaining the structural and operational integrity of essential public facilities during flooding.
9	Flood	The City will implement flood hazard mitigation prior to new development by not approving new development in areas subject to a 100-year flood event, unless and until the flood hazard has been mitigated.	City of Patterson Executive Team, Community Development Department, Public Works Department	High	The City will implement flood hazard mitigation prior to new development by not approving new development in areas subject to a 100-year flood event, based on FEMA or on other updated mapping acceptable to the City, unless and until the flood hazard has been mitigated. Mitigation may be accomplished by one, or a combination of, the following: 1) compliance with Title 17 of the City's Municipal Code, Flood Hazard areas; installation of flood control improvements along Del Puerto Creek and/or Salado Creek; and avoidance of flood prone areas.
10	Wildfire	Develop a Public Awareness Campaign on Wildfire Hazards	City of Patterson Executive Team, City's Fire Department	Medium	Develop a Public Awareness Campaign on Wildfire Hazards – The City will organize a Social Media Campaign that will run quarterly on City of Patterson platforms to advertise and promote evacuation routes, fire prevention, and pre-incident preparation that can be done by the public.
11	Wildfire	Consider utilizing prescribed and monitored safe burn to reduce the high fire threat to the west of the City.	City's Fire Department	High	Consider utilizing prescribed and monitored safe burn to reduce the high fire threat to the west of the City.
12	Wildfire	The City shall require property owners to remove fire hazards	City's Fire Department	High	The City shall require property owners to remove fire hazards, including vegetation, hazardous structures and materials, and debris, as directed by the Fire Department
City of Riverbank					
1	Dam Incidents	Dam Safety Awareness Month	Public Works Department, Stanislaus	Medium	Promote dam safety awareness each year on May 31 as part of the National Dam Safety Awareness Day campaign, using FEMA

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
			County Office of Emergency Services, USACE, DSOD, TID, SSJID		templates and background materials coupled with information from the risk assessment.
2	Earthquake, Flood, Drought	Retrofit Potable Water Supply Wells	Public Works Department, Water Utilities Department	High	The City will install retrofits and security upgrades at multiple potable water supply wells, including Well #6 at 6082 Tennessee Avenue, Well #7 at 2308 McAllister Lane, Well #8 at 2402 Novi Drive, #9 at 5201 Prospector Parkway, and Well #3 at 6234 Jackson Avenue, Well #4 at 3017 High Street, Well #10 at 5200 Oakdale Road, and Well #12 at 6343 Chief Tucker.
3	Earthquake, Flood	Upgrade Waste Water Lift Stations in the City	Public Works Department, Water Utilities Department	High	The City needs to upgrade and retrofit several wastewater lift stations. Lift stations that need upgrades include the Silverock Lift Station at the northwest corner of Oakdale Road and Silverock Road, Townsend Lift Station at the northwest corner of 8th Street and Townsend Avenue, Jackson Lift Station on the west side of Jackson Avenue and Country Manor Drive, Estelle Lift Station on the northeast corner of Colony Manor Drive and Estelle Avenue, River Cove Lift Station on the northeast corner of Royal Links Drive and River Cove Drive, Candlewood Lift Station on the south side of Candlewood Place between Arrowwood Drive and Oakdale Road, Jackson Lift Station on the west side of Jackson Avenue between Ward Avenue and Country Manor Drive, Roselle Lift Station on Roselle Avenue between Talbot Avenue and Soares Place, and Terminal Life Station at Terminal Avenue and Virginia Street.
4	Earthquake, Flood	Protect Waste Water Trunk Line	Public Works Department, Water Utilities Department	High	Complete a reinforcement or redesign to improve the structural integrity of the supporting trestle across the Stanislaus River to the City's WWTP.
5	Flood	Storm Drain Outfall Improvement	Public Works Department, Water Utilities Department	High	Upgrade and upsize the Storm Drain Line at the end of 8th Street at the Stanislaus River.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
6	Landslide	Road Stabilization Monitoring	Public Works Department, Caltrans	Medium	The City will continue to coordinate with the California Department of Transportation to annually monitor and stabilize slopes along roads near or adjacent to Stanislaus River subject to landslides, soil erosion, and rock slides.
7	Public Health Hazards	Collaborate with County public health experts and health-related organizations, to understand environmental hazards, communicable diseases, and public health data to explore how to address City public health goals and vulnerability to public health hazards	City Manager's Office, Senior Care Organizations, Housing Authorities, Community Health Centers, Stanislaus County Health Services Agency, and Stanislaus County Public Health Department	Medium	Collaborate with County public health experts and health-related organizations, such as senior care centers, faith-based organizations, and housing authorities to understand environmental hazards, communicable diseases, and public health data in order to explore how to address City public health goals and vulnerability to public health hazards across socially vulnerable populations, such as children, seniors, low-income communities, and other communities disproportionately affected by natural and human-health hazards.
City of Turlock					
1	Dam Incidents	Develop a Public Awareness Campaign on Dam Safety	City of Turlock Executive Team, USACE, DSOD, Merced Irrigation District, TID	Medium	Develop a Public Awareness Campaign on Dam Safety – The City will organize a Social Media Campaign that will run quarterly on City of Ceres platforms to advertise and promote evacuation routes or pre-incident preparation related to dam incidents that can be done by the public.
2	Drought	Limit lawn/landscaping watering days for residential watering to three days per week	City of Turlock Executive Team	High	Limit lawn/landscaping watering days for residential watering to three days per week; there is an existing ongoing discussion to further mandate a reduction to allow for only two days per week.
3	Drought	Continue the installation of water meters in all City parks to monitor water usage and reduce water usage by 20% in the future.	City of Turlock Executive Team, Municipal Services Team	High	Continue the installation of water meters in all City parks to monitor water usage and reduce water usage by 20% in the future.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
4	Drought	Terminate the watering of ornamental grass/turf for commercial and government buildings and fire stations.	City of Turlock Executive Team, Fire Department	High	Terminate the watering of ornamental grass/turf for commercial and government buildings and fire stations.
5	Drought	Develop an educational flyer on Water Conservation to be included in water bills.	City of Turlock Executive Team, Municipal Services Team	Medium	Develop an educational flyer on Water Conservation to be included in water bills.
6	Drought	Restrict water usage for high-flow drills, specifically truck, ground monitor, and master stream appliances	City's Fire Department	High	Restrict water usage for high-flow drills, specifically truck, ground monitor, and master stream appliances
7	Drought	Explore the purchase of a pump pod,	City's Fire Department	High	Explore the purchase of a pump pod, which is a water-recirculating platform for training and pump testing evolutions
8	Drought	Continue working on and finishing the City's planned well and surface water projects by August/ September 2023	City of Turlock Executive Team, City of Ceres, SRWA	High	Continue working on and finishing the City's planned well and surface water projects by August/September 2023, which will offer redundancy in the City's water supply
9	Extreme Temperatures: Freeze and Extreme Heat	Develop an Extreme Temperatures Pilot Program	City of Turlock Executive Team, Fire Department, Catholic Charities of the Diocese of Stockton Environmental Justice Program (potential CBO partner)	Medium	Develop an Extreme Temperatures Pilot Program that addresses Short-term Heat Adaptation Projects, such as Emergency Alerts, Resiliency Hubs, and Cooling Centers and Long-Term Adaptation Projects, such as Urban Greening (Tree plantings, shading, etc.) and Community Cohesion initiatives (Connections with Community-Based Organizations [CBOs], local residents, and volunteers to check on neighbors during extreme heat events) to building capacity within the City related to extreme heat.

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
City of Waterford					
1	Dam Incidents	Dam Safety Awareness Month	Public Works Department, Stanislaus County Office of Emergency Services, USACE, DSOD, MID, TID	Medium	Promote dam safety awareness each year on May 31 as part of the National Dam Safety Awareness Day campaign, using FEMA templates and background materials coupled with information from the risk assessment.
2	Multi-Hazard; Drought, Earthquake, Extreme Heat, Flood, Severe Weather	Water Storage Tanks Upgrades	Public Works Department	High	The City has a very old water system that is slowly getting upgraded, however, the City does not have storage tanks for water. With water storage tanks, the City will always have the emergency capacity, in case a natural disaster knocks out the City's well sites.
Office of Education					
1	Dam Incidents	Emergency Planning Procedures Enhancements	Operations and Support Services Department, USACE, DSOD, PG&E, MID, TID, SSJID, OID, Other Dam Owners and Operators	High	Enhance each District's emergency planning procedures by including evacuation planning for dam incident events and coordinating with Stanislaus County OES, Dam Owners, and Dam Operators.
2	Earthquake	Non-Structural Seismic Safety Enhancements	Operations and Support Services Department	Low	Non-Structural Seismic Safety Enhancements for School Districts on the West Side of the County
3	Earthquake	Conduct Seismic School Safety Project Outreach	District Superintendent Offices	Medium	Conduct Seismic School Safety Project Outreach - educate the public on school safety conditions and improvement projects
4	Earthquake	Perform Seismic Evaluations and Create Inventory of School Buildings that require upgrades	Operations and Support Services Department	Medium	Perform seismic evaluations and create a seismic inventory of school buildings and facilities; subsequently develop projects to address the buildings determined to be in the greatest need of both non-structural and structural upgrades

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
5	Severe Weather	Permanent Back-Up Power Generation	Operations and Support Services Department	High	Install back-up and permanent power generation at school districts that provide reliable power during energy shortages.
6	Severe Weather	Preliminary Feasibility Study on Solar Technology at Schools	Operations and Support Services Department	High	Conduct a preliminary feasibility study on the investment benefits of purchasing and installing solar technology and backup generation facilities at school sites within the SCOE.
7	Multi-Hazard: Earthquake, Severe Weather	Tree and Vegetation Management	Operations and Support Services Department, All School Districts within SCOE	High	Tree and Vegetation Management – The SCOE will conduct routine planting and maintenance projects.
8	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather	Emergency Preparation Drills	District Superintendent Offices, All School Districts within SCOE	High	Emergency Preparation Drills - update emergency drill protocols within SCOE, home alert systems, and shelter-in-place guidelines.
9	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather, Cyber Attack	Comprehensive School Modernization Projects	Operations and Support Services Department, All School Districts within SCOE	Medium	Comprehensive Modernization Projects: New Construction and Modernization, Infrastructure Improvements, and Technology Upgrades.
10	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather	Resiliency and Energy Efficiency Enhancements at Existing Schools	Operations and Support Services Department, All School Districts within SCOE	Medium	Enhance resiliency by improving energy efficiency and clean energy improvements at existing schools through lighting improvements, HVAC replacement, and load adjustments.
11	Multi-Hazard: Earthquake, Dam Inundation,	Continuity of Operations Plan	District Superintendent Offices	High	Create a Continuity of Operations Plan

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
	Severe Weather				
12	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather	Individual Emergency Plans for Students with Disabilities	Special Education Department	High	Create an Individual Emergency Plans for Students with Disabilities
13	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather	Campus Emergency Response Team to Implement the SCOE Incident Plan	District Superintendent Offices	High	Formulate a Campus Emergency Response Team to Implement and Modify the SCOE Incident Plan
14	Multi-Hazard: Earthquake, Dam Inundation, Severe Weather	Hazard Mitigation Public Education and Outreach	Communications Department, All School Districts within SCOE	Medium	Public Education and Outreach Enhancements with students and school staff on hazard mitigation and emergency preparedness
15	Public Health Hazards	Pandemic Safety Plan	District Superintendent Offices, All School Districts within SCOE	High	Maintain an up-to-date Pandemic Safety Plan according to CDC and State requirements
16	Public Health Hazards	COVID-19 & General Pandemic Prevention Program	District Superintendent Offices, All School Districts within SCOE	High	Maintain the operation of the COVID-19 & General Pandemic Prevention Program
17	Public Health Hazards	Update Faculty and Student Health and Safety Plan and Training Guidance Protocols	District Superintendent Offices, All School Districts within SCOE	Medium	Update Faculty and Student Health and Safety Plan and Training Guidance Protocols related to a Public Health Prevention Strategy (screening, masking, disinfection, ventilation, automation of equipment, cleaning, contract tracing, etc.) that align with CDC recommendations and State regulations

ID	Hazard(s) Mitigated	Project Title	Lead Agency and Partners	Priority	Project Description
18	Public Health Hazards	HVAC Upgrades to Improve School Ventilation	Operations and Support Services Department, All School Districts within SCOE	Medium	Upgrade or enhance HVAC units to improve school ventilation

6 Plan Adoption, Implementation, and Maintenance

6.1 Adoption

DMA Requirements §201.6(c)(3):
[The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

The purpose of formally adopting this plan is to secure buy-in from Stanislaus County and the participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this MJHMP by passing a resolution.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This section provides an overview of the overall strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, updating, and evaluating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6.2 Implementation

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, the participating jurisdictions will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each action (see Section 5 for County mitigation actions and the annexes for local participating jurisdiction mitigation actions), and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits of each project to the Stanislaus County community and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. The three main components of implementation are:

- **Implement** the action plan recommendations of this plan;
- **Utilize** existing rules, regulations, policies, and procedures already in existence; and
- **Communicate** the hazard information collected and analyzed through this planning process so that the community better understands what can happen where, and what they can do themselves to be better prepared. Also, publicize the "success stories" that are achieved through the HMPC's ongoing efforts.

During implementation of these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements, should grants be pursued. When funding becomes available, the participating jurisdiction's will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

For this update, the County's implementation program will emphasis mitigation projects and setting priorities based upon loss reduction consistent with both DMA requirements and the EMAP Standard 4.2 Hazard Mitigation requirements.

6.2.1 Role of the Hazard Mitigation Planning Committee (HMPC) in Implementation and Maintenance

With adoption of this plan, the participating jurisdictions and the County's Office of Education will be tasked with plan implementation and maintenance. The participating jurisdictions and the County's Office of Education, led by the Stanislaus County OES agree to:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the Stanislaus County Board of Supervisors and the governing boards of the other participating jurisdictions; and
- Inform and solicit input from the public.

The primary duty of the participating jurisdictions and the County's Office of Education is to see the plan successfully carried out and to report to their community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the county website (and others as appropriate).

6.3 Maintenance and Monitoring

DMA Requirement §201.6(c)(4)(i):
[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as required or as progress, roadblocks, or changing circumstances are recognized. This section describes how public participation will be integrated throughout the plan maintenance and implementation process. It also explains how the mitigation strategies outlined in this plan will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, CIP project planning and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

6.3.1 Maintenance Schedule

In order to track progress and update the mitigation strategies identified in the action plan, the HMPC will revisit this plan at the following times or occurrences:

- Annually, to assess if mitigation actions/projects have been completed;
- Following a significant hazard event;
- Following a disaster declaration; or
- Any other time the HMPC sees it is prudent or necessary.

Annual Reviews: The HMPC will meet annually to assess progress on plan implementation. Stanislaus County's OES Department will facilitate these reviews and an associated meeting. The timing of the annual meeting is recommended for the first or second quarter of each year to identify potential mitigation grants, some of which have a submittal period in the fourth quarter. A template for the annual meeting and a summary report is provided in Appendix E. Another tool developed during the 2021 – 2022 update process to facilitate regular review and implementation and make the plan more of a "living document" is the MJHMP website, where the updated 2021 MJHMP and HMPs from previous years are available for public access.

Various links to additional disaster and emergency preparation, hazard mitigation, as well as other related local, state, and federal-level information are also included on the MJHMP website. This website is accessible from the Stanislaus County OES homepage. The County can use the MJHMP to post updates on the plan implementation process, such as grants submitted, grants pending review, and grant awards.

Critical Facility Database Maintenance: Moving forward the County and its municipalities will maintain the critical facility database that was prepared during the 2021 update. The County's OES Coordinator will work with the County GIS Manager to lead periodic reviews of the database and assess the need for updates.

Five-Year Update: This plan will be updated, approved, and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000. Efforts to begin the update should begin no later than June 2025 in order to provide at least 9 to 12 months to facilitate the planning process, update the plan, and provide adequate time for public review. The County will monitor planning grant opportunities from the Cal OES and FEMA for funds to assist with the update. This may include submitting a BRIC grant application. This grant should be submitted in 2024, as there is a three-year performance period to expend the funds, and there is no guarantee that the grant will be awarded when initially submitted. This allows time to resubmit the grant in subsequent years if needed. Updates to this plan will follow the most current FEMA and Cal OES planning guidance. The next plan update should be completed and reapproved by Cal OES and FEMA Region VIII by June 2027.

6.3.2 Maintenance and Evaluation Process

The HMPC will continually observe the incorporation process, evaluation method, updating method, continued public participation, and completion of the action/projects to assure that the HMPC and the plan itself are performing as anticipated. By monitoring these processes, the HMPC will then be able to evaluate them at the time of the plan update, determining if any changes are needed.

The every five-year MJHMP plan update provides an opportunity to determine whether there have been any significant changes in the County that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, increased exposure to hazards, increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect the necessary content of the MJHMP.

The plan review provides County officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses that were avoided due to the implementation of specific mitigation measures. The process for setting new priorities based on loss reduction is also emphasized in this MJHMP update process, as it relates the EMAP Standard 4.2 Hazard Mitigation. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned.

During the five-year plan update process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the MJHMP:

- Do the goals address current and expected conditions?
- Are the goals and objectives consistent with changes in state and federal policy?
- Complete status update on all mitigation projects. What strategies should be revised?
- Has the nature or magnitude of risks changed (current and expected conditions)?
- Are the current resources appropriate for implementing the MJHMP?
- Are there implementation problems, such as technical, political, legal or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did the County and participating agencies and other partners participate in the plan implementation process as assigned?

The County of Stanislaus is committed to involving the public in the continual reshaping and updating of the MJHMP, as discussed in Subsection 6.3.4.

6.3.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is the incorporation of the HMP recommendations and their underlying principles into other county and city plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. This plan should also be cross-referenced when related planning mechanisms are updated. As previously stated above, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment and jurisdictional annexes, the County and participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

These existing mechanisms include (but are not limited to) the following:

- County and local general plans (General Plan Safety Element)
- Community service district area plans and master plans
- County and local emergency operations plans
- County and local ordinances
- Flood/stormwater management/master plans
- Community wildfire protection plans
- GSPs
- IRWMPs
- Stormwater Resource Plans
- Urban Water Management Plans (UWMPs)
- CIPs
- Other plans and policies outlined in the capability assessments in the jurisdictional annexes
- Other plans, regulations, and practices with a mitigation focus

HMPC members involved in the updates to the planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As an action step to ensure integration with other planning mechanisms, the County OES Manager or designee will discuss this topic at the annual meeting of the HMPC described above in Subsection 6.3.1. The HMPC will discuss where there are opportunities to incorporate the plan into other planning mechanisms and who would be responsible for leveraging those opportunities. HMPC members representing local jurisdictions will work with their jurisdictional Planning Committees to integrate their identified mitigation actions into their local plans and programs. Efforts to integrate the HMP into local plans, programs, and policies will be reported on at the annual HMPC plan review meeting, and a record of successful integration efforts will be kept.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan. Examples of a process for incorporation of the MJHMP into specific existing or upcoming planning mechanisms include:

- Each community (County, Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, Waterford) should adopt (by reference or incorporation) this MJHMP into the Safety Element of their General Plan(s), as encouraged by AB 2140. Evidence of such adoption (by formal, certified resolution) shall be provided to Cal OES and FEMA to become eligible or maintain eligibility for CDDA funding. Also, specific risk and vulnerability information from the Stanislaus County MJHMP can be incorporated into the General Plan; which, can in turn, inform the development of hazard overlay zones, or other policy changes designed to minimize hazard impacts. Each jurisdiction has a specific mitigation action related to this process outlined in Subsection 5.3.
- Reference into the State of California CVFPP. The MJHMP will provide information that can be included in the CVFPP and Mid-San Joaquin River FMP, and other water and flood management plans. The process for updating these regional plans will vary, but the flood data developed for the MJHMP can be used in other plans, as it relates to exposure estimates and overall vulnerability to floods.

- Stanislaus County Board of Education Comprehensive Safe School Plans. The Office of Education Annex provides valuable information on the vulnerability of the County's school facilities. This information can be integrated into school safety plans, and incorporated as a way to leverage additional state funding for hazard mitigation.
- Stanislaus County Board of Education Prevention Programs (School Crisis Response Seminars, Bullying Prevention Training).
- Incorporation into the City of Modesto EOP and Strategic Plan.
- Referencing the HMP in the California State University, Stanislaus' EOP.

6.3.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. Efforts will be made to involve the public in the plan maintenance, evaluation, and review process. This includes maintaining a digital version of the plan on the County OES website for public review, or the County's MJHMP webpage (https://www.stanoes.com/lhmp.shtm) that should continue to function as a repository of the current and past HMPs. In addition, information on who to contact within the OES will be posted with the plan. The Stanislaus County OES will maintain a file of comments received for reference during the next five-year update. Any revisions to the plan that may occur as a result of a disaster will also be made public and posted on the County website.

The next five-year update process also provides an opportunity to solicit participation from new and existing stakeholders and publicize success stories from the plan implementation and seek additional public comment. A public hearing(s) or survey to receive public comment on the plan will be held during the plan update period. When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public notice will be posted, and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets as well as email and social media announcements.

Public involvement strategies that were used during the 2021 – 2022 planning process are captured in the Outreach Strategy in Appendix F. The appendix can serve as a reference for continued public involvement over the next several years and lays the foundation for outreach associated with the next formal five-year update. The HMPC should incorporate the following engagement concepts from the Outreach Strategy:

- Collaborate with CBOs and faith-based organizations (i.e., Stockton Environmental Justice Program of Catholic Charities of Stockton).
- Create stories and mitigation success announcements to use for publishing at media outlets.
- Distribute emails and postcards and newsletters to the public about hazard mitigation
- Circulate information on hazard mitigation through the K-12 schools through collaboration with the Office of Education Local Planning Team.
- Participate in existing community events to share information about hazard mitigation (e.g., community farmer's markets, library events, senior centers).
- Continue to use the County's MJHMP Webpage as a distribution point or repository for HMP information.

7 Plan Adoption

DMA Requirement §201.6(c)(5):
[The plan shall include...] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council).

7.1 Element E.1 Formal Plan Adoption Documentation

Adoption by the local governing body demonstrates the community's commitment to implementing the mitigation strategy and authorizes responsible agencies to execute their actions. The final plan is not approved until Stanislaus County and each participating jurisdiction adopts the plan and FEMA receives documentation of formal adoption by the governing body of each jurisdiction requesting approval. This plan is for Stanislaus County, the unincorporated County, and its incorporated cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, Water, as well as the County's Office of Education.

Stanislaus County and the nine participating cities, together with the County's Office of Education plan to submit this plan to the Stanislaus County Board of Supervisors (BOS), County Office of Education, and their respective city councils upon successful completion of State and federal review and following the issuance of an Approved Pending Adoption (APA) designation from FEMA. This provides an efficient approval process if FEMA determines the MJHMP requires revisions because the County and each participating city as well as the Office of Education can make these revisions prior to initiating the local plan adoption process.

Once FEMA issues APA notification, adoption by each participating jurisdiction must take place within one year for each jurisdiction to become or remain eligible for FEMA HMA program funding. Given this is a multi-jurisdictional planning process, Stanislaus County will coordinate the adoption of all nine jurisdictions and the County's Office of Education adoption process as soon as the plan receives APA status. Because each City/Board governing bodies have different meeting schedules, Stanislaus County will also coordinate with each participating jurisdiction/agency regarding the timing of their adoptions to submit adoption documentation to Cal OES and FEMA at the same time.

Once the County records and submits the adoption documentation to Cal OES and FEMA, FEMA will issue an official approval letter stating which jurisdictions/agency have adopted and are approved and eligible for FEMA HMA program funding. The approval letter will include the expiration date five years from the date of the letter and attached to the approval letter will be a final FEMA Local Mitigation Plan Review Tool that provides feedback on the strengths of the plan, recommendations for plan improvements during future plan updates, and suggestions for implementing the mitigation strategy.

7.2 General Plan Safety Element Integration

The MJHMP was prepared consistent with the Stanislaus County General Plan Safety Element. The planning mechanisms cover common overlapping natural hazard issues and mutually-reinforcing policies and implementation programs. California Government Code Section 65302.10, (AB 2140) encourages California counties and cities to adopt their current, FEMA-approved LHMPs into the Safety Element of their General Plan. This adoption by reference or incorporation of the MJHMP into the Safety Element of the General Plan follows plan approval and makes Stanislaus County and each participating jurisdiction eligible to be considered for part or all of its local-share costs on eligible public assistance funding to be provided by the State under the CDAA. As such, AB 2140 compliance provides additional funding after a disaster occurs and this is an optional state incentive to help counties and cities become more resilient to natural hazards. Because compliance with AB 2140 expires when the MJHMP expires, the County must re-adopt the plan into the Safety Element during update cycles to ensure continued compliance and funding eligibility. Additionally, each participating jurisdiction must adopt their annex into their own General Plan Safety Element, as the annex jurisdictions are not covered under the County's General Plan Safety Element adoption.

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Appendix A: Hazard Mitigation Planning Committee

Appendix B: Planning Process Documentation

Appendix C: Approval and Adoption Documentation

Appendix D: Mitigation Categories and Alternatives

Appendix E: Annual Progress Meeting Agenda and Report Template

Appendix F: Outreach Strategy