

# SIERRA COUNTY



## MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

Volume 1 – Countywide Information



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## EXECUTIVE SUMMARY



River Canyon (Photo Credit: LeTina Vanetti)

Hazard mitigation involves implementing cost-effective and sustainable measures to minimize the risk to human life, property, and infrastructure from potential hazards. Through mitigation planning, Sierra County and its participating jurisdictions developed a framework to lessen the impacts of natural disasters and create more resilient communities.

### HAZARD MITIGATION OVERVIEW

Sierra County has updated its hazard mitigation plan (HMP) to continue its commitment to reducing risk of natural hazards for the residents, assets, and community lifelines within the County. This update aims to safeguard the people and essential services provided throughout the planning area.

While the prior plan focused only on the County, this update is a multi-jurisdictional hazard mitigation plan (MJHMP) that includes annexes for jurisdictions throughout the County to address their specific capabilities, vulnerabilities, and mitigation opportunities. The Sierra County MJHMP the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repetitive damage. This plan aligns with federal and state hazard mitigation planning regulations and



requirements to ensure eligibility for pre- and post-disaster mitigation funding through the Federal Emergency Management Agency (FEMA) for all jurisdictions that participated as Planning Partners:

- Unincorporated Sierra County
- City of Loyalton
- Alleghany County Water District
- Downieville Fire Protection District
- Downieville Public Utility District
- Pliocene Ridge Community Services District
- Sierra City Fire Protection District
- Sierra County Fire Protection District #1
- Sierra County Waterworks Calpine District No. 1
- Sierra-Plumas Joint Unified School District
- Sierraville Public Utility District

## BUILDING THE PLANNING TEAMS

Sierra County brought together a diverse and inclusive group of individuals to participate, develop, and implement the MJHMP. A Core Planning Team, Steering Committee, and Planning Partnership oversaw the planning process and were responsible for coordinating, overseeing, and executing the planning process.



### CORE PLANNING TEAM

The Core Planning Team was made up of key personnel from the County and disciple leads from the County’s contract consultant, Black & Veatch.



### STEERING COMMITTEE

The Steering Committee consisted of a variety of personnel from County departments and agencies, local jurisdictions, and stakeholders that guided the County and participating jurisdictions through the process of updating the MJHMP.



### PLANNING PARTNERSHIP

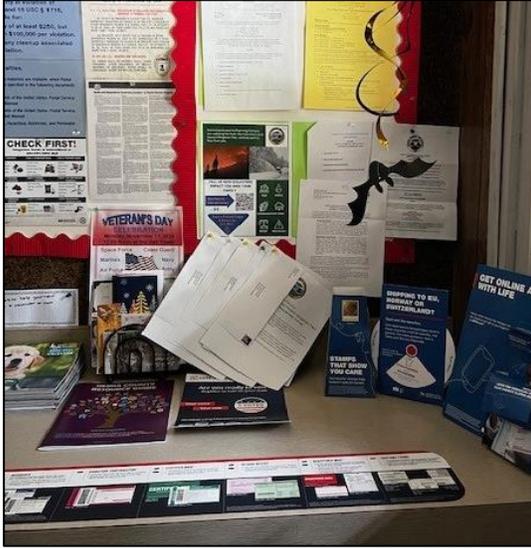
The Planning Partnership included jurisdictional representatives seeking DMA 2000 compliance. They participated throughout the process, reviewed information, provided input, informed the risk assessment, developed mitigation strategies, and adopted the MJHMP.

## OUTREACH STRATEGY

The Core Planning Team (CPT) implemented a multimedia public involvement strategy that was approved by the Hazard Mitigation Steering Committee (HMSC). The strategy included a community hazard mitigation awareness survey; a project web page; and multiple print media distributed on post office bulletin boards and other local gathering places throughout the County (Figure ES-1). Additionally, the HMSC helped amplify public outreach efforts to their networks.



Figure ES-1. Public Survey Distribution at Local Post Office Bulletin Boards and Inserted in Commodities Bags



(Photo Credit: LeTina Vanetti)

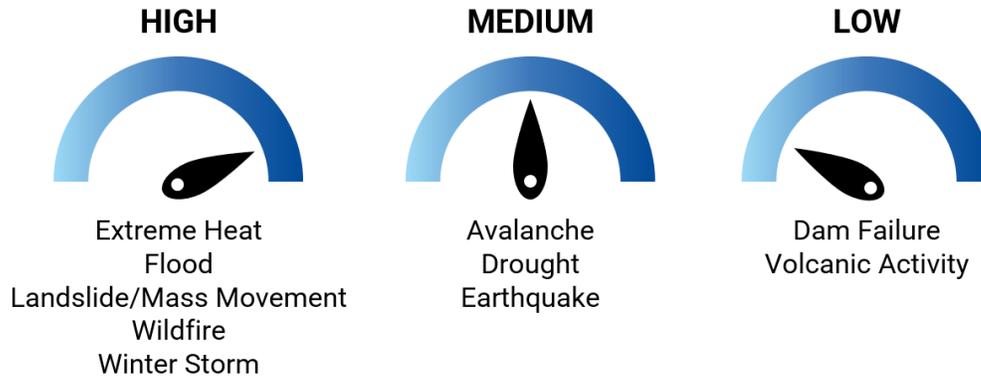
## RISK ASSESSMENT

A risk assessment is the process of measuring the potential loss of life resulting from natural hazards, as well as personal injury, property damage, and environmental damage. The assessment determines a community's overall vulnerability to hazard events. The HMSC used the risk assessment to gauge the potential impacts of natural hazards identified as "hazards of concern" for this plan.

Risk assessment models for hazards of concern were based on current data and technologies. The assessment of each hazard of concern includes discussion of the following:

- Hazard identification and profile.
- The exposure of population, property, and the environment to the hazards.
- The estimated cost of potential damage, where applicable.

Based on the risk assessment, the hazards of concern were ranked for the risk they pose to the planning area. Countywide results are as follows:



In addition to assessing the hazards of concern, this plan provides a review of “hazards of interest.” The MHSC determined that these other hazards, though not required to be evaluated under federal guidelines for hazard mitigation plans, are important to recognize qualitatively in this plan. Hazard profiles, without quantitative risk assessments, are provided for the following hazards of interest:

- Cybersecurity
- Mass Gatherings
- Transportation Hazards
- Wildlife & Human Interactions

## CAPABILITY ASSESSMENT

A robust assessment of mitigation capabilities was completed by each participating jurisdiction to identify gaps that may need to be addressed so mitigation actions can be successfully implemented. The following capability types were analyzed:

- Planning and Regulatory
- Development and Permitting
- Administrative and Technical
- National Flood Insurance Program (NFIP) Compliance
- Public Outreach
- Fiscal
- Participation in Other Programs
- Adaptive Capacity



## MITIGATION STRATEGY

The HMSC reviewed and updated the mitigation goals from the prior plan to reflect the current focus of Sierra County and its participating jurisdictions. The HMSC determined the following goals for this MJHMP:

- **Goal 1.** Protect lives and reduce hazard-related injuries.
- **Goal 2.** Minimize or reduce current and future changing conditions that may cause damage from natural hazards to property, including critical facilities and the environment.
- **Goal 3.** Develop and implement long-term, cost-effective mitigation projects that foster resilience for the whole community.
- **Goal 4.** Maintain, enhance, and restore the natural environment’s capacity to deal with the impacts of natural hazard events.
- **Goal 5.** Improve emergency management preparedness, collaboration, and outreach within the planning area.



Mitigation actions presented in this plan are designed to reduce or eliminate losses resulting from natural hazard events. The development process resulted in the identification of more than 50 mitigation actions for implementation by individual Planning Partners, as presented in the jurisdictional annexes in Volume 2 of this MJHMP. Several of these actions are within the current capabilities of each jurisdiction, resulting in a high priority for implementation over the next 5 years. Additionally, the HMSC and Planning Partners identified three Countywide actions benefitting the whole Planning Partnership, as listed in Table ES-1.

Table ES-1. Countywide Mitigation Actions

Action Number	Description	Implementation Priority	Grant Pursuit Priority
CW-1	Continue to maintain a website that will house the multi-jurisdictional hazard mitigation plan and any amendments to it adopted during the next 5-year period to provide the Planning Partners and the public with ongoing access to the plan and its implementation.	High	Low
CW-2	Continue to leverage/support/enhance ongoing, regional public education and awareness programs, such as Firewise Communities, Fire Safe Council, Heath Fairs, Everbridge, Genasys, and other community notifications and events, as methods to educate the public on risk, risk reduction, and community resilience.	High	Low
CW-3	Provide notification through links on the website or email distribution for available grant funding opportunities to the Planning Partnership.	High	Low



## IMPLEMENTING, ADOPTING AND MAINTAINING THE PLAN

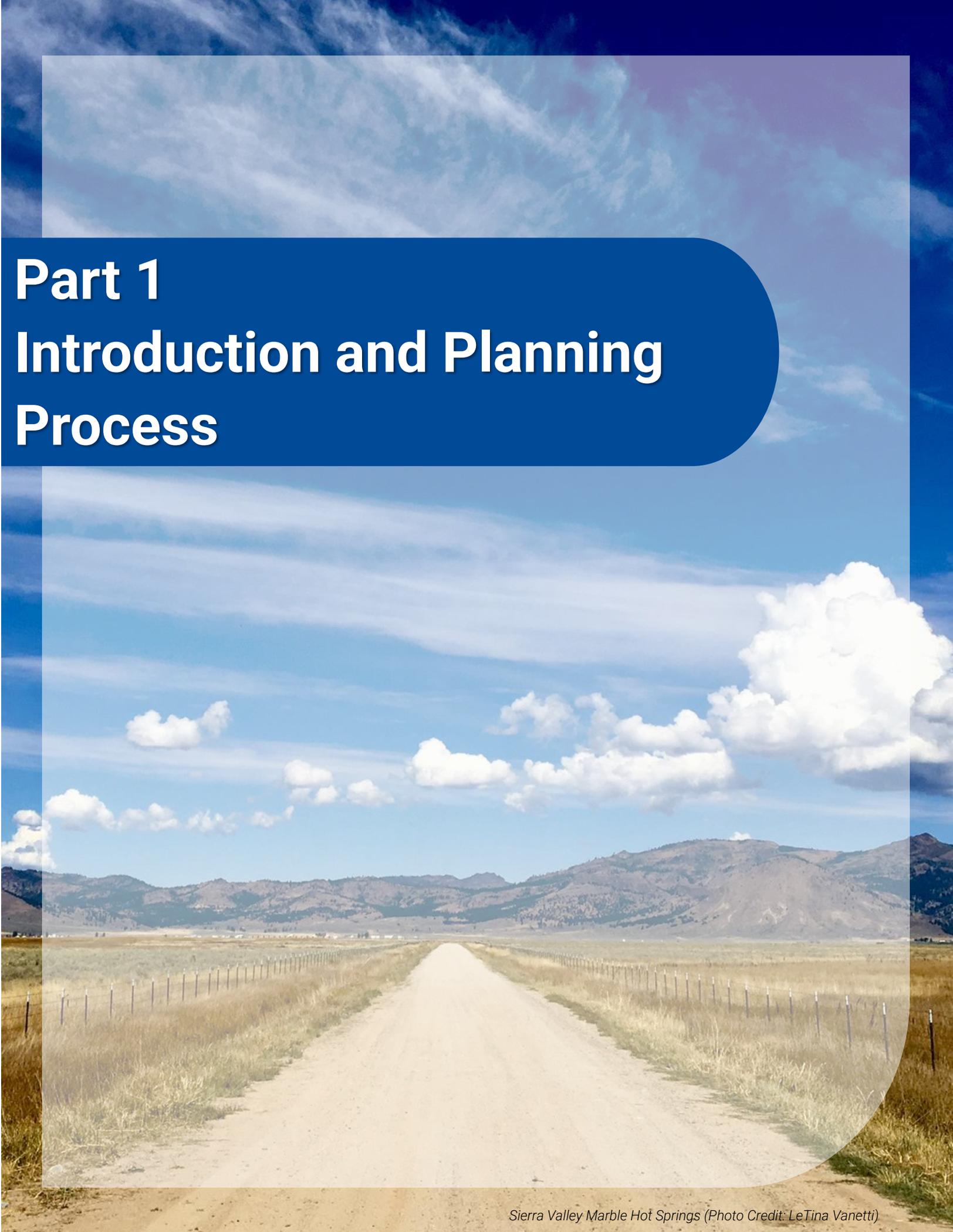
Implementing the mitigation actions in this MJHMP will take time and resources over its 5-year performance period. The CPT developed an implementation and maintenance strategy that includes the following:

- Monitoring mitigation action implementation.
- Progress reporting.
- A strategy for continued public involvement.
- Plan integration with other relevant plans and programs.

This MJHMP is designed with an adaptive management approach that can evolve along with funding sources and state and federal mandates. Sierra County and its Planning Partners will assume responsibility for adopting the recommendations of this plan and committing resources toward implementation. The framework established by this plan will enable the Planning Partnership to pursue FEMA Hazard Mitigation Assistance (HMA) grant funding for feasible, eligible, cost-effective actions. The Planning Partnership developed this plan with extensive opportunities for public involvement and input. Public support of the mitigation actions identified in this MJHMP will ensure its success.

# Part 1

# Introduction and Planning Process





# 1. INTRODUCTION

## 1.1 WHY PREPARE THIS PLAN?



*Bear Fire Plane Drop, 2024 (Photo Credit: LeTina Vanetti)*

Sierra County and its participating jurisdictions, the Planning Partnership, prepared this MJHMP update to better protect the residents, property, and assets throughout Sierra County from the effects of natural hazards.

Hazard mitigation plays a crucial role in emergency management by working to reduce the impacts of disasters on individuals, communities, and important assets. By implementing mitigation measures, we can help prevent the same areas from being repeatedly impacted by disasters. Mitigation is part of the emergency management cycle, which is divided into the following four phases:

- **Preparedness** is when we develop or update activities, programs, and systems before an event happens. These activities are often tested (or exercised) in non-emergency situations. This tests their effectiveness. Emergency managers also assess potential risks, hazards, and vulnerabilities in this phase.



- **Response** focuses on the immediate and short-term effects of a disaster. It is usually focused on life safety and preventing immediate damage.
- **Recovery** is a long-term phase that looks to return a community to normal, or to a more resilient state, after a disaster.
- **Mitigation** focuses on building (or rebuilding) in ways that reduce the risk more permanently. It is an activity that can occur at any point in the emergency management cycle. For example, communities can undertake mitigation actions before a disaster (the preparedness phase) or while rebuilding after a disaster (the recovery phase) (FEMA 2023).



This multi-jurisdictional hazard mitigation plan (MJHMP) update highlights the dedication of the County and the Planning Partnership to reducing risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations.

### 1.1.1 Federal Eligibility

#### *Disaster Mitigation Act*

In an effort to reduce the nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for state and local government entities to closely coordinate on mitigation planning activities and requires an HMP for any local government applying for federal mitigation grant funds. These funds primary fall under the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) program. Grant programs under HMA include the following:

- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)

**Hazard mitigation** is any sustained action taken to reduce or eliminate long-term risk to life and property from hazards.

FEMA defines a **Hazard Mitigation Plan** as a community-driven process to help state, local, tribal, and territorial governments plan for hazard risk. By planning for risk and setting a strategy for action, governments can reduce the negative impacts of future disasters.

Entities with an adopted and federally-approved HMP are pre-positioned to receive available mitigation funds before and after the next disaster strikes. The plan was developed to make the Planning Partnership eligible for pre- and post-disaster FEMA grants.



### 1.1.2 Purposes for Planning

This MJHMP update highlights the County's dedication to reducing risk from hazards, enhancing overall resilience, and providing a practical tool for decision makers to incorporate mitigation into daily operations. The County prepared this DMA-compliant HMP to identify 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 the intent of the County and its residents to mitigate hazards. The plan will help guide mitigation activities throughout the planning area. It was developed to meet the following needs:

- Meet or exceed program requirements specified under DMA;
- Enable the County to apply for federal grant funding to reduce hazard risk through mitigation;
- Fulfill state and federal requirements for hazard mitigation planning;
- Create a risk assessment that focuses on the hazards of concern in the County's planning area; and
- Coordinate existing plans and programs so high-priority projects to mitigate potential disaster impacts are funded and implemented.

An HMP is a living document that jurisdictions use to reduce vulnerability to natural hazards. It serves as the groundwork for a jurisdiction's long-term plan to lessen disaster impacts and establishes a framework for decision-making to mitigate harm to individuals, assets, and the economy from future natural disasters. Mitigation projects include a broad range of actions to help reduce vulnerability, allowing Sierra County to bounce back more quickly from disasters. This ongoing effort ensures that Sierra County has the necessary information to create and implement a successful mitigation strategy, reduce the impacts of natural disasters, and enhance overall resilience.

## 1.2 PLAN UPDATES

### 1.2.1 Previous Plans

The County has shown dedication to reducing disaster impacts by adopting its initial single-jurisdictional HMP in December 2012.

### 1.2.2 Why Update

The 2012 plan needed to be updated for funding eligibility and to include a diverse Planning Partnership. Throughout the planning process, the entire plan was updated with a focus on assessing changes in vulnerability caused by hazard events, evaluating capabilities and their utilization in implementing hazard mitigation measures, reviewing the 2012 mitigation strategy, and identifying new initiatives to enhance overall resilience within Sierra County.

### *Federal and State Requirements*

In response to the requirements of the DMA 2000, which requires local governmental agencies to develop and update its HMP every 5 years, this plan serves as the 2025 update to the 2012 County Local Hazard Mitigation Plan. The Sierra County MJHMP update is in alignment with FEMA's Local Mitigation Planning



Policy Guide (April 2025), FEMA’s Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements.

### ***Changes in Hazards***

The 2012 HMP assessed the following eight hazards of concern:

- Avalanche
- Dam Failure
- Drought
- Earthquakes
- Flood
- Severe Weather – Winter Storms
- Volcano
- Wildland Fires

The 2025 MJHMP update includes the previously identified hazards, along with two additional hazards of concern (*italicized*), as follows:

- Avalanche
- Dam Failure
- Drought
- Earthquake
- *Extreme Heat*
- Flood
- *Landslide/Mass Movement*
- Volcanic Activity
- Wildfire
- Winter Storms

Figure 1-1. Landslide on Highway 49



(Photo Credit: Steve Folsom)



## Changes in Development and Population



### Local Plan Requirement E1—44 CFR Part 201.6(d)(3)

*A local jurisdiction must review and revise its plan to reflect changes in development.*

Tracking previous and future growth in potential hazard areas provides an overview of increased exposure to hazards within a community. This requirement ensures that the mitigation strategy continues to address the risk and vulnerability of existing and potential development and takes into consideration possible future conditions that could impact vulnerability.

As of January 1, 2025, the reported population for Sierra County was 3,170, representing a decrease of 1.9% from the 2012 report population (California Department of Finance 2025).

Based on development permit data provided by the municipal Planning Partners (see Volume 2), permits were issued for the construction of 31 new structures over the past five years.

This plan assumes that some of this new development occurred in hazard areas. All such new development would have been regulated pursuant to local programs and codes, such as the International Building Code and flood damage prevention requirements of the National Flood Insurance Program (NFIP). Therefore, it is assumed that hazard vulnerability did not measurably increase, even if exposure did. Sierra County municipalities have general plans that govern land-use decisions and policymaking, as well as building codes and flood-management regulations based on state and federal mandates.

### 1.2.3 The Updated Plan - What Has Changed?

The overall planning process and the 2012 HMP have been improved and revised for this 2025 MJHMP in response to changes in planning requirements and overall improvements. Key changes are outlined as follows:

- **Plan Integration** – Goals and objectives have been established for the updated MJHMP to align with current County initiatives and programs, as well as to meet identified state priorities.
- **Updated Hazards of Concern** – The list of assessed hazards was updated to reflect the most current community experience and concerns.
- **Socially Vulnerable Populations** – The 2025 MJHMP update defines vulnerable populations based on Sierra County's demographic characteristics and includes a dedicated subsection for each identified hazard of concern.
- **Climate Change Impacts** – The 2025 MJHMP update dedicated a subsection for each hazard of concern to the issue of climate change and its effects on state-identified climate-related hazards.

The following table indicates the changes between the 2012 and the 2025 HMP as they relate to federal requirements for local HMPs (Table 1-1).



Table 1-1. Sierra County HMP Changes Since 2012

44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
<b>Element A: Planning Process</b>		
<p>Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (44 CFR § 201.6(c)(1))</p>	<p>The 2012 HMP plan documented the whole planning processes. The process included public workshops, geographically dispersed throughout the County. The hazard mitigation planning process was discussed at various public meetings such as Board of Supervisors, Operational Area Council, Local and Regional Public Health, Fire Chiefs, School Board, and the Transportation Commission meetings.</p>	<p>The 2025 updated plan outlines the planning processes in Chapter 2, Planning Process. This includes formation of a Core Planning Team, a Steering Committee, and a Planning Partnership, each with defined roles and responsibilities. These groups included representatives from Sierra County departments, local jurisdictions, and special service districts. Each participating jurisdiction submitted a formal letter of intent to participate, designated points of contact, and contributed to the development of jurisdiction-specific annexes.</p>
<p>Does the plan document 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? (44 CFR § 201.6(b)(2))</p>	<p>The 2012 HMP documented engagement with local agencies. Two primary forums facilitated collaboration of the planning process with adjacent jurisdictions and the Sierra County communities. The first was the Mutual Aid Regional Advisory Committee for California Mutual Aid Region III, which includes emergency management representatives from counties adjacent to Sierra County. The second forum was the Public Health Coordination group within Region III, which enabled a multi-county, multi-agency approach to addressing public health-related mitigation and prevention.</p>	<p>Section 2.5, Stakeholder Coordination and Involvement, documents stakeholders and stakeholder participation in the planning process. Outreach efforts included direct email invitations, stakeholder surveys, and participation in planning meetings. The plan document engaged nearly 30 stakeholders and neighboring communities, including utility providers, fire protection districts, school districts, and health care organizations. These stakeholders were invited to serve on the Steering Committee, participate in surveys, and review the draft plan. Their feedback was incorporated into the plan’s risk assessment and mitigation strategies. The plan also includes a detailed table listing stakeholder organizations, their roles, and the community lifelines they support.</p>
<p>Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval? (44 CFR § 201.6(b)(1))</p>	<p>The 2012 HMP described several public involvement opportunities. The planning team invited members of the public to participate in the official planning team meetings. A notice was posted around the county such as public message boards, advertised in the local newspaper, and</p>	<p>The 2025 update plan outlines a public engagement strategy in Section 2.6, Public Participation, that includes a public survey and a formal public comment period. The survey was distributed both online and in print, including through local post offices and community programs such as Meals on Wheels. Each of the Hazard Mitigation Steering</p>



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
	<p>passed out at the seasonal drive through flu shot clinics.</p> <p>After the first draft of the plan was developed, Sierra County made it available on their website and hard copies were available in various government and county buildings, such as the County Administration in Downieville, County Library Branches, and Loyalton City Hall.</p> <p>In addition, two educational workshops were held to inform the public on hazard mitigation plan and individual/family mitigation and preparedness actions.</p>	<p>Committee and Planning Partnership meetings was open and advertised for public attendance.</p> <p>Additionally, the draft plan was made available on the County’s website, and the public was invited to submit comments during a review period in May 2025.</p>
<p>Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (44 CFR § 201.6(b)(3))</p>	<p>The 2012 HMP references numerous existing resources used. Hazard data is primarily drawn from the USGS “Walker Lake Belt Region” report. Flood information comes from State DWR, FEMA guidance, and HAZUS modeling. Wildfire data was sourced from the U.S. Forest Service, Cal Fire, and local studies. Weather data was provided by the NWS and historical records. Demographic data came from the 2010 Census and the California Department of Finance. Local hazard guidance was drawn from Sierra County’s Emergency Operations Plan and the Safety Element of its General Plan. Historical disaster impacts were informed by James J. Sinnot’s history of Sierra County.</p> <p>State-level hazard perspectives were provided by the California HMP and mapping from the California Earthquake Projects, Geological Survey, and Cal EMA. State and local regulations form the legal basis for Sierra County’s mitigation goals and projects.</p>	<p>Section 2.8 of the 2025 updated plan provides a review of laws and ordinances in effect with the planning area that can affect hazard mitigation. Many of the technical studies and databases from 2012 were reviewed for development of this plan and are cited throughout the document.</p>



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
<b>Element B: Risk Assessment</b>		
<p>Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events? (44 CFR § 201.6(c)(2)(i))</p>	<p>The 2012 plan included a risk assessment of eight hazards of concern:</p> <ul style="list-style-type: none"> <li>• Avalanche</li> <li>• Dam Failure</li> <li>• Drought</li> <li>• Earthquakes</li> <li>• Flood</li> <li>• Severe Weather – Winter Storms</li> <li>• Wildland Fires</li> <li>• Volcano</li> </ul> <p>Each hazard was profiled with discussions on nature, history, location, extent, and probability of future events. A summary of hazard significance and priority of hazards were ranked.</p>	<p>The 2025 plan presents a risk assessment of 10 hazards of concern and risk profiles. The identified hazards of concern are as follows:</p> <ul style="list-style-type: none"> <li>• Avalanche</li> <li>• Dam Failure</li> <li>• Drought</li> <li>• Earthquake</li> <li>• Extreme Heat</li> <li>• Flood</li> <li>• Landslide/Mass Movement</li> <li>• Volcanic Activity</li> <li>• Wildfire</li> <li>• Winter Storms</li> </ul> <p>Hazard profiles are standardized for each hazard of concern, so that there is uniformity in the discussion of each hazard and the information provided can support rating of risk for each jurisdiction. All profiled hazards of concern were ranked based on their quantified impacts.</p>
<p>Does the plan include a summary of the jurisdiction’s vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods? (44 CFR § 201.6(c)(2)(ii))</p>	<p>The vulnerability analysis in the 2012 plan is based on general impacts on the community, exposure and estimate loss.</p>	<p>For this plan update, this aspect of the plan was significantly enhanced. Vulnerability was assessed for all hazards of concern. FEMA’s Hazus risk assessment platform was used for evaluating earthquake. The analyses supplemented the data built into the Hazus program with locally defined city and county data (Hazus refers to this as a Level 2 analysis). Site-specific data on County-identified critical facilities were entered into the Hazus model. Hazus outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from Hazus. The risk assessment methodology used is described in Chapter 5.</p>



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
		<p>The vulnerability assessments for each hazard profile has been updated to specifically discuss the following factors:</p> <ul style="list-style-type: none"> <li>• Impact on life, health, and safety</li> <li>• Impact on general building stock</li> <li>• Impact on community lifelines</li> <li>• Impact on the economy</li> <li>• Impact on historic and cultural resources</li> <li>• Impact on ecosystems and natural resources</li> </ul>
<b>Element C: Mitigation Strategy</b>		
<p>Does the plan document each participant’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (44 CFR § 201.6(c)(3))</p>	<p>The 2012 HMP documents existing mitigation objectives and outlines specific action items that were developed in collaboration with local stakeholders. These action items reflect the County’s current capabilities, including available resources, policies, and programs. Each project is ranked based on criteria such as time horizon, cost, risk, and benefit,</p>	<p>Each participating jurisdiction conducted a capability assessment as part of the jurisdictional annex process. The plan identifies opportunities to expand or improve these capabilities and integrates them into the mitigation strategy. The assessment also includes current and future integration opportunities, ensuring that mitigation actions are aligned with existing planning mechanisms and can be supported by or enhance other local efforts.</p>
<p>Does the plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (44 CFR § 201.6(c)(3)(ii))</p>	<p>The 2012 HMP identified Sierra County Planning Department’s continued efforts to enforce the compliance with the NFIP through their Flood Plain Management Ordinance of the Sierra County code Part 32.</p> <p>The County has worked with FEMA in three broad areas of the NFIP:</p> <ol style="list-style-type: none"> <li>1. Actively working with FEMA to revise floodplain identification</li> <li>2. Working with local governments to manage development in the floodplain;</li> <li>3. As part of the emergency services and NFIP public education process - the encouragement of residents to purchase flood insurance.</li> </ol>	<p>The 2025 update plan includes Section 17.5.4 specifically focused on NFIP compliance and floodplain management capabilities. Each jurisdiction’s participation in the NFIP is documented, including the designation of floodplain administrators and their involvement in the planning process. The plan also discusses how NFIP participation supports access to flood-related grant funding and outlines strategies to maintain or improve compliance.</p>



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
	<p>The planning department has also worked collectively with FEMA to update the flood zone hazard maps for Sierra County.</p>	
<p>Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (44 CFR § 201.6(c)(3)(i))</p>	<p>The 2012 HMP identified five goals and 11 objectives.</p>	<p>Five goals are described in Chapter 18 of this volume. These goals were developed by the Steering Committee and reflect updates from the previous plan. Goals help establish priorities for the action items identified in the plan. The goals are the basis for identifying and prioritizing multi-objective actions.</p>
<p>Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (44 CFR § 201.6(c)(3)(ii))</p>	<p>The 2012 HMP identifies and analyzes a range of mitigation actions aimed at reducing flood risk, particularly in the eastern basin area that includes Loyalton and Sierraville, where FEMA-designated flood zones are concentrated. Although relatively few residences currently fall within these floodplains, the plan acknowledges the potential for future changes due to ongoing FEMA remapping efforts.</p>	<p>The 2025 update plan identifies and analyzes a wide range of mitigation actions for each jurisdiction. These actions are categorized by scale (community, organizational, government) and by function (prevention, property protection, public education, natural resource protection, etc.). The plan emphasizes both new and existing buildings and infrastructure, and each jurisdiction selected actions based on their specific risk and capability assessments.</p>
<p>Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction? (44 CFR § 201.6(c)(3)(iv)); (§201.6(c)(3)(iii))</p>	<p>For the 2012 HMP, the OES Coordinator consulted with the Sierra County planning team to rank each mitigation project's priority based on community needs and concerns. Projects identified as top properties are outlined separately and more detailed explanations are presented.</p>	<p>An action plan that outlines how mitigation actions will be prioritized, implemented, and administered. Each action is assigned to a lead department or partner, with a timeline for implementation and potential funding sources identified. The plan also describes the criteria used to prioritize actions, which include considerations such as cost-effectiveness, feasibility, and alignment with community goals.</p>
<p><b>Element D: Plan Maintenance</b></p>		
<p>Is there discussion of how each community will continue public participation in the plan maintenance process? (44 CFR § 201.6(c)(4)(iii))</p>	<p>The 2012 HMP discussed several initiatives for the community to continue public participation. Copies of the HMP will be catalogued and kept at all appropriate agencies in the County as well as at the Main Public Library, posted on official</p>	<p>Chapter 19 outlines a comprehensive strategy for maintaining the mitigation plan. A key component is ongoing public engagement, which includes keeping the 2025 Updated Plan accessible on the County's website. The Planning Partners intend to regularly post updates and information related to</p>



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
	websites and be available as read-only files on CD-ROM. Public meetings will be held as part of each annual review. The meetings will provide a forum for public input to the Plan. In addition to public meetings, the OES office will provide an update to the Board of Supervisors (BOS) on the process of mitigation planning in Sierra County.	hazard and risk assessments on their communication channels, including the County's hazard mitigation website.
Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (44 CFR § 201.6(c)(4)(i))	The 2012 HMP identified an annual review, or as deemed necessary by knowledge of new hazards, vulnerabilities, or other pertinent reasons. The review will determine whether a plan update is needed prior to the required 5-year update.	The 2025 updated plan provides a clear description of the method and schedule for monitoring, evaluating, and updating the plan in Chapter 19.5, Updating the Plan. The Planning Partnership is scheduled to meet annually to review progress on mitigation actions, assess the effectiveness of the plan, and make necessary revisions. The Sierra County OES Coordinator is designated as the lead for reconvening the Planning Partnership and initiating the 5-year review process. The plan also outlines that the update process will begin approximately 2 years before the plan's expiration, including securing funding and coordinating with Cal OES and FEMA for compliance review and approval.
Does the plan describe a process by which each community will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (44 CFR § 201.6(c)(4)(ii))	The 2012 HMP discussed several processes for integration. The Sierra County Operational Area Hazard Mitigation Plan will be used to focus project prioritization. Mitigation projects will be considered for funding through federal and state grant programs, the Capital Improvement Project Budget, which is developed based on current and future funding availability. The Sierra County Operational Area Disaster Council will be the coordinating agency for project implementation.	Chapter 19, Maintaining the Mitigation Plan, describes in the plan integration and implementing the plan into other planning mechanisms, such as: <ul style="list-style-type: none"> <li>• Comprehensive plan</li> <li>• Emergency response plan</li> <li>• Capital improvement programs</li> <li>• Municipal code and standards</li> </ul> Every proposed action listed in the mitigation action plan is assigned to a specific "lead" department or Planning Partner and an implementation time period. Specific current and future plan and program integration activities are detailed in each participating jurisdiction's annex.



44 CFR Requirement (April 2023)	2012 HMP	2025 Updated Plan
<b>Element E: Plan Update</b>		
Was the plan revised to reflect changes in development? (44 CFR § 201.6(d)(3))	No revision necessary. The 2012 HMP was a new plan.	Changes in development are reflected in Chapter 3.2, Sierra County Profile. Specifically, the plan includes a detailed section on land use, development trends, and general building stock, highlighting updates since the previous 2012 HMP. It discusses zoning districts, residential and commercial land use designations, and the extent of development in various sectors of the county. While the county has experienced a slight population decline, residential development has continued, particularly in the form of single-family homes. These updates are used to assess how new development may affect vulnerability to hazards and to inform future mitigation strategies.
Was the plan revised to reflect changes in priorities and progress in local mitigation efforts? (44 CFR § 201.6(d)(3))	No revision necessary. The 2012 HMP was a new plan.	The County reviewed the mitigation actions from the 2012 HMP and provided status updates for each. Actions that were no longer relevant were removed, while others were revised or carried forward into the updated mitigation strategy. The plan also includes a revised prioritization process for new mitigation actions and outlines updated goals and objectives that align with current county initiatives. Mitigation accomplishments since 2012 are documented. Mitigation actions are outlined in the Unincorporate Sierra County annex in Volume 2.
<b>Element F: Plan Adoption</b>		
For single-jurisdictional plans, has the governing body of the jurisdiction formally adopted the plan to be eligible for certain FEMA assistance? (44 CFR § 201.6(c)(5))	The 2012 HMP was a single-jurisdictional plan. Sierra County submitted the 2012 plan to the Sierra County Board of Directors upon successful completion of state and federal review.	Appendix F includes all supporting document for adoption of the multi-jurisdictional plan by all Planning Partners.
For multi-jurisdictional plans, has the governing body of each jurisdiction officially adopted the plan to be eligible for certain FEMA assistance? (44 CFR § 201.6(c)(5))	The 2012 HMP was a single-jurisdictional plan. Sierra County submitted the 2012 plan to the Sierra County Board of Directors upon successful completion of state and federal review.	Appendix F includes all supporting document for adoption of the multi-jurisdictional plan by all Planning Partners.



## 1.3 HOW TO USE THIS PLAN

The 2025 Sierra County MJHMP was prepared to align with FEMA’s Local Mitigation Planning Policy Guide (April 2025), FEMA’s Local Mitigation Planning Handbook (June 2025), and the State of California planning requirements. The MJHMP is organized into two volumes as follows:

### 1.3.1 Volume 1

- Executive Summary
- Part 1 - Introduction and Planning Process
- Part 2 - Risk Assessment
- Part 3 - Capability Assessment and Mitigation Strategy
- Part 4 - Maintaining the Plan
- Appendix A – Public Outreach
- Appendix B – Hazard Selection
- Appendix C – Meeting Documentation
- Appendix D – Federal and State Agencies, Programs and Regulations
- Appendix E – Plan Maintenance Agendas
- Appendix F – FEMA Approval and City Council Adoption

### 1.3.2 Volume 2

- Federally required jurisdiction-specific elements, in annexes for each participating jurisdiction
- Description of the participation requirements confirmed by the CPT and HMSC
- Instructions and templates that the partners used to complete their individual annexes

### 1.3.3 Planning Requirement Icons

Throughout this plan, FEMA’s local hazard mitigation planning requirements and state-specific compliance are identified using the icons below. These provide a pathway to show where the HMP meets each requirement.



#### FEMA Mitigation Plan Requirement – 44 CFR Part 201.6

*Used to identify the requirements met for a local hazard mitigation plan.*



#### California Senate Bill Compliance

*Used to identify where the plan complies with California Senate Bills related to hazard mitigation planning.*



## 2. PLANNING PROCESS



### Local Plan Requirement A1 – 44 CFR Part 201.6(c)(1)

*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.*



View from Sierra Buttes Lookout (Photo Credit: LeTina Vanetti)

### 2.1 INTRODUCTION

The following section describes the overall process of updating the MJHMP, including how it was prepared, who was involved, and how stakeholders and the public participated. To adhere to the requirements of the DMA 2000 and ensure that the planning process received wide and robust support from the participating jurisdictions, regional and local stakeholders, and the public, the approach to the planning process and plan documentation included the following:

- The Sierra County MJHMP considers all natural hazards that pose a threat to the County. This satisfies the natural hazards requirements specified in DMA 2000 and Element B of FEMA's Local Mitigation Planning Policy Guide (April 2025).
- The County selected a contract consultant, Black & Veatch, to assist with the development and implementation of the plan.
- A Core Planning Team (CPT) was formed to lead the planning effort, as shown in Table 2-1.



- Sierra County invited all jurisdictions located within the County to participate in the MJHMP update. The County and 11 jurisdictions agreed to participate and meet participation expectations, where appropriate, as shown in Table 2-1.
- This MJHMP was developed and updated following the process outlined by DMA 2000, FEMA’s Local Mitigation Planning Handbook (June 2025), FEMA’s Local Mitigation Planning Policy Guide (April 2025), and the State of California planning requirements. Following these processes ensures that all requirements have been met and supports state and federal reviews of the MJHMP.

The planning process for this MJHMP update, as shown below consisted of the following six steps:

1. Organize Resources
2. Assess Risk
3. Engage the Public
4. Mitigation Strategy
5. Plan Maintenance Strategy
6. Assemble and Adopt the Plan

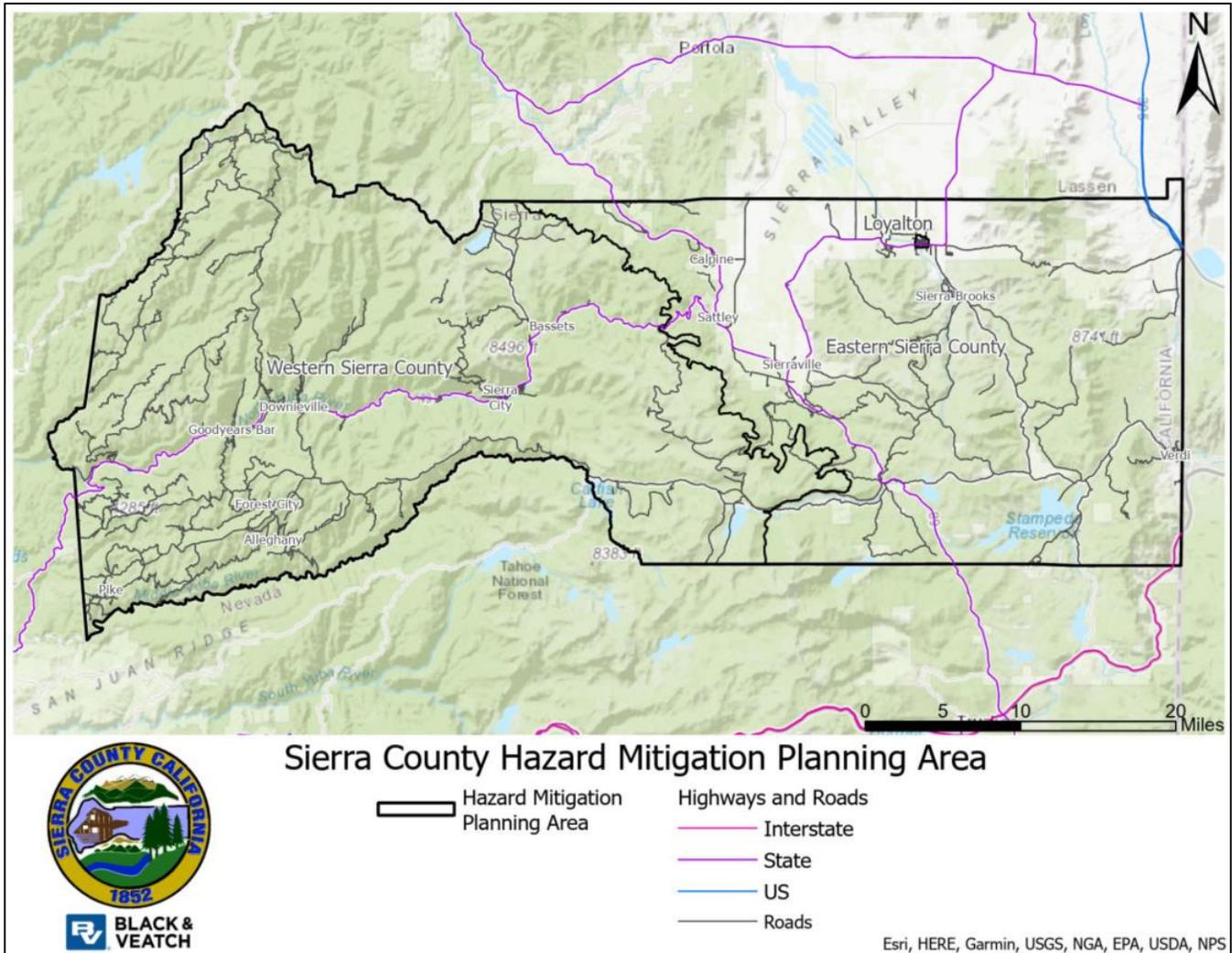




## 2.2 DEFINING THE PLANNING AREA

The planning area consists of the entire area within Sierra County. Relevant planning area characteristics are described in Chapter 3 (Sierra County Profile) and in each jurisdictional annex in Volume 2. The risk assessment for this MJHMP is performed for the entire planning shown on Figure 2-1. For the risk analysis, western and eastern Sierra County divisions loosely followed the Yuba Pass, the standardly accepted divider for the County.

Figure 2-1. Sierra County Hazard Mitigation Planning Area



## 2.3 FUNDING

Funding for this MJHMP was fully funded through Cal OES HMGP DR-4683-683-03P with a State funded Prepare California match.



## 2.4 FORMATION OF THE PLANNING TEAMS

A successful planning effort includes active participation and buy-in from the whole community – individuals and communities, all levels of government, private and nonprofit sectors, non-governmental establishments, community lifelines, and members of the public.



### CORE PLANNING TEAM

The CPT comprised key personnel from the County and discipline leads from the City's contract consultant, Black & Veatch. They were responsible for monitoring plan progress milestones and identifying input need for the HMSC.



### STEERING COMMITTEE

A 23-member HMSC comprised CPT members, county personnel, and stakeholders. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

#### 2.4.1 Core Planning Team

The **Core Planning Team** was made up of discipline leads from the County's contract consultant, Black & Veatch, and key personnel from the County.

Table 2-1 lists the County's Core Planning Team members. They were responsible for monitoring plan progress milestones and identifying input need for the Steering Committee and Planning Partners.

#### 2.4.2 Steering Committee

The **Steering Committee** consisted of a variety of personnel from county departments and agencies, local jurisdictions, and stakeholders that guided the County and participating jurisdictions through the process of updating the HMP.

Table 2-1 lists the Steering Committee members. They were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

#### 2.4.3 Planning Partnership

The **Planning Partnership** was made up of jurisdictional representatives seeking DMA 2000 compliance. They were responsible for participating throughout the process, reviewing information and providing input, informing the risk assessment, developing mitigation strategies, and adopting the HMP.



In September 2024, the County notified its municipality and special service districts of the planning process and invited them to participate. They were asked to formally notify the County by letter of intent to participate and to identify points of contact to represent the municipality and participate throughout the planning process. The contacts each jurisdiction identified in the letter of intent to participate were informed of the planning process, attended meetings, provided direct input, and reviewed plan documents.

Table 2-1 lists the Planning Partnership members and Appendix C (Meeting Documentation) identifies the individuals who represented their jurisdictions during the planning effort. Members of the Planning Partnership were responsible for participating throughout the process, reviewing information, providing input, informing the risk assessment, and developing mitigation strategies.

Jurisdictional involvement is demonstrated through the completion of an annex in Volume 2 of this plan. Each annex was developed with input gathered during the planning process and includes points of contact, risk assessments for relevant hazards, evaluation of capabilities for mitigation, identification and prioritization of mitigation measures, and ultimately, adoption of the updated plan through a resolution.

Table 2-1. Sierra County Hazard Mitigation Planning Participation

Jurisdiction / Organization	Name	Core Planning Team Member	Steering Committee Member	Steering Committee Member (Alternate)	Planning Partnership Member
Sierra County OES	LeTina Vanetti, OES Coordinator	■	■		■
Sierra County Public Works	Billy Epps, PW Engineering Technician II	■	■		■
Alleghany County Water District Pliocene Ridge Community Services District	Rae Bell Arbogast		■		■
Sierraville Public Utility District	Tom Archer		■		■
Sierra County Fire Safe Council	Danielle Bradfield		■		
Family Resource Center	Vickie Clark		■		
Inc. Senior Citizens of Sierra County/Meals on Wheels	Magdalene DeBerg		■		
Downieville Public Utility District	Paul Douville		■		■
Downieville Day Spa	Kathy Fischer		■		■
Sierra County Sherriff's Office	Mike Fisher		■		■
Eastern Plumas Health Care Board	Victoria Fisher		■		
Downieville Fire Protection District	Steve Folsom		■		■
USFS Leadership Tahoe Forest	Joe Griffin		■		
Sierra City Fire Protection District	Scott Hall		■		■
Liberty Utilities	Lee Kiolbasa		■		
Sierra County Fire Protection District #1	Rick Maddalena		■		■



Jurisdiction / Organization	Name	Core Planning Team Member	Steering Committee Member	Steering Committee Member (Alternate)	Planning Partnership Member
Sierra County Fire Protection District #1	Jeff McCollum			■	■
City of Loyalton	Sue McIlrav		■		■
Sierra County Building/Planning	Brandon Pangman		■		■
Sierra County Health	Tina Slowan-Pomeroy		■		■
Sierra-Plumas Joint Unified School District	Sean Snider		■		■
Sierra County Waterworks Calpine District No. 1	Bruce Troedson		■		■
Sierra County Waterworks Calpine District No. 1	Janet Drummond			■	■
Sierra County Public Works	Bryan Davey			■	■
Black & Veatch	Rob Flaner, Project Manager	■			
Black & Veatch	Megan Brotherton, Lead Planner	■			
Black & Veatch	Carol Baumann, Risk Assessment Lead	■			
Black & Veatch	Erin Schanen, Planner	■			

## 2.5 STAKEHOLDER COORDINATION AND INVOLVEMENT

**Local Plan Requirement A2 – 44 CFR Part 201.6(b)(2)**

*The planning process shall include 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 non-profit interests to be involved in the planning process.*

Outreach to stakeholders was conducted in a timely manner and maintained throughout the planning process. This section outlines the stakeholders who were involved in the creation of this MJHMP and outlines their participation.

### 2.5.1 Types of Stakeholders

Stakeholders consist of individuals and groups that mitigation actions or policies affect. For this MJHMP, businesses, private organizations, public entities, and neighboring communities were identified and invited to participate. The County made conscientious efforts to ensure diverse regional, county, and local representation in the planning process. Refer to Table 2-3 for the list of stakeholders.



## 2.5.2 Stakeholder Participation

Throughout the entire planning process, stakeholders were invited to participate via email notifications and phone calls informing them of the planning effort and giving them an opportunity to get involved. Stakeholders were invited to participate as follows:

- Participate as a member of the Steering Committee and/or as a Planning Partner.
- Take a Public Hazard Awareness Survey.
- Attend Steering Committee and Planning Partner meetings.
- Share public outreach information within their organization.
- Comment on the draft plan.

Below is a summary of the stakeholders' involvement in the planning process, demonstrating the extensive outreach efforts made by the County. Key elements of stakeholder outreach include:

- 24 stakeholders agreed to serve as members of the Steering Committee and as a Planning Partner.
- The web link to the draft plan was emailed to all 26 stakeholders and neighboring communities, inviting them to comment on the draft plan.



### Federal and State Agencies

The following section lists the government agencies that were involved during the planning process. Note that Sierra County agencies are included in the Local Stakeholders section.

Table 2-2 describes how federal and state agencies participated in the Sierra County MJHMP update. Those listed in the table below were directly or indirectly involved in the process and provided crucial information to update the plan.

Table 2-2. Federal and State Agencies

Agency/Department	Federal	State	Participation
FEMA Region 9	■		FEMA provided updated planning guidance; provided summary and detailed NFIP data for the planning area; presented preliminary regulatory flood products to municipalities and the public; and conducted plan review.
FEMA National Risk Index (NRI)	■		FEMA's NRI was used as a baseline for natural hazard selection for this MJHMP.
National Centers for Environmental Information (NCEI)	■		NCEI's online tools were accessed to obtain information regarding hazard identification, hazard details, and risk assessments to incorporate into the MJHMP update.



Agency/Department	Federal	State	Participation
CAL FIRE		■	Provided updated maps for Local Responsibility Areas that were used in the wildfire risk assessment.
Cal OES – Mitigation Planning Division		■	Oversaw the planning process; reviewed the draft plan

***Local Stakeholders and Neighboring Communities***

Nearly 30 stakeholders and neighboring communities were invited to participate in the MJHMP update process and are listed in Table 2-3. Of those invited to participate, 26 different agencies and organizations provided input in a variety of ways. Those that served on the HMSC and as a Planning Partner, that provide services to socially vulnerable populations, and that were informed of the planning process are noted accordingly (Table 2-3). Stakeholders are aligned with applicable community lifelines. Refer to Section 3.53.5, Community Lifelines, for descriptions of each lifeline category.



Sierra City (Photo Credit: LeTina Vanetti)



Table 2-3. Local Stakeholders and Neighboring Communities Involved in the Planning Process

Agency or Organization Name	Stakeholder Category	Description of Services and Hazard Mitigation Capabilities	Community Lifelines Supported	Member of the HMSC and/or Planning Partner	Email Notification of Planning Process
Alleghany County Water District	 	Regional utility providing water service to Alleghany County Water District customers.		■	
City of Loyalton		The City of Loyalton is the only incorporated city in Sierra County and is located in the northeastern part of the county.		■	
Downieville Day Spa		Business in Sierra County.		■	
Downieville Fire Protection District	 	Regional fire department with mutual aid/automatic aid agreements.	 	■	
Downieville Public Utility District	 	Regional utility providing water service to the Townsite of Downieville.		■	
Eastern Plumas Health Care Board	 	Provides medical services to the community.		■	
Sierra Senior Providers, Inc. (Meals on Wheels)		Provides food and care services to seniors in the community.		■	



Agency or Organization Name	Stakeholder Category	Description of Services and Hazard Mitigation Capabilities	Community Lifelines Supported	Member of the HMSC and/or Planning Partner	Email Notification of Planning Process
Liberty Utilities		Regional utility providing electric, natural gas, water, and wastewater treatment utility systems to the community.	 	■	
Nevada County		Nevada County is located south of Sierra County.			■
Plumas County		Plumas County is located northwest of Sierra County.			■
Pliocene Ridge Community Services District	 	Regional fire department with mutual aid/automatic aid agreements.	 	■	
Sierra City Fire Protection District	 	Regional fire department with mutual aid/automatic aid agreements.	 	■	
Sierra County Building/Planning		Public works department responsible for Land Use Application Processing, Zoning, General Plan, Surface Mining and Reclamation Act, Addressing, and Planning Commission.		■	
Sierra County Fire Protection District #1	 	Regional fire department with mutual aid/automatic aid agreements.	 	■	



Agency or Organization Name	Stakeholder Category	Description of Services and Hazard Mitigation Capabilities	Community Lifelines Supported	Member of the HMSC and/or Planning Partner	Email Notification of Planning Process
Sierra County Fire Protection District #1	 	Regional fire department with mutual aid/automatic aid agreements.	 	■	
Sierra County Fire Safe Council		Regional fire council providing wildfire safety education, outreach, and resources with the community.		■	
Sierra County Fire Safe Council	 	Regional fire department with mutual aid/automatic aid agreements.	 		■
Sierra County OES	 	Coordinating and collaborating agency for emergency management for Sierra County. Government office located in Downieville.		■	
Sierra County Public Works		Example services for Sierra County Public Works includes road maintenance, solid waste management, and water supply. Government office located in Downieville.	 	■	
Sierra County Sheriff's Office		Provides law enforcement, emergency response, and administrative services to the community.		■	
Sierra Valley Groundwater Management District		Oversees the management and monitoring of groundwater supply for Sierra County.			■



Agency or Organization Name	Stakeholder Category	Description of Services and Hazard Mitigation Capabilities	Community Lifelines Supported	Member of the HMSC and/or Planning Partner	Email Notification of Planning Process
Sierraville Public Utility District	 	Regional utility providing water service to the town of Sierraville and surrounding community.		■	
U.S. Forest Service	 	Provides services and resources for recreation, fire management and response, and permitting for Sierra National Forest.		■	
U.S. Forest Service Leadership Tahoe Forest		Provides services and resources for recreation, land management, and permitting for Lake Tahoe Basin.		■	
Yuba County		Yuba County is located southwest of Sierra County.			■



### 2.5.3 Draft Plan Review

All the entities listed above were provided an opportunity to review and comment on the draft plan during the public comment period, primarily through the link on the MJHMP web page. Each entity was sent an email informing them that the draft plan was available for comment and included a link to the web page and online comment tool. Additional invitations to review the draft plan were released through social media posts and on a banner on the County's website.

The public draft review period extended from July 28 to August 10, 2025. **XX** comments were received on the draft plan.

Upon completion of a public comment period, the complete draft plan was sent to the California Governor's Office of Emergency Services (Cal OES) and FEMA Region 9 for a pre-adoption review to ensure program compliance.

## 2.6 PUBLIC PARTICIPATION



### Local Plan Requirement A3 – 44 CFR Part 201.6(b)(1)

*The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.*

An important component of the mitigation planning process involved public participation. Input from the public provides the County with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of County officials. Public awareness is a key component of a successful mitigation strategy and is aimed at making the community at large safer from the potential effects of hazards.

Public involvement during the development of the Sierra County HMP was sought using a public survey, which permitted open comment; and a digital copy of the draft plan was made available on the County's website and advertised for public review and comment. Comments received in July 2025 were incorporated in the draft plan as applicable.

### 2.6.1 Hazard Mitigation Plan Web Page

At the beginning of the planning process, the County established a hazard mitigation web page to provide information about the process. The web page was used to keep the public informed about milestones and public participation opportunities and to solicit input.



Figure 2-2. Sierra County Hazard Mitigation Web Page

### 2.6.2 Print Media

Given Sierra County's predominantly remote setting, the use of print media was a highly effective tool to engage and promote the planning effort (Figure 2-3.). Refer to Section 2.6.42.6.43.5, Public Survey, for descriptions and promotion of the Public Hazard Awareness Survey and public engagement.

Print media was utilized in the following ways:

- Paper copies of the survey with postage-paid envelopes were made available at all U.S. Post Offices throughout the County.
- Inclusion of the printed Public Hazard Awareness Survey with the daily meal services delivered by Sierra Senior Providers, Inc. Meals on Wheels program.
- Inclusion of the printed Public Hazard Awareness Survey in Commodities Bags distributed by Fire Districts to provide robust outreach to isolated populations.
- Posting of printed flyers at permitted campsites, post offices, grocery stores, County buildings, and community centers.



Figure 2-3. Print Media Promoting Hazard Awareness



# SIERRA COUNTY CALIFORNIA

# HAZARD MITIGATION PLAN 2025 UPDATE



## OVERVIEW

Sierra County is working on a plan called the Hazard Mitigation Plan (HMP) to help protect the county from natural disasters like floods, droughts, and earthquakes. This plan will help identify ways to reduce the risks of these types of disasters. Having an HMP is important because it makes the county eligible for funding from the Federal Emergency Management Agency (FEMA) to help with disaster relief.

The HMP is being updated with the help of a company called Black & Veatch, following state and federal rules. The plan will be used by the county and its partners to respond to natural disasters and help people affected by them. Once the plan is finished, the county and its partners will be better prepared for natural disasters and can get help before and after they happen.

## BENEFITS OF MITIGATION PLANNING

The goal of the HMP is to keep people safe and protect communities in Sierra County from natural disasters. The plan looks at ways to reduce the risks of floods, droughts, earthquakes, and other natural hazards that can harm people, the environment, and the economy. The plan has to be reviewed and updated every five years and needs to be officially approved by each group involved. During this planning project, leaders from the county and local communities will work together to identify risks, figure out what they can do, and come up with a plan to reduce the chances of a disaster happening.

Sierra County and its Planning Partners will be working on updating the HMP over the next year. The goals of this process are:

- To give people chances to share their thoughts and ideas during the planning process.
- To carefully study the risks of natural disasters using the most up-to-date information available.
- To make a plan to help reduce the chances of people getting hurt or property getting damaged in a natural disaster.
- To save money in the long run by reducing the damage to buildings and the cost of repairs.
- To make sure the HMP is approved by the state and federal government.
- To be able to get federal funding to plan ahead for disasters before they happen.

## WE WANT TO HEAR FROM YOU!

Complete a quick survey by scanning the QR code and tell us which natural disasters you think affect Sierra County and what the County can do to reduce their impact.



## QUESTIONS?

If you have any questions, please contact  
LeTina Vanetti, OES Coordinator  
([lvanetti@sierracounty.ca.gov](mailto:lvanetti@sierracounty.ca.gov))

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## MORE INFO

Learn more about the HMP on the County OES website:  
<https://www.sierracounty.ca.gov/818/Hazard-Assessment-Plans>



### 2.6.3 Public Meetings

Each of the Hazard Mitigation Steering Committee and Planning Partnership meetings was open and advertised for public attendance (Figure 2-4). Refer to Section 2.9, Plan Development Milestones, for descriptions and details of the Hazard Mitigation Steering Committee and Planning Partnership meetings.

Figure 2-4. Public Meeting Participation

The screenshot shows the Sierra County Calendar interface. At the top, there are navigation tabs: 'YOUR GOVERNMENT', 'COMMUNITY', 'COUNTY DEPARTMENTS', and 'HOW DO I'. Below these are search filters for 'Start Date', 'End Date', and 'Word or Phrase', along with a 'Show Past Events' checkbox. The main content area displays a calendar for April 2025 and a list of events. The event 'Hazard Mitigation Plan Up-date Stakeholder/Planning Partner Meeting' on April 22, 2025, from 10:00 AM to 11:50 AM, is highlighted with a yellow box. The event details indicate it will have both in-person and virtual options.

### Participation

The public is welcome and encouraged to participate during the LHMP process! Upcoming meeting information and materials will be shared on this page and all meetings are open to the public.

If you live, work, or play in the County, please take a moment to [fill out a short survey](#). This survey aims to collect your thoughts on any hazards and risks we face locally. Results from the survey will help us better coordinate future mitigation activities to create more resilient communities!



## 2.6.4 Public Survey

The CPT developed and posted a public survey early in the planning process. The survey was designed to capture information from members of the public, especially those who might not be able to attend public meetings or participate through other means in the planning process. The survey was posted from October 28, 2024, through July 2025. The County posted the survey on the planning website and distributed through multiple print media venues. Paper copies of the survey with postage-paid envelopes were made available at all U.S. Post Offices throughout the County and included in Commodities Bags to provide robust outreach to isolated populations. A link to the electronic public survey was also shared with Steering Committee members, Planning Partners, and Stakeholders.

Figure 2-5. Paper Surveys with Postage-Paid Envelopes Distributed at Local Post Offices



(Photo Credit: LeTina Vanetti)



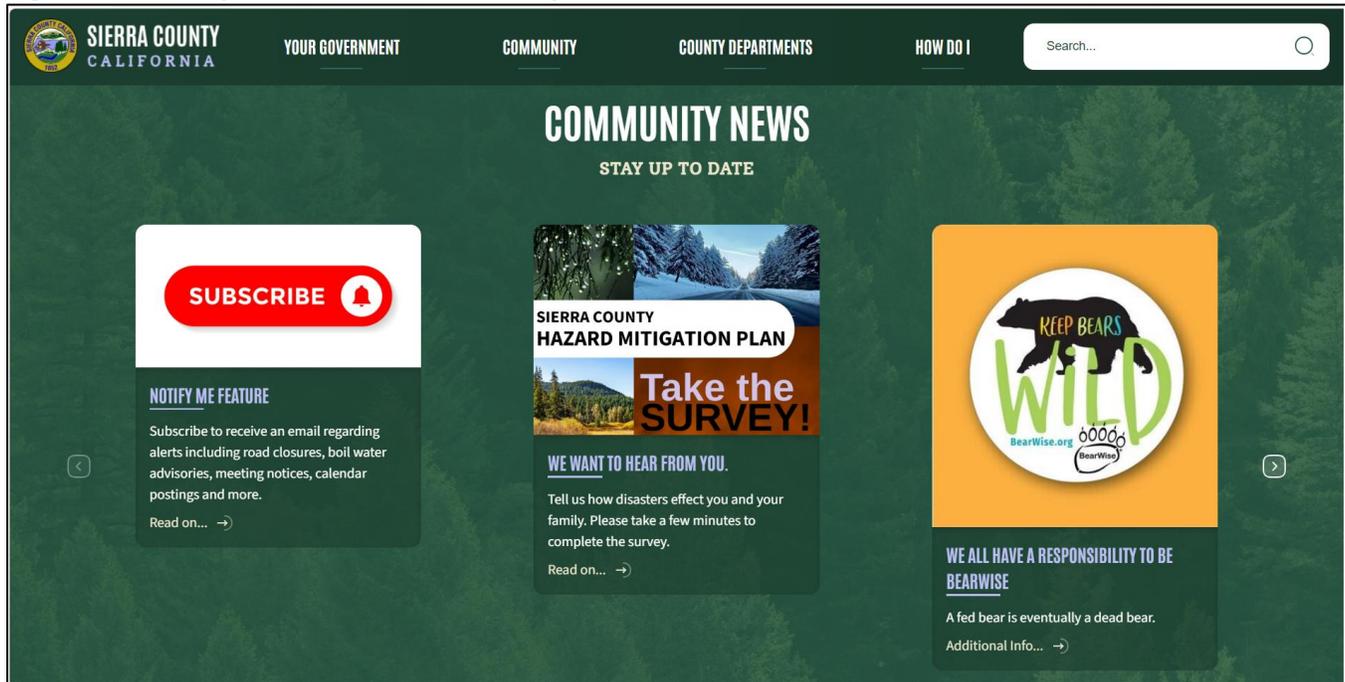
Figure 2-6. Commodities Bags Included Surveys for Remote Areas of Alleghany, Pike, and Forest City



(Photo Credit: LeTina Vanetti)



Figure 2-7. Survey Promotion on the County Website



### Summary of Survey Results

During the nine-month period that the survey was open, 156 members of the public completed the public survey. The complete survey and detailed results are included in Appendix A (Public Outreach). The following summarizes highlights from the survey:

- Nearly 71% of respondents are very concerned or extremely concerned about the wildfire hazard.
- Almost 44% of the respondents have not made a fire escape plan.
- About 60% of the respondents would consider retrofitting or upgrading their home through incentive programs.

### Incorporation of the Public Survey into the Hazard Mitigation Plan

Survey participants, including those from socially vulnerable communities, suggested actions the County should continue to do or should start doing to reduce or eliminate risk of future hazard events. Of those suggestions, all are included in the mitigation action plan, or are existing core capabilities that the County will continue to carry out. Refer to Table 2-4 for examples of the suggestions and how they were incorporated in the MJHMP update.



Table 2-4. Public Survey Comment Examples and HMP Incorporation

Public Comment	2025 HMP Incorporation
It is the government’s job to teach people and create programs to help them protect themselves from natural hazards.	Countywide Mitigation Action CW-2: Continue to leverage/support/enhance ongoing, regional public education and awareness programs, such as Firewise Communities, Fire Safe Council, Heath Fairs, Everbridge, Genasys, and other community notifications and events, as methods to educate the public on risk, risk reduction, and community resilience.
Flooding and severe winter storms occur here more than large wildland fires, Fires causes the most damage and are unpredictable, whereas flooding and winter storms can be forecast days ahead, unlike fires. There is still a lot of mitigation work to be done for flooding, winter storms and wildland fires.	Mitigation actions for each jurisdiction in Volume 2 of this plan address flood, winter storm, and wildfire hazards.

### 2.6.5 Public Review Period

Members of the public were provided an opportunity to comment on the draft plan throughout the last two weeks of July 2025. The County’s website included a link to the draft plan and an online tool that allowed community members to submit comments. In addition to the website, the public comment period was promoted on Sierra County’s media channels and website.

## 2.7 IDENTIFICATION AND OUTREACH TO SOCIALLY VULNERABLE POPULATIONS AND UNDERSERVED COMMUNITIES

Due to the rural, isolated nature of Sierra County, the entire resident and visitor population was defined as vulnerable.

Due to a lack of broadband and cellular coverage in many parts of the County, successful outreach was carried out through in-person engagement and printed materials posted in public buildings, including post offices, County buildings, and grocery stores.

## 2.8 REVIEW AND INCORPORATION OF EXISTING PROGRAMS



Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

*Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

Sierra County utilized the most current technical information, plans, studies, and reports during the planning process to assist in hazard profiling, risk and vulnerability assessment, reviewing mitigation capabilities, and identifying, developing, and prioritizing mitigation strategies at the County and local levels.



- **Overall Planning Process** – The 2025 FEMA Local Mitigation Planning Policy Guide and Handbook were reviewed and used to develop the MJHMP for the County. The 2023 California State HMP was reviewed for alignment with mitigation goals, identified hazards, risk assessments, and mitigation actions. In addition, neighboring jurisdiction mitigation plans were reviewed for alignment with identified hazards and mitigation actions.
- **Risk Assessment** – Asset and inventory data collected was used to complete the risk assessment of the MJHMP. This included local, state, and federal hazard technical information (e.g., US Geological Survey [USGS] earthquake data, CAL FIRE wildfire data, FEMA disaster declarations). Details of the data used, along with how the data was used, is presented in Chapter 1 and throughout the hazard profiles (Chapters 6 through 15).
- **Capability Assessment** – Numerous plans, reports, regulations, codes, and technical information were obtained from the HMSC, and stakeholders involved in the planning process, as well as through independent research conducted by the planning consultant. Sierra County and the Planning Partners were responsible for providing the inventory of their Planning and Regulatory capabilities in each jurisdictional annex in Volume 2, and noted relevant planning and regulatory documents as needed.
- **Mitigation Strategy** – The Planning Partnership developed more than 50 mitigation actions to address the results of the risk assessment and input received from the public and local stakeholders. These actions considered the current capabilities of the Planning Partners to implement each strategy.

## 2.9 PLAN DEVELOPMENT MILESTONES

Table 2-5 summarizes the planning process activities, efforts, and key milestones conducted to prepare the MJHMP update. Meeting documentation (e.g., presentations, agendas, sign-in sheets, meeting minutes) are located in Appendix C (Meeting Documentation). The table only identifies formal meetings held during the plan update; it does not reflect all planning activities conducted by individuals and groups throughout the planning process.

Table 2-5. Plan Development Milestones

Date	Event	Description	Attendance
	Support Contractor Secured	Sierra County executed a contract with Black & Veatch to facilitate the HMP process.	N/A
	Organize Resources	CPT formed	N/A
August 6, 2024	Project Kickoff Meeting	<ul style="list-style-type: none"> <li>• Introductions</li> <li>• HMP Overview</li> <li>• Scope &amp; Schedule</li> <li>• Core Planning Team</li> <li>• Steering Committee</li> <li>• Risk Assessment</li> <li>• Planning Partnership</li> <li>• County Department Responsibilities</li> <li>• Communication Protocols</li> </ul>	
August 14, 2024	CPT Meeting #1	<ul style="list-style-type: none"> <li>• Steering Committee</li> <li>• Planning Partnership</li> </ul>	6



Date	Event	Description	Attendance
		<ul style="list-style-type: none"> <li>• GIS</li> <li>• File Sharing Site</li> </ul>	
September 3, 2024	CPT Meeting #2	<ul style="list-style-type: none"> <li>• Steering Committee/Coordinating Stakeholder Invitations</li> <li>• Planning Partnership</li> <li>• GIS/Hazards</li> <li>• Public and Stakeholder Outreach</li> </ul>	4
September 25, 2024	CPT Meeting #3	<ul style="list-style-type: none"> <li>• Steering Committee/Coordinating Stakeholder Invitations</li> <li>• Planning Partnership</li> <li>• GIS/Hazards</li> <li>• Public and Stakeholder Outreach</li> </ul>	6
October 9, 2024	CPT Meeting #4	<ul style="list-style-type: none"> <li>• Steering Committee/Planning Partner Meeting Prep</li> <li>• Planning Partnership</li> <li>• Public and Stakeholder Outreach</li> </ul>	5
October 23, 2024	CPT Meeting #5	<ul style="list-style-type: none"> <li>• Equity Priority Communities</li> <li>• Website Content</li> <li>• Steering Committee/Planning Partner Meeting</li> </ul>	4
October 29, 2025	HMSC and Planning Partner Meeting #1	<ul style="list-style-type: none"> <li>• Introductions</li> <li>• Hazard Mitigation Planning Overview</li> <li>• Role of the Steering Committee</li> <li>• Meeting Ground Rules</li> <li>• Planning Partner Expectations</li> <li>• Confirm Hazards</li> <li>• Public Outreach Strategy</li> </ul>	16
November 6, 2024	CPT Meeting #6	<ul style="list-style-type: none"> <li>• Steering Committee/Planning Partner Kickoff Follow-Ups</li> <li>• Public Outreach (Survey) Updates</li> <li>• Planning Partner Annex Phase 1 Process</li> <li>• Mission/Vision Statement</li> <li>• Goal Setting</li> </ul>	4
December 11, 2024	CPT Meeting #7	<ul style="list-style-type: none"> <li>• Steering Committee/Planning Partner Updates</li> <li>• Public Outreach Updates</li> <li>• Planning Partner Annex Phase 1 Process</li> <li>• Mission/Vision Statement</li> </ul>	6
January 15, 2025	CPT Meeting #8	<ul style="list-style-type: none"> <li>• Current Events</li> <li>• Public Outreach Updates</li> <li>• Goals</li> <li>• Mission/Vision</li> <li>• Planning Partner Annex Templates &amp; Instructions</li> <li>• Steering Committee/Planning Partner Meeting Agenda</li> </ul>	4
January 28, 2025	HMSC and Planning Partner Meeting #2	<ul style="list-style-type: none"> <li>• Welcome and Introductions</li> <li>• Confirm Vision Statement for the Plan</li> </ul>	15



Date	Event	Description	Attendance
		<ul style="list-style-type: none"> <li>Confirm Mitigation Goals</li> <li>Planning Partner Annex Overview of Phase 1</li> </ul>	
February 5, 2025	CPT Meeting #9	<ul style="list-style-type: none"> <li>Meeting was held as a working session for Sierra County Annex</li> </ul>	4
March 12, 2025	CPT Meeting #10	<ul style="list-style-type: none"> <li>Phase 1 Annex Coordination</li> <li>In-person Assistance in April</li> </ul>	4
March 26, 2025	CPT Meeting #11	<ul style="list-style-type: none"> <li>Review of Mitigation Strategies</li> <li>Phase 1 Annex Coordination</li> <li>In-person Assistance in April</li> </ul>	7
April 2, 2025	CPT Meeting #12	<ul style="list-style-type: none"> <li>Phase 2 Annex Workshop Coordination</li> <li>Public Outreach Assistance for Planning Partners</li> <li>Stakeholder and Neighboring Community Outreach</li> <li>Community Lifelines Definition</li> </ul>	5
April 22, 2025	HMSC and Planning Partner Meeting #3	<ul style="list-style-type: none"> <li>Approval January Meeting Summary</li> <li>Revise FEMA Planning Requirements</li> <li>Vulnerable Communities for Mitigation Planning</li> <li>Public Outreach Update</li> <li>Planning Partner Annex Development</li> </ul>	12
April 23, 2025	CPT Meeting #14	<ul style="list-style-type: none"> <li>Review of Mitigation Strategy Actions</li> </ul>	3
May 21, 2025	CPT Meeting #15	<ul style="list-style-type: none"> <li>Virtual Assistance for Annex Development</li> </ul>	3
July 28, 2025	Public Outreach	Public comment period on the draft plan opens	N/A
August 10, 2025	Public Outreach	Public comment period on the draft plan closes	N/A
August 11, 2025	Plan Submittal to Cal OES	Submittal of draft plan and plan review tool to Cal OES for review and approval	N/A
Month day, 2025	Plan Submittal to FEMA Region 9	Submittal of draft plan to FEMA Region 9 by Cal OES	N/A
Month day, 2025	Approval Pending Adoption	Approval Pending Adoption provided by FEMA Region 9	N/A
Month day, 2025	Adoption	XXXX Council adoption of draft plan	N/A
Month day, 2025	Approval	Proof of adoption documentation submitted to FEMA Region 9 and Cal OES	N/A
Month day, 2025	Approval	Final approval of the plan by FEMA Region 9	N/A



## 3. SIERRA COUNTY PROFILE



Beckwourth Peak (Photo Credit: LeTina Vanetti)

This section provides general information about Sierra County, including its historical information, physical setting, general building stock, land use, population, demographics, population trends, and community lifelines. Analyzing this information leads to an understanding of the study area, including economic, structural, and population assets at risk, and of concerns that could be related to hazards analyzed in this plan (e.g., low-lying areas prone to flooding, high percentage of vulnerable persons in an area).

### 3.1 OVERVIEW

#### 3.1.1 Historical Overview

Sierra County was officially established on April 16, 1852, after California achieved statehood in 1850. Prior to its formation, the area was part of Yuba County. Covering approximately 980 square miles, Sierra County is the second least populated county in California.



Sierra County is known for its rugged terrain that ranges in elevation from 2,200 to 8,900 feet. The western side of the County features deep canyons and lush forests, while the eastern side of the county is home to the Sierra Valley, the largest valley in the Sierra Nevada range. Sierra County shares borders with Yuba County, Nevada County, Plumas County, and Lassen County in California, as well as Washoe County in Nevada. Much of the county is designated as national forest land, managed by the Plumas, Tahoe, and Toiyabe National Forests, making it a popular destination for outdoor recreation.

Historically, Sierra County played a significant role in the California Gold Rush (1848-1955). Before the influx of miners, the region was the home to the Maidu and Washoe Indians. The discovery of gold and subsequent gold rush brought approximately 16,000 miners to settle within the area between 1848 and 1860, shaping the county's early development (Sierra County Chamber of Commerce 2024).

### 3.1.2 Jurisdictions

The City of Loyalton is the only incorporated city of Sierra County. The U.S. Census Bureau also recognizes several Census Designated Places within the county, including Alleghany, Bassett's-Green Acres, Calpine, Downieville, Forest City, Goodyear's Bar, Indian Valley, Pike City, Sattley, Sierra Brooks, Sierra City, Sierraville, and Verdi.

Originally known as Smith's Neck, Loyalton was renamed in 1863 to reflect the community's support for the Union during the Civil War. It was incorporated in 1901 as a dry town, covering 50.6 square miles. At that time, it was California's second largest city after Los Angeles. Today, Loyalton remains as the county's only incorporated city in Sierra County (Sierra County Chamber of Commerce 2024). Due to its status and population, Loyalton hosts approximately half of the Sierra County Board of Supervisors' meetings, with the remaining meetings held in Downieville, the county seat.

### 3.1.3 Government

Sierra County operates under a board-administrative form of government. The county is governed by a five-member Board of Supervisors, each elected from one of the county's supervisorial districts. The Board is responsible for setting policy, adopting ordinances, and overseeing the county budget. Daily operations are managed by a County Administrative Officer, who is appointed by the Board and coordinates the activities of various county departments. The County oversees a multitude of issues through several departments including agriculture, behavioral health, building, child support services, district attorney, emergency planning, environmental health, information systems, local agency formation commission, personnel, planning, probation, public health, public works, social services, and transportation.

## 3.2 PHYSICAL SETTING

This section describes the geography, land use, and land cover of Sierra County.

### 3.2.1 Location

Sierra County is located in the northeastern region of California within the Sierra Nevada Mountain range. Positioned between the Sacramento Valley and the Nevada state line, the county offers a remote and scenic setting far from major urban centers. It shares borders with Nevada County to the south, Plumas



County to the north, and Lassen County to the northeast, while sharing its eastern boundary with the state of Nevada. Sierra County is California's second most rural and sparsely populated county, offering rich outdoor recreation and historical significance from the Gold Rush era.

### 3.2.2 Geography and Topography

Situated along the scenic Highway 49, Sierra County lies in the heart of the northern Sierra Nevada and spans approximately 980 square miles. The landscape features densely forested canyons, pristine mountain lakes and streams, wild rivers, and the largest alpine valley in North America.

The county is also home to historic Gold Rush towns and long-standing ranching and logging communities. The western portion of the county, including Downieville, Goodyears Bar, Pike, and Alleghany, is heavily wooded and rich in Gold Rush history. These areas are dotted with historic buildings and well-preserved examples of 19th-century architecture. Towering above the landscape are the Sierra Buttes, which rise to elevations of approximately 8,600 feet.

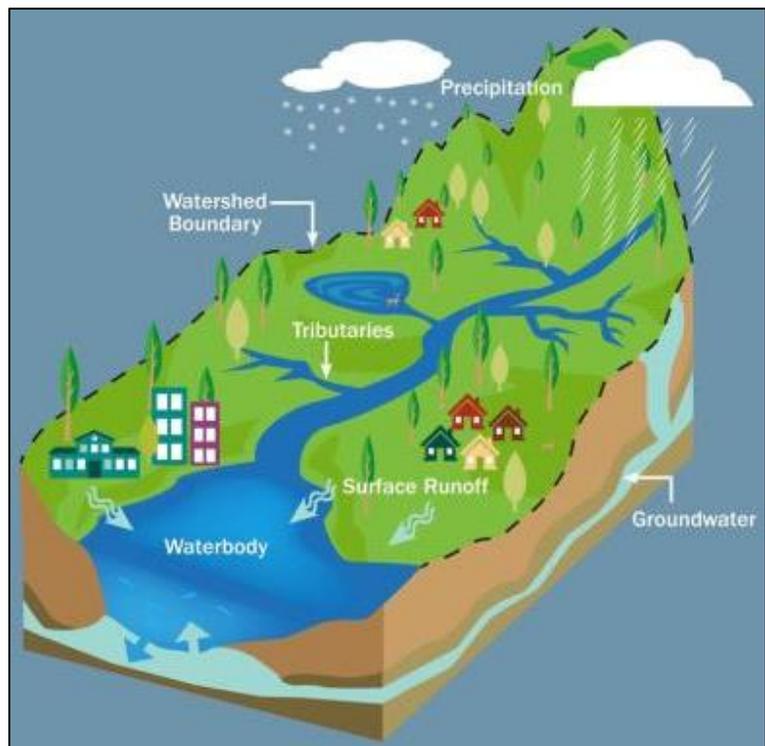
Sierra County has more than 40 alpine lakes, most of which are located in the Sierra Buttes Lakes Basin Recreation Area. Crossing the 6,700-foot Yuba Pass leads to the eastern part of the county, where the towns of Loyalton, Sierraville, Calpine, and Sattley are nestled in the scenic Sierra Valley. At an elevation of around 5,000 feet, this high mountain valley offers a glimpse into the rural lifestyle of the historic American West, with open pastures, grazing cattle, and century-old barns built by early settlers.

### 3.2.3 Watersheds and Surface Waters

A watershed is a geographical area that directs precipitation and snowmelt towards creeks, streams, rivers, and ultimately outflow locations such as reservoirs, bays, and the ocean. Watersheds vary in size and configuration, encompassing anything from a small body of water or county to vast regions covering thousands of square miles with numerous waterways (National Ocean Service 2024). Figure 3-1 depicts the general makeup of a watershed.

Shown on Figure 3-2 are several distinct watersheds found within Sierra County. Table 3-1 depicts unique ecological characteristics outlined in Sierra County's General Plan.

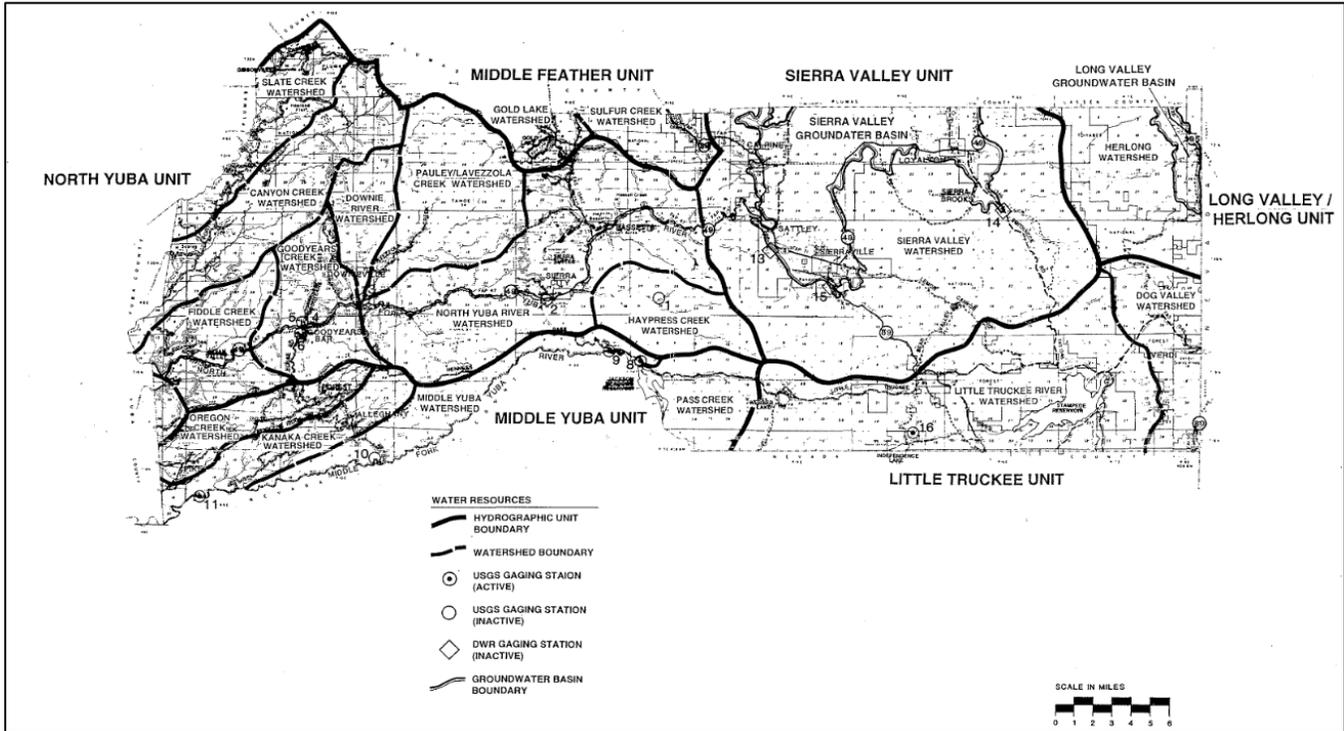
Figure 3-1. Watershed Diagram



Source: NOAA Fisheries, 2022



Figure 3-2. Watersheds of Sierra County



Source: Sierra County General Plan 2012

Table 3-1. Watershed Details

Watershed Name	Description
Sierra Valley Watershed	Special plants and wildlife include deer migration corridor, critical deer summer and winter range, Washoe pine and fir forest, deer fawning areas, Smithneck Creek Wildlife Refuge, and Antelope Valley Wildlife area.
Long Valley / Herlong Watershed	Special plants and wildlife include deer migration corridor, critical deer winter range, Washoe pine and fir forest, deer fawning areas, and the Hallelujah Junction Wildlife area.
Dog Valley Watershed	Special plants and wildlife include deer migration corridor and critical deer winter range.
Little Truckee River Watershed	Special plants and wildlife include deer migration corridor, critical deer summer range, water courses, reservoirs, deer fawning areas, Sardine Valley, and Kyburz Flat.
Oregon & Kanaka Creeks, Middle Yuba and Pass Creek Watersheds	Special plants and wildlife include deer migration corridor, critical deer winter range, ultra mafic rocks and possible sensitive natural communities, water courses, and reservoirs.
Haypress Creek Watershed	Special plants and wildlife include deer migration corridor and deer fawning areas.
Gold Lake & Sulfur Creek Watersheds	Special plants and wildlife include deer migration corridor and water courses.
North Yuba River Watershed	Special plants and wildlife include deer migration corridors, ultra mafic rocks and possible sensitive natural communities, and water courses such as Lakes Basin.



Watershed Name	Description
Goodyears Creek & Downie Rivers Watershed	Special plants and wildlife include deer migration corridors, ultra mafic rocks and possible sensitive natural communities, and water courses.
Fiddle Creek Watershed	Special plants and wildlife include ultra mafic rocks, possible sensitive natural communities, and water courses.
Lavezzola/Pauley Creeks Watershed	Special plants and wildlife include deer migration corridor, ultra mafic rocks and possible sensitive natural communities, and water courses.
Canyon Creek Watershed	Special plants and wildlife include deer migration corridors, ultra mafic rocks, and possible sensitive natural communities.
Slate Creek Watershed	Special plants and wildlife include deer migration corridor, ultra mafic rocks, and possible sensitive natural communities.

Source: General Plan, 2012

### 3.2.4 Climate

The climate of Sierra County varies due to its mountainous climate. The average annual temperature is approximately 41° F, and the historic average monthly rainfall is approximately 27.6 inches (NOAA NCEI 2025), with most precipitation typically occurring between November and April. Summers are generally warm and dry, especially in lower elevations. During winter months, Highways 49 and 89 leading into the area are regularly maintained and the Yuba Pass rarely closes.

## 3.3 POPULATION AND DEMOGRAPHICS

Those who live in the County are one of the most important assets and this MJHMP update will assess risk to people and identify mitigation strategies to protect them, including underserved and socially vulnerable populations.

### 3.3.1 General Population

Sierra County is the second smallest county in California, with the population located within pockets of communities, such as Downieville, Sierra City, Verdi, Sierra Brooks, and Sierraville.

#### Current and Historical Population

Table 3-2 shows past population estimates for Sierra County from 2000 to 2024. Over that time, California’s population grew by 17.4%. The County’s population has experienced a decline or stagnant population change since 2000.

Table 3-2. Recent Population by Jurisdiction

Jurisdiction	2000 Population	2010 Population	2020 Population	2024 Population
City of Loyalton	862	769	738	732
Unincorporated Area	2,693	2,471	2,498	2,445
Total	3,555	3,240	3,236	3,177

Source: California Department of Finance Historical Population Estimates



### ***Future Population Projections***

According to the Sierra County Housing Element 2024-29 and the California Department of Finance, Sierra County is projected to see a continued decline from over 3,000 in 2020 to 2,711 by 2060 (Sierra County 2025).

### **3.3.2 Vulnerable Populations**

Underserved communities are populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life. Social vulnerability is the potential for loss within an individual or social group. The term recognizes that some traits influence an individual's or group's resilience. This is their ability to prepare, respond, cope or recover from an event (FEMA 2023).

Underserved communities and socially vulnerable populations may be more at-risk during hazard events due to a variety of factors, such as their physical capacity to react or respond effectively, as well as the location, quality of their housing, and lack of access to emergency services. Those with greater vulnerability may experience more severe impacts during emergencies or disasters. It is essential for public officials to consider the distinct needs of vulnerable populations in order to ensure their safety.

The identification of socially vulnerable populations and underserved communities within the planning area was emphasized throughout the planning process. See Section 2.7 for more information on how vulnerable communities were identified and included in the planning process.

The Planning Partnership identified the following socially vulnerable populations and underserved communities within Sierra County and prioritized understanding risk and the development of mitigation strategies to support these groups.

#### ***Isolated Resident Populations***

The entire County has limited access to communication including cellular service and broadband coverage. Many communities throughout the County have barriers to physical access with only one road providing access. Community lifelines are also limited with limited medical facilities, no banking institutions, limited gas stations, and few grocery stores in the County.

#### ***Visitor Populations***

Additionally, the large visitor population in the County presents unique challenges to vulnerability. Visitors may not understand risks to the natural hazards present in the County and lack ability to communicate in an emergency with limited cell phone service. The visitor population can be triple the resident population in the County during summer months, especially during mass gathering sporting events.



### 3.4 DEVELOPMENT PROFILE

	<p><b>Local Plan Requirement B2— 44 CFR Part 201.6(c)(2)(ii)(C)</b></p>	<p><b>Local Plan Requirement E1— 44 CFR Part 201.6(d)(3)</b></p>
	<p><i>The plan should describe vulnerability in terms of 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.</i></p>	<p><i>A local jurisdiction must review and revise its plan to reflect changes in development.</i></p>

#### 3.4.1 Land Use

Land use describes the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place. Public and private lands frequently represent very different uses (U.S. EPA 2024).

Land cover describes how much of an area is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Water types include wetlands or open water (National Ocean Service 2024).

Land use varies from land cover in that certain uses may not always be immediately apparent (e.g., land utilized for timber production without harvest for an extended period and wooded areas designated as wilderness may both appear as forested areas but serve different purposes) (U.S. EPA 2024).

Land Use Diagrams from the county build upon previous land use designations and zonings. Sierra County has 25 zoning districts. Residential zoning districts include R1 Residential One Family, R2 Residential One and Two Family, and R3 Residential Multiple Family. Residential uses are also permitted in additional zoning districts, including CR Commercial Residential; RR-1, RR-2, and RR-4 Rural Residential; and OS-20, OS-40, OS-60, OS-80, and OS-160 Open Space Residential. Table 3-3 shows a summary of existing land use designations in the unincorporated area communities, excluding the City of Loyalton. Transportation land use excludes streets and highways.

Table 3-3. Land Use Summary for Sierra County

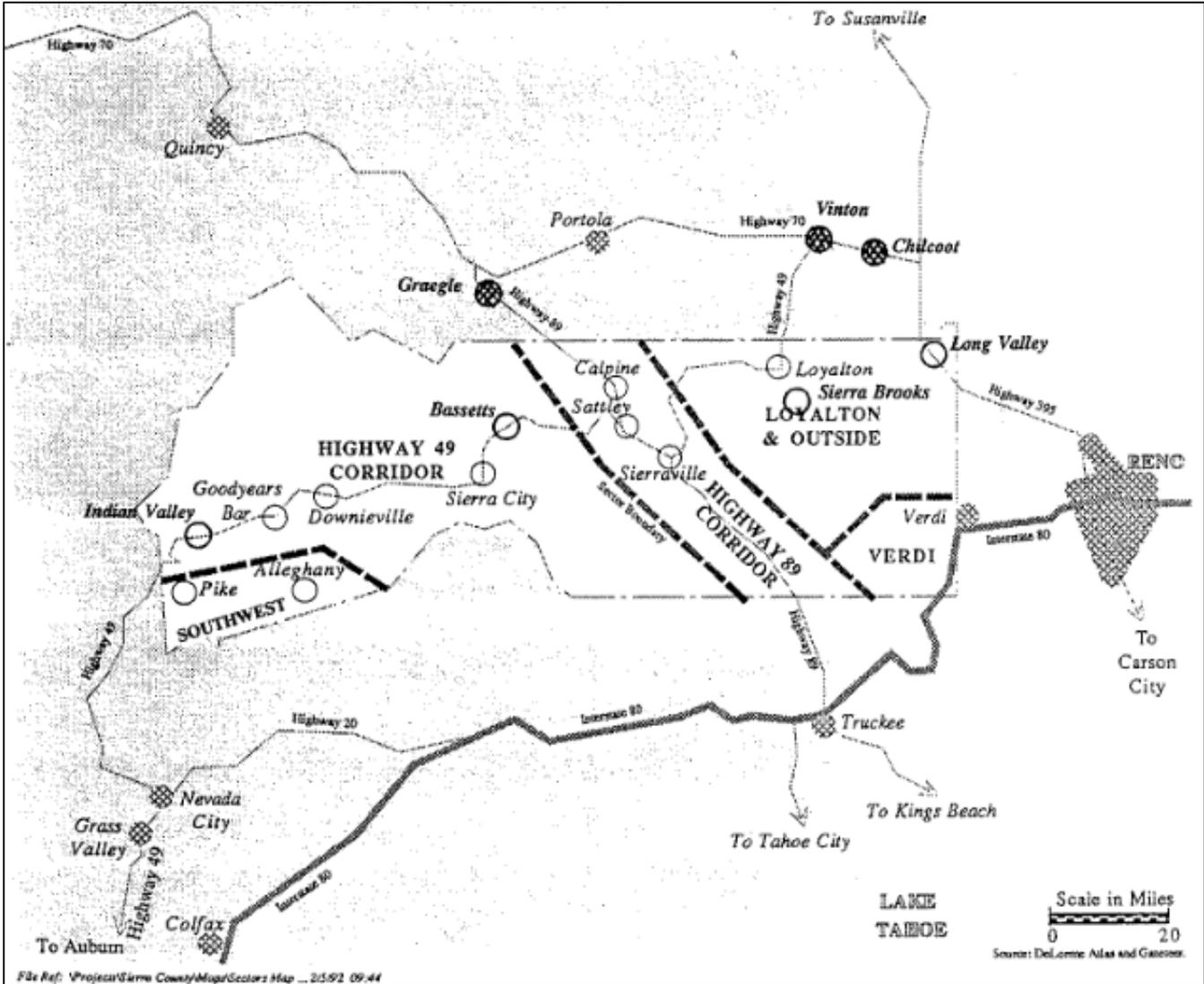
Land Use Category	General Plans Data	
	Acreage	Percent of County
Residential	1,569	31.4
Community Uses	48	1
Seasonal Residential/Lodging	2,216	44.4
Commercial	85	1.7
Office Type Uses	13	0.3
Industrial	921	18.4
Utilities	40	0.8
Transportation	101	2
<b>Total</b>	<b>4,993</b>	<b>100</b>

Source: 2012 Sierra County General Plan



The land use analysis used the following planning sectors: Southwest Sector, Highway 49 Corridor, Highway 89 Corridor, Outside Loyalton Sector, and Verdi Sector Areas. Figure 3-3 shows the delineated sectors and the locations of major communities and highways within Sierra County.

Figure 3-3. Land Use Delineation in Sierra County



**Land Use and Land Cover Trends**

Approximately 55.6% of residential land use is developed in the Southwest Sector. Highway 89 Corridor is primarily developed as seasonal residential and lodging use. Other non-urban land resource uses, such as forest, agriculture, open space, and water cover approximately 581,596 acres, with forest as the most dominant.



### 3.4.2 General Building Stock

#### Current Building Stock

The County’s housing stock, predominantly characterized by single-family detached site-built structures, makes up 88% of the housing in unincorporated Sierra County. Partially due to limited public infrastructure, such as community water and sewers, the County has not experienced any apartment or other multiple-family development in the last 10 years. Based on County Building Department records of actual new construction that has taken place over the last 10 years up to 2023, approximately 65 new houses were constructed in the County, of which approximately 18 were mobile and/or manufactured houses.

## 3.5 COMMUNITY LIFELINES

FEMA released initial guidance on the community lifelines concept in 2019 to describe the assets that enable the continuous operation of critical government and business functions and are essential to human health and safety or economic security. Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required (FEMA 2023a).

The Planning Partnership identified lifelines that support Sierra County before, during, and after hazard events. A summary of the critical facilities or lifelines located within the planning area is listed in Table 3-4 and shown on Figure 3-4.

Table 3-4. Community Lifelines in Sierra County

Planning Area	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
Loyalton	2	0	4	2	2	10	1	0*	21
Eastern Sierra County	23	2	2	6	0	12	21	0*	66
Western Sierra County	26	2	6	12	1	17	41	0*	105
Total	51	4	12	20	3	39	63	0*	192

Note: \*Spatial data for analysis of Water Systems is not currently available for Sierra County

Figure 3-4. Sierra County Critical Facilities

Figure will be inserted in agency review draft.



### 3.5.1 Safety and Security

Safety and security lifelines include law enforcement/security (e.g., police stations, correctional facilities, site security), fire service, search and rescue, government service (e.g., emergency operation centers, government offices, schools), and community safety (e.g., flood control, protective actions). Overall, 39 safety and security lifelines were identified in the County of this MJHMP.



### 3.5.2 Food, Hydration, Shelter

Food, hydration, and shelter lifelines include food (e.g., grocery stores, food banks), hydration (e.g., water supply chain, bottled water distribution), shelter, and agriculture. Overall, 12 food, hydration, and shelter lifelines were identified in the County for this LHMP. These lifelines exist within the County, but GIS data was not available for a spatial analysis. Many of these facilities, including grocery stores, are part of the general building stock analysis. Shelters, food distribution centers, and cooling centers are included in the safety and security lifeline category (e.g., library, religious institution).



### 3.5.3 Health and Medical

Health and medical lifelines include medical care (e.g., hospitals, pharmacies, long-term care), public health (e.g., health surveillance, behavioral health, labs), patient movement (e.g., emergency medical service), fatality movement, and medical supply chain. Overall, three health and medical lifelines were identified in the County for this MJHMP.



### 3.5.4 Energy

Energy lifelines include power grid (e.g., generation systems, transmission systems, distribution systems) and fuel (e.g., refineries, fuel storage, pipelines, gas stations). Four energy systems lifelines were identified in the County for this MJHMP.



### 3.5.5 Communication

Communication lifelines include infrastructure (e.g., wireless, cable systems, television/radio, internet), alerts/warnings/messages, 911 and dispatch, responder communications, and finance (e.g., banks and electronic payment processing). Overall, 51 communication lifelines were identified in the County for this MJHMP.



### 3.5.6 Transportation

Transportation lifelines include highway/roadway/motor vehicle (e.g., roads, bridges), mass transit, railway (e.g., freight, passenger), aviation, and maritime. Overall, 63 transportation lifelines were identified in the County for this MJHMP.



### 3.5.7 Hazardous Materials

Hazardous materials lifelines include facilities and HAZMAT, pollutants, or contaminants. Twenty locations identified by the Environmental Protection Agency (EPA) dataset are located in the County.



### 3.5.8 Water Systems

Water systems lifelines include potable water infrastructure (e.g., intake, treatment, storage, distribution) and wastewater management (e.g., collection, storage, treatment, discharge).

Overall, no water systems lifelines were identified for this MJHMP due to a lack of spatial data for analysis.

### 3.5.9 Development Trends

#### *Future Trends*

According to the Sierra County Housing Element 2024-29, the County has been experiencing a decline in population since 2020. The State estimates that the County's population (including Loyalton) will continue to decline to 2,711 by 2060. The County has an extremely low rental vacancy rate of 0.41%, which points to the need for more long-term rental housing in Sierra County. The County's housing vacancy rate continues to increase, growing with only 36% of units reported as seasonal in 2010 to over 52% in 2020. This is reflective of houses either being converted or built for vacation/seasonal units or limited occupancy purposes.

Although population has been generally declining in Sierra County since 2020, residential development continues to increase. In the previous planning period, development primarily involved construction of single-family homes on individual lots. No requests for development were received that involved development of lower densities than allowed by either the general plan or zoning code or lower than what was assumed in the County Housing Element sites inventory.

#### *Planning Framework*

Future growth and redevelopment in Sierra County will be directed by its General Plan. As a growth Management state, the State of California mandates that all cities and Counties develop and adopt General Plans. California Government Code 65041.1 established state planning priorities which are intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety in the state, including in urban, suburban, and rural communities, shall be as follows:

1. To promote infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.
2. To protect environmental and agricultural resources by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands; natural lands such as wetlands, watersheds, wildlife habitats, and other wildlands; recreation lands such as parks, trails, greenbelts, and other open space; and landscapes with locally unique features and areas identified by the state as deserving special protection.
3. To encourage efficient development patterns by ensuring that any infrastructure associated with development, other than infill development, supports new development that does all of the following:
  - a. Uses land efficiently.



- b. Is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision.
- c. Is located in an area appropriately planned for growth.
- d. Is served by adequate transportation and other essential utilities and services.
- e. Minimizes ongoing costs to taxpayers.

By providing goals and policies, the Sierra County General Plan guides development of Sierra County into the type of community that its citizens desire. The General Plan is a "constitution" for local decision-making that addresses the range of immediate, mid-, and long-term issues with which the community is concerned. The Plan is intended to allow land use and policy determinations to be made within a comprehensive framework that incorporates public health, safety, and quality of life considerations in a manner that recognizes the resource limitations and the fragility of the community's natural environment.

## 3.6 ECONOMY

### 3.6.1 Industry, Businesses, and Institutions

Government is the primary employer in Sierra County, making up 59% of all employment. Within the County's private-sector employment, service-providing is the largest industry, accounting for 31.25% of the total employment base.

According to the 2012 Sierra County General Plan, there were 69 employer establishments in the County. Of these employers, 83% have fewer than five employees and another 14% have five to nine employees. These are no particular centers or areas of employment in the County for most of these businesses. The largest government employment bases are in Loyalton and Downieville, with the schools and County government, and in Sierraville with the school and Forest Service. Table 3-5 highlights the largest employees in the County as of 2025.

Self-employed businesses account for approximately 25% of all employment within Sierra County, with 73.8% of those self-employed businesses. The largest number of self-employed businesses are in agriculture, forestry, fishing and hunting, and mining industries, at 53%, with the second largest at 44% in the construction industry.

**Table 3-5. Principal Employers in Sierra County**

Principal Employer	Industry	Location
Alleghany Volunteer Fire Department	Fire Departments	Alleghany
City of Loyalton Fire Department	Fire Departments	Loyalton
Downieville Schools	Schools	Downieville
Downieville Volunteer Fire Department	Fire Departments	Downieville
EPHC Loyalton Skilled Nurse	Skilled Nursing Care Facilities	Loyalton
Haypress Power Project	Electric Companies	Sierra City
Herrington's Sierra Pines	Resorts	Sierra City
Leonards-Loyalton	Grocers-Retail	Loyalton
Loyalton Elementary School	Schools	Loyalton
Loyalton Fire Department	Fire Departments	Loyalton
Loyalton High School	Schools	Loyalton
Pike City Volunteer Fire Department	Fire Departments	North San Juan



Principal Employer	Industry	Location
Sardine Lake Resort	Resorts	Sierra City
Senior Thrift Store	Thrift Shops	Loyalton
Sierra City Volunteer Fire	Fire Departments	Sierra City
Sierra County Coroner	Medical Examiners	Loyalton
Sierra County Fire Protection	Fire Departments	Sierraville
Sierra County Fire Protection	Fire Departments	Calpine
Sierra County Human Services	Government Offices-County	Downieville
Sierra County Human Services	Government Offices-County	Loyalton
Sierra County Public Works	Government Offices-County	Downieville
Sierra County Sheriff	Government Offices-County	Downieville
Sierra County Waterworks District	State Government-General Offices	Calpine
Sierraville Maintenance Sta	Government Offices-State	Sierraville
Western Sierra Med Clinic Inc	Physicians and Surgeons	Downieville

Source: (EDD 2025)

Table 3-6 summarizes the breakdown of industry types in the County, according to Sierra County’s Housing Element 2024-29. Arts, entertainment, recreation, accommodation, and food services remains the largest industry employer.

**Table 3-6. Employment in Sierra County by Industry Sector**

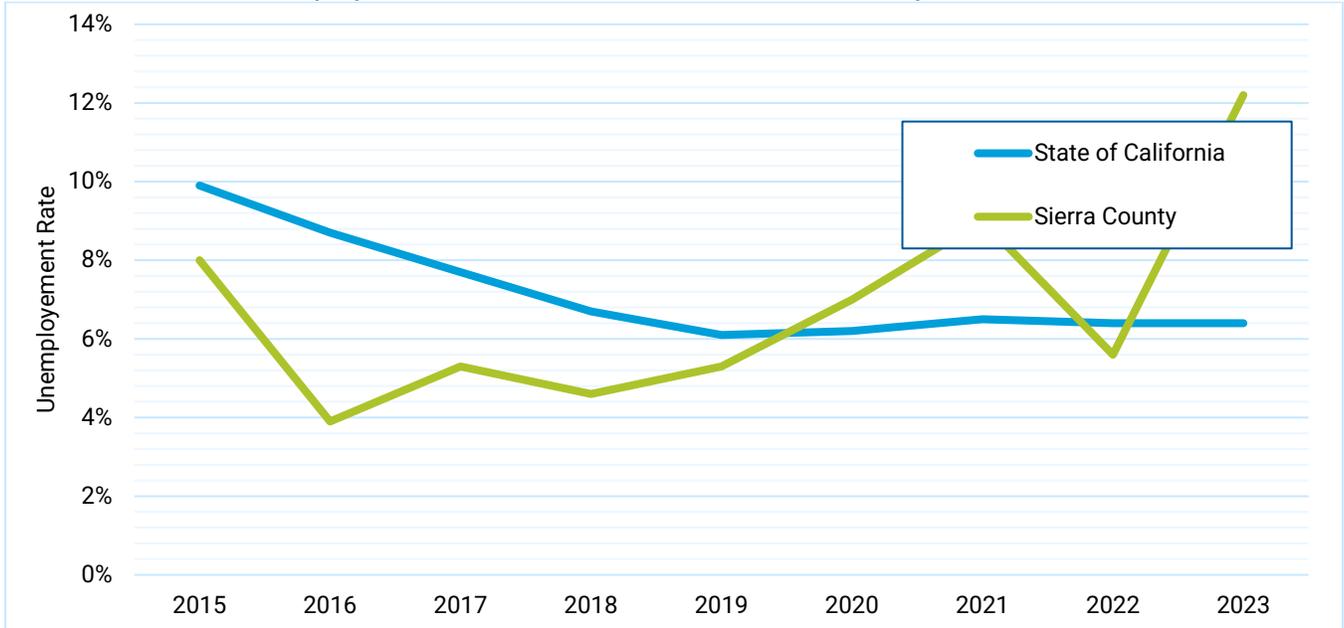
Industry Sector	Percentage
Agriculture, Forestry, Fishing and Hunting, Mining	14.3%
Construction	17.7%
Manufacturing	6.4%
Retail Trade	1.1%
Transportation and Warehousing, Utilities	4.5%
Finance and Insurance, Real Estate, Rental and Leasing	2.2%
Professional, Scientific, Management and Administrative, Waste Management Services	4.1%
Educational Services, Health Care and Social Assistance	16.9%
Arts, Entertainment, Recreation, Accommodation and Food Services	22.9%
Other Services (except Public Administration)	1%
Public Administration	8.8%

Source: (Sierra County 2025)

Based on the American Community Survey 5-year estimates data profiles from the U.S. Census Bureau, the unemployment rate for California in 2023 was approximately 6.4%. In contrast, Sierra County reported a slightly higher unemployment rate of 12.2%. Table 3-7 illustrates the unemployment rates for Sierra County in relation to the State. The local economic conditions, including limited industry diversity and geographic isolation, may contribute to fluctuations in employment levels, especially within 2021 through 2023. These factors can influence job availability and access, particularly in smaller, remote communities like Sierra County.



Table 3-7. Recent Unemployment Rates for California and Sierra County



Source: (U.S. Census 2025)

Figure 3-5. Downieville, the County Seat



(Photo Credit: LeTina Vanetti)

# Part 2

# Risk Assessment





## 4. HAZARDS OF CONCERN

### 4.1 WHAT IS A HAZARD OF CONCERN?

Defining the hazards that present the greatest risk to the planning area is the first step in assessing overall risk to the community. The Core Planning Team and Steering Committee reviewed available information to determine what types of hazards may affect the planning area, how often they can occur, and their potential severity.

Natural hazards are eligible for FEMA HMA grant funding and generally occur because of natural processes. Some natural hazards may also be caused by humans, such as dam failure and wildfire. Human caused hazards are not reviewed by FEMA for plan approval and are not eligible for FEMA HMA grant funding. The Core Planning Team and Steering Committee chose to add them in the Plan because of their current and potential impact on the County and to align with other County plans and programs.

### 4.2 FEDERAL DISASTER DECLARATIONS

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 4-1 summarizes the federal disaster declarations that included Sierra County since 1964.

Table 4-1. Federal Disaster Declarations in Sierra County

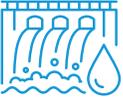
Disaster Number	Event Date Start Date	Incident Type	Title
EM-3592	March 9, 2023	Flood	Severe Winter Storms, Flooding, Landslides, and Mudslides
DR-4699	February 21, 2023	Severe Storm	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
DR-4558	August 14, 2020	Fire	Wildfires
DR-4482	January 01, 2020	Biological	COVID-19 Pandemic
DR-4308	February 1, 2017	Flood	Severe Winter Storms, Flooding, and Mudslides
DR-4301	January 3, 2017	Severe Storm	Severe Winter Storms, Flooding, and Mudslides
DR-1628	December 17, 2005	Severe Storm	Severe Storms, Flooding, Mudslides, and Landslides
DR-1155	December 28, 1996	Severe Storm	Severe Storms, Flooding, Mud and Landslides
DR-1046	February 13, 1995	Severe Storm	Severe Winter Storms, Flooding Landslides, Mud Flow
DR-979	January 5, 1993	Flood	Severe Winter Storm, Mud & Landslides, & Flooding
DR-758	February 12, 1986	Flood	Severe Storms & Flooding
EM-3023	January 20, 1977	Drought	Drought
DR-253	January 26, 1969	Flood	Severe Storms & Flooding
DR-183	December 24, 1964	Flood	Heavy Rains & Flooding

Source: (FEMA 2024)



### 4.3 NATURAL HAZARDS OF CONCERN AND HAZARDS OF INTEREST

Based on a review of the 2023 California State Hazard Mitigation Plan, the National Risk Index, and input from the Steering Committee, 10 hazards, listed alphabetically, were identified as natural hazards of concern affecting the County and will be addressed in this plan update:

- |   |  |
|---|--|
|  Avalanche     |  Flood  |
|  Dam Failure   |  Landslide/Mass Movement also includes a discussion on subsidence.        |
|  Drought       |  Volcanic Activity  |
|  Earthquake    |  Wildfire also includes discussions of tree mortality and wildfire smoke. |
|  Extreme Heat |  Winter Storm also includes a discussion of extreme cold.                |

Four hazards of interest listed below are discussed in a narrative, but not fully assessed in the plan.

- |   |   |
|---|---|
|  Cybersecurity   |  Transportation Hazards        |
|  Mass Gatherings |  Wildlife & Human Interactions |

Please refer to Appendix A for a complete comparison of hazards included in the 2023 California State Hazard Mitigation Plan, the 2012 Sierra County Hazard Mitigation Plan, and this plan update.



## 5. RISK ASSESSMENT METHODOLOGY AND TOOLS

### 5.1 ASSESSING RISK

In hazard mitigation planning, risk is the potential for damage or loss when natural hazards interact with people or assets, such as buildings, infrastructure, and resources. A risk assessment is a process used to identify potential hazards and analyze what could happen if a disaster or hazard occurs. It involves a data-driven analysis to identify potential hazards, what could happen if hazards occur, and determine vulnerabilities to hazards (FEMA 2023).

The risk assessment process focuses on three main elements – hazard identification, exposure identification, and vulnerability identification and loss estimation.

### 5.2 RISK ASSESSMENT TOOLS



Local Plan Requirement A4 – 44 CFR Part 201.6(b)(3)

*Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

For this HMP, GIS and FEMA’s Hazus software were used to conduct the risk assessment.

#### 5.2.1 Mapping

GIS tools provide a mechanism to perform quantitative analysis. Hazards that have specified geographic boundaries permit analysis using GIS. These hazards include the following:

- Dam Failure
- Earthquake
- Flood
- Landslide/Mass Movement
- Wildfire

#### 5.2.2 Modeling

FEMA’s Hazus Model 6.1 was used to evaluate the following hazards:

- Earthquake—A Level 2 analysis was performed to assess earthquake exposure and vulnerability for four deterministic scenarios: 2,500-year probability, Mohawk Valley M7.13, and Polaris M6.79. The Hazus methodology uses ground motion and ground failure fragility curves to estimate damage state probabilities which are then used to estimate losses at the Census tract level.



## **Overview**

FEMA developed the Hazards U.S., or Hazus, model in 1997 to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology with new models for estimating potential losses from hurricanes and floods. The use of Hazus for hazard mitigation planning offers the following numerous advantages:

- Provides a consistent methodology for assessing risk across geographic and political entities.
- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a HMP throughout its implementation.

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, community lifelines, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program can be used to map hazard data and the results of damage and economic loss estimates for buildings and infrastructure.

## **Level of Detail for Evaluation**

Hazus provides default data for inventory, vulnerability and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out the following three levels of analysis, depending on the format and level of detail of information about the planning area:

- Level 1—All of the information needed to produce an estimate of losses is included in the software’s default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- Level 2—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- Level 3—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.



## 5.3 RISK ASSESSMENT APPROACH

This plan evaluated risks associated with each identified hazard for the County. Each hazard was profiled using the following steps:

- *Description of the Hazard*: Defining the hazard and a discussion of potential impacts
- *Location*: Geographic areas most affected by the hazard
- *Extent*: Measuring the intensity of the hazard, warning time for preparations, and the reasonable worst-case scenario
- *Previous Occurrences*: Summary of past events that have impacted the planning area
- *Future Occurrences*: Probability estimates, including potential frequency and intensity shifts caused by climate change and population and development trends

For each hazard, one of the following assessment approaches was used, depending on the type of information available for the hazard:

- *Quantitative assessment*—Performed when numerical data are available to define risk. Available numerical hazard data may include financial impact and probability.
- *Qualitative assessment*—Uses words to describe and categorize the likelihood and consequences of a risk when numerical data are unavailable.

Vulnerability of exposed structures and infrastructure was evaluated by estimating the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard.

- Impact on Life, Health, and Safety
- Impact on General Building Stock
- Impact on Community Lifelines
- Impact on the Economy
- Impact on Historic and Cultural Resources
- Impact on Natural Resources
- Change in Vulnerability Since the Previous HMP

A range of potential opportunities for mitigating each hazard is included for jurisdictions to consider during the development of their mitigation strategies.

## 5.4 SOURCES OF DATA USED IN RISK ASSESSMENT

Hazard information and data were collected for all hazards from a variety of sources, described in the sections below.

### 5.4.1 Building and Cost Data

Parcel and building information from the Sierra County Assessor were used to compile a detailed, citywide structure inventory including replacement costs. Replacement cost is the cost to replace the



entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in RS Means Square Foot Costs. It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. The construction class and number of stories for single-family residential structures also factor into determining the square foot costs.

### 5.4.2 Community Lifelines

An inventory of critical facilities and infrastructure was compiled from city, county, state, and national datasets. The facilities were categorized by FEMA's Community Lifelines: Safety and Security; Food, Hydration, Shelter; Health and Medical; Energy; Communications; Transportation; Hazardous Material; and Water Systems. To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

### 5.4.3 Population

Vulnerable communities for mitigation planning are defined through two categories: visiting populations and isolated populations. In preparation for spatial overlays with the hazard data, the planning areas was divided into three geographic zones: Loyalton, Eastern Sierra County, and Western Sierra County.

### 5.4.4 Hazus Data Inputs

The following hazard datasets were used for the Hazus analyses conducted for the risk assessment:

Earthquake—ShakeMap data from the USGS Building Seismic Safety Council 2014 Event Set were used for the analysis of this hazard. This set of ShakeMap earthquake scenarios is the authoritative USGS collection for the continental United States. The scenario fault ruptures are derived from the latest National Seismic Hazard Model. Landslide susceptibility data from the California Geological Survey (CGS) was also incorporated into the Hazus model to replace the default data.

### 5.4.5 Other Local Hazard Data

Local sources used in the risk and vulnerability assessment include the following:

- Dam Failure – An exposure analysis was conducted using dam failure inundation area data from the U.S. Army Corps of Engineers National Inventory of Dams (NID).
- Landslide – An exposure analysis was conducted using deep-seated landslide susceptibility data from CGS. This data differentiates areas based on rock strength and steepness of slopes combined to create susceptibility classes. For the purposes of the exposure analysis, the classes were grouped as follows:
  - Low– Susceptibility Classes I and II
  - Moderate – Susceptibility Classes III and V
  - High – Susceptibility Classes VII, VIII, and IX
  - Very High – Susceptibility Class X



- Wildfire – An exposure analysis was conducted using fire hazard severity zones data from CAL FIRE. These zones were mapped based on fuel loading, slope, fire weather, and other relevant factors including winds. The zones are classified as Moderate, High, or Very High fire hazard.

### 5.4.6 Data Source Summary

Table 5-1 describes the data used for spatially-based exposure and vulnerability assessments.

Table 5-1. Data Source Summary

Data	Source	Date(s)	Format(s)
Sierra County Boundaries	CA State GeoPortal	Downloaded 11/2024	Digital (GIS) format
Incorporated City Boundaries	Sierra County	Provided 8/2024	Digital (GIS) format
Incorporated City Boundaries	CA State GeoPortal	Downloaded 11/2024	Digital (GIS) format
Service or Taxing Districts Boundaries	Sierra County	Provided 8/2024	Digital (GIS) format
Water Districts Boundaries	CA State GeoPortal	2/2022	Digital (GIS) format
School Districts Boundaries	CA Dept of Education	8/2024	Digital (GIS) format
Fire Districts Boundaries	CAL FIRE	3/2024	Digital (GIS) format
Census Designated Places	Census Bureau	2024 version	Digital (GIS) format
Sierra County Parcels	Sierra County	4/2024	Digital (GIS) format
Assessor Property & Building Information	Sierra County	8/2024	Digital (tabular) format
Building Footprints	Microsoft	Downloaded 11/2024	Digital (GIS) format
California Statewide Zoning	CA Office of Planning and Research	10/2024	Digital (GIS) format
Recreation Structures	Esri US Federal Data (USGS National Map)	12/2024	Digital (GIS) format
Recreation Sites	United States Forest Service (USFS)	9/2023	Digital (GIS) format
Sierra County Mines	Mines	Provided 8/2024	Digital (GIS) format
Local Law Enforcement Locations	Homeland Infrastructure Foundation-Level Data (HIFLD)	2/2021	Digital (GIS) format
Police Station Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Fire Station Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Emergency Operations Center Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
California School District Offices 2023-24	CA Dept of Education	8/2024	Digital (GIS) format
California Schools 2023-24	CA Dept of Education	12/2024	Digital (GIS) format
School Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Medical Care Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Electric Power Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
California Power Plants	California Energy Commission	9/2024	Digital (GIS) format



Data	Source	Date(s)	Format(s)
Power Plants	HIFLD	9/2023	Digital (GIS) format
California Electric Transmission Lines	California Energy Commission	6/2024	Digital (GIS) format
Transmission Lines	HIFLD	12/2022	Digital (GIS) format
Repeater Sites	Sierra County	Provided 8/2024	Digital (GIS) format
Cellular Towers	HIFLD	7/2024	Digital (GIS) format
Microwave Service Towers	HIFLD	7/2024	Digital (GIS) format
SHN Lines	CA State GeoPortal	12/2024	Digital (GIS) format
TIGER/Line data	Census Bureau	2024 version	Digital (GIS) format
CRS - Functional Classification	CA State GeoPortal	7/2024	Digital (GIS) format
Train tracks	Sierra County	Provided 8/2024	Digital (GIS) format
California Rail Network	CA State GeoPortal	10/2023	Digital (GIS) format
Public Airport	CA State GeoPortal	10/2024	Digital (GIS) format
Airport Facilities	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Highway Bridges	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
Railway Bridges	Hazus v6.1	Hazus v6.1 released 11/2023	Digital (GIS) format
State Highway Bridges	CA State GeoPortal	12/2024	Digital (GIS) format
Local Bridges	CA State GeoPortal	3/2024	Digital (GIS) format
Facilities from the California Environmental Reporting System (CERS)	CalEPA	11/2024	Digital (GIS) format
Independence Dam (Main Dam) Sunny Day Breach inundation depth grid	USACE	Downloaded 9/2024	Digital (GIS) format
Effective DFIRM for Sierra County (dated 4/19/2019; latest LOMR effective 8/16/2013)	FEMA	9/27/2019	Digital (GIS) format
DWR Awareness 100 year	CA DWR	Downloaded 11/2024	Digital (GIS) format
Mohawk Valley M7.13 ShakeMap	USGS	5/16/2017	Digital (GIS) format
Polaris M6.79 ShakeMap	USGS	5/16/2017	Digital (GIS) format
CGS Map Sheet 48: Shear-wave Velocity in Upper 30m of Surficial Geology (Vs30)	CGS	9/30/2016	Digital (GIS) format
UCERF3 Faults	USGS	Downloaded 7/2024	Digital (GIS) format
CGS Map Sheet 58: Susceptibility to Deep-Seated Landslides in California	CGS	10/1/2018	Digital (GIS) format
Fire Hazard Severity Zones, in SRA Effective April 1, 2024	CAL FIRE	Downloaded 11/2024	Digital (GIS) format
Wildland Urban Interface	CAL FIRE	Downloaded 11/2024	Digital (GIS) format
Historic Fire Perimeters 2023	CAL FIRE	Downloaded 11/2024	Digital (GIS) format
State Responsibility Areas	CAL FIRE	12/2024	Digital (GIS) format



## 5.5 DATA LIMITATIONS

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment.

Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study.
- Incomplete or dated inventory, demographic, or economic parameter data.
- The unique nature, geographic extent, and severity of each hazard.
- Mitigation measures already employed by the participating municipalities.
- The amount of advance notice residents have to prepare for a specific hazard event.
- Uncertainty of climate change projections.

Hazus currently represents the industry best management practice for assessing risk in support of hazard mitigation planning. However, the Hazus model is limited by the availability of data to support its working components. The model makes assumptions where firm data are not available. Assumptions are used, for example, to estimate ground deformation caused by liquefaction. These model limitations can lead to an understatement or overstatement of risk.

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Sierra County will collect additional data to update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock utilizing best available data. Sierra County acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.



## 6. AVALANCHE

### 6.1 HAZARD PROFILE



#### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

#### 6.1.1 Description of the Hazard

##### *Defining the Hazard*

An avalanche is a rapid flow of snow down a hill or mountainside. Although avalanches can occur on any slope given the right conditions, certain times of the year and certain locations are naturally more dangerous than others (NWS, Avalanche Safety n.d.). Wintertime, particularly from December to April, is when most avalanches tend to happen. However, avalanche fatalities have been recorded for every month of the year. Avalanches occur when loading of new snow increases stress at a rate faster than strength develops, and the slope fails. Critical stresses develop more quickly on steeper slopes and where deposition of wind-transported snow is common. The vast majority of avalanches occur during or shortly after storms. This hazard generally affects a small number of people, such as snowboarders, skiers, and hikers, who venture into backcountry areas during or after winter storms. Roads and highway closures, damaged structures, and destruction of forests are also a direct result of avalanches. The combination of steep slopes, abundant snow, weather, snowpack, and an impetus to cause movement creates avalanches. Areas prone to avalanche hazards include hard-to-access areas deep in the backcountry.

##### *Cause of the Hazard*

An avalanche path describes the terrain where an avalanche can occur, from its starting point to its terminus. An avalanche path has three main parts: starting zone, avalanche track, and runout zone. Figure 6-1 depicts the following three parts (Avalanche, Start Zone n.d.):

- The **start zone** is the portion of the avalanche path where an avalanche releases. Start zones are located at the top of an avalanche path and are characterized by terrain steeper than about 30 degrees that lack dense forest cover.
- The **avalanche track** is the middle portion of the avalanche path covered by an avalanche in motion. It connects the start zone to the runout zone. An avalanche typically releases in the start zone above but will continue to flow and entrain more snow in the track, often gaining momentum.
- The **runout** is the lower portion of an avalanche path where the avalanche slows down and stops. The location of the runout depends on terrain characteristics and the relative size of the avalanche. Historic runout zones are commonly demarcated by mature trees. Under certain conditions, people can trigger avalanches from low in the runout zones which can then overrun their position.



Figure 6-1. Avalanche Path Parts



Several factors may affect the likelihood of an avalanche, including weather, temperature, slope steepness, slope orientation (whether the slope is facing north or south), wind direction, terrain, vegetation, and general snowpack conditions. Different combinations of these factors can create low, moderate, or extreme avalanche conditions. Some of these conditions, such as temperature and snowpack, can change on a daily or hourly basis. Snow avalanches are most likely to occur after a fresh snowfall adds a new layer to a snowpack. If new snow piles up during a storm, the snowpack may become overloaded, setting off a slide. Earthquakes and smaller vibrations, such as vibration from a single skier, can set off avalanches (National Geographic 2024).

### ***Summary of Potential Impacts***

Avalanches often result in the loss of life and serious injuries, particularly among outdoor enthusiasts such as skiers and mountaineers. Economically, avalanches can destroy infrastructure like roads, power lines, and buildings, leading to costly repairs and disruptions to local economies, especially in tourism-dependent regions. Environmentally, avalanches can strip mountainsides of vegetation, disrupt wildlife habitats, and alter landscapes through soil erosion and debris deposition. These events are influenced by factors such as snowpack conditions, terrain, and weather, and their frequency and intensity may be exacerbated by climate change.



### ***Cascading Hazard Impacts***

The most significant cascading impacts from snow avalanches are the closure of transportation corridors, which can isolate populations and interrupt commodity flows. Avalanches tend to occur independently of other types of hazards, although it is possible for avalanches to be triggered by severe weather and earthquakes. Avalanches might cause erosion on sloped terrain, thereby increasing the likelihood of future landslides. In addition, debris deposited in a river or stream because of avalanches might alter its flow and contribute to flooding later (CalOES 2023).

#### **6.1.2 Location**

Snow avalanches occur in the steep mountainous areas of California that receive significant amounts of snow. They are weather-related threats to communities, residents, and visitors in the high mountain areas of the State. Avalanches tend to occur in three distinct areas in California: the Eastern Sierras, the Central Sierra Nevada, and the southern part of the Cascade Range near Mount Shasta. Each avalanche-prone area has an organization monitoring conditions, forecasts, and safety information.

#### **6.1.3 Extent**

The central drainage divide of Sierra County above 8,000 feet is a prime avalanche danger zone. The area North from Highway 80 to Highway 49 in Sierra County is prime avalanche country. Avalanches usually occur above 7,500 to 8,000 feet in elevation, are due to three principal conditions/concerns, and are usually an annual threat.

#### ***Measuring Intensity***

Avalanche sizes vary depending on snowpack conditions and terrain. Avalanches are sized based on their destructive potential and relative size within a given avalanche path (Avalanche 2025).

The destructive potential of avalanches is a function of the mass, speed, and density of avalanche debris paired with the length and cross-section of the avalanche path. Observers rate the size of an avalanche based on its destructive potential: D1 avalanches are harmless, D2 avalanches can injure or kill people, D3 avalanches can destroy a house or car, D4 avalanches can destroy buildings or mature forests, and D5 avalanches can gouge the landscape. Given the somewhat subjective nature of these descriptions, observers can further reference guidance defining typical mass, deposit volumes, impact pressures, and lengths to rate destructive size. While typical avalanche length is the easiest to quantify in the field, it is the least reliable measure of size. An avalanche of a given destructive size has a wide range of potential runout lengths, depending on the width and thickness of the avalanche and the characteristics of the terrain (Avalanche 2025). Figure 6-2 shows the D Scale, an estimate of the destructive potential of moving avalanche debris, rated on a scale from 1 to 5.



Figure 6-2. D Scale Avalanche Classifications

Size	Destructive potential	Typical length	Typical deposit volume
D1	Rel. harmless to people	Bus	Avg apartment ≤ 1 m deep
D2	Injure/bury/kill a person	Football field	Floor large house ~2 m deep
D3	Bury/destroy a car or house	1 km	Hockey rink 2-3 m deep
D4	Destroy a large truck or 4 ha forest	2 km	4 hockey rinks 4 m deep
D5	Destroy a village or 40 ha forest	3 km	5+ football fields 8 m deep

The relative size of an avalanche is a holistic measure considering everything that contributes to the size of the avalanche, including the depth and width of the slab, the distance from the crown to the staunchwall, and the amount of snow entrained in the track. R1 avalanches are very small relative to what the path can produce, R3 avalanches are medium relative to the path, and R5 avalanches are maximum relative to the path. The relative size scale is a function of many factors including the horizontal extent and vertical depth of the fracture, the volume and mass of debris, and the runout distance of the avalanche on a given terrain feature. Figure 6-3 outlines the relative size rated on a scale from 1 to 5.

Figure 6-3. R Scale Avalanche Classification





**Warning Time**

The North American Public Avalanche Danger Scale (NAPADS) is a system that rates avalanche danger and provides general travel advice based on the likelihood, size, and distribution of expected avalanches. It consists of five levels, from least to highest amount of danger: 1 – Low, 2 – Moderate, 3 – Considerable, 4 – High, 5 – Extreme. Danger ratings are typically provided for three distinct elevation bands. Although the danger ratings are assigned numerical levels, the danger increases exponentially between levels. In other words, the hazard rises more dramatically as it ascends toward the higher levels on the scale (Avalanche 2025). The scale is presented on Figure 6-4.

Figure 6-4. North American Public Avalanche Danger Scale

<b>North American Public Avalanche Danger Scale</b> <i>Avalanche danger is determined by the likelihood, size, and distribution of avalanches.                      Safe backcountry travel requires training and experience. You control your risk by choosing when, where, and how you travel.</i>				
Danger Level		Travel Advice	Likelihood	Size and Distribution
<b>5 - Extreme</b>		<b>Extraordinarily dangerous avalanche conditions.</b> Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Very large avalanches in many areas.
<b>4 - High</b>		<b>Very dangerous avalanche conditions.</b> Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
<b>3 - Considerable</b>		<b>Dangerous avalanche conditions.</b> Careful snowpack evaluation, cautious route-finding, and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
<b>2 - Moderate</b>		<b>Heightened avalanche conditions on specific terrain features.</b> Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
<b>1 - Low</b>		<b>Generally safe avalanche conditions.</b> Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.

The National Weather Service (NWS) provides current weather conditions and forecast information to regional avalanche forecast centers that in turn issue avalanche forecasts. Avalanche warnings and special advisories are included on NWS websites and broadcast over National Oceanic Atmospheric Administration (NOAA) Weather Radio (NWS, Avalanche Safety n.d.). In California, several avalanche centers provide forecasts, advisories, and warnings. The Eastern Sierra Avalanche Center focuses on the Eastern Sierra Nevada mountain range in California. The Sierra Avalanche Center, based in Truckee, focuses on the Central Sierra Nevada/Lake Tahoe area (Sierra Avalanche Center n.d.), which also includes parts of Sierra County.



**Worst-Case Scenario**

The worst-case scenario for avalanches in Sierra County would be an avalanche with a destructive potential of a scale of 5 at a relative scale of R5, and a NAPADS scale of 5.

**6.1.4 Previous Occurrences**

The following sections provide a review of previous avalanche occurrences in Sierra County.

**Declarations**

**Federal Declarations**

Between 1954 and 2024, Sierra County experienced no avalanche-related disasters (DR) or emergencies (EM).

**State Declarations**

Between 2012 and 2024, California declared no disasters related to avalanche activity in Sierra County.

**USDA Declarations**

Between 2012 and 2024, the USDA declared no disasters related to avalanche activity in Sierra County.

**Summary of Significant Events**

In 1853, a major avalanche destroyed Sierra City. This event is unlikely to reoccur due to the regrowth of timber around the area. The approximate cause of this avalanche was record snowfalls coupled with the overharvesting of the forest in the immediate area of the community. Numerous small avalanches occur annually with the destruction of unoccupied homes and outbuildings as recent as the winter of 2011. No lives have been lost due to avalanche in Sierra County since 1853 (Sierra County Office of Emergency Services 2012).

**Recent Events**

Numerous small avalanches occur annually. The NOAA NCEI Storm Events Database categorizes Sierra County in the following zones: West Slope Northern Sierra Nevada and Lassen-Eastern Plumas – Eastern Sierra Counties. The database reported two avalanche events impacting one of the zones from 2012 through 2024. Table 6-1 shows a summary of significant avalanche events (NOAA 2025).

Table 6-1. Recent Avalanche Hazard Events

Date (s) of Event	Disaster Declaration	County Included	Description
December 24, 2012	426142	West Slope Northern Sierra Nevada (Zone)	A series of Pacific storms tracked across Northern California Thursday through the weekend bringing periods of moderate to heavy snow in the mountains and gusty winds. Low snow levels brought snow as low as 500 feet before snow levels rose to 3000 to 4500 feet by the weekend. Significant rainfall was brought to the lower elevations. Winds gusted up to 40-55 mph in the Northern, Central, and Southern Sacramento Valley, as well as the northeast foothills and northern Sierra Mountains, on December 23. These winds caused an estimated 10,000 to 30,000 power outages, and also resulted in downed trees and



Date (s) of Event	Disaster Declaration	County Included	Description
			<p>tree branches. Power outages were located near the Redding vicinity, mountain valleys such as Quincy and Chester, near the Chico/Paradise/Oroville area, and also the Sacramento metropolitan. Two fatalities occurred with this episode: one fatality due to a fallen tree, and one fatality due to an avalanche.</p> <p>One fatality occurred when a male snowboarder, age 49, was caught in an avalanche at Donner Ski Ranch on Dec. 24 that occurred between 11 a.m. and noon. The man's body was found under 2-3 feet of snow at the base of the avalanche. The wind had blown snow to depths of 7 feet or more where the man was snowboarding.</p>
April 1, 2019	821593	West Slope Northern Sierra Nevada (Zone)	<p>Redeveloping thunderstorms brought road flooding and a minor debris flow from heavy rain; An avalanche closed Highway 50 at Echo Summit. Up to 3 inches of snow fell in the Sierra.</p> <p>Caltrans reported the closure is between Echo Summit and Chiapa Road in nearby Meyers, reopening at 5 p.m. PST.</p>

Source: NOAA

### 6.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections that follow.

#### **Probability**

The probability of future avalanche occurrences in Sierra County is occasional or annually during average to above average snowpack years.

#### **Climate Change**

While avalanches are a natural part of snowy mountain ecosystems, increases in air temperature, precipitation, and rain-on-snow events are altering avalanche patterns and behaviors, making them more frequent in some areas and more destructive in others, and generally harder to predict. (USGS 2025). Some experts believe that an overall reduction in snowpack could lead to fewer avalanches in winter but changing precipitation patterns could make avalanches more frequent in the springtime instead (Peitzsch, et al. 2021).

#### **Potential Future Impacts**

The fact that avalanches take place in remote settings far from large population centers means they do not pose the same degree of danger to life and property as other hazards do. The people most vulnerable to avalanches tend to be skiers, snowboarders, and others engaged in recreational activities in snow-covered, mountainous areas. Transportation infrastructure and structures that serve those areas also are vulnerable (CalOES 2023).



## 6.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 6.2.1 Summary of Vulnerability

Avalanches pose a localized but potential threat in Sierra County, particularly in mountainous regions. While the overall population exposure is limited due to the remote nature of avalanche-prone areas, the risk remains significant for outdoor recreationists, tourists, and seasonal workers. There are currently no models available to measure direct impacts from avalanche risks, therefore, for this assessment vulnerability has been associated with exposure. The following vulnerability assessments are qualitative in nature.

### 6.2.2 Impact on Life, Health, and Safety

Avalanches directly impact life and safety for individuals engaged in outdoor recreations, such as skiing, snowboarding, snowmobiling, and backcountry hiking. Tourists unfamiliar with local terrain and avalanche risks may be particularly vulnerable. Both residents and visitors may be vulnerable to the avalanche hazard, especially in the mountainous western side of the County.

### 6.2.3 Impact on General Building Stock

With no mapping of avalanche hazard zones available, there is no valid way to quantify the exposure of State assets to this hazard. Given the remoteness of avalanche areas, it is unlikely that State-owned or leased facilities are directly exposed. Critical infrastructure such as roads are more likely to be exposed. Impacts on these lifelines could isolate populations and interrupt commodity flows.

Snow avalanche events are not likely to result in any losses associated with damage or impairment to State assets. All losses from this hazard would be associated with impacts on the economy, based on limitations on activities in avalanche risk areas.

### 6.2.4 Impact on Community Lifelines

Avalanches can severely impact community lifelines, particularly transportation and emergency services. Roads and highways in mountainous terrain are susceptible to closure or damage, which can delay emergency response times and restrict access to essential services. The extent of property damage from avalanches depends on several factors, including snowpack volume, slope angle, terrain features, and the presence of structures in the avalanche path. Large external snow loads can exert immense pressure on buildings and infrastructure, potentially resulting in structural collapse and fatalities.



### 6.2.5 Impact on the Economy

Avalanches can have a profound impact on transportation networks. Roads, railways, and other infrastructure can be blocked or damaged by snow slides, affecting the movement of goods and people. For example, in mountainous regions, highways often suffer from closures after significant snowfall or shifting weather patterns. Delays can lead to economic losses, detours, and increased travel times. The complexity of managing snow removal in avalanche-prone areas adds another layer of challenge.

### 6.2.6 Impact on Historic and Cultural Resources

Before the avalanche of 1853, Sierra City had two large buildings, a bakery shop, and several gambling houses and saloons (Sierra County Chamber of Commerce 2024). This event erased many early structures and artifacts from the initial Gold Rush period, making it difficult for historians and archaeologists to study layout and architecture during its initial establishment as a mining town pre-1853. Avalanches can displace or bury archaeological materials. This makes it challenging to interpret the historical significance of artifacts or features that may have been part of mining camps, indigenous sites, or early settler homesteads. Today, avalanche-prone areas in the Sierra Buttes region pose risks to preserved or partially restored historic buildings and infrastructure, such as cabins, mills, and mining equipment.

### 6.2.7 Impact on Ecosystems and Natural Resources

Avalanches are extremely important to the mountain ecosystem (Muller and Straub 2016). They shape the landscape, adding heterogeneity, thus biodiversity, to an area. Avalanche chutes and debris create habitat for both flora and fauna and can serve as firebreaks and affect bark beetle outbreaks. Avalanches influence the survival, growth rates, and forms of trees. Trees that experience avalanches become stronger and more resilient, and these more robust trees in turn reduce the frequency of avalanches by reinforcing the snowpack and reducing the effects of strong winds.

### 6.2.8 Change in Vulnerability Since 2012 HMP

Since the 2012 HMP, Sierra County has experienced little change in population, with minimal new development in avalanche-prone areas. Due to the county’s mountainous terrain and remote communities, vulnerability to avalanches remains relatively stable. However, vulnerability may have increased slightly due to a modest rise in recreational use of backcountry areas, which could place more individuals at risk during winter months.

## 6.3 MITIGATION OPPORTUNITIES

Table 6-2 presents a range of potential opportunities for mitigating the avalanche hazard.

Table 6-2. Potential Opportunities to Mitigate the Avalanche Hazard

Community Scale	Organizational Scale	Government Scale
Manipulate the Hazard		
• None	• None	• None
Reduce Exposure and Vulnerability		



Community Scale	Organizational Scale	Government Scale
<ul style="list-style-type: none"> <li>• Monitor avalanche reports before any winter-related outdoor activities</li> <li>• Avoid avalanche areas</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Controlled avalanches as necessary (i.e., triggering an avalanche through detonation)</li> <li>• Install static defense structures in avalanche areas</li> <li>• Identify and map avalanche paths and avalanche areas in the State</li> <li>• Construct snow sheds over highways and railroads that cross potential avalanche paths</li> <li>• Have proper equipment to support rescue, mitigate head injuries, and create air pockets (avalanche beacon, portable shovel, avalanche probe in backpack, helmet, and avalanche airbags)</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and map avalanche paths and avalanche areas in the County</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>• Restrict or prohibit new development downslope of areas susceptible to avalanche and preserve these areas for open space/recreational uses</li> <li>• Preserve forest ecosystems in avalanche-prone areas to provide a resistance buffer area to absorb impacts from avalanches</li> </ul>		



## 7. DAM FAILURE

### 7.1 HAZARD PROFILE



#### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

#### 7.1.1 Description of the Hazard

##### *Defining the Hazard*

A dam is an artificial barrier that can store water, wastewater, or any liquid-borne material, for the purpose of storage or control of water. A dam failure is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release (ASDSO, Important Terms Defined for Media Coverage n.d.).

There are two types of dams (ASDSO, Dams 101 n.d.):

- Embankment Dams: An embankment dam is termed an “earthfill” or “rockfill” dam depending on whether it is composed of compacted earth or mostly compacted or dumped rock.
- Concrete Dams: They are commonly categorized as gravity, buttress, and arch according to designs used to resist stress due to reservoir water pressure.
  - Gravity dams are the most common form, and they are constructed of vertical blocks of concrete with flexible seals in the joints between the blocks.
  - Buttress dam is a specific type of gravity dam in which the large mass of concrete is reduced, and the forces are diverted to the dam foundation through vertical or sloping buttresses.
  - Arch dams are typically rather thin in cross-section. The reservoir water forces acting on an arch dam are carried laterally into the abutments.

##### *Cause of the Hazard*

The Association of State Dam Safety Officials identifies the most likely causes of dam failures as follows (ASDSO, Dam Failures and Incidents n.d.):

- Overtopping caused by water spilling over the top of a dam. Overtopping of a dam is often a precursor of dam failure.
- Foundation defects, including settlement and slope instability.
- Cracking caused by movements like the natural settling of a dam.
- Inadequate maintenance and upkeep.
- Seepage through a dam that is not properly filtered, so that soil particles form sinkholes in the dam.



**Summary of Potential Impacts**

Hundreds of dam failures have occurred throughout U.S. history. These failures have caused immense property and environmental damages and have taken thousands of lives. As the nation’s dams age and population increases, the potential for deadly dam failures grows (ASDSO, Dam Failures and Incidents n.d.).

**Cascading Hazard Impacts**

Dam failure can cause cascading hazards such as landslides, bank erosion, and destruction of downstream habitat. Dam failure may worsen the severity of a drought by releasing water that might have been used as a potable water source. Other notable cascading impacts from dam failures include potential to impact multiple downstream jurisdictions, loss of power associated with facilities that provide hydropower, loss of water supply, damage to agricultural lands, and impacts on multiple jurisdictions.

**7.1.2 Location**

According to the Division of Safety of Dams, there are five dams within the jurisdiction of the state of California as of September 2024 (California Department of Water Resources 2025) in Sierra County that were constructed for flood control, storage, electrical generation, and recreational purposes. Figure 7-1 identifies rating categories for the five dams in Sierra County. Figure 7-2 outlines the County’s dam failure inundation areas.

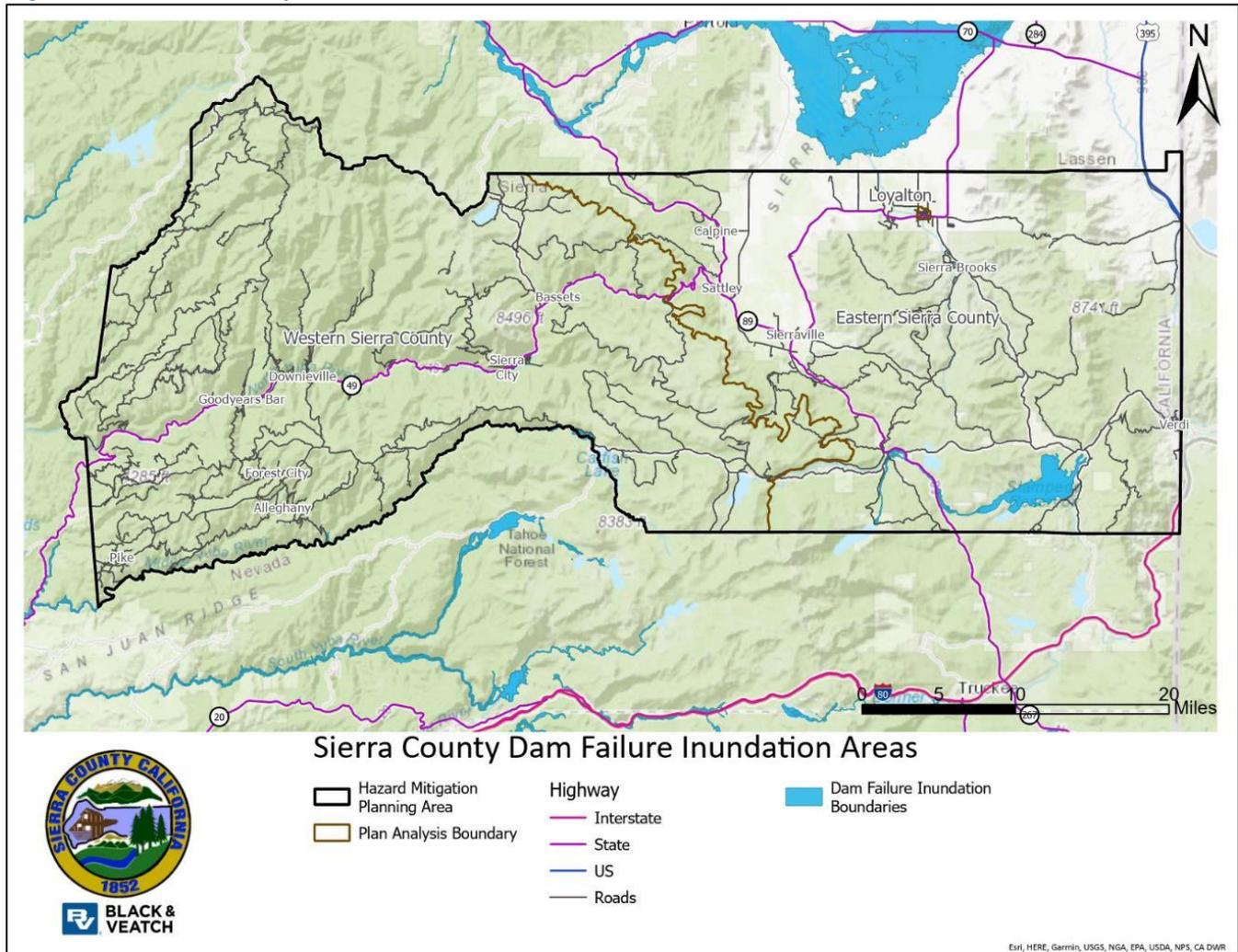
Figure 7-1. Jurisdictional Dams in Sierra County

Dam Number	Dam Name		Owner Name	Dam Height	Reservoir Capacity	Certified Status	Condition Assessment	County
National ID No.	Latitude	Longitude	Owner Type	Crest Length	Dam Type	Downstream Hazard	Reservoir Restrictions	Year Built
1034-2 CA00864	Hour House		Yuba County Water Agency	68	285	Certified	Satisfactory	Sierra
	39.41	-121.00	County, county agency, or county district	364	VARA	Low	No	1968
105-6 CA00458	Independence		Truckee Meadows Water Authority	31	18,500	Certified	Satisfactory	Sierra
	39.45	-120.29	Water agency or authority	847	ERTH	High	No	1939
291-0 CA00536	Lake Buck		Wendy Baroli and Jill S. Heaton	37	140	Certified	Fair	Sierra
	39.63	-120.00	Individual owner	500	ERTH	Low	Yes	1951
1-51 CA00038	Lower Sardine Lake		California Department of Fish and Wildlife	17	280	Certified	Satisfactory	Sierra
	39.62	-120.62	State agency	162	ERRK	Low	No	1965
290-0 CA00535	Palen		Harris Family Trust	25	146	Certified	Satisfactory	Sierra
	39.65	-120.31	Private company, corporation, LLC, partnership	260	ERTH	Low	No	1951

Source: (California Department of Water Resources 2025)



Figure 7-2. Sierra County Dam Failure Inundation Areas



### 7.1.3 Extent

#### Measuring Intensity

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) assigns a downstream hazard classification and condition assessment rating to large dams within the State. The downstream hazard is based solely on potential downstream impacts to life and property should the dam fail when operating with a full reservoir. This hazard is not related to the condition of the dam or its appurtenant structures. Table 7-1 outlines the potential classifications for downstream hazard.



Table 7-1. Downstream Hazard Categories

Downstream Hazard Potential Classifications	Description Potential Downstream Impacts to Life and Property
Low	No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.
Significant	No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
High	Expected to cause loss of at least one human life.
Extremely High	Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more.

DSOD uses NID's condition rating definitions (updated 2021) as a guideline in assigning condition assessments. A dam safety deficiency is defined as a load capacity limit or other issue that can result in a failure of the dam or appurtenant structure. It is a characteristic or condition that does not meet the applicable minimum regulatory criteria. Condition assessment definitions are shown in Table 7-2.

Table 7-2. Condition Assessment Ratings

Ratings	Definitions from the National Inventory of Dams
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Note: Rare or extreme event is defined by the regulatory agency based on their minimum applicable state or federal criteria.
Poor	A dam safety deficiency is recognized for normal operating conditions which may realistically occur. Remedial action is necessary. Poor may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Investigations and studies are necessary.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.
Not Rated	The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

### Warning Time

Warning time for dam failure varies depending on the cause of the failure, the size of the dam and volume of water retained, and the location of the dam. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Once a breach is initiated, discharging water erodes the breach until either the reservoir water is depleted, or the breach resists further erosion. The time of breach formation ranges from a few minutes to a few hours. (County of Monterey n.d.).



## ***Worst-Case Scenario***

A worst-case dam failure scenario for Sierra County would involve the sudden and complete breach of a high-hazard dam, releasing a massive volume of water downstream with little to no warning. Given the county's mountainous terrain and narrow river valleys, floodwaters would travel rapidly. Communities located downstream, especially those in low-lying areas, could face catastrophic flooding, resulting in significant loss of life, widespread property damage, and long-term displacement of residents. Critical infrastructure such as roads, bridges, and power lines could be destroyed, isolating affected areas and hampering emergency response efforts.

### **7.1.4 Previous Occurrences**

The following sections provide a review of previous dam failure occurrences in Sierra County.

#### ***Declarations***

##### **Federal Declarations**

Between 1954 and 2024, Sierra County experienced no dam failure-related disasters (DR) or emergencies (EM).

##### **State Declarations**

Between 2012 and 2024, California declared no disasters related to dam failure in Sierra County.

##### **USDA Declarations**

Between 2012 and 2024, the USDA declared no disasters related to dam failure in Sierra County.

#### ***Summary of Significant Events***

There have been no occurrences of dam failure in Sierra County since 1883.

#### ***Recent Events***

There have been no recent events of dam failure in Sierra County since 1883.

### **7.1.5 Future Conditions**

Future hazard conditions, including frequency and severity of future events, is discussed in the sections that follow.

#### ***Probability***

Since no recorded failures have occurred on a dam that impacted the planning area, no estimate of frequency or probability of future occurrence can be developed based on the historical record. However, the risk of failure increases as dams age (ASDSO 2024). Older dams are often more vulnerable to seismic activity and have a higher possibility of failure in the event of a major earthquake. That probability for failure is a statewide concern.



**Climate Change**

Probability of dam failure could increase with changing climate conditions. Increases in the frequency and intensity of extreme rain events could increase the probability that dams will fail or overtop. Although dam failure is not considered a direct result of a changing climate, changes in climate can impact the functionality of a dam’s infrastructure and/or the operation of dams. All dam operations are based on hydrographs. As the hydrographs change, dam operations will change. The 2017 Oroville Dam Spillway incident is a perfect example of how increased precipitation associated with climate change impacts affected dam operations.

**Potential Future Impacts**

The future impacts from dam failure on the County are not anticipated to increase since the current impacts are so negligible.

**7.2 VULNERABILITY ASSESSMENT**

**Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)**

*The plan must include a description of the jurisdiction’s vulnerability to the hazards of concern and include an overall summary of the hazard’s impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

**7.2.1 Summary of Vulnerability**

Risk assessment findings for dam failure are estimates of exposure. Because the analysis found very limited exposure to the dam failure hazard, a Hazus vulnerability assessment was not conducted.

No critical facilities are within the mapped dam failure inundation area, and no residential populations are exposed to the inundation area.

**7.2.2 Impact on Life, Health, and Safety**

The dam inundation area is very small and not anticipated to impact populations in the County. Table 7-3 summarizes the results.

Table 7-3. Estimated Dam Failure Impacts on Population

Planning Area	Population Exposed in Surrounding Census Blocks
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Note: Rare or extreme event is defined by the regulatory agency based on their minimum applicable state or federal criteria.



### ***Socially Vulnerable Populations***

No residential populations are exposed to the inundation area. Those who may be vulnerable are visitors in the backcountry area who may be unable to get themselves out of the inundation zone.

### **7.2.3 Impact on General Building Stock**

The potential dam inundation area in Sierra County is very small. According to GIS analysis, the inundation area does not include general building stock.

### **7.2.4 Impact on Community Lifelines**

No community lifelines are in the potential dam failure inundation zone.

### **7.2.5 Impact on the Economy**

The potential impacts are limited to an exposure analysis with no specific estimated damage. However, economic impacts could include cascading effects of a temporary loss of access to the City Public Works Yard and interruption of water well capacity.

### **7.2.6 Impact on Historic and Cultural Resources**

The dam failure hazard is not expected to impact historic resources.

### **7.2.7 Impact on Ecosystems and Natural Resources**

The environment would be vulnerable to risk in the event of dam failure. The inundation could introduce foreign elements into local waterways. This could result in destruction of the downstream habitat and could have detrimental effects on animals.

### **7.2.8 Change in Vulnerability Since 2012 HMP**

The vulnerability to dam failure in Sierra County has not significantly changed since 2012. The population remains sparse and stable, and there has been no development downstream of existing dams. Given the county's isolated nature and limited infrastructure expansion, the risk profile remains largely unchanged. Any slight increase in vulnerability would be due to aging dam infrastructure rather than population or development pressures.

## **7.3 MITIGATION OPPORTUNITIES**

Table 7-4 presents a range of potential opportunities for mitigating the dam failure hazard.

**Table 7-4. Potential Opportunities to Mitigate the Dam Failure Hazard**

<b>Community Scale</b>	<b>Organizational Scale</b>	<b>Government Scale</b>
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>Remove dams</li> <li>Harden dams</li> </ul>	<ul style="list-style-type: none"> <li>Remove dams</li> <li>Harden dams</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>Relocate out of dam failure inundation areas</li> </ul>	<ul style="list-style-type: none"> <li>Replace or rehabilitate dams with deficiencies</li> </ul>	<ul style="list-style-type: none"> <li>Replace earthen dams with hardened structures</li> </ul>



Community Scale	Organizational Scale	Government Scale
<ul style="list-style-type: none"> <li>Elevate home to appropriate levels</li> </ul>	<ul style="list-style-type: none"> <li>Flood-proof facilities within dam failure inundation areas</li> </ul>	<ul style="list-style-type: none"> <li>Relocate critical facilities out of dam failure inundation areas</li> <li>Consider open space land use in designated dam failure inundation areas</li> <li>Adopt higher floodplain standards in mapped dam failure inundation areas</li> <li>Retrofit critical facilities within dam failure inundation areas</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>Learn about risk reduction for the dam failure hazard</li> <li>Learn the evacuation routes for a dam failure event</li> <li>Become educated about early warning systems and the dissemination of warnings</li> </ul>	<ul style="list-style-type: none"> <li>Educate employees on the probable impacts of a dam failure</li> <li>Develop a continuity of operations plan</li> </ul>	<ul style="list-style-type: none"> <li>Map dam failure inundation areas</li> <li>Enhance emergency operations plan to include a dam failure component</li> <li>Institute monthly communications checks with dam operators</li> <li>Inform the public on risk reduction techniques</li> <li>Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas</li> <li>Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard</li> <li>Establish early warning capability downstream of listed high-hazard dams</li> <li>Consider the residual risk associated with protection provided by dams in future land use decisions</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>Restore and reconnect floodplains that intersect dam failure inundation areas that have been degraded by development and structural flood control</li> <li>Use soft approaches for stream bank restoration and hardening. Soft approaches can include but are not limited to the introduction of large woody debris into a system</li> <li>Set back levees on systems that rely on levee protection to allow the river channel to meander, which reduces erosion and scour potential</li> <li>Acquire property within dam failure inundation areas, remove or relocate structures, and preserve these areas as open space in perpetuity</li> <li>Preserve floodplain storage capacity by limiting or prohibiting the use of fill within the floodplain</li> </ul>		



## 8. DROUGHT

### 8.1 HAZARD PROFILE



#### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

#### 8.1.1 Description of the Hazard

##### *Defining the Hazard*

Drought is defined as a deficiency in precipitation over an extended period that results in a water shortage (National Integrated Drought Information System n.d.). It is a gradual phenomenon and occurs slowly over a period of time (California Governor's Office of Emergency Services 2024). Drought can have devastating impacts on communities due to its cascading impacts, including but not limited to negative impacts on public health, tree mortality, land subsidence, water quality, and energy as well as increased wildfire risk.

The occurrence of drought is a normal phase in the climate cycle of most regions, originating from a deficiency of precipitation over an extended period of time, usually a season or more. This leads to a water shortage for some activity, group, or environmental sector. Drought can be characterized based on the following:

- Meteorological measurements such as rainfall deficit compared to normal or expected rainfall.
- Agricultural impacts due to reduced rainfall and water supply (e.g., crop loss, herd culling, etc.).
- Hydrological measurements of stream flows, groundwater, and reservoir levels relative to normal conditions.
- Direct and indirect socio-economic impacts on society and the economy (e.g., increased unemployment due to failure of an industry because of drought).

##### *Cause of the Hazard*

Drought can be caused by various atmospheric conditions such as climate change, ocean temperatures changes in the jet stream, and changes in the local landscape (NASA, 2024). Droughts are long-term climatic patterns that emerge from complex interactions among global weather patterns. Persistent, upper-level high-pressure systems along the West Coast result in warm, dry air and reduced precipitation. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of global weather systems.

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months



or years, the drought is considered long-term. It is possible for a region to experience a long-term pattern that produces drought, and to have short-term changes that result in wet spells within the long-term pattern. Likewise, it is possible for a long-term wet pattern to be interrupted by weather spells that result in short-term drought.

### ***Summary of Potential Impacts***

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to structures, as do other natural disasters.

The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- **Economic Impacts**—These impacts of drought cost people (or businesses) money. Farmers' crops are destroyed; low water supply necessitates spending on irrigation or drilling of new wells; water-related businesses (such as sales of boats and fishing equipment) may experience reduced revenue.
- **Environmental Impacts**—Plants and animals depend on water. When a drought occurs, their food supply can shrink, and their habitat can be damaged.
- **Social Impacts**—Social impacts include public safety, health, conflicts between people when there is not enough water to go around, and changes in lifestyle.

The demand that society places on water systems and supplies—such as expanding populations, irrigation, and environmental needs—contributes to drought impacts. Drought can lead to difficult decisions regarding the allocation of water, as well as stringent water use restrictions, water quality problems, and inadequate water supplies for fire suppression. There are also issues such as growing conflicts between agricultural uses of surface water and in-stream uses, surface water and groundwater interrelationships, and the effects of growing water demand on uses of water.

Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand. The impacts of drought vary between sectors of the community in both timing and severity:

- **Water supply**—The water supply sector encompasses urban and rural drinking water systems that are affected when a drought depletes groundwater supplies due to reduced recharge from rainfall.
- **Agriculture and commerce**—Impacts on the agriculture and commerce sectors include the reduction of crop yield and livestock sizes due to insufficient water supply for crop irrigation and maintenance of ground cover for grazing.
- **Environment, public health, and safety**—The environmental, public health, and safety sector focuses on wildfires that are both detrimental to the forest ecosystem and hazardous to the public. It also includes the impact of desiccating streams, such as the reduction of in-stream habitats for native species.



## ***Cascading Hazard Impacts***

Cascading impacts result from when one type of hazard event triggers one or more other hazard events, which may in turn still trigger others. The following sections describe notable cascading impacts associated with drought:

### **Public Health**

Drought can lead to various physical and mental health impacts: diminished water quality, groundwater contamination, reduced air quality from arid lands and dust, and increased stagnant water creating breeding grounds for disease-carrying pests, such as mosquitoes. These impacts, in turn, increase the risk of water food-borne diseases, worsen chronic respiratory conditions, and increase risk of Valley fever as well as vector-borne diseases. Drought and its consequences can also lead to increased mental health impacts, including acute or post-traumatic stress, substance abuse, domestic violence, and suicide (California Governor's Office of Emergency Services 2024).

### **Wildfire**

Droughts can create hazardous conditions in forests and other vegetation-covered spaces, providing fuel for wildfires and exacerbating the severity of potential wildfires (LAO 2022). Additional information on Sierra County wildfires can be found in Section 14 of the HMP.

### **Tree Mortality**

Droughts put stress on trees and can make them more susceptible to pest infestations, increasing tree mortality. This phenomenon has resulted in millions of dead trees around the State, causing hazards to people, property, and infrastructure and creating a greater risk of wildfires (Borrunda 2020). According to the Fourth National Climate Assessment Report, the combination of expanding bark beetle populations due to warming winter and worsening droughts has killed 7% of the western U.S. Forest area from 1979 to 2012 (U.S. Global Change Research Program 2018); (California Governor's Office of Emergency Services 2024).

### **Subsidence**

Groundwater pumping greatly increases during dry years. Overpumping can cause land subsidence, which can permanently damage or collapse underground aquifers, increase flood risk in low-lying areas, and pose hazards to buildings, infrastructure, and water storage facilities (USGS 2018). If long-term, subsidence can alter water system flow patterns and restrict capabilities to move and distribute water supplies to and within subsided areas (California Governor's Office of Emergency Services 2024).

### **Water Quality**

Overpumping of groundwater can lead to contamination from agricultural runoff or infiltration of saltwater in coastal basins, diminishing groundwater quality. This can cause water to become unsafe to drink and require costly treatment to remove contaminants. This challenge can be insurmountable for rural residents who rely on private wells as well as water systems that are dependent on local basins or aquifers (Hanak, Lund and Harter 2017); (California Governor's Office of Emergency Services 2024). This



issue is especially applicable to Sierra County as it is the second least-populated county in the state of California.

**Energy**

Energy and water are interdependent as all sources of energy require water in their production processes, and energy is required to extract, convey, and deliver water. Because of this, the availability and predictability of water resources can directly affect energy systems (California Governor's Office of Emergency Services 2024).

**8.1.2 Location**

The entire State of California is vulnerable to drought. While the conditions of drought are not experienced uniformly across the State, Sierra County is included in the vulnerable areas and covers 980 square miles along California’s border with Nevada. Within Sierra County, drought is typically experienced uniformly rather than confined to a specific area. A drought’s impact can depend on climate zone, type of water supply available, and water users’ ability to manage drought impacts.

In California, one dry year does not normally constitute a drought. The State’s extensive system of water supply infrastructure, which includes reservoirs, groundwater basins, and interregional conveyance facilities, are designed to mitigate the effects of short-term dry periods for most water users (DWR n.d.). However, prolonged dry periods still lead to water shortage emergencies, especially in rural communities.

**8.1.3 Extent**

*Measuring Intensity*

Droughts are dynamic, and locations of the State susceptible to drought can change monthly. The U.S. Drought Monitor is a map that is updated weekly to show the location and intensity of drought across the country. The drought monitor uses the five-category system shown in Table 8-1.

Table 8-1. U.S. Drought Monitor Categories

Category	Description	Possible Impacts
D0	Abnormally Dry	<ul style="list-style-type: none"> <li>• Short-term dryness slowing planting, growth of crops</li> <li>• Some lingering water deficits</li> <li>• Pastures or crops not fully recovered</li> </ul>
D1	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Some water shortages developing</li> <li>• Voluntary water-use restrictions requested</li> </ul>
D2	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture loss likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>
D3	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>
D4	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water creating water emergencies</li> </ul>



## Warning Time

The State of California uses three indicators to define the severity of a drought: weather, runoff, and water supply. Most of California's moisture originates from the Pacific Ocean. During the wet season, the atmospheric high-pressure belt that sits off western North America shifts southward, allowing Pacific storms to bring moisture to California. On average, 75% of the State's average annual precipitation occurs between November and March, with half of it occurring between December and February. A persistent high-pressure zone over California during the peak winter water production months predisposes the water year to be dry. The ability to reliably predict precipitation conditions at seasonal or annual timescales is very limited. The El Niño-Southern Oscillation—a periodic shifting of ocean atmosphere conditions in the tropical Pacific that ranges from El Niño (warm phase) to neutral to La Niña (cold phase)—offers only limited predictive capability for precipitation in California. La Niña conditions tend to favor a drier outlook for Southern California, but do not typically show significant correlation with water year type for Northern and Central California. Seasonal precipitation forecasting is an important drought response tool and a research area requiring focused investment to develop the predictive ability needed to support water management. Dry conditions become a drought when the impacts of prolonged dry conditions create problems (California Governor's Office of Emergency Services 2024).

## Worst-Case Scenario

The worst-case drought scenario for Sierra County would include a D4 drought compounded by high winds. This would not only intensify typical impacts caused by water shortage but also increase wildfire risk and reduce the county's capability to respond to emergencies. An extreme multi-year drought can impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon Sierra County.

## 8.1.4 Previous Occurrences

The following sections provide a review of previous drought occurrences in Sierra County.

### Declarations

#### Federal Declarations

Between 1954 and 2024, FEMA declared that Sierra County experienced one drought-related disaster (DR) or emergency (EM).

Table 8-2. FEMA Drought Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-3023	January 20, 1977- December 20, 1978	January 20, 1977	FEMA declared that drought was present in Sierra County, CA on January 20, 1977.

Source: OpenFEMA Datasets ([OpenFEMA Data Sets | FEMA.gov](https://openfema.org/))

#### State Declarations

Between 2012 and 2024, California declared no disasters related to drought in Sierra County.



## USDA Declarations

Between 2012 and 2024, the USDA declared that Sierra County experienced disasters relating to drought.

Table 8-3. USDA Drought Disaster Declarations

Disaster Number	Incident Period	Description
S5371	10/1/2022 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S5379	1/1/2023 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S5146	10/1/2021 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S5155	1/1/2022 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4916	10/1/2020 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4921	1/1/2021 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4697	4/21/2020 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4765	6/23/2020 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4824	9/29/2020 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S4427	8/28/2018 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S3952	1/1/2016 - ongoing	The USDA declared that drought, wind, fire/wildfire, insects were present in Sierra County, CA.
S3953	9/1/2015 – ongoing	The USDA declared that drought, wind, fire/wildfire, insects were present in Sierra County, CA.
S3784	1/1/2015 – ongoing	The USDA declared that drought, wind, fire/wildfire, heat, insects were present in Sierra County, CA.
S3789	9/1/2014 - ongoing	The USDA declared that drought, wind, fire/wildfire, heat, insects were present in Sierra County, CA.
S3963	1/1/2015 - 12/31/2015	The USDA declared that drought was present in Sierra County, CA.
S3631	9/1/2013 - 10/26/2013	The USDA declared that drought, wind, fire/wildfire, heat, insects were present in Sierra County, CA.
S3637	1/14/2014 – ongoing	The USDA declared that drought, wind, fire/wildfire, heat, insects were present in Sierra County, CA.
S3631	1/1/2014 - ongoing	The USDA declared that drought was present in Sierra County, CA.
S3637	2/21/2012 - 5/14/2012	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.
S3743	2/7/2012 - ongoing	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.
S3797	10/2/2012 - 11/26/2012	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.
S3268	9/1/2012 – ongoing	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.



Disaster Number	Incident Period	Description
S3283	1/1/2013 - 2/25/2013	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.
S3440	5/25/2013 - 8/19/2013	The USDA declared that drought, wind, fire/wildfire, heat, and insects were present in Sierra County, CA.
S3462	10/1/2022 - ongoing	The USDA declared that drought was present in Sierra County, CA.
S3491	1/1/2023 – ongoing	The USDA declared that drought was present in Sierra County, CA.
S3569	10/1/2021 - ongoing	The USDA declared that drought was present in Sierra County, CA.

Source: USDA Disaster Designation Information (<https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index>)

**Summary of Significant Events**

1976 and 1977 were California’s driest years on record and caused the drying of many surface water sources within the state. Groundwater pumping was increased to make up for this deficit and was over-extracted. Livestock agriculture was the industry most severely impacted by the drought (California Water Library 2017).

**Recent Events**

According to the U.S. Drought Monitor, parts of the Sierra region has faced intensified drought since the start of the 2025 water year (October 1, 2024). While the most severe impacts have been concentrated in southern and central California, the Sierra Nevada region has also seen below-average precipitation and increased dryness, contributing to moderate to severe drought classifications (U.S. Drought Monitor 2025).

**8.1.5 Future Conditions**

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

**Probability**

The cyclical occurrence of drought point to a strong probability that California will continue to be vulnerable to short and longer-term drought impacts. The State has a high probability of future drought events based on the historical and more recent drought events in California. According to FEMA, USDA, and NOAA, California experienced 117 drought events between 1950 and 2022. California can anticipate at least one period of drought somewhere in the State every year (California Governor's Office of Emergency Services 2024).

**Climate Change**

Climate change is expected to affect California’s water supply conditions over the long term. A significant impact is a reduction in mountain snowpack, which has historically been an integral part of California’s water supply systems (Water Education Foundation 2022). Climate change models show pronounced impacts by the end of the century, with noticeable impacts occurring by mid-century. This includes such a 48% to 65% loss of the Sierra Nevada snowpack by the end of the 21st century (Giraldo 2022). This is



especially important to Sierra County due to its direct location in the northern Sierra Nevada Mountains between the Plumas and Tahoe National Forests.

The record warm temperatures California experienced in the winters of Water Years 2014 and 2015 illustrate how future droughts may unfold. This includes many areas with greatly reduced spring runoff into major reservoirs and water temperatures too warm to support anadromous fish populations. Climate change is intensifying drought impacts, as observed in the 2012-16 drought and in the 2020-2022 drought years.

### **Potential Future Impacts**

Although Sierra County remains relatively rural and its population is projected to continue declining, even modest population growth or shifts in development patterns can place significant strain on its limited water resources. The county's General Plan emphasizes preserving its rural character, but any increase in development, particularly in wildland-urban interface areas, can elevate both water demand and wildfire risk. These changes may lead to water shortages, reduced water quality, and heightened public health risks, especially for vulnerable populations. Additionally, a growing or more dispersed population could complicate emergency response efforts during drought-related events like wildfires, which are intensified by prolonged dry conditions. Economic impacts may also arise, including reduced tourism, agricultural losses, and increased utility costs, all of which could further challenge the county's resilience to future droughts.

## **8.2 VULNERABILITY ASSESSMENT**

### **Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)**



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### **8.2.1 Summary of Vulnerability**

The entire planning area is exposed to the drought hazard, with the potential to affect the entire population.

Drought can affect a wide range of economic, environmental, and social activities. Its impacts can span many sectors of the economy because water is integral to the ability to produce goods and provide services. The impacts can reach well beyond the area undergoing physical drought. Vulnerability of an activity to drought depends on its water demand and the water supplies available to meet the demand.

### **8.2.2 Impact on Life, Health, and Safety**

The impacts of drought can lead to harmful health impacts. Drought can have financial, physical, and emotional impacts on farmers and farm workers and others in Tribal Nation, rural, and farming communities (Walters 2021). In 2021, water allocations and deliveries to farms were significantly



reduced across the State. Total surface water deliveries for Central Valley and North Coast farms dropped 41% below the 2002-2016 average (Escriva-Bou, et al. 2025). Impacts include hardships for farmers, farm workers, packers, and shippers of agricultural products. In some cases, drought can cause significant increases in food prices to the consumer due to agriculture production shortages and can result in lack of water and feed for grazing livestock, potentially leading to risk of livestock death (Anderson 2022).

Drought is harmful to water quality and public health. Reduced stream and river flows can increase the concentration of pollutants and bacteria in water, making contamination or water-related illness more likely (CDC 2024). Other infectious disease threats arise when drought leads to the contamination of surface waters and other types of water that are used for recreational purposes (CDC 2024). When temperatures rise and rainfall declines, algal blooms can grow and release dangerous toxins. At the same time, people are more likely to participate in water-related recreation, and those exposed to contaminated recreational waters are more likely to become infected with pathogens (CDC 2024). Drought and its consequences can also lead to increased mental health impacts, including acute or post-traumatic stress, substance abuse, domestic violence, and suicide (National Integrated Drought Information System 2025). Droughts can exasperate conditions in water sources and recreational areas such as the Little Truckee River and Stampede Reservoir where harmful algal blooms can develop (CA My Water Quality Monitoring Council, 2024). Lack of rainfall in droughts leads to a higher buildup of land nutrient loading. Once it rains again, the increased nutrients enters waterways all at once rather than gradually, leading to potential eutrophication and algal blooms. Drought also lowers reservoir levels, causing surface level harmful algal blooms to occur close to water intakes that are typically situated in deep water when the reservoirs are full. Water treatment plants may shut down water intakes to avoid cyanotoxin exposure as a result, furthering a potable water shortage in local areas. These blooms can also be toxic or harmful to people, fish, shellfish, marine mammals, and birds through dermal contact, ingestion, or inhalation.

### ***Socially Vulnerable Populations***

During California droughts, impacts are most severe on those most dependent on annual rainfall and snowpack. These groups include but are not limited to agencies fighting forest fires, ranchers engaged in dryland grazing, farmers growing crops in arid zones, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source (California Governor's Office of Emergency Services 2024).

In addition to water scarcity, drought conditions can also lead to power outages. Reduced water availability can limit hydroelectric power generation, while extreme heat and wildfire threats can strain the electrical grid or necessitate public safety power shutoffs. These outages can severely impact individuals with disabilities, older adults, and those with access and functional needs who rely on powered medical devices, refrigerated medications, or climate control for health and safety.

### **8.2.3 Impact on General Building Stock**

The general building stock will not be directly affected by drought conditions. Droughts can have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.



### 8.2.4 Impact on Community Lifelines

Community lifelines as defined for this plan will continue to be operational during a drought. The cost of potable water may increase, but the community lifeline that includes hydration will still function. Landscaping at community lifeline facilities may not be maintained due to limited resources, but the risk to those areas will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas may not be watered frequently and may die. These aesthetic impacts are not considered significant.

### 8.2.5 Impact on the Economy

A prolonged drought can have a serious economic impact for rural communities like Sierra County. As drought conditions persist, the availability of water for both residential and agricultural use becomes increasingly limited. Local and state agencies may impose water restrictions. These restrictions may include placing limitations on when or how frequently lawns can be watered, car washing services, or any other recreational/commercial outdoor use of water supplies. In Sierra County, where agriculture and natural resource-based industries are vital to the local economy, reduced water availability can lead to crop losses, resulting in lower yields or total crop failure. This not only impacts farmers' incomes but also contributes to regional food shortages and rising prices. Livestock operations are also affected, as drought reduces the availability of pasture and water, increasing feed costs and forcing some ranchers to reduce herd sizes. Cost of accessing and transporting may also rise, placing further strain on household budgets and business operations. Industries that rely on water, such as nurseries, landscaping services, and tourism, may experience reduced demand or be forced to scale back.

### 8.2.6 Impact on Historic and Cultural Resources

Drought can contribute to the physical deterioration of historic structures. The reduced soil moisture can lead to ground shifting or subsidence, which may destabilize foundations and cause structural damage to older buildings. Cultural landscapes, such as traditional agricultural areas, sacred sites, and ceremonial grounds, may also suffer from loss of vegetation and change in land. In some cases, drought may force the relocation of cultural activities or disrupt long-standing traditions tied to specific natural features or seasonal cycles.

### 8.2.7 Impact on Ecosystems and Natural Resources

Drought increases wildfire risk, and wildfires in turn increase demand for water. Prolonged periods of drought can result in detrimental changes in the vegetative structure, weakening trees and make forests more vulnerable to wildfire or insect outbreaks (EPA 2025). The loss of forests due to distressed health, pests, or fire can produce increased risk of other hazards due to reduced ability to retain runoff during heavy rainfall events (Hoegh-Guldberg, et al. 2018).

During droughts, groundwater use intensifies, stressing groundwater-dependent ecosystems and potentially resulting in increased overdraft, subsidence, and saltwater intrusion (in some areas), which can result in permanent loss of storage and damage to overlying infrastructure. Groundwater is the only source of water for much of California's most productive farmland, and agricultural water needs are likely to be heightened during prolonged hot and dry periods. Groundwater is also often the only source of



water for small, rural water systems and households (CNRA 2018). Additionally, droughts exacerbate headwater streams’ ability to naturally recharge groundwater.

### 8.2.8 Change in Vulnerability Since 2012 HMP

Sierra County’s vulnerability to drought may slightly increase due to prolonged dry periods and climate variability, not due to population or development. Sierra County’s population has declined since the 2012 HMP, and agricultural activity has not expanded significantly. The county’s reliance on limited water resources, however, continues to make it sensitive to drought conditions. The extremely low rental vacancy rate, discussed in the Sierra County Housing Element 2024-29, suggests that long-term housing is in high demand, potentially concentrating water use in certain areas. While agricultural expansion has been minimal, the cumulative impact of residential development and prolonged dry conditions could exacerbate water scarcity.

## 8.3 MITIGATION OPPORTUNITIES

Table 8-4 presents a range of potential opportunities for mitigating the drought hazard.

Table 8-4. Potential Opportunities to Mitigate the Drought Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Stormwater management</li> <li>• Identify alternative water sources</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>• Drought-resistant landscapes</li> <li>• Reduce water system losses</li> <li>• Modify plumbing systems (through water saving kits)</li> </ul>	<ul style="list-style-type: none"> <li>• Drought-resistant landscapes</li> <li>• Reduce private water system losses</li> </ul>	<ul style="list-style-type: none"> <li>• Water use conflict regulations</li> <li>• Reduce water system losses</li> <li>• Distribute water saving kits</li> <li>• Implement/expand water reuse projects</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• Practice active water conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Practice active water conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Public education on drought resistance</li> <li>• Expand recycled water network</li> <li>• Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers</li> <li>• Develop drought contingency plan</li> <li>• Develop criteria “triggers” for drought-related actions</li> <li>• Improve accuracy of water supply forecasts</li> <li>• Modify rate structure to influence active water conservation techniques</li> <li>• Increase emergency storage capacity</li> </ul>



Community Scale	Organizational Scale	Government Scale
Nature-based Opportunities		
<ul style="list-style-type: none"><li>• Promote and use reclaimed water supplies</li><li>• Increase capacity for stored surface water to create habitats and ecosystems for aquatic species</li><li>• Promote and use active groundwater recharge</li></ul>		



Babbit Lookout (Photo Credit: LeTina Vanetti)



## 9. EARTHQUAKE

### 9.1 HAZARD PROFILE



#### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

#### 9.1.1 Description of the Hazard

##### *Defining the Hazard*

An earthquake occurs when rock beneath the Earth's surface suddenly breaks and shifts, causing the ground to shake. An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter.

##### *Cause of the Hazard*

In California, the Pacific and North American plates slide past each other in opposing directions at a rate of about 1.5 inches per year. Friction between the plates can cause sections to stick. When they break free sudden movements, the movements release energy that travels through the ground as waves, causing shaking at the surface in the form of earthquakes (California Governor's Office of Emergency Services 2024).

##### **Tectonic Plates**

The Earth's crust, which is the rigid outermost shell of the planet, is broken into seven or eight major tectonic plates (depending on how they are defined) and many minor plates. Where the plates meet, they move in one of three ways along their mutual boundary: convergent (two plates moving together), divergent (two plates moving apart), or transform (two plates moving parallel to one another). Earthquakes, volcanic activity, mountain-building, and oceanic trench formation occur along these plate boundaries. Subduction is a geological process that takes place at convergent boundaries of tectonic plate, in which one plate moves under another. Regions where this process occurs are known as subduction zones, and they have the potential to generate highly damaging earthquakes.



California is seismically active because of movement of the North American Plate, east of the San Andreas Fault, and the Pacific Plate to the west, which includes the state’s coastal communities. The transform (parallel) movement of these tectonic plates against one another creates stresses that build as the rocks are gradually deformed. The rock deformation, or strain, is stored in the rocks as elastic strain energy. When the strength of the rock is exceeded, rupture occurs along a fault. The rocks on opposite sides of the fault slide past each other as they spring back into a relaxed position. The strain energy is released partly as heat and partly as elastic waves called seismic waves. The passage of these seismic waves produces the ground shaking in earthquakes.

### Seismic Fault Lines

Geologists have found that earthquakes reoccur along faults, which are zones of weakness in the earth’s crust. When a fault experiences an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake can still occur. In fact, relieving stress along one part of a fault may increase it in another part.

Faults are more likely to have future earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve the accumulating tectonic stresses. Geologists classify faults by their relative hazards. “Active” faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). “Potentially active” faults are those that displaced layers of rock from the Quaternary period (the last 1,600,000 years) (USGS 2022).

Determining if a fault is “active” or “potentially active” depends on geologic evidence, which may not be available for every fault. The majority of the seismic hazards are on well-known active faults. However, inactive faults, where no displacements have been recorded, also have the potential to reactivate or experience displacement along a branch sometime in the future. An example of a fault zone that has been reactivated is the Foothills Fault Zone. The zone was considered inactive until evidence of an earthquake (approximately 1.6 million years ago) was found near Spenceville, California. Then, in 1975, an earthquake occurred on another branch of the zone near Oroville, California (now known as the Cleveland Hills Fault). The State Division of Mines and Geology indicates that increased earthquake activity throughout California may cause tectonic movement along currently inactive fault systems.

### Summary of Potential Impacts

Earthquakes can directly cause buildings and bridges to collapse; disrupt utility services; and trigger landslides, avalanches, flash floods, fires, and tsunamis. Infrastructure collapses during earthquakes produced eight of California’s 10 costliest disasters in the last 100 years (California Governor's Office of Emergency Services 2024).



## Cascading Hazard Impacts

Cascading impacts result when one hazard event triggers one or more other hazard events that may still trigger others. The following cascading impacts associated with earthquakes are relevant to Sierra County (California Governor's Office of Emergency Services 2024):

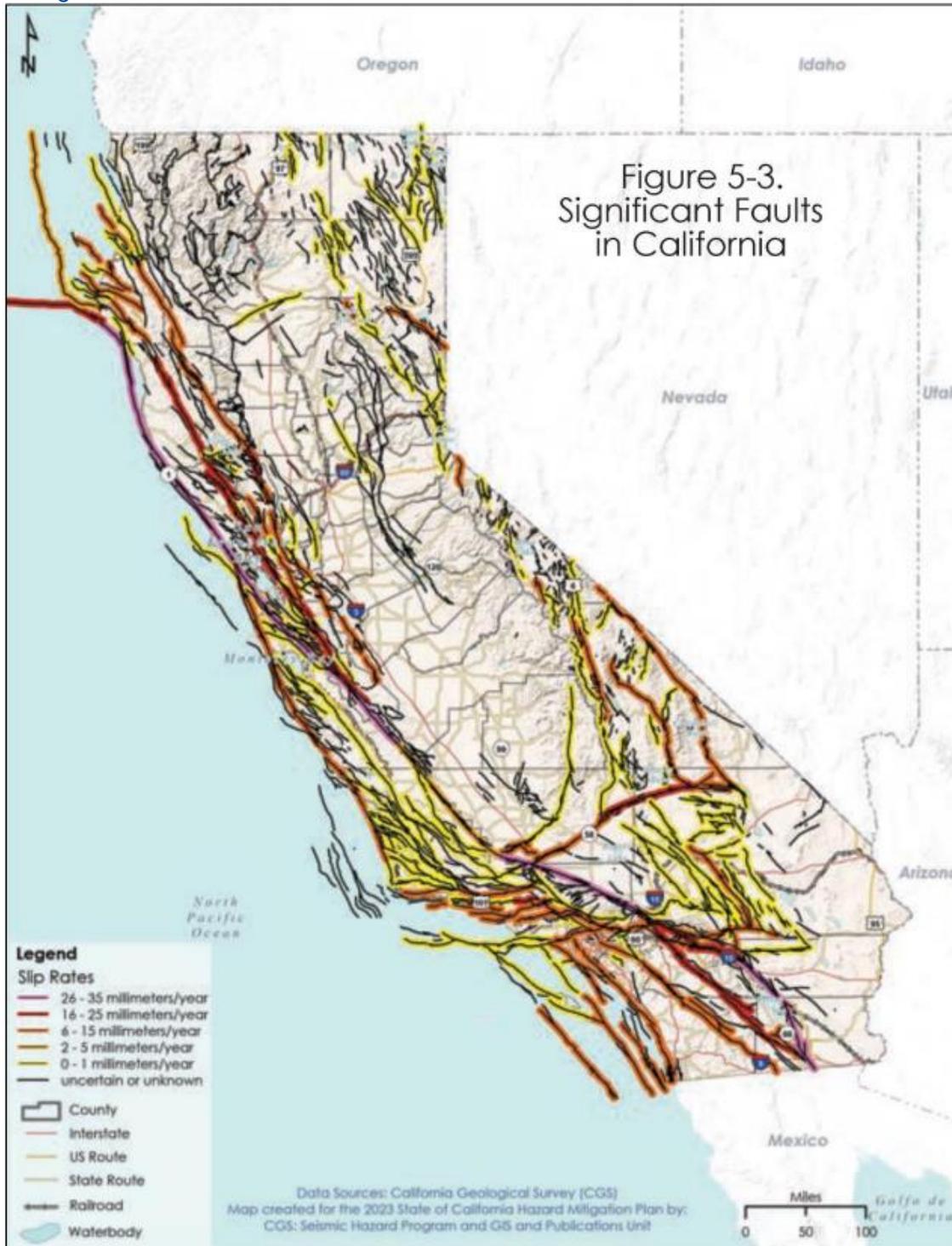
- **Surface Fault Rupture**—When a fault rupture extends to the earth's surface, the displacement can catastrophically damage structures or utilities. Fissuring, settlement, and permanent horizontal and vertical ground shifting often accompany large earthquakes. Such displacement can significantly increase damage and may be a contributing cause of damage.
- **Fires**—Fires following earthquakes may result from multiple causes, including overturned burning candles, sparking from downed power lines, and broken gas pipelines. Additionally, fire departments may be severely strained after earthquakes. Impaired communications, water supply, transportation, and other resources affect fire department response. Several computer programs, such as Hazus, URAMP, SERA, and RiskLink provide ways to assess the fire-following-earthquake vulnerability of a community in future earthquakes.
- **Liquefaction**—Ground settlement during liquefaction can cause damage when the settlement varies significantly across the length of a structure. Liquefaction can occur in susceptible soils such as NEHRP Types D, E, and F. This can severely damage structures at ports and harbors, as well as underwater utility lines.
- **Landslides**—Landslides caused by earthquakes can be widespread over the immediate area and at greater distances where hillsides are susceptible. These landslides can significantly damage structures and transportation and utility lifelines.
- **Dam or Levee Failure**—Earthquake ground shaking in and around dams and levees can affect structure performance. The dam or levee's foundation (such as peat or alluvium) will influence its performance during a seismic event.
- **Power Outages**—Earthquakes of all magnitudes can damage power lines and electrical facilities, impacting community lifelines that rely on power.
- **Hazardous Materials Release**—Earthquakes can lead to the release of hazardous materials from collapsed buildings and severed pipelines. This which may include oil spills, the release of gases, and runoff of hazardous materials.

### 9.1.2 Location

California has many faults with the potential to produce damaging earthquakes. Sierra County contains several significant faults that slip at a rate of 0-1 millimeters/year, as shown on Figure 9-1. In previous LHMPs, the county ranked earthquakes as a high-impact hazard. Generally, faults with greater slip rates are more likely to produce earthquakes (California Governor's Office of Emergency Services 2024).



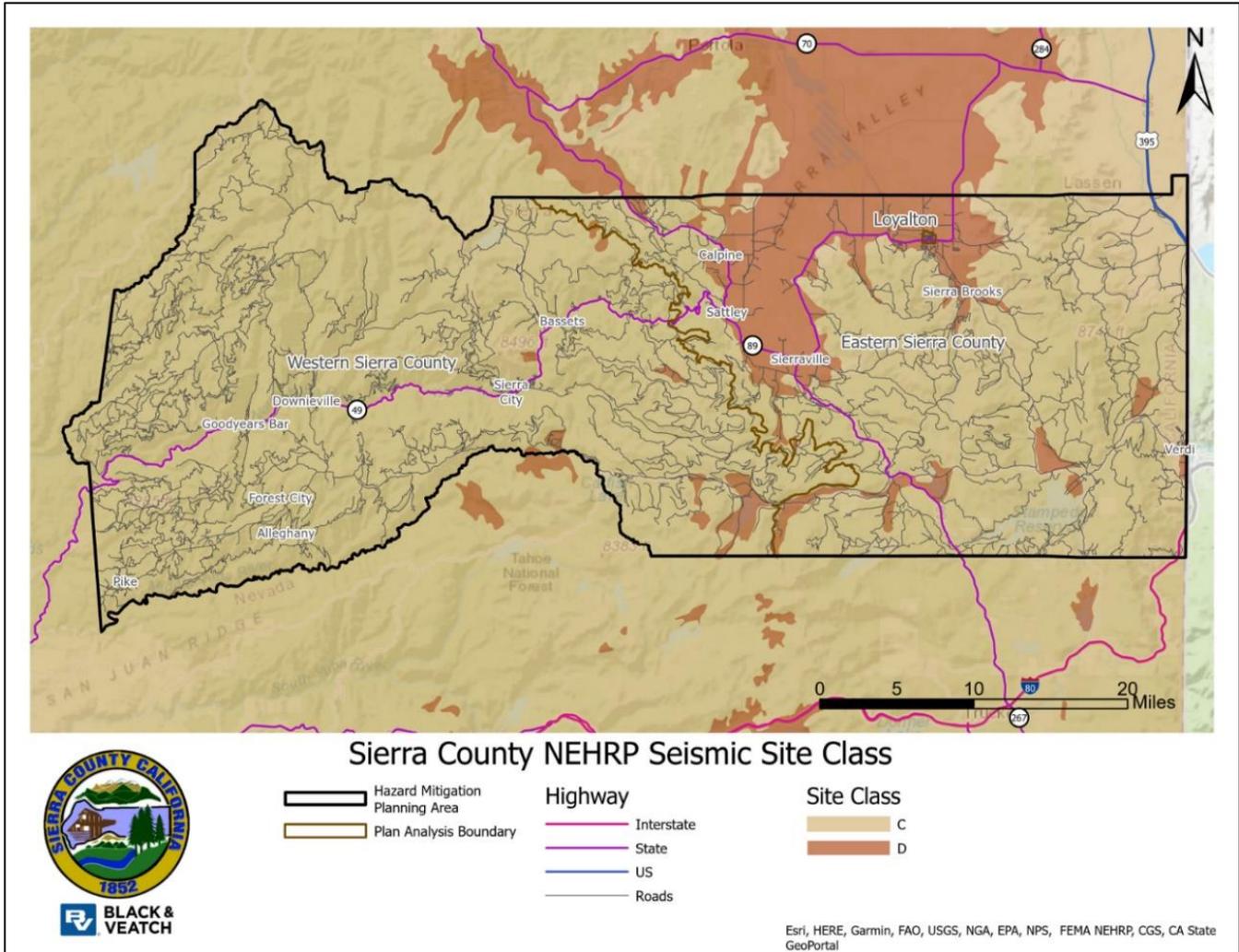
Figure 9-1. Significant Faults in California





Additionally, sections of northern and southernmost Sierra County are located on NEHRP Type D Soil, making state infrastructure (roads, highways, dams, and State water projects) more vulnerable to cracking, rip apart, settle, and slough during an earthquake, as shown on Figure 9-2 (California Governor's Office of Emergency Services 2024).

Figure 9-2. Sierra County NEHRP Seismic Site Class



### 9.1.3 Extent

#### Measuring Intensity

An earthquake's intensity is a measure of how strong an earthquake feels at any one location. It can vary widely across the range where an earthquake is experienced. The modified Mercalli intensity scale is most used. The range of ground shaking can depend on multiple factors such as the distance from the earthquake, rock and soil conditions of the impacted area, and complexities in the structure of the earth's crust (California Governor's Office of Emergency Services 2024).



Table 9-1. Mercalli Intensity Scale

Modified Mercalli Intensity	PGA (% gravitational acceleration)	Perceived Shaking	Potential Shaking
I	< 0.17	Not Felt	None
II	0.17 – 1.4	Weak	None
III	0.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy

The modified Mercalli intensity scale is generally represented with ShakeMaps, which shows the expected ground shaking produced by an earthquake with a specified magnitude and epicenter.

### Warning Time

Researchers are studying potential earthquake warning systems to give notice before damaging earthquake events. The warning time could allow someone to take preventative measures such as to get under a desk, step away from a hazardous material, or shut down a computer system (California Governor's Office of Emergency Services 2024).

Cal OES's Earthquake Early Warning California (MyShake), developed in partnership with UC Berkeley and USGS ShakeAlert, is a statewide, publicly available warning system that provides seconds or tens of seconds to take cover before shaking occurs, depending on the location of the event. The system uses data from motion sensors and Global Navigation Satellite System to detect earthquakes and notify Californians of an earthquake in advance. Individuals can download the MyShake App on their mobile devices for earthquake warnings (California Governor's Office of Emergency Services 2024).

### Worst-Case Scenario

The worst-case scenario for an earthquake in Sierra County would involve an earthquake reaching a Modified Mercalli Intensity of VIII. At this intensity, significant structural damage would occur, particularly to older, unreinforced masonry buildings and infrastructure not built to modern seismic standards. Followed by earthquakes, secondary hazards such as severe landslides could worsen the situation. Ground shaking could trigger slope failures, blocking transportation and isolating communities in remote or high elevated areas. In dry and peak wildfire conditions, the combination of damaged infrastructure and power lines along with dry vegetation could ignite wildfires.

### 9.1.4 Previous Occurrences

The following sections provide a review of previous earthquake occurrences in Sierra County.



## Declarations

### Federal Declarations

Between 1954 and 2023, Sierra County experienced no earthquake-related disasters (DR) or emergencies (EM).

### State Declarations

Between 2012 and 2024, California declared no disasters related to earthquakes in Sierra County.

### USDA Declarations

Between 2012 and 2024, the USDA declared no disasters related to earthquakes in Sierra County.

## Summary of Significant Events

Among the most notable seismic events affecting Sierra County, the magnitude 5.9 earthquake near Truckee on September 12, 1966, stands out for its regional impact. Although the epicenter was located just outside Sierra County, the quake was widely felt across Northern California and western Nevada, causing minor structural damage and prompting public concern due to its intensity and reach (CDPH 2022). The event occurred along the eastern Sierra Nevada fault system, a seismically active region influenced by complex tectonic interactions between the Pacific and North American plates.

Between 2000 and 2024, the USGS reported that Sierra County experienced 18 earthquakes with a magnitude of 3.1 or greater (Table 9-2).

Table 9-2. USGS Earthquake Reports

Incident Period	Magnitude	Description
February 10, 2024	3.2 ml	The USGS reported that a 3.2 ml earthquake occurred 8 km NNE of Truckee, CA in Sierra County, CA.
June 23, 2021	3.3 mw	The USGS reported that a 3.3 mw earthquake occurred 24km WNW of Truckee, CA in Sierra County, CA.
May 7, 2021	4.65 ml	The USGS reported that a 4.65 mw earthquake and 3 aftershock quakes ranging from 2.74 md - 3.14 ml occurred 19km NW of Truckee, California in Sierra County, CA.
August 30, 2018	3.75 mw	The USGS reported that a 3.75 mw earthquake occurred 5km W of Tahoe Vista, CA in Sierra County, CA.
July 26, 2018	3.47 mw	The USGS reported that a 3.47 mw earthquake occurred 5km NNW of Dollar Point, CA in Sierra County, CA.
June 27, 2017	3.95 mw	The USGS reported that a 3.95 mw earthquake and five aftershock quakes ranging from 2,91 md - 3.73 occurred 13 km SSE of Sierraville, California in Sierra County, CA.
July 19, 2015	3.19 mw	The USGS reported that a 3.19 mw earthquake occurred 16 km NNW of Truckee, California in Sierra County, CA.
April 8, 2015	3.41 mw	The USGS reported that a 3.41 mw earthquake and an aftershock quake of 2.8 mh occurred 3 km S of Floriston, California in Sierra County, CA.
September 11, 2014	3.41 mw	The USGS reported that a 3.41 mw earthquake occurred 1 km WNW of Carnelian Bay, California in Sierra County, CA.
December 29, 2010	3.3 ml	The USGS reported that a 3.3 ml earthquake occurred 1 km WNW of Carnelian Bay, California in Sierra County, CA.



Incident Period	Magnitude	Description
October 18, 2010	3.09 mw	The USGS reported that a 3.09 mw earthquake occurred 5 km SSW of Floriston, California in Sierra County, CA.
May 29, 2006	3.7 mw	The USGS reported that a 3.7 mw earthquake occurred 5 km NNW of Kingvale, California in Sierra County, CA.
June 26, 2005	4.77 mw	The USGS reported that a 4.77 mw earthquake occurred 8 km NNW of Tahoe Vista, California in Sierra County, CA.
June 12, 2004	3.65 mw	The USGS reported that two earthquakes ranging from 3.65-3.4 mw occurred 9 km NNW of Truckee, California on 6/12/2004 in Sierra County, CA.
June 3, 2004	4.2 mw	The USGS reported that a 4.2 mw earthquake and an aftershock quake of 3.04 ml occurred 6 km S of Floriston, California in Sierra County, CA.
March 27, 2001	3.61 md	The USGS reported that a 3.61 md earthquake occurred 5 km NNW of Kingvale, California in Sierra County, CA.
December 2, 2000	4.4 mw	The USGS reported that a 4.4 mw earthquake and 3 aftershock quakes ranging from 2.51-3.28 md occurred 5 km NW of Kingvale, California in Sierra County, CA.
February 6, 2000	3.46 md	The USGS reported that a 3.46 md earthquake occurred 7 km S of Floriston, California in Sierra County, CA.

Source: (USGS 2024)

**Recent Events**

Within the past 5 years, the earthquake of greatest magnitude in Sierra County occurred 19 km NW of Truckee, CA in 2021. Its original magnitude was 4.65 ml and resulted in in three aftershock quakes that ranged from 2.74 md – 3.14 ml.

**9.1.5 Future Conditions**

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

**Probability**

According to the USGS earthquake database, California experienced 285 earthquakes between 1950 and 2021 with magnitude 5 and greater. Based on these statistics, the State can expect at least four earthquakes with a magnitude of 5 or greater each year.

Fault rupture is the sliding movement of rock on either side of a fault. This phenomenon is responsible for causing the resulting shaking. Scientists have developed the Third Uniform California Earthquake Rupture Forecast (UCERF3) as an earthquake forecast model for California (SCEC 2023). The model estimates the location, magnitude, and likelihood of earthquake fault rupture throughout the State and serves as a reminder that damaging earthquakes are inevitable in California (California Governor's Office of Emergency Services 2024).

Figure 9-3 and Figure 9-4 show potential earthquake scenarios ranging from moderate to severe in the Mercalli Intensity Scale.



Figure 9-3. Sierra County Potential Earthquake Scenario: Mohawk Valley M7.13

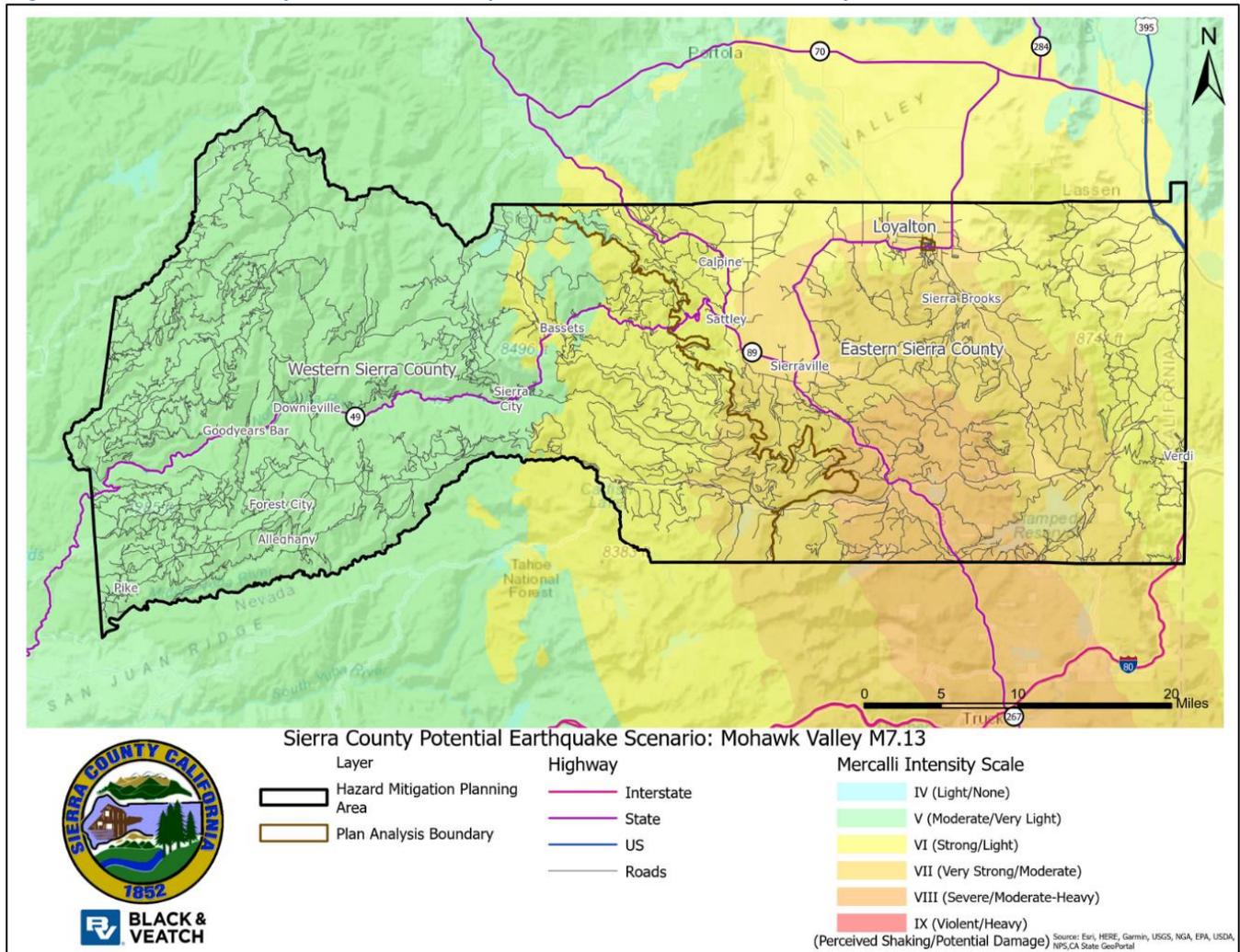
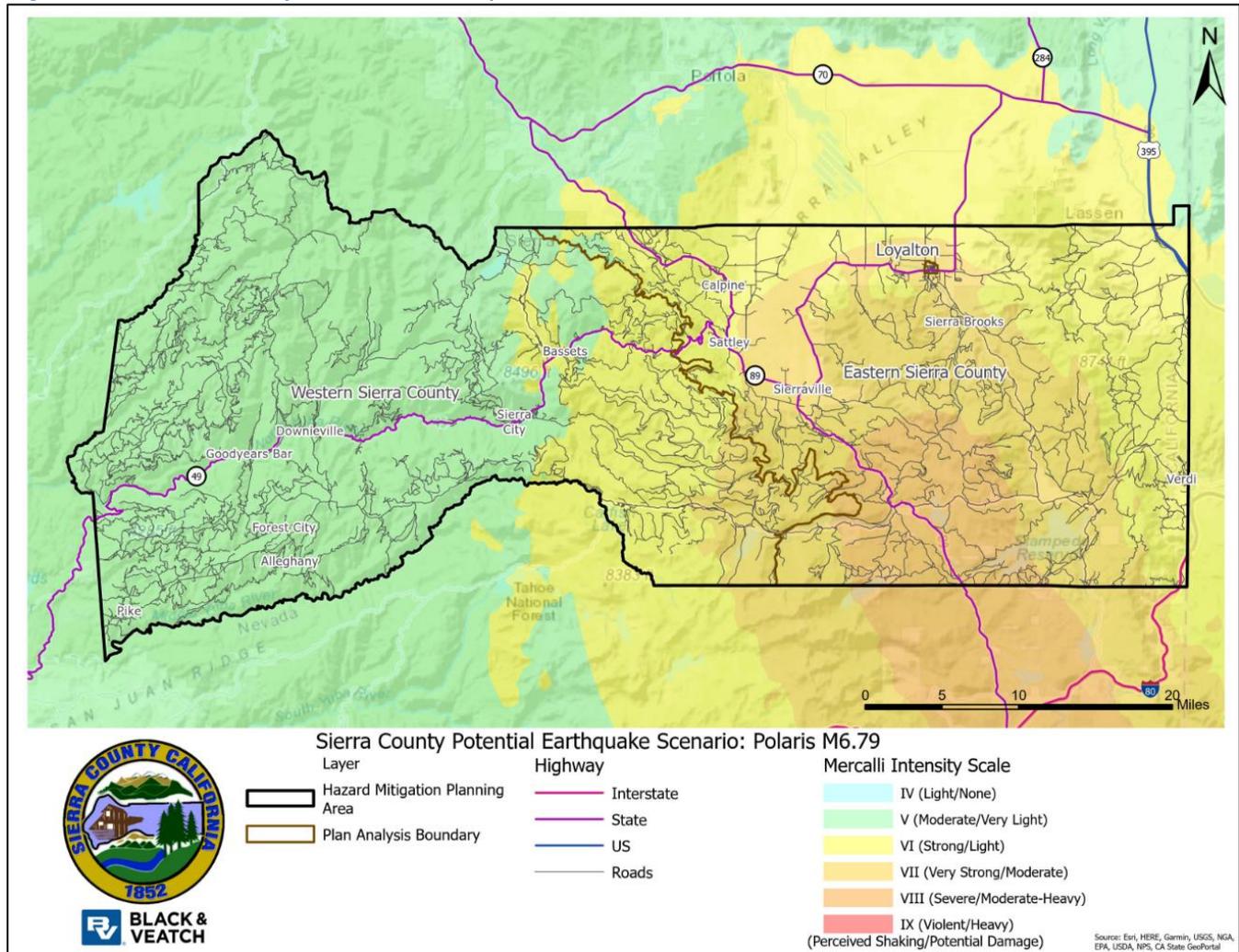




Figure 9-4. Sierra County Potential Earthquake Scenario Polaris M6.79



### Climate Change

The potential impacts of climate change on earthquake probability are unknown. Climate change can exacerbate the cascading hazards related to earthquakes such as landslides. Soil breakdown can be facilitated by rising air temperatures, affecting erosion rates, sediment control, and the likelihood of landslides. Climate change may also increase the probability of more frequent and intense rainstorms. This can result in further erosion, higher sediment transport in rivers and streams, and a higher probability of landslides (California Governor's Office of Emergency Services 2024).

### Potential Future Impacts

Since all of the planning area is located within earthquake hazard zones, all future development will, to some extent, be exposed to the earthquake hazard. The County is located in Seismic Zone 3, as defined by the Uniform Building Code. Building standards and regulations in this zone assume earthquakes with the potential to make standing difficult and to cause stucco and some masonry walls to fall. Strong ground shaking could result in damage to unreinforced masonry buildings built before 1933. While the



County has a history of seismic activity, the likelihood and magnitude of a future significant incidents are minimal.

## 9.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction’s vulnerability to the hazards of concern and include an overall summary of the hazard’s impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 9.2.1 Summary of Vulnerability

The entire planning area is exposed to the earthquake hazard, so an earthquake has the potential to affect the entire population, all 1,957 buildings in the planning area, with a total replacement value of \$1,159,880,290, all of the planning area’s identified critical facilities, and the entire environment of the planning area.

### 9.2.2 Impact on Life, Health, and Safety

Depending on the severity of the earthquake some people may be directly injured or killed. In addition, homes and businesses may be damaged, resources and supplies may be scarce, business interruptions may keep people from working, utilities may have outages, schools may be temporarily closed, and road closures may cause extra time and travel. All of these indirect effects could impact people who suffered no direct harm from the earthquake. Thus, the entire population must deal with the consequences of earthquakes to some degree.

Impacts on persons and households in the planning area were estimated for the scenario events assessed through the Level 2 Hazus analysis. Table 9-3 summarizes the results.

Table 9-3. Estimated Earthquake Impact on Persons and Households

Planning Area	2500-year Probability		Mohawk Valley M7.1		Polaris M6.79	
	Displaced Households	Short-Term Shelter	Displaced Households	Short-Term Shelter	Displaced Households	Short-Term Shelter
Loyalton	17	8	4	2	3	1
Eastern Sierra County	30	14	15	7	4	2
Western Sierra County	22	10	2	1	0	0
<b>Totals</b>	<b>70</b>	<b>32</b>	<b>21</b>	<b>9</b>	<b>7</b>	<b>3</b>

### Socially Vulnerable Populations

Socially vulnerable populations may live in structures that do not conform to seismic building codes; therefore, homes will sustain more damage during an event. Those experiencing homelessness are also



especially vulnerable due to their lack of stable shelter and, depending on their location, may be threatened by bridge or other structural collapse. Those organizations with physical structures that provide care, services, and shelter may be impacted as a result of an earthquake. Loss of water, power, roads, phones, and transportation due to earthquake events can be particularly dangerous for those with certain medical conditions.

### 9.2.3 Impact on General Building Stock

#### *Building Age*

The western part of the county is somewhat more earthquake resistant. It is farther from the major faults. It has predominately more earthquake resistant ground types, predominantly bedrocks with a slight alluvial overlay along the streams, and the Sierra Block mastiff dampening quake effects from east of the Sierra and the Tahoe basin. The weakness is in infrastructure. Homes, although wood frame, are predominately pre-1970 and have low building code standards. The roads are susceptible to debris flows and landslides, many of the commercial buildings date back to the 19th century and are primarily masonry.

The eastern parts of the county have somewhat newer construction, less population density and less threat from debris flows and landslides except for the access and egress corridors to the North, South, and West. However, the eastern part of the county is dominated by Sierra Valley. As discussed in the flood section, this prehistoric lake bed has over 2,000 feet of alluvial deposits and a modern clay alluvial layer of 100 to 200 feet on top of the prehistoric deposits. This creates a vast area of soils that will amplify shaking from a major earthquake. Moderate earthquake effects on the county are described in the following tables from the HAZUS modeling software.

Table 9-4 identifies loss estimates represented by a percentage of the replacement cost value of structures in Sierra County.

Table 9-4. General Building Stock Replacement Cost Values

Planning Area	Total Building Value (Structure and contents)	10% of Total Building Value	30% of Total Building Value	50% of Total Building Value
Loyalton	\$227,354,323	\$22,735,432	\$68,206,297	\$113,677,162
Eastern Sierra County	\$469,207,778	\$46,920,778	\$140,762,333	\$234,603,889
Western Sierra County	\$463,318,188	\$46,331,819	\$138,995,456	\$231,659,094
<b>Totals</b>	<b>\$1,159,880,290</b>	<b>\$115,988,029</b>	<b>\$347,964,087</b>	<b>\$579,940,145</b>

#### *Loss Potential*

Property losses were estimated through the Level 2 Hazus analysis for the assessed earthquake fault scenarios. Table 9-5 shows the estimates for damage to structures and building contents with the percent of total replacement value. The Hazus analysis also estimated the amount of earthquake-caused debris in the planning area for the assessed events, as summarized in Table 9-6.



Table 9-5. Loss Estimates for Fault Scenarios

Planning Area	Estimated Loss Associated with Earthquake			% of Total Replacement Value
	Structure	Contents	Total	
<b>2500-year Probability</b>				
Loyalton	\$16,954,287	\$7,547,948	\$24,502,235	10.8%
Eastern Sierra County	\$28,855,249	\$13,985,121	\$42,840,370	9.1%
Western Sierra County	\$18,760,928	\$12,396,666	\$31,157,594	6.7%
Total	\$64,570,464	\$33,929,735	\$98,500,198	8.5%
<b>Mohawk Valley M7.1</b>				
Loyalton	\$3,719,386	\$1,578,232	\$5,297,618	2.3%
Eastern Sierra County	\$15,694,742	\$5,540,050	\$21,234,792	4.5%
Western Sierra County	\$1,670,054	\$1,003,108	\$2,673,162	0.6%
Total	\$21,084,182	\$8,121,390	\$29,205,572	2.5%
<b>Polaris M6.79</b>				
Loyalton	\$2,496,543	\$1,195,035	\$3,691,578	1.6%
Eastern Sierra County	\$4,296,151	\$1,952,436	\$6,248,588	1.3%
Western Sierra County	\$159,964	\$99,534	\$259,498	0.1%
Total	\$6,952,658	\$3,247,006	\$10,199,664	0.9%

Table 9-6. Estimated Earthquake-Caused Debris

Planning Area	Debris to Be Removed (tons)x 1000		
	2500-year Probability	Mohawk Valley M7.1	Polaris M6.79
Loyalton	11	5	2
Eastern Sierra County	25	11	3
Western Sierra County	16	2	0
Total	52	19	6

### 9.2.4 Impact on Community Lifelines

The entire planning area is vulnerable to earthquakes, including all community lifelines. Functional downtime is the most significant earthquake impact on critical facilities and community lifelines. The severity of this impact is based on the amount of time it takes to restore damaged facilities to operational status. Hazus estimates damage and functional downtime for earthquake scenarios. Refer to Table 3-4 for a summary of all community lifelines locate in Sierra County.

Transportation routes, including bridges and highways, are vulnerable to earthquakes, especially in NEHRP Soil Types D and E and liquefaction zones. Aging infrastructure and those already in poor condition are most vulnerable.

### 9.2.5 Impact on the Economy

In Sierra County, where small-scale farming, ranching, and forestry contribute to the local economy, even moderate seismic events can result in disproportionate economic losses due to limited redundancy and access to emergency resources. Damage to roads, bridges, and utility lines can isolate rural communities, delay harvests, and disrupt the delivery of perishable goods. Power outages, which often accompany seismic events, can further complicate response and recovery efforts by disabling irrigation systems, refrigeration units, and communication networks. These disruptions can lead to business



interruption losses, spoilage of produce, and animal welfare concerns, such as livestock operations that rely on continuous power for feeding, watering, and climate control. Recovery may be slowed by limited local resources, aging infrastructure, and geographic isolation.

### 9.2.6 Impact on Historic and Cultural Resources

Several historic and cultural sites of Sierra County feature buildings dating back to the 1800s. Particularly, Downieville is considered the least changed of all the gold rush towns in California. Many of these structures were built before modern seismic safety standards and rely on aging infrastructure that may not be retrofitted. In the event of an earthquake, these buildings face a heightened risk of severe damage or total collapse. The loss would not only be structural but also cultural, erasing irreplaceable links to the region's past. Earthquakes could also disrupt tourism, a key economic contributor tied to the county's heritage.

### 9.2.7 Impact on Ecosystems and Natural Resources

Earthquakes can cause a range of environmental impacts. Earthquake-induced landslides may severely damage surrounding habitats, while shifts in the earth's structure can reroute streams, altering water quality and disrupting ecosystems. Groundwater-fed streams or springs may dry up due to changes in underlying geology. Additionally, earthquakes pose a significant risk of hazardous material release through various mechanisms, including:

- The toppling of elevated tanks or overturning of horizontal tanks
- Structural failures
- Dislodging of asbestos
- Sloshing from open-topped containers
- Falling containers or shelves, especially in laboratories
- Storage container failures
- Under- or above-ground pipeline breaks
- Structural fire in industrial facilities following earthquake event

### 9.2.8 Change in Vulnerability Since 2012 HMP

There has been little change in earthquake vulnerability in Sierra County since 2012. The population remains small and dispersed, and there has been minimal new construction that would alter the county's exposure. While seismic risk is inherent due to regional fault lines, the lack of significant development means that overall vulnerability has not increased meaningfully. The shift toward seasonal housing also raises concerns about structural resilience, especially if these homes are not built to modern seismic standards.

## 9.3 MITIGATION OPPORTUNITIES

Table 9-7 presents a range of potential opportunities for mitigating the earthquake hazard.



Table 9-7. Potential Opportunities to Mitigate the Earthquake Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>• Locate outside of hazard area (off soft soils)</li> <li>• Retrofit structure (anchor house structure to foundation)</li> <li>• Secure household items that can cause injury or damage (such as water heaters, bookcases, and other appliances)</li> <li>• Build to higher design</li> </ul>	<ul style="list-style-type: none"> <li>• Locate or relocate critical functions outside hazard area where possible</li> <li>• Build redundancy for critical functions and facilities</li> <li>• Retrofit critical buildings and areas housing critical functions</li> </ul>	<ul style="list-style-type: none"> <li>• Locate critical facilities or functions outside hazard area where possible</li> <li>• Harden infrastructure</li> <li>• Provide redundancy for critical functions</li> <li>• Adopt higher regulatory standards</li> <li>• Perform seismic retrofits for vulnerable critical buildings and areas</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• Practice “drop, cover, and hold”</li> <li>• Develop household mitigation plan, such as creating a retrofit savings account, communication capability with outside, 72-hour self-sufficiency during an event</li> <li>• Keep cash reserves for reconstruction</li> <li>• Become informed on the hazard and risk reduction alternatives available</li> <li>• Develop a post-disaster action plan for your household</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt higher standard for new construction; consider “performance-based design” when building new structures</li> <li>• Keep cash reserves for reconstruction</li> <li>• Inform your employees on the possible impacts of earthquake and how to deal with them at your work facility.</li> <li>• Develop a continuity of operations plan</li> </ul>	<ul style="list-style-type: none"> <li>• Provide better hazard maps</li> <li>• Provide technical information and guidance</li> <li>• Enact tools to help manage development in hazard areas (e.g., tax incentives, information)</li> <li>• Include retrofitting and replacement of critical system elements in capital improvement plan</li> <li>• Develop strategy to take advantage of post-disaster opportunities</li> <li>• Warehouse critical infrastructure components such as pipe fittings, valves, pumps, power line, and road repair materials</li> <li>• Solidify supplemental power supply to tanks and pump stations (generator program)</li> <li>• Develop and adopt a continuity of operations plan</li> <li>• Initiate triggers guiding improvements (such as &lt;50% substantial damage or improvements)</li> <li>• Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities</li> <li>• Develop a post-disaster action plan that includes grant funding and debris removal components</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>• None identified</li> </ul>		



# 10. EXTREME HEAT

## 10.1 HAZARD PROFILE



### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

### 10.1.1 Description of the Hazard

#### *Defining the Hazard*

Extreme heat is defined as temperatures that hover 10° F or more above the average high temperatures for a region for several days or weeks. In California, an extreme heat event is defined as 3 days over 100° F (FEMA). Extreme heat events can lead to an increase in heat-related illnesses and deaths, worsen drought, and impact water supplies and other industries such as transportation, agriculture, and energy (California Office of Environmental Health Hazard Assessment 2022).

#### *Cause of the Hazard*

Extreme heat events, or heat waves, are usually a result of both high temperatures and high relative humidity. The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures, posing significant risk to human health. Anthropogenic climate change is fueling an increase in frequency of extreme heat days in California.

The severity of extreme heat can be amplified by the “urban heat island effect” which is the phenomena defined by the National Integrated Heat Health Information System in which cities experience more intense warming than their surrounding rural landscapes, particularly during the summer. This temperature difference occurs when cities’ unshaded roads and buildings absorb heat during the day and release this heat slowly (California Office of Environmental Health Hazard Assessment 2022). As a result, highly developed urban areas can experience mid-afternoon temperatures that are 15° F to 20° F warmer than surrounding, vegetated areas (California Office of Environmental Health Hazard Assessment 2022).

#### *Summary of Potential Impacts*

Extreme heat has impacts on human health and infrastructure. Extreme heat is one of the leading causes of weather-related deaths in the United States, killing an average of more than 702 people per year from 2004–2018, more than all other weather hazards (except hurricanes) combined. Heat-related illness includes a spectrum of illnesses ranging from heat cramps to severe heat exhaustion and life-threatening heat stroke. Those who work outside are at risk for heat stroke or sun stroke, heat exhaustion, fatigue, and dehydration (California Office of Environmental Health Hazard Assessment 2022). Elevated nighttime temperatures are likely key ingredients in causing heat-related illness and mortality.



Heat impacts infrastructure safety and agencies' ability to provide timely and efficient services to its customers. Extreme heat impacts infrastructure and economies. Urban infrastructure is especially threatened by cascading effects of extreme heat stress on interdependent water, power, and transportation systems. High heat can deteriorate pavement, buckle railway tracks, and restrict aircraft operations. During hot weather, increased use of air conditioning and refrigeration increases electricity usage, thus straining the electrical grid (California Office of Environmental Health Hazard Assessment 2022).

### ***Cascading Hazard Impacts***

Extreme heat events can lead to both droughts and wildfire, depending on the severity and length of the event. Existing drought and wildfire conditions can be severely exacerbated by extreme heat events, further drying out soil and vegetation and increasing electricity demand. These hazards are covered in Sections 8 and 14.

#### **10.1.2 Location**

Extreme heat has not historically been a hazard of main concern for Sierra County. This is due to the county's low urban density and heavily forested areas. However, future projections indicate that Sierra County could experience more frequent and intense episodes of extreme heat, which will impact the entire county, especially those without air conditioning.

#### **10.1.3 Extent**

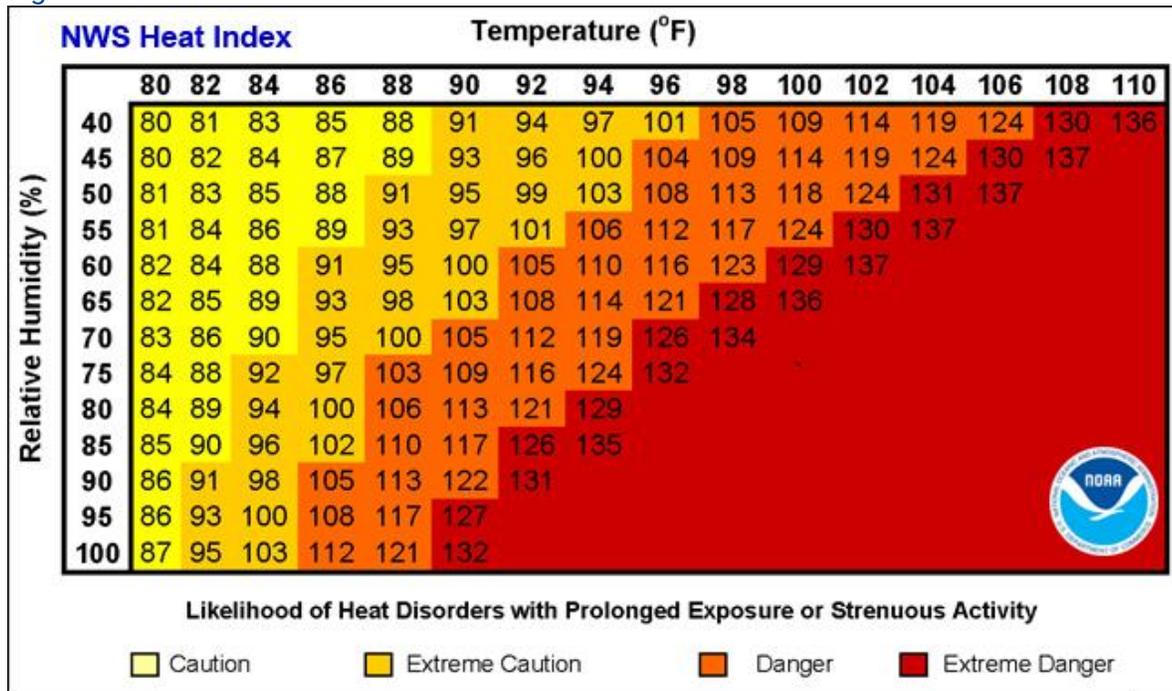
Heat emergencies are often slow to develop and usually hurt vulnerable populations and already aging and damaged infrastructure. It could take several days of oppressive heat for a heat wave to have a significant or quantifiable impact in areas of Sierra County.

### ***Measuring Intensity***

Extreme heat extent can be defined by local record highs and the NWS Heat Index. The NOAA and NWS devised the "Heat Index" chart shown on Figure 10-1, which uses air temperature and humidity to determine the heat index or apparent temperature. In addition, information regarding the likelihood of health dangers by temperature range is presented (National Weather Service & National Oceanic and Atmospheric Administration 2024).



Figure 10-1. NWS Heat Index



**Warning Time**

The NWS is producing experimental forecasts called HeatRisk to assess the heat risk to local thresholds in California, Nevada, Utah, and Arizona. The NWS issues excessive heat watches, excessive heat warnings, and heat advisories to warn of an extreme heat event (a “heat wave”) within 36 hours of the predicted event (National Weather Service 2023).

Table 10-1. NWS HeatRisk Index

Category	Risk of Heat-Related Impacts
Green 0	Little to no risk from expected heat.
Yellow 1	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
Red 3	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.
Magenta 4	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure.



The NWS will use the HeatRisk Index (Table 10-1) to determine if an excessive heat watch/warning or heat advisory is warranted. The NWS issues the following types of heat-related advisories: Heat Advisory—HeatRisk category is on the orange/red (Level 2-3) thresholds and Excessive Heat Watch/Warning—HeatRisk category is on the red/magenta (Level 3-4) thresholds. An Excessive Heat Watch is a way to give the public and emergency officials a warning that extreme temperatures are expected. If high temperatures remain forecasted for 24 to 28 hours, the excessive heat *watch* will be upgraded to an excessive heat *warning* (National Weather Service 2023).

### **Worst-Case Scenario**

The worst-case scenario for an extreme heat wave in Sierra County would be a heat wave lasting longer than 3 days with an Excessive Heat Warning Level 4. This heat wave would have temperatures near or above 100° F with no overnight cooling, especially in denser urban areas. A heat wave of this magnitude would impact a broad swath of the population, including those with air conditioning. Prolonged heat would put a strain on the county’s energy grid, health system, and cause widespread damage to infrastructure. A prolonged extreme heat event can occur with cascading hazards, most importantly drought and wildfire. California’s current projections indicate an increase in extreme heat days, which would raise the snowline and decrease snowpack in the Sierras and increase the likelihood of drought conditions in Sierra County. Rising temperatures and a lack of precipitation can lead to ideal conditions for wildfires, which could impact all residents in the county. The destruction caused by these wildfires, including denuding vegetation and burn scars, increases the risk of mudslides and flooding when heavy rain occurs (NOAA National Centers for Environmental Information 2021).

### **10.1.4 Previous Occurrences**

The following sections provide a review of previous Extreme Heat occurrences in Sierra County.

#### **Declarations**

Historically, FEMA has denied requests and subsequent appeals for federal disaster declarations related to extreme heat events, stating that the cascading impacts of heat-related events, such as wildfires, cause the damage for which states seek assistance (Congressional Research Service 2024).

#### **Federal Declarations**

There have been no federal declarations for extreme heat for Sierra County.

#### **State Declarations**

There have been no state declarations related to extreme heat for Sierra County.

#### **USDA Declarations**

There have been no USDA declarations related to extreme heat for Sierra County.



## Summary of Significant Events

California has only experienced four “declared” extreme heat disasters or emergencies since 1950. This is due to limitations in the Stafford Act, which allocates funds to states for natural disasters. Despite this, six excessive heat events have occurred in the Sierra County region since 2021. These events broke high temperature records and, in some cases, led to injury. It is important to note that in September 2023, FEMA Administrator Deanne Criswell testified that an emergency declaration for extreme heat is impossible if, “...the incident exceeds the capacity of a state and local jurisdiction...” Members of Congress have also introduced legislation to include extreme heat in the Stafford Act (Congressional Research Service 2024).

## Recent Events

The NOAA NCEI Storm Events Database reported a total of six “excessive” or extreme heat events impacting Sierra County forecast zones from 1950 through August 2024. Table 10-2 shows a summary of significant extreme heat events. The details provided do not fully describe impacts to the county, but they illustrate the risks faced by the county residents during extreme heat events, especially to those working outdoors (National Weather Service 2023).

Table 10-2. Recent Heat and Excessive Heat Hazard Events

Date (s) of Event	Event ID	County Zone	Description
June 16-20, 2021	969655	West Slope Northern Sierra Nevada (Zone)	Portions of Zone 69 saw high temperatures reach the mid to upper 90s with warm overnight lows.  High to very high heat risk impacted the region with a 4-day heatwave. Several daily high temperature records were either tied or broken on the 18th.
July 9-12, 2021	977400	West Slope Northern Sierra Nevada (Zone)	Portions of the region saw high temperatures reach the mid to upper 90s.  High to very high heat risk impacted the region with a several day heat wave. One daily high temperature record was tied and one daily high temperature record was broken. During the event, cooling centers were made available to the public across interior Northern California.
September 7-9, 2021	987043	West Slope Northern Sierra Nevada (Zone)	Downieville reported a high temperature of 102 on the 7th. Generally, the region saw high temperatures reach the mid to upper 90s.  High to very high heat risk impacted the region. One daily high temperature record was broken. During the event, cooling centers were made available to the public across interior Northern California.
September 4-9, 2022	1057566	West Slope Northern Sierra Nevada (Zone)	Portions of the West Slope of the Northern Sierra saw high temperatures reach up to 95 to 107, with lows in the 70s to around 80. The hottest days were the 5th and 6th.  Triple-digit high temperatures were observed across most of the Central Valley, Delta, and foothills through



Date (s) of Event	Event ID	County Zone	Description
			the first 9 days of September. The hottest temperatures were on September 5 and 6, when temperatures exceeding 110 were observed at many locations. Numerous daily and monthly record high-temperatures were also set in the area.
July 15-16, 2023	1132263	West Slope Northern Sierra Nevada (Zone)	Daytime highs reached the mid-80s to near 100 degree range.  Excessive heat over a mid-July weekend brought very hot temperatures to interior Northern California and Major HeatRisk. Widespread triple digit temperatures were observed in the Valley and foothills. Redding Municipal Airport reached 111 degrees. Records were set for overnight temperatures on July 17.
July 21-23, 2023	1132293	West Slope Northern Sierra Nevada (Zone)	Daytime highs were in the upper 80s to near 100 degrees below 6,000 feet in this zone.  Hot temperatures brought widespread Moderate HeatRisk and areas of Major HeatRisk over a late July weekend. Redding Municipal Airport and Red Bluff Airport tied the previous record daily high of 112 degrees for July 21. Redding then set a new daily record high temperature of 113 degrees on July 22.

### 10.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, are discussed in the sections below.

#### **Probability**

Extreme heat has become more frequent in California since 1950, especially at night. Across most locations studied here, the number and magnitude of extreme heat events have significantly increased. Heat waves – two or more consecutive heat events – vary from year to year but have become more frequent in the past decade (California Office of Environmental Health Hazard Assessment 2022).

#### **Climate Change**

Climate change will have a direct impact on the number and intensity of extreme heat days in Sierra County and the rest of the Sierra Nevada Region. The mean temperature has increased 3° F in the last 60 years (from 46° F in 1960 to 49° F in 2020). In the next 20 years, the mean is anticipated to increase up to 1°–2° F, and in the next 40 years is anticipated to increase an additional 2°–3° F (Sierra Business Council 2022). Sierra County is projected to have a sixfold increase in extreme heat days above 88.9° F and a fivefold increase in warm nights above 50.4° F (Sierra Business Council 2022).

Projected warming temperatures will influence snowpack, runoff, evaporation, and evapotranspiration, as well as drought and overall ecological health in the region. This includes longer growing seasons, shifts in vegetative populations, and invasive species encroachment.



### Potential Future Impacts

Sierra County is projected to have a drastic increase in extreme heat days above 88.9° F and warm nights above 50.4° F. This could impact the health of 95% of residents without household air-conditioning. Extreme heat days and a decrease in water supply from snowpack could cause more dramatic drought conditions. This could impact the ranching communities and the tourism industry, which makes up 44% of local jobs (Sierra Business Council 2022).

## 10.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 10.2.1 Summary of Vulnerability

The entire planning area is exposed to the extreme heat hazard, so an event has the potential to affect the entire population. Extreme heat generally does not impact buildings, but all buildings in the planning area will have an increased energy demand for cooling. All of the planning area's identified critical facilities and the entire environment of the planning area are vulnerable to the extreme heat hazard.

### 10.2.2 Impact on Life, Health, and Safety

Extreme heat poses wide-ranging impacts on public health, energy usage, infrastructure, risks of wildfire, and more. Specifically, as relates to public health, extreme heat can cause illness such as heat exhaustion and heat stroke, and can induce or exacerbate illnesses related to cardiovascular, respiratory, renal, and mental health (UCLA Luskin Center for Innovation and Public Health Alliance of Southern California 2025). According to the California Healthy Places Index: Extreme Heat Edition tool, Sierra County is projected to experience an average of 15.9 days per year with temperatures exceeding 90° F between 2035 and 2064.

### Socially Vulnerable Populations

Individuals with physical or mobility constraints, cognitive impairments, economic constraints, and social isolation. Such populations include the elderly, young children, low-income people, people with life-threatening illnesses and those who are overweight. Power outages can be life threatening to those dependent on electricity for life support. Outdoor recreational users may also be more vulnerable to severe weather events.

Those experiencing homelessness are particularly vulnerable to extreme heat during the summer when increased humidity keeps nighttime temperatures above 80° F. The cumulative effects over several days of continuous exposure to heat, without relief, put the homeless at serious risk of heat stroke or worse. Others at significant risk are low-income populations who do not have access to air-conditioning. This



population, like the homeless, would lack nighttime relief from the heat, elevating their risk of heat stroke or other complications.

### **10.2.3 Impact on General Building Stock**

Extreme heat events can significantly impact the built environment by causing infrastructure damage, increasing energy demand, exacerbating urban heat island effects, and posing health risks to residents and workers, necessitating adaptation strategies like green infrastructure and heat-resilient design. All of the general building stock within Sierra County is considered to be exposed to the extreme heat hazard with varying degrees of vulnerability based on the age and condition of the structures

### **10.2.4 Impact on Community Lifelines**

Extreme heat events can severely impact community lifelines by straining infrastructure, increasing energy demand, and disrupting essential services like healthcare, transportation, and food security, potentially leading to power outages, heat-related illnesses, and economic damage.

### **10.2.5 Impact on the Economy**

The economic and societal consequences of extreme heat are pervasive. Impacts encompass reductions in gross domestic product, as workers and infrastructure systems become less productive, as well as wider detrimental effects on well-being, as healthcare outcomes worsen, and people are unable to access outdoor space. Impacts include transitory ones, from people enduring uncomfortable conditions and workers taking sick leave, and enduring losses, for example, due to interruptions to education or property damage from wildfires which can be more severe due to extreme heat's effect on the environment. Tourism and other leisure activities are also affected as temperatures rise, making walking, shopping, and sightseeing uncomfortable and potentially dangerous.

According to the Atlantic Council's Adrienne Arsht Rockefeller Foundation Resilience Center, extreme heat-related labor productivity losses already affect all regions and sectors of the U.S. economy. Under baseline climate conditions, the United States could lose on average approximately \$100 billion annually from heat-induced lost labor productivity.

### **10.2.6 Impact on Historic and Cultural Resources**

Extreme heat events pose significant threats to historic and cultural resources, leading to accelerated deterioration of materials, damage to structures and artifacts, and disruption of ecosystems around these sites. Specifically for historic sites with outdoor exhibits, such as the Loyaltan Museum, extreme heat can also significantly reduce visitor engagement. High temperatures may deter tourists and local visitors, leading to decreased foot traffic and reduced revenue, which in turn limits funding for preservation and maintenance. Over time, this cycle can contribute to the neglect and decline of culturally significant places. Moreover, staff and volunteers working at these sites may face health risks during heatwaves, further complicating operations and public access.

### **10.2.7 Impact on Ecosystems and Natural Resources**

Rising temperatures affect all types of ecosystems through shifts in species distribution and population structure and increase the risk of species extinction. These changes can impact ecosystem services,



such as carbon storage, and affect crop production. Higher temperatures also naturally increase the risk of arid conditions and droughts.

### 10.2.8 Change in Vulnerability Since 2012 HMP

Extreme heat vulnerability may be increasing slightly, not due to population growth, but due to climate change and the aging population that remains in the County. Seasonal homes may not be equipped with adequate cooling systems, and the low rental vacancy rate suggests that permanent residents may have limited options for relocating during heat events. While the county’s elevation offers some natural protection, prolonged heatwaves could still pose health risks, particularly for vulnerable populations.

## 10.3 MITIGATION OPPORTUNITIES

Table 10-3 presents a range of potential opportunities for mitigating the extreme heat hazard.

Table 10-3. Potential Opportunities to Mitigate the Extreme Heat Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>Plant trees to create shade in urban areas</li> <li>Remove concrete and other hard surfaces and replace them with native vegetation</li> </ul>	<ul style="list-style-type: none"> <li>Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage</li> <li>Remove concrete and other hard surfaces and replace them with native vegetation</li> </ul>	<ul style="list-style-type: none"> <li>Plant trees in urban areas experience urban heat island effects or with below average tree canopy coverage</li> <li>Remove concrete and other hard surfaces and replace them with native vegetation</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>Insulate structures to provide greater thermal efficiency</li> <li>Provide redundant power sources</li> <li>Install air conditioning</li> </ul>	<ul style="list-style-type: none"> <li>Relocate critical infrastructure underground</li> <li>Provide cooling centers for employees</li> <li>Install “cool roofs” and “green roofs”</li> </ul>	<ul style="list-style-type: none"> <li>Relocate critical infrastructure underground</li> <li>Trim trees away from power lines</li> <li>Install “cool roofs” and “green roofs”</li> <li>Establish and promote accessible cooling centers in the community</li> <li>Use the best available technology to enhance the warning systems for extreme heat events</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>Promote 72-hour self-sufficiency</li> <li>Obtain a NOAA weather radio</li> <li>Obtain an emergency generator</li> </ul>	<ul style="list-style-type: none"> <li>Provide safety training and resources for employees that work primarily outside and at field locations</li> <li>Create redundancy in power supply</li> <li>Equip facilities with a NOAA weather radio</li> <li>Equip vital facilities with emergency backup power</li> </ul>	<ul style="list-style-type: none"> <li>Enhance public awareness and outreach to address actions to take during extreme heat events</li> <li>Coordinate severe weather warning capabilities and the dissemination of warning among agencies with the highest degree of capability</li> </ul>



Community Scale	Organizational Scale	Government Scale
		<ul style="list-style-type: none"> <li>• Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors</li> <li>• Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines</li> <li>• Provide NOAA weather radios to the public</li> <li>• Review and update heat response plan to account for climate change projections</li> <li>• Promote programs that support community-scale microgrids</li> <li>• Evaluate and revise building codes to address and mitigate extreme heat impacts on residents</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>• Manage invasive species that thrive in warmer temperatures</li> <li>• Incorporate nature-based heat-reduction measures with plantings in green spaces, trail areas, and community parks</li> </ul>		



# 11. FLOOD

## 11.1 HAZARD PROFILE



### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

### 11.1.1 Description of the Hazard

#### *Defining the Hazard*

Flooding typically occurs when prolonged rain falls over several days, when intense rain falls over a short period of time, or when an ice or debris jam causes a river or stream to overflow onto the surrounding area. Flooding could also occur because of dam failure, previously covered in Section 7. The most common cause of flooding is water due to rain and/or snowmelt that accumulates faster than soils can absorb it, or rivers can carry it away (NWS, Flood Related Hazards n.d.). Most of the flooding in Sierra County can be characterized as riverine, stream and waterway overflow, and drainage events.

#### *Cause of the Hazard*

The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Flood events can be brought on by heavy rainfall. The following are several types of flooding presented and defined by the California Department of Water Resources (DWR):

- **Flash Flooding** is a sudden, rapid flooding of low-lying areas typically caused by intense rainfall. Flash floods can also occur from the collapse of a manmade structure. Rapidly rising water can reach heights of 30 feet or more.
- **Localized Flooding** occurs in both urban and non-urban areas during or after a storm. Any storm, particularly slow-moving, steady rainstorms, can overwhelm drainage systems. When the system backs up, pooling water can flood streets, yards, and even the lower floors of homes and businesses. Even less intense storms can cause this type of flooding when leaves, sediment, and debris plug storm drains.
- **Riverine Flooding** occurs when rivers, streams, and lakes overflow their banks. This includes flooding caused by levee failure and channel erosion. Areas adjacent to local streams and creeks can also experience flooding as a result of excessive runoff from heavy rainfall and accumulation of water flowing over broad flat areas (DWR 2019).

The land area susceptible to being inundated or flooded by water from any source (e.g., river, stream, lake, estuary) is referred to as a floodplain. The floodplain includes the floodway and the floodway fringe to convey the flood event and provide flood water storage. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood



and erosion control. However, not all flooding occurs in such areas. Flash and localized flooding often occurs outside of designated floodplain areas.

Stormwater flooding, also referred to as pluvial flooding, is a result of local drainage issues and high groundwater levels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. Flooding issues of this nature generally occur within areas with flat gradients, and generally increase with urbanization, which speeds accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows.

Urban drainage flooding is caused by increased water runoff due to urban development and drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and within other urban areas. These systems utilize a closed conveyance system that channels water away from an urban area to surrounding streams, and bypasses natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development within that area.

### ***Summary of Potential Impacts***

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; riverine floodplain land is fertile and suitable for farming; transportation by water is easily accessible; land is flatter and easier to develop; and there is value placed in ocean views. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels or causing erosion of natural flood protection systems such as dunes. Flood potential can be increased in several ways: reducing a stream's capacity to contain flows; increasing flow rates or velocities downstream; and allowing waves to extend further inland. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

### ***Cascading Hazard Impacts***

The most problematic secondary hazard for flooding is bank erosion. In many cases, the threat and effects of erosion are worse than actual flooding. This is especially true on the upper courses of rivers where there are steep gradients. Floodwaters in these reaches may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows oversaturate soils on steep slopes, causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers, or drainage sewers.

## **11.1.2 Location**

FEMA defines flood hazard areas through statistical analyses of records of river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys;



and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FIRMs, which are official maps of a community on which the Federal Insurance and Mitigation Administration has delineated special flood hazard areas (SFHAs). The SFHA is the land area on a digital FIRM covered by floodwaters of the “base flood,” which is the flood with a 1% chance of occurrence in any given year (also called the 1% annual chance flood). In Sierra County, FEMA has designated several areas along rivers and creeks, such as the North Yuba River and its tributaries, as SFHAs due to their susceptibility to seasonal flooding and runoff from steep terrain. These mapped areas are subject to federal floodplain management regulations under the National Flood Insurance Program (NFIP), and property owners in these zones may be required to carry flood insurance if they have federally backed mortgages.

Figure 11-1 and Figure 11-2 display the FEMA 1% Annual Chance Flood zones for Sierra County.

Figure 11-1. FEMA 1% Annual Chance Flood Zones – Countywide

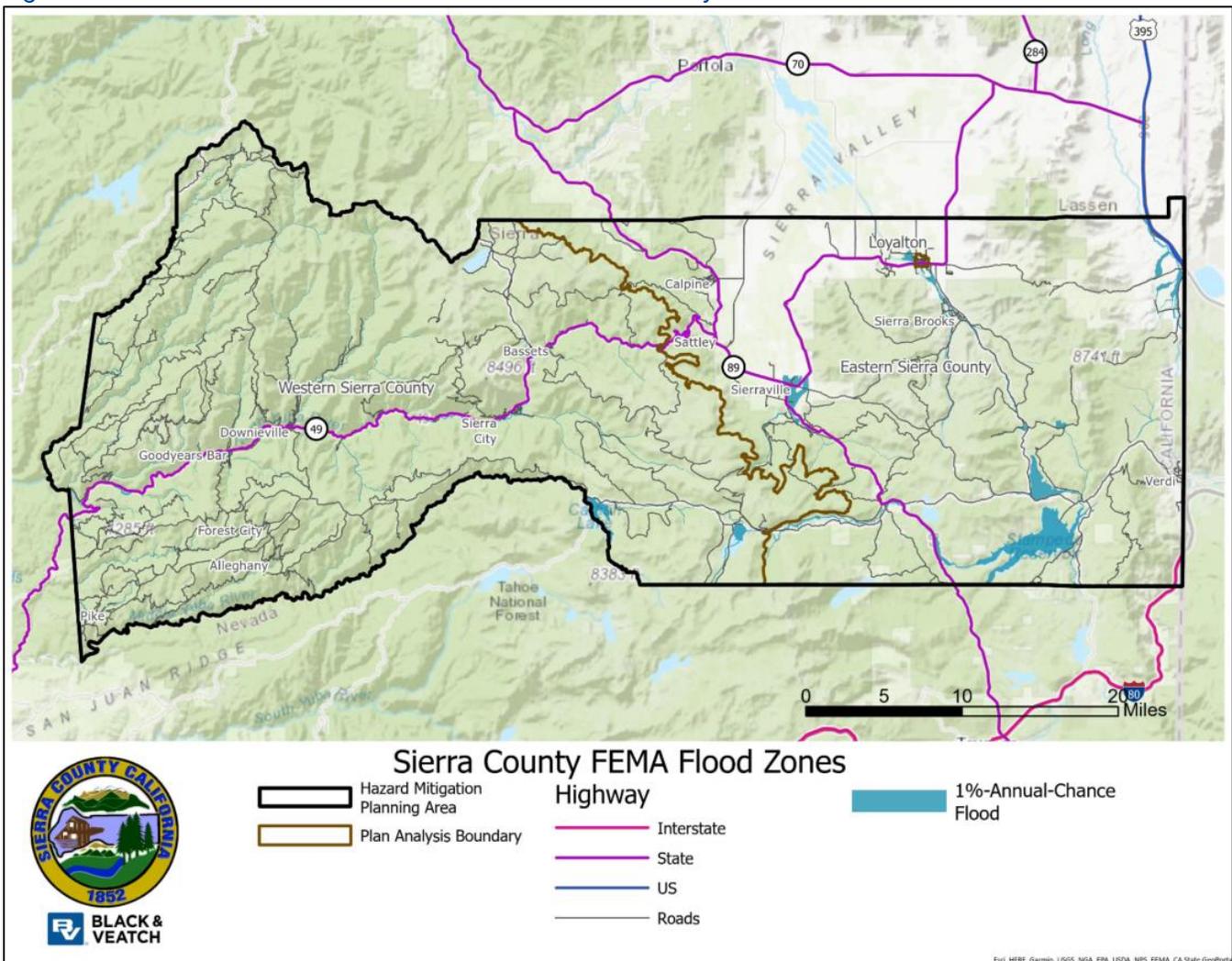




Figure 11-2. FEMA 1% Annual Chance Flood Zones – Detail

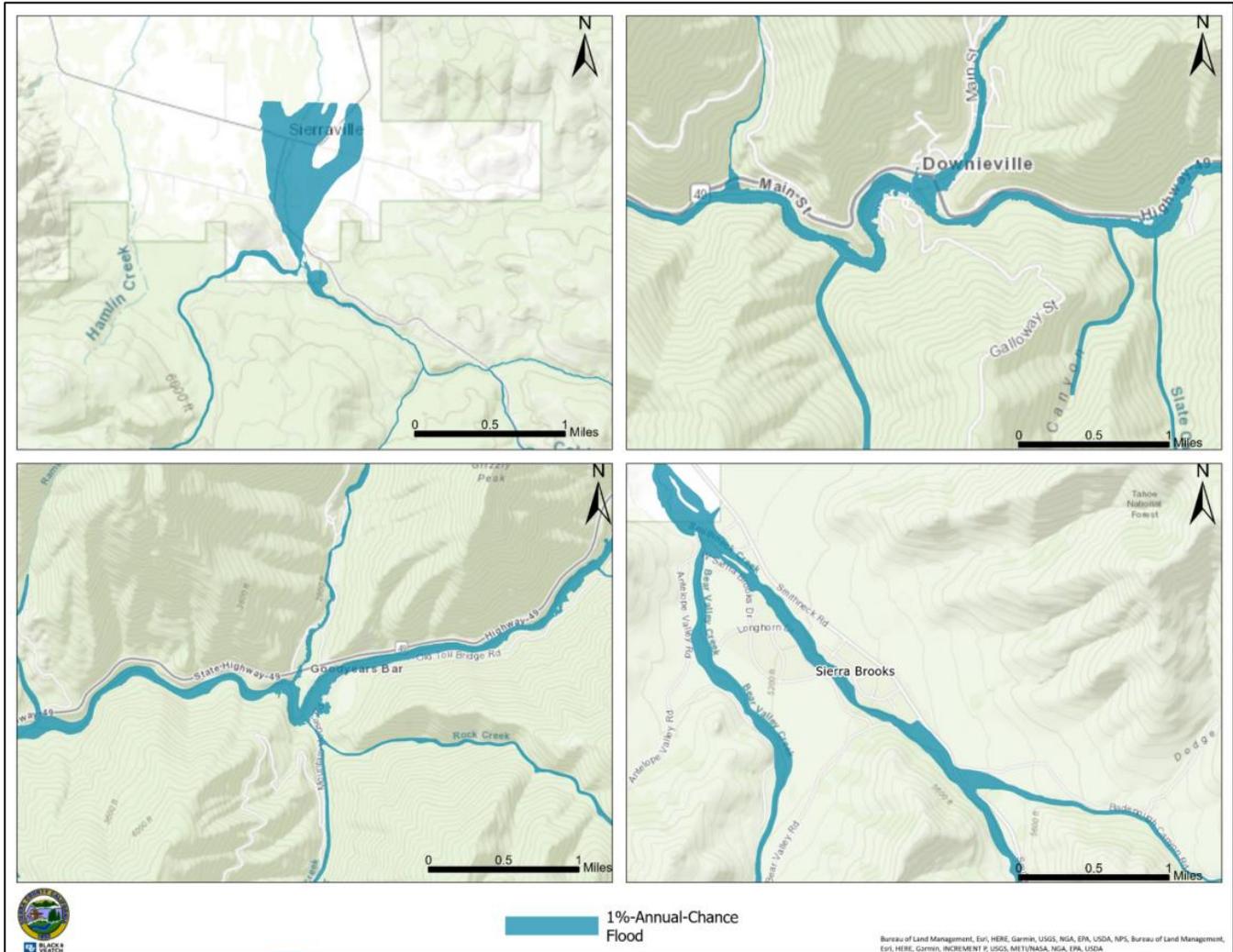




Figure 11-3 and Figure 11-4 display DWR Flood Awareness Zones, designated regions where there is a recognized risk of flooding, and where residents, businesses, and local authorities are encouraged to be especially aware of flood risks and take appropriate precaution.

Figure 11-3. Sierra County DWR Flood Awareness Zones – Countywide

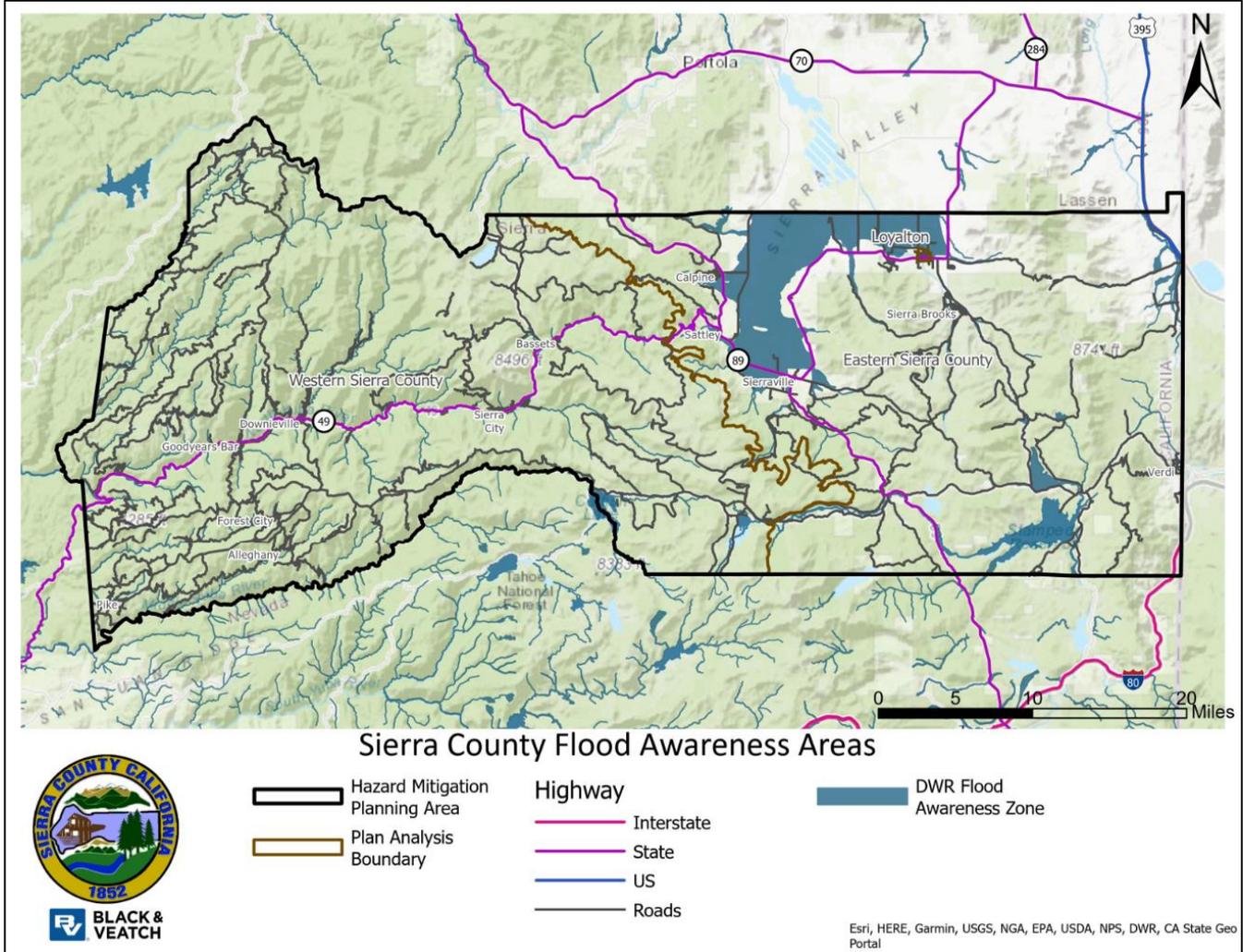
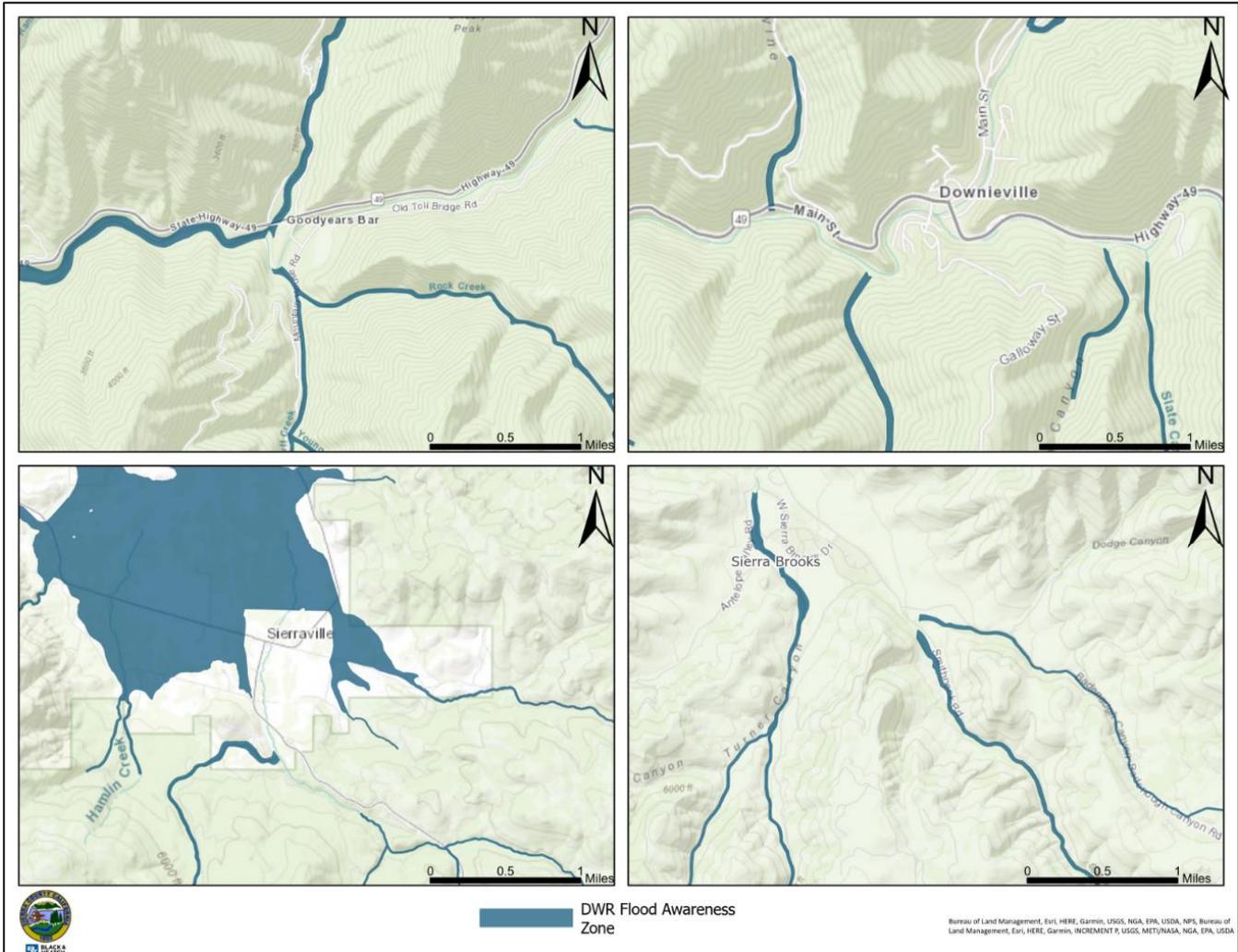




Figure 11-4. Sierra County DWR Flood Awareness Zones – Detail



Downieville is vulnerable to significant flood risk due to its steep mountainous terrain, confined river valleys, and the potential for rapid snowmelt and intense rainfall events, particularly during winter storms and atmospheric river conditions. Located at the confluence of the Downie River and the North Fork of the Yuba River, the Downieville levee serves as a critical component in managing flood hazards for Sierra County.

### 11.1.3 Extent

#### Measuring Intensity

Flood categories are defined for each gage location that describe or categorize the observed or expected severity of flood impacts in the corresponding stream segment or nearby stream. The severity of flooding at a given stage is not necessarily the same at all locations along a stream due to varying channel/bank characteristics on portions of the stream. Therefore, the stage for a given flood category is usually associated with lowest water level corresponding to the most significant flood impacts somewhere in



the reach. The flood categories used in the NWS are the following (NWS, High Water Level Terminology n.d.):

- **Minor Flooding**—Minimal or no property damage, but possibly some public threat. A Flood Advisory product is issued to advise the public of events that are expected not to exceed the minor flood category.
- **Moderate Flooding**—Some inundation of structures and roads near streams. Some evacuations of people or transfer of property to higher elevations are necessary. A Flood Warning should be issued if moderate flooding is expected during the event.
- **Major Flooding**—Extensive inundation of structures and roads. Significant evacuations of people or transfer of property to higher elevations. A Flood Warning should be issued if major flooding is expected during the event.

The three flood categories do not necessarily exist for each gage location. Most commonly, gages in remote areas may not have a major flood stage assigned. Record flooding is flooding that equals or exceeds the highest stage or discharge at a given site during the period of recordkeeping.

### **Warning Time**

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without warning. Warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger.

Each watershed has unique qualities that affect its response to rainfall. A hydrograph, which is a graph showing stream flow in relation to time, is a useful tool for examining a stream's response to rainfall. Once rainfall starts falling over a watershed, runoff begins, and the stream begins to rise. Water depth in the stream channel (stage of flow) will continue to rise in response to runoff even after rainfall ends. Eventually, the runoff will reach a peak and the stage of flow will crest. It is at this point that the stream stage will remain the most stable, exhibiting little change over time until it begins to fall and eventually subside to a level below flooding stage.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time to the time that a community has to take actions to protect lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage.

The NWS issues warnings or advisories when confidence is greater than 80% that an event will occur. Depending on the type of event, these may be issued anywhere from hours before an event to days in advance of an event. Warnings include the following (NWS, Flood Related Products n.d.):

- **Flash Flood Warning:** A Flash Flood Warning is issued to inform the public, emergency management and other cooperating agencies that flash flooding is in progress, imminent, or highly likely. Flash Flood Warnings are urgent messages as dangerous flooding can develop very



rapidly, with a serious threat to life and/or property. Flash Flood Warnings are usually issued minutes to hours in advance of the onset of flooding.

- **Flash Flood Watch:** A Flash Flood Watch is issued to indicate current or developing conditions that are favorable for flash flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flash flooding.
- **Flood Warning:** A Flood Warning is issued to inform the public of flooding that poses a serious threat to life and/or property. A Flood Warning may be issued hours to days in advance of the onset of flooding based on forecast conditions. Floods occurring along a river usually contain river stage (level) forecasts.
- **Flood Watch:** A Flood Watch is issued to indicate current or developing conditions that are favorable for flooding. The occurrence is neither certain nor imminent. A watch is typically issued within several hours to days ahead of the onset of possible flooding. In situations where a river or stream is expected to be the main source of the flooding, forecast confidence may allow for a Flood Watch to be issued several days in advance.
- **Flood Advisory:** A Flood Advisory is issued when a flood event warrants notification but is less urgent than a warning. Advisories are issued for conditions that could cause a significant inconvenience, and if caution is not exercised, could lead to situations that may threaten life and/or property.

A Flood Advisory product is issued to advise the public of events that are expected not to exceed the minor flood category. A Flood Warning should be issued if moderate or major flooding is expected during the event.

**Worst-Case Scenario**

The worst-case scenario is a series of storms that flood numerous drainage basins in a short time. This would overwhelm local response and floodplain management departments. Major roads would be blocked, preventing access for many residents and critical functions. High river flows could cause rivers to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, the County would not be able to make repairs quickly enough to restore critical facilities.

**11.1.4 Previous Occurrences**

The following sections provide a review of previous flood occurrences in Sierra County.

**Declarations**

**Federal Declarations**

Between 1954 and 2024, Sierra County experienced six flood-related major disaster (DR) or emergency declarations (EM).

Table 11-1. Federal Flood Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-183	December 24, 1964	December 24, 1964	Heavy Rains and Flooding
DR-253	January 26, 1969	January 26, 1969	Severe Storms and Flooding



Disaster Number	Incident Period	Declaration Date	Description
DR-758	February 12, 1986 – March 10, 1986	February 21, 1986	Severe Storms and Flooding
DR-979	January 5, 1993 – March 20, 1993	February 3, 1993	Severe Winter Storm, Mudslides, Landslides, and Flooding
DR-4308	February 1, 2017 – February 23, 2017	April 1, 2017	Severe Winter Storms, Flooding, and Mudslides
EM-3592	March 9, 2023 – July 10, 2023	March 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides

Source: OpenFEMA Datasets ([OpenFEMA Data Sets | FEMA.gov](https://openfema.org/))

### State Declarations

Between 2012 and 2024, California declared no disasters related to floods in Sierra County.

### USDA Declarations

Between 2012 and 2024, the USDA declared no disasters related to floods in Sierra County.

### Summary of Significant Events

Significant and damaging flooding has occurred in the winters of 1958, 1962, 1969, 1982, 1986, 1992, 1995, 1997, and 2005.

### Recent Events

The NOAA NCEI Storm Events Database reported a total of 3 days flood events impacting Sierra County forecast zones from 1950 through 2024. Table 11-2 shows a summary of significant flood events.

Table 11-2. Recent Flood Hazard Events

Date (s) of Event	Disaster Declaration	County Included	Description
December 30-31, 2005	5482179	Sierra County	Debris in streams caused water to back up and caused flooding in portions of eastern Sierra County. Several buildings experienced flooding, including the U.S. Forest Service office in Sierraville. California Highway 89 was closed across Sierra County from the Nevada County line to Calpine.
February 9-10, 2017	706013	Sierra County	Flooding from creeks covered the intersection of Highways 49 and 89 in Sierraville on the afternoon of the 9th. Shallow water was photographed up against buildings at the Sierraville Ranger Station on the morning of the 10th. A washout caused the closure of Highway 49 between Sattley and Yuba Pass. Damage estimates are only for repairs to Highways 49 and 89 based on a CALTRANS report.
March 9-10, 2023	1099340	Sierra County	The public reported 4.0 mi ENE of Sattley of flooding along CA-49 from Sierraville and Loyaltan. Most of the flooding is due to the berms blocking the flow of water off the roadway. It was only 1 to 3 inches deep in most locations.



### 11.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

#### *Probability*

Flooding is common in California and can take place any time of the year. Based on historical flood events, the State has a high probability of future riverine, flash, localized, and alluvial fan flood events. The frequency and severity of fluvial flooding for river systems are based on “discharge probability.” The discharge probability is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for different discharge levels. These measurements reflect statistical averages only; it is possible for multiple floods with a low probability of occurrence (such as a 1% annual chance flood) to occur in a short time period. A single flood event can have flows at different points on a river or stream that correspond to different probabilities of occurrence.

#### *Climate Change*

Climate change plays a significant role in the increasing frequency and intensity of extreme weather events, particularly floods. According to scientific reports, as global temperatures rise, the hydrological cycle becomes more dynamic and unpredictable. Warmer air holds more moisture, which often leads to heavier and more intense rainfall. This accelerates the risk of flooding, as seen in numerous impactful events around the world. Additionally, the shift in weather patterns caused by climate change contributes to prolonged periods of drought in some regions, further exacerbating water-related challenges.

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Scientists project greater storm intensity with climate change, resulting in more direct runoff and flooding. High frequency flood events in particular will likely increase with a changing climate. What is currently considered a 1% annual chance also may strike more often, leaving many communities at greater risk. Going forward, model calibration must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted.

Climate change is already impacting water resources, and resource managers have observed the following:

- Historical hydrologic patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply and quality, flood management and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection, drought preparedness and emergency response.



The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain areas to contribute to peak storm runoff. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

### **Potential Future Impacts**

While regulated floodplains for the region have not been clearly identified, Sierra County will be well-equipped to manage growth in floodplains with its flood damage prevention ordinance, its building code, and the Safety Element of its General Plan. Proper application of these tools requires accurate hazard mapping. Flood mapping should be taken into account as future land use decisions are made for areas impacted by flooding.

## **11.2 VULNERABILITY ASSESSMENT**

### **Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)**



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### **11.2.1 Summary of Vulnerability**

The following sections provide a qualitative assessment of flood risk in Sierra County.

### **11.2.2 Impact on Life, Health, and Safety**

Floods present threats to public health and safety. Floodwater is generally contaminated by pollutants such as sewage, human and animal feces, pesticides and insecticides, fertilizers, oil, asbestos, and rusting building materials. The following health and safety risks are commonly associated with flood events:

- **Unsafe food**—Floodwaters contain disease-causing bacteria, dirt, oil, human and animal wastes, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and thus must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.



- **Contaminated drinking/washing water and poor sanitation**—Flooding impairs clean water sources with pollutants and affects sanitary toilets. Direct and indirect contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne infectious disease. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection and illnesses if they are broken or overflow. Unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks, including life-threatening cholera, typhoid, dysentery, and some forms of hepatitis.
- **Mosquitoes and animals**—Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities.
- **Molds and mildews**—Excessive exposure to molds and mildews can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases and to trigger cold-like symptoms such as sore throat, watery eyes, wheezing and dizziness. Molds grow in as short a period as 24 to 48 hours in wet and damp areas of buildings and homes that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets, and bathrooms. Very small mold spores can be easily inhaled by human bodies and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people and pregnant women are considered most vulnerable to mold-induced health problems.
- **Carbon monoxide poisoning**—Carbon monoxide poisoning is as a potential hazard after major floods. Carbon monoxide can be found in combustion fumes, such as those generated by small gasoline engines, stoves, generators, lanterns and gas ranges, or by burning charcoal or wood. In the event of power outages following floods, flood victims tend to use alternative sources of fuels for heating, cooling, or cooking inside enclosed or partly enclosed houses, garages or buildings without an adequate level of air ventilation. Carbon monoxide builds up from these sources and poisons the people and animals inside.
- **Hazards when reentering and cleaning flooded homes and buildings**—Flooded buildings can pose health hazards after floodwaters recede. Electrical power systems can become hazardous. People should avoid turning on or off the main power while standing in floodwater. Gas leaks from pipelines or propane tanks can trigger explosion when entering and cleaning damaged buildings or working to restore utility service. Flood debris—such as broken bottles, wood, stones, and walls—may cause wounds and injuries when cleaning damaged buildings. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks and other industrial chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup.



- Mental stress and fatigue**—Exposure to extreme disaster events can cause psychological distress. Having experienced a devastating flood, seen loved ones lost or injured, and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Post-flood recovery—especially when prolonged—can cause anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Behavior changes may also occur in children. There is also a long-term concern among the affected that their homes can be flooded again in the future.

**Socially Vulnerable Populations**

In Sierra County, socially vulnerable populations face heightened risks from flooding due to a combination of geographic, economic, and infrastructural factors. Many residents live in remote or low-lying areas with limited access to emergency services and flood mitigation infrastructure. Populations such as low-income families, elderly individuals, people with disabilities, and those living in mobile homes are particularly at risk. These groups often lack the financial resources to prepare or recover from flood events, such as purchasing insurance or repairing damaged property. Limited transportation options and communication barriers can also hinder timely evacuation and access to aid.

**11.2.3 Impact on General Building Stock**

Many buildings, especially in older or rural communities, were constructed before modern floodplain management standards were adopted, making them more susceptible to water damage. Flooding can lead to significant structural damage, mold growth, and long-term deterioration of foundations and materials, especially in homes and public buildings not elevated above base flood elevations. These impacts not only threaten the physical integrity of the building stock but also strain local resources for repair and recovery.

Property exposure and losses were estimated through the Level 2 Hazus analysis for the assessed flood zones. Table 11-3 and Table 11-4 show the estimates for the flood exposure and damage to structures and building contents with the percent of total replacement value.

Table 11-3. Loss Estimates for FEMA 100-year Flood Hazard

Planning Area	Estimated Loss Associated with 100-year Flood			% of Total Replacement Value
	Structure	Contents	Total	
Loyalton	\$296,037	\$243,452	\$539,489	0.2%
Eastern Sierra County	\$992,961	\$621,466	\$1,614,427	0.3%
Western Sierra County	\$4,884,681	\$6,126,982	\$11,011,662	2.4%
<b>Total</b>	<b>\$6,173,679</b>	<b>\$6,991,900</b>	<b>\$13,165,579</b>	<b>1.1%</b>

Table 11-4. Exposure Estimates for DWR Flood Awareness Zones

Planning Area	Estimated Exposure in DWR Flood Awareness Zones			% of Total Replacement Value
	Structure	Contents	Total	
Loyalton	\$0	\$0	\$0	0.0%



Planning Area	Estimated Exposure in DWR Flood Awareness Zones			% of Total Replacement Value
	Structure	Contents	Total	
Eastern Sierra County	\$14,731,124	\$7,873,916	\$22,605,039	4.8%
Western Sierra County	\$3,793,028	\$2,086,017	\$5,879,045	1.3%
<b>Total</b>	<b>\$18,524,152</b>	<b>\$9,959,933</b>	<b>\$28,484,085</b>	<b>2.5%</b>

### 11.2.4 Impact on Community Lifelines

As most flooding in the county are riverine, stream and waterway overflow and drainage events, these types of flooding often result in property damage, road washouts, and transportation disruptions. General impacts of these events may include commercial and residential structural damage. Loss of water, power, roads, phones, and transportation may occur, which can be particularly dangerous for those with certain medical conditions. Critical facilities and community lifelines exposed to the riverine flood hazard are likely to experience functional downtime following a flood event, which could increase the net impact of the event. Refer to Table 11-5 for a summary of community lifelines in the flood hazard areas.

Table 11-5. Community Lifelines in Flood Hazard Areas

Planning Area	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
<b>100-year Flood</b>									
Loyalton	0	0	0	0	0	0	1	0*	1
Eastern Sierra County	5	0	1	1	0	4	5	0*	16
Western Sierra County	2	1	0	2	0	0	27	0*	32
<b>Total</b>	<b>7</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>33</b>	<b>0*</b>	<b>49</b>
<b>DWR Flood Awareness Zones</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	0	0	0	0	0	0	11	0*	11
Western Sierra County	0	1	0	1	0	0	23	0*	25
<b>Total</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>34</b>	<b>0*</b>	<b>36</b>

Note: \*Spatial data for analysis of Water Systems in not currently available for Sierra County

### 11.2.5 Impact on the Economy

Flooding can lead to significant economic impacts, including damage to infrastructure, businesses, and property, as well as disruptions to transportation and supply chains.

### 11.2.6 Impact on Historic and Cultural Resources

Most of the county’s cultural and historic resources tie to the region’s Native American heritage and early settler history. Events like the 1997 flood demonstrated how quickly infrastructure and heritage sites can



be damaged or isolated due to washed-out roads and bridges (Nourse 2007). The 1997 flood damaged Goodyear’s Bar Bridge, a historic bridge; several historic cabins such as the Wild Plum Road cabin were swept away. Structures such as historic bridges hold generational and cultural significance for the community. Floods lead to the erosion of foundations, water damage to wooden structures, and the loss of archival materials stored in basements or poorly protected facilities.

**11.2.7 Impact on Ecosystems and Natural Resources**

Floods can have both beneficial and detrimental effects on ecosystems and natural resources, including habitat destruction, erosion, water contamination, and changes to soil fertility, while also potentially recharging groundwater and creating new habitats. Seasonal floods can renew ecosystems, providing life-giving waters in more ways than one. Floods transport vital nutrients, such as nitrogen, phosphorus, and organic material, to the surrounding land. When the water recedes, it leaves behind nutrient-rich sediment on the floodplains, enhancing soil fertility and promoting biodiversity. Floods can also help recharge groundwater supplies and create new aquatic habitats that support a variety of species.

However, floods can also cause significant ecological disruption. Rapid or severe flooding may lead to habitat destruction, increased erosion, water contamination, and the displacement of wildlife. In Sierra County, flooding is a particular concern due to the region’s steep canyons, mountainous terrain, and fast-flowing rivers. Heavy rainfall or rapid snowmelt can quickly overwhelm river systems, leading to flash floods that threaten both natural environments and human infrastructure. Lakes and reservoirs may also overflow, affecting aquatic habitats and nearby communities.

**11.2.8 Change in Vulnerability Since 2012 HMP**

Flood vulnerability in Sierra County has remained relatively stable since 2012. The county’s population has not shifted significantly, and there has been little new development in flood-prone areas. Due to the county’s topography and limited urbanization, flood risk is more influenced by natural hydrological patterns than by human activity.

**11.3 MITIGATION OPPORTUNITIES**

Table 11-6 presents a range of potential opportunities for mitigating the flood hazard.

Table 11-6. Potential Opportunities to Mitigate the Flood Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>• Clear storm drains and culverts</li> <li>• Use low-impact development techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Clear storm drains and culverts</li> <li>• Use low-impact development techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain drainage systems</li> <li>• Institute low-impact development techniques on property</li> <li>• Structural flood control, levees, channelization, or revetments</li> <li>• Stormwater management regulations and master planning</li> <li>• Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		



Community Scale	Organizational Scale	Government Scale
<ul style="list-style-type: none"> <li>• Locate outside of hazard area</li> <li>• Elevate utilities above base flood elevation</li> <li>• Use low-impact development techniques</li> <li>• Raise structures above base flood elevation</li> <li>• Elevate items within house above base flood elevation</li> <li>• Build new homes above base flood elevation</li> <li>• Flood-proof structures</li> </ul>	<ul style="list-style-type: none"> <li>• Locate outside of hazard area</li> <li>• Use low-impact development techniques</li> <li>• Build critical function redundancy or retrofit critical buildings</li> <li>• Provide floodproofing when new critical infrastructure must be located in floodplains</li> </ul>	<ul style="list-style-type: none"> <li>• Locate or relocate critical facilities outside of hazard area</li> <li>• Acquire or relocate identified repetitive loss properties</li> <li>• Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks</li> <li>• Adopt land development criteria such as planned unit developments, density transfers, clustering Institute low impact development techniques on property</li> <li>• Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff</li> <li>• Harden infrastructure, bridge replacement program</li> <li>• Provide redundancy for critical functions and infrastructure</li> <li>• Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold, compensatory storage, non-conversion deed restrictions</li> <li>• Stormwater management regulations and master planning</li> <li>• Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities</li> <li>• Improve unpaved roads to reduce their likelihood to fail due to flooding</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• Buy flood insurance</li> <li>• Develop household plan, such as retrofit savings, communication with outside, 72 hour self-sufficiency during and after an event</li> </ul>	<ul style="list-style-type: none"> <li>• Keep cash reserves for reconstruction</li> <li>• Support and implement hazard disclosure for sale of property in risk zones</li> <li>• Solicit cost-sharing through partnerships on projects with multiple benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Produce better hazard maps</li> <li>• Provide technical information and guidance</li> <li>• Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information)</li> <li>• Incorporate retrofitting or replacement of critical system elements in capital improvement plan</li> <li>• Develop strategy to take advantage of post-disaster opportunities</li> <li>• Warehouse critical infrastructure components</li> <li>• Develop and adopt a continuity of operations plan</li> <li>• Consider participation in the Community Rating System</li> <li>• Maintain and collect data to define risks and vulnerability</li> <li>• Train emergency responders</li> </ul>



Community Scale	Organizational Scale	Government Scale
		<ul style="list-style-type: none"> <li>• Create an elevation inventory of structures in the floodplain</li> <li>• Develop and implement a public information strategy</li> <li>• Charge a hazard mitigation fee</li> <li>• Integrate floodplain management policies into other planning mechanisms within the planning area.</li> <li>• Consider impacts of climate change on the risk associated with the flood hazard</li> <li>• Consider the residual risk associated with structural flood control in future land use decisions</li> <li>• Enforce National Flood Insurance Program</li> <li>• Adopt a Stormwater Management Master Plan</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>• Restore and reconnect floodplains that have been degraded by development and structural flood control</li> <li>• Use soft approaches for stream bank restoration and hardening</li> <li>• Set back levees on systems that rely on levee protection to allow the channel to meander, which reduces erosion and scour potential</li> <li>• Preserve floodplain storage capacity by limiting or prohibiting the use of fill in the floodplain</li> <li>• Incorporated green infrastructure into stormwater management facilities</li> <li>• Protect and/or restore riparian buffers</li> </ul>		

Figure 11-5. Sierra Valley Flooding



(Photo Credit: LeTina Vanetti)



## 12. LANDSLIDE/MASS MOVEMENT

### 12.1 HAZARD PROFILE



#### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

#### 12.1.1 Description of the Hazard

##### *Defining the Hazard*

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation driven by gravity. Both natural and human-induced changes in the environment can trigger landslides. The following are the several types of landslides:

- **Rock falls** are rapid movements of bedrock, which result in bouncing or rolling.
- **Topple** is a section or block of rock that rotates or tilts before falling to the slope below.
- **Slides** are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material.
- **Mudflows**, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or “slurry.”
- **Slurry** can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing larger as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.
- **Creep** is the imperceptibly slow downward movement of slope forming rock or soil that can be accelerated during wet weather events or earthquakes.

##### *Cause of the Hazard*

Landslides are caused by a combination of geological and climate conditions and the influence of urbanization. They can be initiated by storms, earthquakes, fires, volcanic eruptions, or human modification of the land. Vulnerable natural conditions are affected by human development and the infrastructure that supports it. In some cases, irrigation increases the landslide potential. The following factors can contribute to slide formation:

- Change in slope of the terrain
- Increased load on the land
- Shocks and vibrations
- Change in water content
- Groundwater movement



- Frost action
- Weathering of rocks
- Removing or changing
- The type of vegetation covering slopes

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes.

While small landslides are frequently a result of human activity, the largest landslides are often naturally occurring phenomena with little or no human contribution. The sites of large landslides are typically areas of previous landslide movement that are periodically reactivated by significant precipitation or seismic events.

### ***Summary of Potential Impacts***

Landslides in hillside terrain can pose serious hazard to downslope property and structures. They can disrupt roadways and other infrastructure lifelines, destroy private property, and cause flooding, bank erosion, and rapid channel migration. A slide can move rapidly down slopes or through channels and can strike with little or no warning. It can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path. Although slides behave as fluids, they convey many times the hydraulic force of water due to the mass of material they carry.

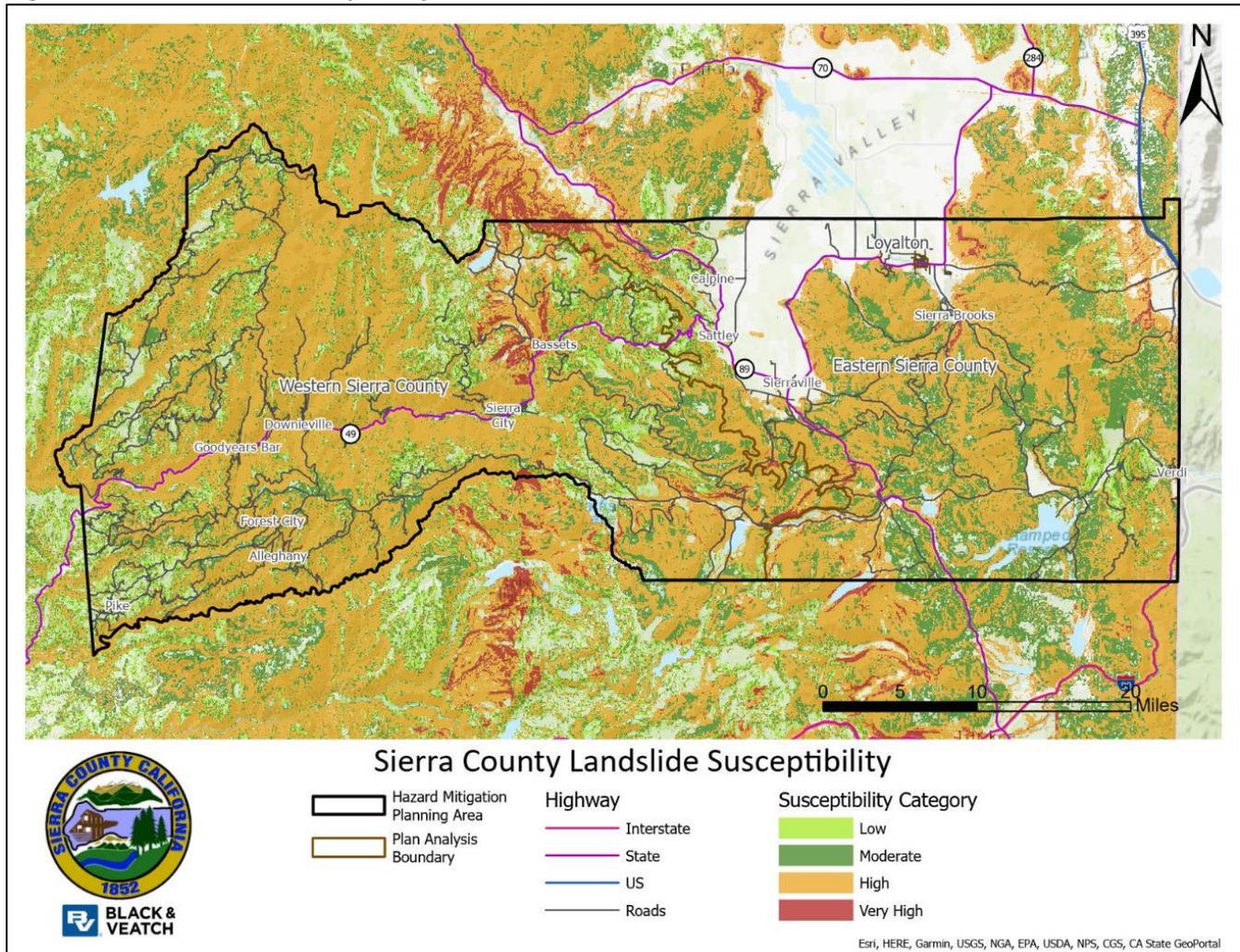
Despite their destructive potential, landslides can serve beneficial functions to the natural environment. They supply sediment and large wood to the channel network and can contribute to complexity and dynamic channel behavior critical for aquatic and riparian ecological diversity.

### ***Cascading Hazard Impacts***

Landslides that block rivers or streams can form unstable natural dams, trapping water and creating temporary lakes. These impoundments pose a serious risk of sudden failure, which can create destructive flash flooding downstream. Saturated soils from these events can likely destabilize nearby slopes, triggering additional landslides and cause cascading effects such as damaged infrastructure and roads, isolating rural communities, disrupting emergency services, and contaminating water sources.



Figure 12-1. Landslide Susceptibility



### 12.1.2 Location

Sierra County lies within a geologically dynamic region of Northern California, influenced by both tectonic and volcanic activity. The County is situated relatively close to Lassen Peak, which experienced a series of explosive eruptions in 1914–1915. Its proximity to such events highlights the broader regional susceptibility to landslides and debris flows, especially in areas with steep terrain, loose soils, and seasonal snowmelt. The county’s mountainous topography, combined with intense winter storms and wildfire-scarred landscapes, increases the potential for localized landslides. Figure 12-1 shows deep-seated landslide susceptibility classes (none, low, moderate, high, and very high).

### 12.1.3 Extent

#### Measuring Intensity

Landslides are typically a function of soil type and steepness of slope. Soil type is a key indicator for landslide potential and is used by geologists and geotechnical engineers to determine soil stability for



construction standards. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33%
- Post-wildfire areas
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, mixed with granular soils, such as sand or gravel

The best predictor of where slides might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges. The recognition of ancient dormant landslide sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

### **Warning Time**

Landslides can occur suddenly or slowly. The velocity of slide may range from a slow creep of inches per year to many feet per second, depending on slope angle, material, and water content. Generally accepted warning signs for landslide activity include the following:

- Springs, seeps, or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures such as decks and patios tilting or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity (soil content)
- Sudden decrease in creek water levels though rain is still falling or just recently stopped
- Sticking doors and windows and visible open spaces indicating frames out of plumb
- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together



Some methods used to monitor landslides can provide an idea of the type of slide and the amount of time prior to failure. Assessing the geology, vegetation, and amount of predicted precipitation for an area can help in predictions of what areas are at risk during general time periods. Currently, there is no practical warning system for individual landslides, however. The standard operating procedure is to monitor situations on a case-by-case basis and respond after an event has occurred.

**Worst-Case Scenario**

The worst-case scenario for landslide hazards in the planning area would generally correspond to a severe storm with heavy rain that caused flooding in an area that had been burned by fire. Landslides are more likely during the late winter when the water table is high. After heavy rains from November to December, soils become saturated with water. As water seeps downward through upper soils that may consist of permeable sands and gravels and as it accumulates on impermeable silt, it will weaken and destabilize the slope. A short intense storm could cause saturated soil to move, resulting in landslides. As rains continue, the groundwater table rises, adding to the weakening of the slope. Gravity, poor drainage, a rising groundwater table, and poor soil exacerbate hazardous conditions.

**12.1.4 Previous Occurrences**

The following sections provide a review of previous landslide/mass movement occurrences in Sierra County.

**Declarations**

**Federal Declarations**

Between 1954 and 2024, Sierra County experienced eight landslide/mass movement-related major disaster (DR) or emergency declarations (EM).

Table 12-1. Federal Landslide/Mass Movement Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-979	January 5, 1993 – March 20, 1993	February 3, 1993	Severe Winter Storm, Mudslides, Landslides, and Flooding
DR-1046	February 13, 1995 – April 19, 1995	March 12, 1995	Severe Winter Storms, Flooding, Landslides, and Mudflow
DR-1155	December 28, 1996 – April 1, 1997	January 4, 1997	Severe Storms, Flooding, Mudslides, and Landslides
DR-1628	December 17, 2005 – January 3, 2006	February 3, 2006	Severe Storms, Flooding, Mudslides, and Landslides
DR-4301	January 3, 2017 – January 12, 2017	February 14, 2017	Severe Winter Storms, Flooding, and Mudslides
DR-4308	February 1, 2017 – February 23, 2017	April 1, 2017	Severe Winter Storms, Flooding, and Mudslides
DR-4699	February 21, 2023 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds,



Disaster Number	Incident Period	Declaration Date	Description
			Flooding, Landslides, and Mudslides
EM-3592	March 9, 2023 – July 10, 2023	March 10, 2023	Severe Winter Storms, Flooding, Landslides, and Mudslides

Source: OpenFEMA Datasets ([OpenFEMA Data Sets | FEMA.gov](https://openfema.com/))

**State Declarations**

Between 2012 and 2024, California declared no disasters related to landslide/mass movement in Sierra County.

**USDA Declarations**

Between 2012 and 2024, the USDA declared no disasters related to landslide/mass movement in Sierra County.

**Summary of Significant Events**

In the near vicinity of Sierra County, Lassen Volcano was the second most recent eruption in the Western Region. Explosions recurred at irregular intervals on Lassen Peak for most of 1914. On May 19, 1915, a mass of lava rose in the summit crater and spilled 1,000 feet down the western side of the volcano. Extensive mudflows were created on the northeastern side as snow banks were melted. The resulting debris swept down the slope. Divided by Raker Peak, part of this mudflow raced down Lost Creek; the remaining flow passed over the 100-foot rise east of the park road and rushed down Hat Creek. A wide barren swath was torn through the forest.

**Recent Events**

There are no recent landslide events of note within Sierra County.

**12.1.5 Future Conditions**

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

**Probability**

Mass movements are often triggered by other natural hazards such as earthquakes, heavy rain, floods, or wildfires, so their frequency is often related to the frequency of the precipitating hazards. The probability of future occurrences is unlikely in Sierra County given the location of the nearest volcano but may occur during and after severe storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. Most weather-induced landslides occur in the winter after the water table has risen. Landslides that result from earthquakes can occur at any time.

**Climate Change**

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature is likely to affect the snowpack and its ability to



hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Each these factors would increase the probability of landslides.

**Potential Future Impacts**

According to the California Department of Finance, the population of Sierra County region is expected to continue a gradual decline over the next several decades. decrease over the next 45 years. As one of the smallest and most rural counties in the state, Sierra County has limited potential and need for expansion. The County will be well-equipped to manage development with its building code, and the Safety Element of its General Plan.

**12.2 VULNERABILITY ASSESSMENT**

**Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)**



*The plan must include a description of the jurisdiction’s vulnerability to the hazards of concern and include an overall summary of the hazard’s impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

**12.2.1 Summary of Vulnerability**

A small part of the planning area is exposed to the landslide hazard. Summary findings of the risk assessment for landslide are shown below.

**12.2.2 Impact on Life, Health, and Safety**

All people exposed to the landslide hazard are potentially vulnerable.

**Socially Vulnerable Populations**

Socially vulnerable populations may experience greater impacts from landslides and other earth movements due to a financial inability to react or respond to these events. Vulnerable populations may reside in areas with only one means of ingress and egress, making them more vulnerable in the event of an evacuation. Populations with access and functional needs as well as elderly populations and the very young are more vulnerable to the landslide hazards as they may not be able to evacuate quickly enough to avoid the impacts of a landslide.

**12.2.3 Impact on General Building Stock**

Loss estimates for the moderate, high, and very high landslide hazard areas are shown in Table 12-2.

Table 12-2. Loss Estimates for Landslide Hazard Areas

Planning Area	Estimated Loss Associated with Landslides			% of Total Replacement Value
	Structure	Contents	Total	
<b>Moderate Hazard Area</b>				
Loyalton	\$0	\$0	\$0	0.0%



Planning Area	Estimated Loss Associated with Landslides			% of Total Replacement Value
	Structure	Contents	Total	
<b>Eastern Sierra County</b>	\$30,300,467	\$16,246,437	\$46,546,904	9.9%
<b>Western Sierra County</b>	\$20,410,393	\$10,540,838	\$30,951,231	6.7%
<b>Total</b>	\$50,710,860	\$26,787,275	\$77,498,134	6.7%
<b>High Hazard Area</b>				
<b>Loyalton</b>	\$0	\$0	\$0	0.0%
<b>Eastern Sierra County</b>	\$49,751,879	\$24,979,758	\$74,731,637	15.9%
<b>Western Sierra County</b>	\$54,499,836	\$33,281,095	\$87,780,931	18.9%
<b>Total</b>	\$104,251,715	\$58,260,853	\$162,512,568	14.0%
<b>Very High Hazard Area</b>				
<b>Loyalton</b>	\$0	\$0	\$0	0.0%
<b>Eastern Sierra County</b>	\$789,090	\$394,545	\$1,183,635	0.3%
<b>Western Sierra County</b>	\$3,803,729	\$1,901,864	\$5,705,593	1.2%
<b>Total</b>	\$4,592,819	\$2,296,409	\$6,889,228	0.6%

### 12.2.4 Impact on Community Lifelines

Several types of infrastructure are exposed to landslides, including transportation, water and sewer and power infrastructure. Highly susceptible areas of the county include mountain roads and transportation infrastructure.

Significant amounts of infrastructure can be exposed to landslides and mass movement. Access to major roads is crucial to life and safety. Landslides can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems and delays for public and private transportation. Rural communities within Sierra County would be significantly impacted.

Power lines can be subjected to landslides. A landslide could trigger failure of soil underneath a tower, causing it to collapse and rip down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses. Refer to Table 12-3 for a summary of community lifelines located in Sierra County that are in the moderate, high, and very high landslide hazard areas.



Table 12-3. Community Lifelines in Landslide Hazard Areas

Planning Area	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
<b>Moderate Hazard Area</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	7	0	0	1	0	1	4	0*	13
Western Sierra County	2	0	0	0	0	2	8	0*	12
<b>Total</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>12</b>	<b>0*</b>	<b>25</b>
<b>High Hazard Area</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	6	1	0	1	0	0	3	0*	11
Western Sierra County	16	0	2	3	0	3	8	0*	32
<b>Total</b>	<b>22</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>0</b>	<b>3</b>	<b>11</b>	<b>0*</b>	<b>43</b>
<b>Very High Hazard Area</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	2	0	0	0	0	0	0	0*	2
Western Sierra County	1	0	0	0	0	0	0	0*	1
<b>Total</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0*</b>	<b>3</b>

Note: \*Spatial data for analysis of Water Systems is not currently available for Sierra County

### 12.2.5 Impact on the Economy

Large landslides can cause impacts to the economy, including losses from severely damaged or destroyed property and infrastructure, and indirect impacts like disruptions to businesses and supply chains.

### 12.2.6 Impact on Historic and Cultural Resources

Landslides can cause damage to historical and cultural resources, ranging from structural damage to buildings and monuments to the destruction of artifacts and archaeological sites, impacting cultural heritage.

### 12.2.7 Impact on Ecosystems and Natural Resources

Landslides can destroy natural resources valuable to the community. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost due to landslides. Sensitive habitats may be located in areas prone to landslides, increasing the risk to biodiversity.

Agricultural and natural resources, including rangelands, timberlands, cultivated farmlands and dairy lands are also vulnerable. Particularly, timberland are at a high risk due to their location on steep, remote



slopes. Roads accessing timberlands are often susceptible to slides and frequently are contributing factors to landslides. When landslides occur along these roads, they can render large areas inaccessible, removing them from productive use and increasing the cost and complexity of land management and recovery efforts.

### 12.2.8 Change in Vulnerability Since 2012 HMP

The risk of landslides and mass movement remains largely unchanged. Sierra County’s rugged terrain and sparse population mean that few structures are located in high-risk zones. The increase in residential development on individual lots, if in hilly or mountainous terrain, could slightly raise vulnerability. Seasonal homes may be built in areas with limited geotechnical assessment, and climate change may lead to more intense rainfall events that trigger slope instability. Despite the declining population, the nature and location of new development are important factors to monitor. Since 2012, there has been minimal development in these areas, and the population has remained stable, resulting in no significant change in vulnerability.

## 12.3 MITIGATION OPPORTUNITIES

Table 12-4 presents a range of potential opportunities for mitigating the landslide/mass movement hazard.

Table 12-4. Potential Opportunities to Mitigate the Landslide/Mass Movement Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>Stabilize slope (dewater, armor toe)</li> <li>Reduce weight on top of slope</li> <li>Minimize vegetation removal and the addition of impervious surfaces</li> </ul>	<ul style="list-style-type: none"> <li>Stabilize slope (dewater, armor toe)</li> </ul>	<ul style="list-style-type: none"> <li>Stabilize slope (dewater, armor toe)</li> <li>Reduce weight on top of slope</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>Locate structures outside of hazard area (off unstable land and away from slide-run out area)</li> <li>Retrofit home</li> </ul>	<ul style="list-style-type: none"> <li>Locate structures outside of hazard area (off unstable land and away from slide-run out area)</li> <li>Retrofit at-risk facilities</li> </ul>	<ul style="list-style-type: none"> <li>Adopt higher regulatory standards for new development within unstable slope areas</li> <li>Armor/retrofit critical infrastructure against the impact of landslides</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>Subscribe to warning systems, and develop evacuation plan</li> <li>Keep cash reserves for reconstruction</li> <li>Educate yourself on risk reduction techniques for landslide hazards</li> </ul>	<ul style="list-style-type: none"> <li>Institute warning system, and develop evacuation plan</li> <li>Keep cash reserves for reconstruction</li> <li>Develop a continuity of operations plan</li> <li>Educate employees on the potential exposure to landslide hazards and emergency response protocol</li> </ul>	<ul style="list-style-type: none"> <li>Produce better hazard maps</li> <li>Provide technical information and guidance</li> <li>Enact tools to help manage development in hazard areas: better land controls, tax incentives, information</li> <li>Develop strategy to take advantage of post-disaster opportunities</li> </ul>



Community Scale	Organizational Scale	Government Scale
		<ul style="list-style-type: none"> <li>• Warehouse critical infrastructure components</li> <li>• Develop and adopt a continuity of operations plan</li> <li>• Educate the public on the landslide hazard and appropriate risk reduction alternatives</li> </ul>
Nature-based Opportunities		
<ul style="list-style-type: none"> <li>• Replace or restore native vegetation known to stabilize steep slopes</li> <li>• Hybrid solutions that combine engineering with a nature-based approach using appropriate vegetation</li> </ul>		



Figure 12-2. Rockfall on Highway 49



(Photo Credit: Steve Folsom)



# 13. VOLCANIC ACTIVITY

## 13.1 HAZARD PROFILE



### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

### 13.1.1 Description of the Hazard

#### *Defining the Hazard*

Volcanic eruptions are characterized by a number of different behaviors. Some eruptions involve the slow and non-violent release of molten lava from fissures in the ground over a hot spot in the earth's mantle. Other eruptions are more radical, resulting in the explosive release of molten rock (tephra), ash, and toxic gases. Additional eruptive traits include area seismic activity, lava bombs, landslides, subsidence, peculiar, localized weather phenomenon, and plume dominated columns that can project debris for hundreds of miles.

#### *Cause of the Hazard*

Volcanic activity is mainly caused by the movement of tectonic plates beneath the Earth's surface. The Earth's crust is made up of large plates that float on the semi-liquid mantle below. When these plates move, they can either pull apart, push together, or slide past each other. Volcanic eruptions often happen at plate boundaries. When plates collide, one plate may be forced under the other in a process called subduction, which melts rock and forms magma. This magma can rise through cracks in the crust and erupt as lava. Volcanic activity can also occur at "hotspots," where plumes of hot material rise from deep within the Earth.

#### *Summary of Potential Impacts*

Volcanic eruptions can have serious and wide-ranging effects. Locally, they can destroy homes, forests, and farmland with lava flows, ash, and pyroclastic flows (fast-moving clouds of hot gas and debris). Ash can cover large areas, damaging crops, contaminating water supplies, and collapsing roofs. Volcanic gases like sulfur dioxide can cause air pollution and health problems. On a larger scale, volcanic eruptions can affect the climate by sending ash and gases into the atmosphere, which can block sunlight and lower global temperatures. In some cases, eruptions can trigger other hazards like landslides, tsunamis, or flooding. Despite the dangers, volcanic soils are often very fertile, and many people live near volcanoes for farming and other resources.

#### *Cascading Hazard Impacts*

On the morning of June 24, 2024, two earthquakes were automatically located by the Northern California Seismic Network near Lassen Volcanic National Park. These earthquakes had estimated magnitudes of M1.9 and M2.5, which is larger than usual for the area, but not unprecedented. The California Volcano Observatory seismologists also found dozens of smaller earthquakes. This kind of activity with many



small earthquakes in a short period of time, often called a swarm, is common at volcanoes, even when they aren't erupting or getting ready to erupt. Lassen has a history of swarms that are due either to motion along mapped faults or to the circulation of fluids in hydrothermally active areas like Bumpass Hell. (USGS 2024).

Cascading impacts are the impacts that result when one type of hazard event triggers one or more other hazard events, which may in turn trigger still others. The following are notable cascading impacts associated with volcanoes:

- Mudflows, floods, landslides, and possibly seismic activity can occur in the region of the eruption.
- Tephra can damage vegetation by direct burial, heat, or breakage.
- Tephra modifies hydrology and lowers air quality, affecting human health both directly—through inhalation or the abrasion of skin and eyes—and indirectly—through impacts on terrestrial and aquatic environments.
- Post-eruptive processes extend the area of influence of a volcanic eruption some distance from the initial deposition area and can last for years.
- Volcanic eruptions can substantially disrupt hydrologic systems, most notably by altering stream flow and choking waterways with ash and volcanic debris.
- Volcanic events can severely impact ground transportation on roads and railways, disrupting daily activities, commerce, and response capabilities.
- Exposure of crops, pastures, and livestock to volcanic ash fall can be serious, even for a light dusting. Ash falls on forage most commonly results in digestive tract problems in livestock, including gastrointestinal tract obstruction, and it is common for dairy production to drop significantly owing to cows' off feed.
- Volcanic eruptions can result in heightened health concerns, including infectious disease, respiratory illness, burns, injuries from falls, and motor vehicle crashes related to poor visibility.

### 13.1.2 Location

Though the county does not contain any active volcanos, it lies within a broader region of Northern California that is geologically influenced by past and potential volcanic activity. The county is relatively close to several volcanic centers identified by the USGS as having varying levels of threat, including the Lassen Volcanic Center.

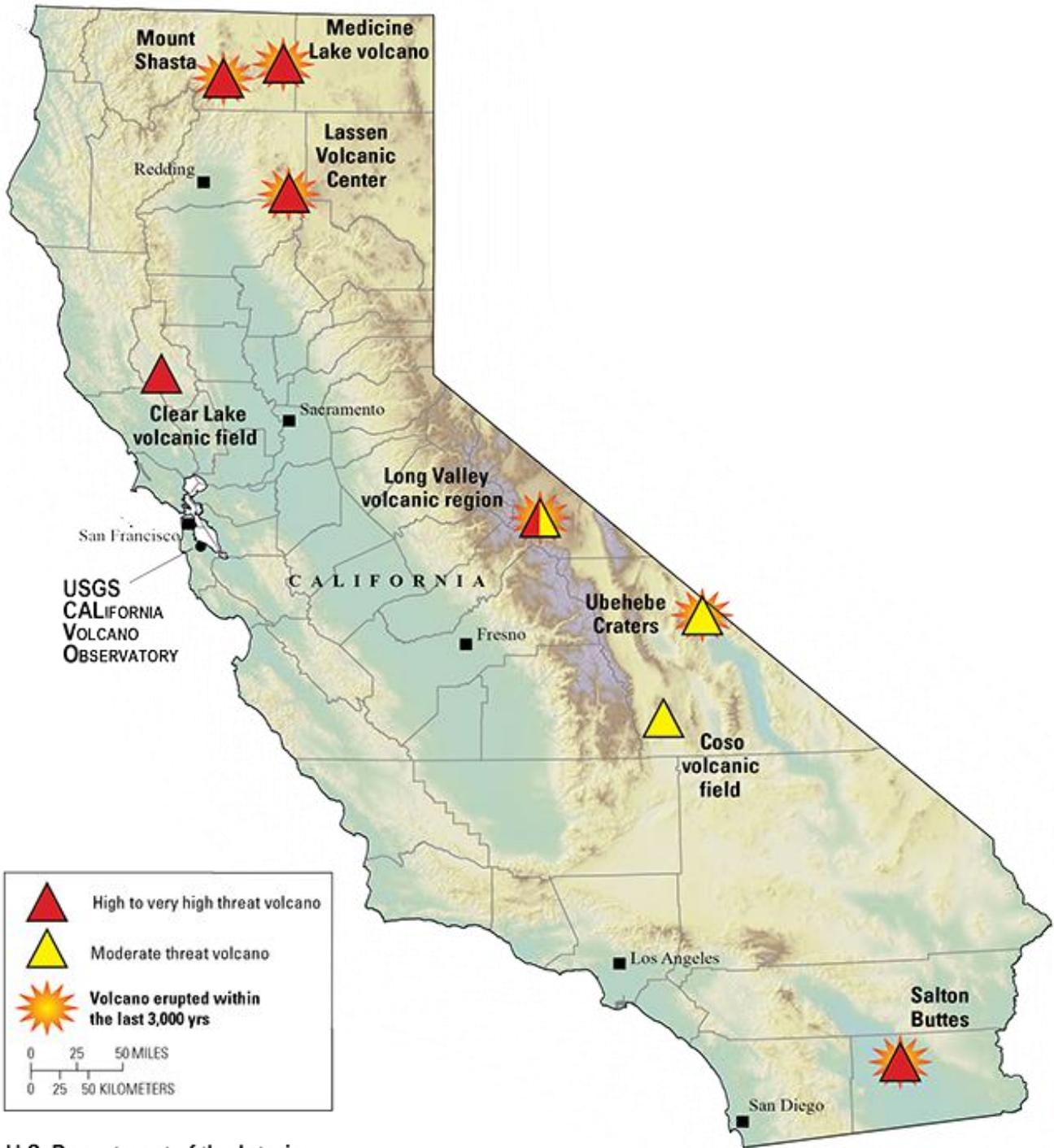
### 13.1.3 Extent

#### *Measuring Intensity*

California is subject to volcanic threats from eight volcanic areas. Figure 13-1 shows the volcanic areas and classifications as moderate, high, and very high threat. These threat level classifications are defined and assigned in the USGS National Volcanic Threat Assessment. Lassen Volcanic Center is classified as a very high threat (USGS 2018).



Figure 13-1. Hazardous Volcanos in California



High to very high threat volcano  
 Moderate threat volcano  
 Volcano erupted within the last 3,000 yrs  
 0 25 50 MILES  
 0 25 50 KILOMETERS

U.S. Department of the Interior  
 U.S. Geological Survey  
 Volcano Hazards Program

Shaded relief from 100-meter U.S. Geological Survey digital data, 2012

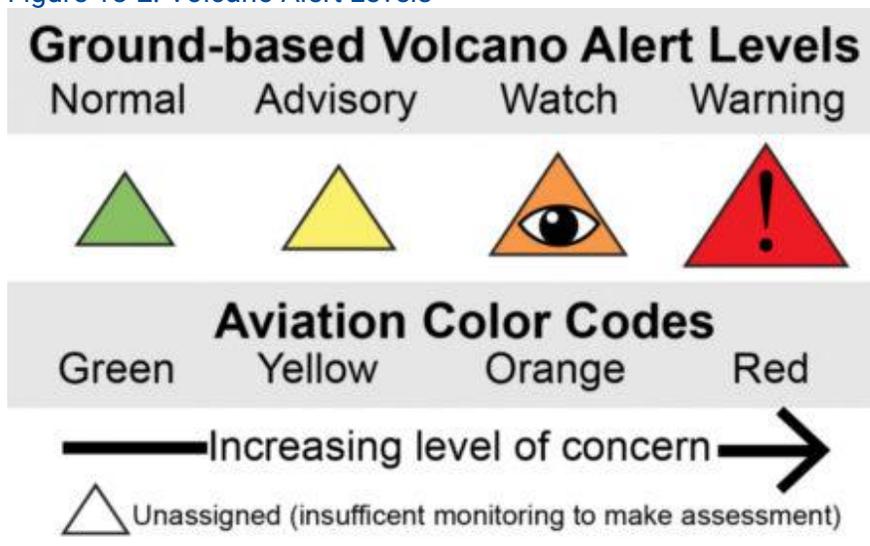
**Warning Time**



The National Volcano Warning System is a national-scale plan to ensure that volcanoes are monitored at levels commensurate to their threats. The plan was developed by the USGS Volcano Hazards Program (VHP) and its affiliated partners in state and academic institutions. VHP uses an alert-notification system to indicate the level of potential danger for volcanoes. Color-coded triangular signs shown on Figure 13-2 are posted along with hazard details. Description on the activation color codes (CalOES n.d.) are listed below:

- **Normal/Green:** The normal/green icon is used when background activity is within the range of typical non-eruptive phenomena seen at the volcano.
- **Advisory/Yellow:** The advisory/yellow icon is used when a volcano is exhibiting signs of elevated activity above normal ranges.
- **Watch/Orange:** The watch/orange icon is used when heightened or escalating unrest is exhibited with an increase in potential for eruption. In this stage the timeframe is unclear or an eruption is occurring posing limited hazard with no or minor emissions of volcanic ash.
- **Warning/Orange:** The warning/orange icon is used when a major eruption is suspected, underway, or imminent, but no or minor volcanic ash emissions to impact aviation (lava flows only).
- **Watch/Red:** The watch/red icon is used when an eruption occurs with limit hazard to ground based communities (little to no lava flow), but significant impacts to aviation with substantial emissions of ash in the atmosphere.
- **Warning/Red:** The warning/red icon is used when a major a major eruption is suspected, underway, or imminent, with significant hazards expected to both ground-based communities, and aviation.
- **Unassigned:** The unassigned icon is used when ground-based instruments are unable to determine that a volcano is within normal parameters.

Figure 13-2. Volcano Alert Levels





### **Worst-Case Scenario**

A worst-case scenario would likely result from a major eruption at Lassen Volcanic Center. While Sierra County is not directly located atop a major volcano, its proximity to Lassen makes it vulnerable to significant secondary effects in the event of a large-scale eruption. A Plinian eruption, a large explosive event that form enormous dark columns of tephra and gas high into the stratosphere (USGS 2013), could send volcanic ash as high as 11 kilometers into the atmosphere. Prevailing winds could then carry the ash into Sierra County. Ashfall of sufficient depth could disrupt transportation, damage infrastructure, and pose health risks may occur. Air quality would deteriorate rapidly, and ash accumulation could lead to power outages and road closures. In such scenario, emergency services would need to activate evacuation protocols and coordinate shelter operations.

### **13.1.4 Previous Occurrences**

The following sections provide a review of previous volcanic activities occurrences in Sierra County.

#### **Declarations**

##### **Federal Declarations**

Between 1954 and 2024, Sierra County experienced no volcanic activity-related disasters (DR) or emergencies (EM).

##### **State Declarations**

Between 2012 and 2024, California declared no disasters related to volcanic activity in Sierra County.

##### **USDA Declarations**

Between 2012 and 2024, the USDA declared no disasters related to volcanic activity in Sierra County.

#### **Summary of Significant Events**

California is susceptible to volcanic-related events, though they are infrequent. At least 76 volcanic vents have erupted, some repeatedly, during the last 10,000 years (CSSC 2022).

Lassen Volcanic Center has experienced hundreds of eruptions scattered over about 200 square miles during the last 825,000 years. The most recent three notable eruptions were: Chaos Crags (1,100 years ago), Cinder Cone (1666 A.D.), and Lassen Peak (A.D. 1914 to 1917) (USGS n.d.).

#### **Recent Events**

The most recent eruption of Lassen Peak occurred between 1914 and 1917, marking the last major volcanic activity in California before Mount St. Helens erupted in 1980. The eruption began on May 30, 1914, with a series of small steam-driven explosions near the summit. Activity escalated over the following year, culminating in a powerful explosive eruption on May 22, 1915, at Lassen Peak, the southernmost active volcano in the Cascade Range and the largest of a group of volcanic domes in Lassen Volcanic National Park (NPS 2015).



### 13.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

#### **Probability**

The probability of future occurrences is unlikely in Sierra County.

#### **Climate Change**

Climate change is not expected to increase the probability of volcanic events. However, when volcanic eruption does occur, climate change could impact the consequences of volcanic events. As the atmosphere warms due to climate change, the plumes of ash and gas emitted by large volcanic eruptions will rise higher. Climate change will also accelerate the transport of volcanic material—in the form of small, shiny droplets called volcanic sulfate aerosols—from the tropics to higher latitudes. For large eruptions, the combined effect of these phenomena will cause the haze created by volcanic aerosols to block more sunlight from reaching Earth’s surface, ultimately amplifying the temporary cooling caused by volcanic eruptions (University of Cambridge 2021).

#### **Potential Future Impacts**

Future volcanic activity in this region could have several indirect but significant impacts on Sierra County. For instance, an eruption at Lassen Peak could produce ashfall that drifts eastward or southeastward depending on prevailing winds, potentially affecting air quality, agriculture, and water supplies in Sierra County. Ash can contaminate reservoirs, damage crops, and cause respiratory issues for residents. Additionally, volcanic eruptions can disrupt transportation and communication infrastructure, especially if ash affects regional airports or major highways that serve the county.

## 13.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction’s vulnerability to the hazards of concern and include an overall summary of the hazard’s impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 13.2.1 Summary of Vulnerability

While volcanic activity would not be considered significant, Sierra County remains vulnerable to secondary impacts from volcanic activity in nearby regions, particularly from tephra. The most significant risk comes from long-range ash dispersal from eruptions in the Cascade Range or Long Valley Caldera. The populations most vulnerable to these effects are socially vulnerable communities, including those with limited access to healthcare, transportation, or emergency information.



### 13.2.2 Impact on Life, Health, and Safety

Volcanic activity poses serious health risks due to the release of harmful gases and ash into the air. These emissions can cause both short and long-term health effects, particularly for vulnerable populations such as people with asthma, children, and those with chronic respiratory or cardiac conditions (CDC 2024). Volcanic ash can also contaminate water supplies and food sources, compounding health risks.

#### *Socially Vulnerable Populations*

The communities and populations especially vulnerable to volcanic eruptions include low-income communities, migrant populations, populations whose primary language is not English, Indigenous populations, communities of older adults, and those with respiratory and other health concerns. These populations may be more susceptible to transport and communication challenges due to limited access in healthcare, transportation, or emergency information.

Vulnerable populations may also be impacted by the effects of toxic volcanic ash and problems of the respiratory system, eyes, and skin. Psychological effects, injuries, waste disposal and water supplies issues, collapse of buildings and power outage are all likely to impact vulnerable populations (Zuskin, et al. 2007).

### 13.2.3 Impact on General Building Stock

While direct lava is not a concern for Sierra County, tephra fall can still damage buildings and infrastructure. Fine ash may accumulate on rooftops, increasing the risk of structural collapse, especially if it occurs under wet or snow conditions. Ash may also infiltrate buildings, damage electronics and HVAC systems. Drainage systems can be clogged, increasing flood risk during rainy seasons. Exposed machinery, such as farm equipment, may be damaged due to clogged filters and moving parts exposed to ash.

### 13.2.4 Impact on Community Lifelines

All community lifelines in Sierra County could be affected by volcanic ashfall, particularly if prevailing winds carry tephra into the region. Water systems are vulnerable to contamination and clogging, while power generation and distribution systems may be disrupted by ash accumulation on transformers. Transportation networks could be impaired by slippery road conditions, increasing the risk of accidents and delaying emergency response. Healthcare facilities may face increased patient loads and potential equipment damage, while communication systems could be disrupted by ash-related outages or infrastructure damage. For a summary of all community lifelines in Sierra County, see Table 3-4.

### 13.2.5 Impact on the Economy

Agriculture may suffer from crop damage, soil contamination, and equipment failure due to volcanic activity. Transportation and supply chains may be interrupted, leading to delays and increased costs. Businesses may face cleanup expenses, reduced productivity, and temporary closures. Tourism and outdoor recreation could decline due to poor air quality and visibility.



### 13.2.6 Impact on Historic and Cultural Resources

Sierra County is home to numerous historical and cultural resources. Ash can erode or discolor historic materials, infiltrate and damage artifacts, and increase the risk of structural damage due to added weight or moisture retention. Sites that are in remote areas or lack regular maintenance may be at a higher risk, as response and cleanup efforts could be delayed.

### 13.2.7 Impact on Ecosystems and Natural Resources

The environment is very vulnerable to the effects of a volcanic eruption, even if the eruption does not directly impact the planning area. This is highly dependent upon the amount of tephra accumulation. Rivers and streams can carry ash throughout the region, affecting aquatic life and water quality. The sulfuric acid contained in volcanic ash could be damaging to area vegetation, waters, wildlife and air quality. Air quality may decline significantly, impacting wildlife. Habitat disruption, particularly in riparian and alpine zones, can have lasting ecological consequences.

### 13.2.8 Change in Vulnerability Since 2012 HMP

Sierra County’s vulnerability to volcanic activity has not changed since the 2012 HMP. The county’s remote location and low population density mean that few people or structures are at risk. There has been no notable development near volcanic hazard zones, and the population remains small and dispersed.

## 13.3 MITIGATION OPPORTUNITIES

Table 13-1 presents a range of potential opportunities for mitigating the volcanic activity hazard.

Table 13-1. Potential Opportunities to Mitigate the Volcanic Activity Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>Locate outside of hazard area</li> </ul>	<ul style="list-style-type: none"> <li>Locate outside of hazard area</li> <li>Protect corporate critical facilities from potential impacts of severe ash fall (air filtration capability)</li> </ul>	<ul style="list-style-type: none"> <li>Locate outside of hazard area</li> <li>Protect critical facilities and utilities from potential problems associated with ash fall</li> <li>Build redundancy for critical facilities and functions</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>Develop and practice a household evacuation plan</li> </ul>	<ul style="list-style-type: none"> <li>Develop and practice a household evacuation plan</li> <li>inform employees through corporate sponsored outreach</li> </ul>	<ul style="list-style-type: none"> <li>Public outreach awareness</li> <li>Tap into State volcano warning system to provide early warning to residents of potential ash fall problem</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>Volcanic ash could be used to supply nutrients and reduce carbon dioxide from the atmosphere</li> </ul>		



# 14. WILDFIRE

## 14.1 HAZARD PROFILE



### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*



Loyalton Fire (Photo Credit: LeTina Vanetti)

### 14.1.1 Description of the Hazard

#### *Defining the Hazard*

The National Wildfire Coordination Group (NWCG) defines wildfire as a wildland fire originating from an unplanned ignition, such as lightning, volcanos, unauthorized and accidental human caused fires, and prescribed fires that are declared wildfires (NWCG 2025). Wildfire can also be ignited by the transport of burning embers by high winds miles away from the initial ignition source. The potential for significant damage to life and property exists in or close proximity to areas designated as “wildland/urban interface areas,” where development is adjacent to densely vegetated areas.



The active spread phase is when the fire begins to grow rapidly, driven by dry vegetation, strong winds and terrain. Fires in California have been found to spread up to 14 times faster under high winds. High winds not only accelerate the fire's spread but also carry embers and firebrands over long distances, igniting new spot fires far ahead of the main fire. These flying embers can travel up to a mile or more, making it difficult to predict and contain the fire's advance. Firefighting and resource coordination during this phase is challenging as high winds can hinder the deployment of aerial resources, such as water-dropping helicopters and firefighting planes.

In the fully developed phase, the fire reaches its peak intensity, consuming significant fuel and spreading aggressively. Extreme heat from wildfires can create pyrocumulonimbus clouds, which can spark new fires miles away. These clouds can exacerbate fire spread by generating erratic winds and even sparking new fires through lightning strikes.

In the decay phase, fire intensity decreases as it runs out of fuel or is under control. However, lingering hotspots can reignite under the favoring conditions.

### ***Cause of the Hazard***

One of the most significant factors is climate change. Warmer temperatures, reduced precipitation or a changed rainfall season, and longer fire seasons have dried out California's landscapes, increasing the potential for ignition and rapid fire spread. Extended periods of drought further exacerbate the issue. Dry vegetation becomes ready to ignite with the slightest spark. These changes have contributed to an annual average burned area in 2020-2023 that is three times higher than in the 2010s.

While some fires are fuel-dominated due to century-long fire suppression and changes in land management, others are wind-dominated. Winds act as accelerants for wildfires. These strong, dry gusts push flames across vast distances, spreading fires at an alarming rate. Combined with already dry conditions, these winds make controlling wildfires exceptionally challenging.

Wildfire spreads include phases of ignition, active spread, fully developed, and decay. During the ignition phase, wildfires can be sparked by natural causes, such as lightning, or human activities like power line failures or campfires. Approximately 84% of wildfires in the United States are caused by human activities. Early detection of ignition would be the most critical but challenging thing to minimize the fire's impact.

### ***Summary of Potential Impacts***

California wildfires have devastating impacts, including loss of life, homes, and livelihoods, along with significant environmental and economic consequences, including air and water quality issues, and increased mental health challenges.

#### **Human Impacts**

- Loss of Life and Property-Wildfires can cause fatalities and destroy homes, businesses, and infrastructure.
- Displacement and Evacuation-Hundreds to thousands of people are forced to evacuate their homes, leading to temporary or long-term displacement.



- Air Quality Issues-Wildfire smoke contains harmful pollutants that can exacerbate respiratory and cardiovascular conditions, and even lead to premature death.
- Mental Health Impacts-The trauma and uncertainty associated with wildfires can lead to increased rates of depression, anxiety, and post-traumatic stress.
- Economic Costs-Wildfires cause significant economic losses, including property damage, business closures, and increased insurance premiums.

### **Environmental Impacts**

- Air Pollution-Wildfire smoke releases pollutants into the atmosphere, impacting air quality and human health both locally and downwind.
- Water Quality Issues-Ash and debris from fires can contaminate water sources, and burned watersheds are prone to increased flooding and erosion.
- Habitat Loss and Ecosystem Changes-Wildfires can destroy forests and other habitats, leading to changes in vegetation and wildlife populations.
- Marine Ecosystems-Firefighting runoff and ash can enter coastal waters, potentially harming marine life and ecosystems.
- Soil Erosion-Burned areas are more vulnerable to erosion, which can lead to landslides and further damage to the environment.

### **Economic Impacts**

- Property and Capital Losses-Wildfires can cause billions of dollars in property damage and economic losses.
- Increased Insurance Premiums-The cost of wildfires can lead to higher insurance premiums or even un-insurability for homeowners and businesses.
- Tourism Impacts-Wildfires can disrupt tourism and negatively impact local economies.
- Supply Chain Disruptions-Wildfires can disrupt transportation and supply chains, leading to shortages and price increases.

### ***Cascading Hazard Impacts***

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. A major fire can lead to ancillary effects such as landslides in steep ravine areas and flooding due to the effects of silt in local watersheds. Wildfires cause the contamination of reservoirs, destroy transmission lines and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes, sometimes several years after a wildfire. Altering of the soil structure can make the ground less permeable. This change increases stormwater runoff and raises the likelihood of flooding. Post-fire flooding tends to be more destructive due to the presence of ash and debris, which can mix with rainwater to form damaging mudflows that carry sediment and cause significant destruction.

Wildfires can have a significant effect on air quality, especially with prolonged periods of burning combined with climatic conditions. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide,



carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather.

### 14.1.2 Location

Every county in California is susceptible to wildfire. California’s seasonally dry climate lends itself to wildfires, and in an effort to better prepare, CAL FIRE is required to classify the severity of fire hazard in areas of California. The State Fire Marshal is mandated to classify lands within both State Responsibility Areas and Local Responsibility Areas into Fire Hazard Severity Zones (FHSZ). FHSZs fall into one of the following classifications: moderate, high, and very high.

The FHSZ maps are developed using a science-based and field-tested model that assigns a hazard score based on the factors that influence fire likelihood and fire behavior. Many factors are considered such as fire history, existing and potential fuel (natural vegetation), predicted flame length, blowing embers, terrain, and typical fire weather for the area.

The California laws that require FHSZs include California Public Resources Code 4201-4204, California Code of Regulations Title 14, Section 1280 and California Government Code 51175-89. Figure 14-2 shows the FHSZ mapped by CAL FIRE within Sierra County.

Fuel-dominated wildfires are common in the timber-rich forests of the Sierra Nevada Mountain Range that contain large fuel loads due to successful fire suppression and timber harvesting. Counties west of the Sierra Nevada Mountains are more susceptible to wind-dominated wildfires.

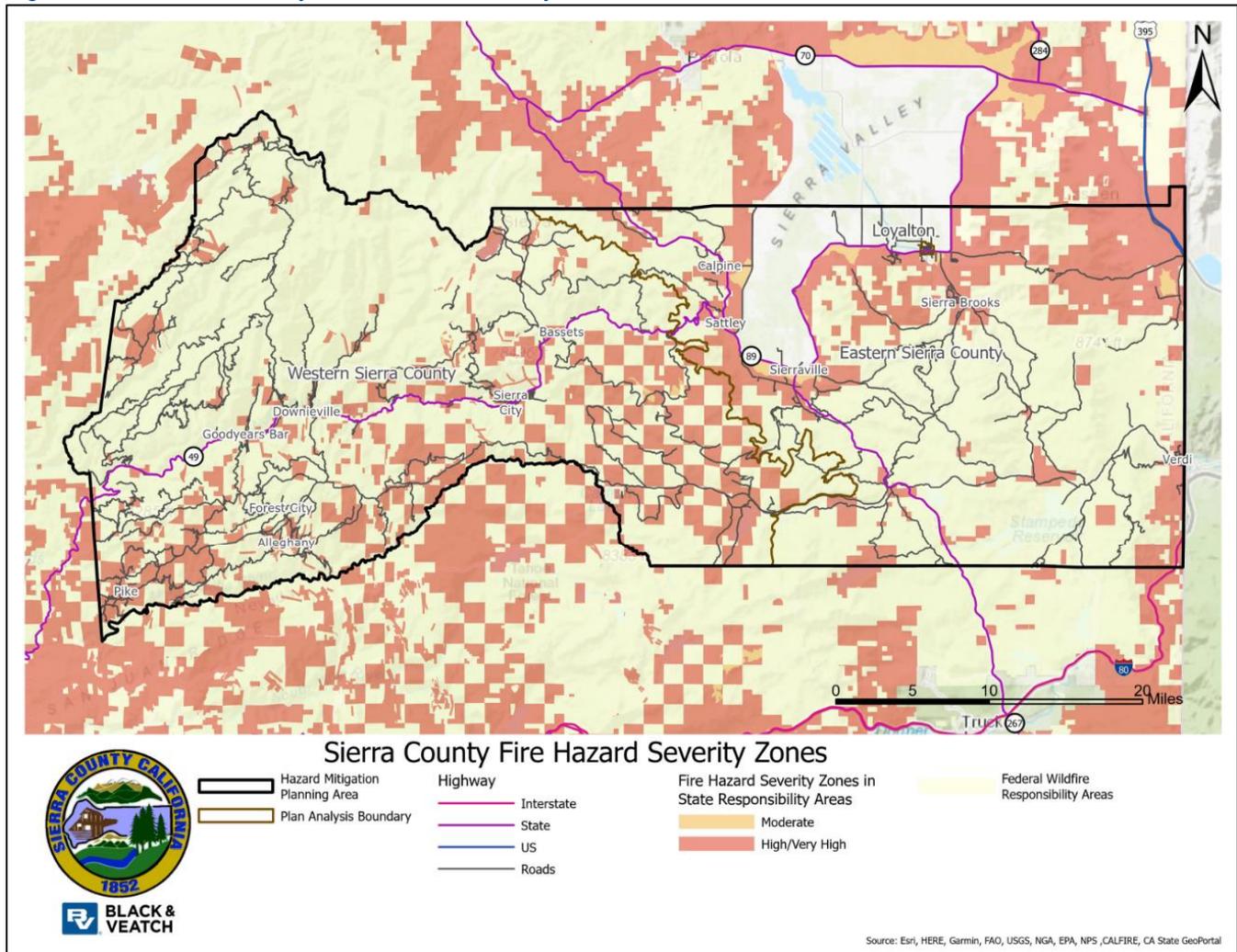
Figure 14-1. Fern Regrowth in Old Burn Area



(Photo Credit: LeTina Vanetti)



Figure 14-2. Sierra County Fire Hazard Severity Zones



### 14.1.3 Extent

#### Measuring Intensity

The National Fire Danger Rating System is a system that allows fire managers to estimate today's or tomorrow's fire danger for a given area. It combines the effects of existing and expected states of selected fire danger factors into one or more qualitative or numeric indices that reflect an area's fire protection needs. Based on the fire danger, managers may impose restrictions or closures to public lands, plan for or pre-position staff and equipment to fight new fires and make decisions whether to suppress or allow fires to burn under prescribed conditions (National Park Service 2023).

Five rating levels are used to describe danger levels in public information releases and fire prevention signing (USFS n.d.):



- **Fire Danger Level: Low**—When the fire danger is "low," it means that fuels do not ignite easily from small embers, but a more intense heat source, such as lightning, may start fires in duff or dry rotten wood. Fires in open, dry grasslands may burn easily a few hours after a rain, but most wood fires will spread slowly, creeping or smoldering. Control of fires is generally easy.
- **Fire Danger Level: Moderate**—When the fire danger is "moderate," it means that fires can start from most accidental causes, but the number of fire starts is usually pretty low. If a fire does start in an open, dry grassland, it will burn and spread quickly on windy days. Most wood fires will spread slowly to moderately. Average fire intensity will be moderate except in heavy concentrations of fuel, which may burn hot. Fires are still not likely to become serious and are often easy to control.
- **Fire Danger Level: High**—When the fire danger is "high," fires can start easily from most causes, and small fuels (such as grasses and needles) will ignite readily. Unattended campfires and brush fires are likely to escape. Fires will spread easily, with some areas of high-intensity burning on slopes or concentrated fuels. Fires can become serious and difficult to control unless they are put out while they are still small.
- **Fire Danger Level: Very High**—When the fire danger is "very high," fires will start easily from most causes. The fires will spread rapidly and have a quick increase in intensity, right after ignition. Small fires can quickly become large fires and exhibit extreme fire intensity, such as long-distance spotting and fire whirls. These fires can be difficult to control and will often become much larger and longer-lasting fires.
- **Fire Danger Level: Extreme**—When the fire danger is "extreme," fires of all types start quickly and burn intensely. All fires are potentially serious and can spread very quickly with intense burning. Small fires become big fires much faster than at the "very high" level. Spot fires are probable, with long-distance spotting likely. These fires are very difficult to fight and may become very dangerous and often last for several days.

### Warning Time

There is no way to predict when a wildfire might break out. Since fireworks often cause brush fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning. Reliable NWS lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

The most common and effective methods used currently to detect wildfires in California are remote sensing and satellite monitoring. Satellites like NASA's MODIS and VIIRS provide real-time data on fire location, size, and intensity. These tools help identify new ignitions and monitor fire progression, even in remote areas. Thermal imaging from drones and ground-based radar complements satellite data, offering high-resolution insights for on-the-ground operations. California is also using an artificial intelligence (AI)-powered wildfire detection system using AI to train a forest-based camera network to recognize early signs of fire (<https://alertcalifornia.org/>).

There have been many controlled or prescribed burns implemented to reduce excess vegetation, like thinning dense forests and clearing underbrush, to mitigate fire severity. There have been robotics



companies starting to try out these controlled burns with the help of robots, like the BurnBot. Autonomous helicopters, like the modified Black Hawk equipped with Sikorsky’s MATRIX autonomy, have demonstrated the ability to detect and suppress fires independently.

Additionally, there are computational models, such as ELMFIRE with wildland-urban interface extensions, that simulate fire spread through communities. These tools incorporate data on vegetation, structure materials and fire dynamics to reconstruct past events and predict future risks.

**Worst-Case Scenario**

In a worst-case scenario, an active fire season across the American West would have firefighting resources limited, leaving Sierra County vulnerable. With exhausted or unavailable firefighting teams focused on other fires across the West, the situation could worsen. Additionally, heavy rains following the fires could cause flooding and landslides in areas stripped of vegetation.

**14.1.4 Previous Occurrences**

The following sections provide a review of previous wildfire occurrences in Sierra County.

**Declarations**

**Federal Declarations**

Between 1954 and 2024, Sierra County experienced one wildfire-related major disaster (DR) or emergency declarations (EM).

Table 14-1. Federal Wildfire Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-4558	August 14, 2020 – September 26, 2020	August 22, 2020	Wildfire

Source: OpenFEMA Datasets ([OpenFEMA Data Sets | FEMA.gov](https://openfema.org/))

**State Declarations**

Between 2012 and 2024, California declared that Sierra County experienced two disasters relating to wildfire.

Table 14-2. State Wildfire Disaster Declarations

Disaster Number	Declaration Date	Description
2020-06	August 18, 2020	August 2020 Wildfires
N/A	November 1, 2024	Bear Fire in Sierra County burned over 3,300 acres before it was fully contained.

Source: (Cal OES 2025)



## USDA Declarations

Between 2012 and 2024, there were no USDA declarations for Sierra County relating to wildfire.

## Summary of Significant Events

Wildfires of varying scales occur on an annual basis in Sierra County. In the last 40 years, the combination of firefighting technology and tactics, environmental restraints, and developmental trends has led to increasing fuel loads, greater occupancy of high threat areas and greater potential for catastrophic wildfire.

A proclamation of a State of Emergency was made November 1, 2024, for the Bear Fire in Sierra County. The fire began on September 2, 2024, burning over 3,300 acres before it was fully contained on September 20, 2024 (OES 2024). Prior to the Bear Fire, Sierra County wildfires have burned 232,000 acres in a county of approximately 1,482,000 acres.

## Recent Events

The NOAA NCEI Storm Events Database reported 26 wildfire events impacting Sierra County zones from 1950 through 2024, including two deaths, 38 injuries, and \$100,000 in damages.

## 14.1.5 Future Conditions

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

### Probability

While wildfires can break out any time of year, the season when they are most likely to occur generally runs from late June through October. This is due to hot, dry conditions and an increase in visitor population throughout the County in the summer months.

Due to fuel buildup following a century of fire exclusion, a lengthened fire season predicted by many climate change models, forest management practices which removed many of the older, larger trees, and massive tree die-off following epidemic bark beetle infestations, fires in mixed-conifer forests are likely to continue to grow in both size and intensity (Viers, Safford and Steel 2015) (Safford and Wayman 2021).

### Climate Change

According to California's Fourth Climate Change Assessment, if greenhouse gas emissions continue to rise, California is likely to see a 50% increase in fires larger than 25,000 acres as well as a 77% increase in average area burned by 2100. Numerous climactic drivers will influence wildfire risk differently between California regions:

- **Increasing Temperatures:** Wildfire risk in California is rising in tandem with increasing temperatures. In the Sacramento, Sierra Nevada, and North Coast regions, forests that experience drought are also more susceptible to wildfire. High heat not only influences fire risk directly, but can also produce indirect impacts.



- Shifting Wind Patterns: The Sundowner and Diablo winds will continue to shape wildfire activity across Central and Northern California, respectively. Modelers are still working to determine how these wind events will be impacted by climate change.
- Shifting Water Patterns: Climate change will cause shifting water patterns that can impact wildfire risk across the state.
- Shifting Insect Habitat: Bark beetle infestations are rising in response to the changing climate, increasing tree mortality and reducing carbon storage.
- Human Impacts: Across all of California's landscapes human factors, such as development patterns and risk mitigation strategies, will have a direct impact on communities' ability to mitigate and adapt to the impacts of climate change. Local decisions are a large factor in determining the future health of a community.

### Potential Future Impacts

The future impacts of wildfires in Sierra County could be profound. Ecologically, more frequent fires threaten forest health, biodiversity, and watershed stability. Economically, wildfires can devastate local industries such as tourism and forestry, while also increasing insurance costs and straining emergency services. Socially, communities may face displacement, health risks from smoke exposure, and long-term recovery challenges. If current trends continue, Sierra County could see a wildfire season that starts earlier, lasts longer, and includes more extreme fire events, potentially overwhelming local resources and infrastructure.

## 14.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 14.2.1 Summary of Vulnerability

For the vulnerability assessment of this hazard, 100% of the planning area has been considered to be exposed to wildfire impacts, either by direct impacts, or cascading impacts from wildfires within the region. There are currently no models available to measure direct impacts from wildfire risks, therefore, for this assessment vulnerability has been associated with exposure.

### 14.2.2 Impact on Life, Health, and Safety

Larger and more intense wildfires are creating the potential for greater smoke production and chronic exposures in the United States, particularly in the West. Wildfires increase air pollution in surrounding areas and can affect regional air quality. The effects of smoke from wildfires can range from eye and respiratory tract irritation to more serious disorders, including reduced lung function, bronchitis, exacerbation of asthma and heart failure, and premature death. Children, pregnant women, and the



elderly are especially vulnerable to smoke exposure. Emissions from wildfires are known to cause increased visits to hospitals and clinics by those exposed to smoke.

**Socially Vulnerable Populations**

Socially vulnerable populations, including low-income individuals, the elderly, people with disabilities, and racial/ethnic minorities, are disproportionately impacted by wildfires, facing greater risks due to factors like inadequate housing, limited resources for preparedness and recovery, and increased exposure to smoke and other hazards.

- **Elderly Populations**—Physical difficulties and cognitive decline can hamper older adults’ ability to keep their properties clear of flammable materials, such as dry shrubs and grasses, and can slow their ability to evacuate in an emergency. The fire that destroyed the town of Paradise, California, in 2018 was a tragic example. Of the 85 victims, 68 were 65 years or older.
- **Disabled Populations**—People with mobility or cognitive impairments may struggle to evacuate or cope with the aftermath of a wildfire.
- **Socioeconomic Factors**—Low-income individuals may lack resources for adequate insurance, home repairs, and relocation after a fire, and may face challenges in accessing emergency services.

**14.2.3 Impact on General Building Stock**

**Fire Hazard Severity Zone Exposure**

CAL FIRE released updated FHSZ mapping for the California that included very high, high, and moderate severity zones within the County. Table 14-3 shows the exposure values in each FHSZ by planning area.

Table 14-3. Buildings in Wildfire Hazard Areas

Planning Area	No. of Buildings Exposed	Structure Value	Contents Value	Total Value	% of Total Value
<b>Moderate FHSZ</b>					
Loyalton	0	\$0	\$0	\$0	0.0%
Eastern Sierra County	41	\$34,554,229	\$29,861,440	\$64,415,669	13.7%
Western Sierra County	1	\$178,713	\$89,357	\$268,070	0.1%
<b>Total</b>	<b>42</b>	<b>\$34,732,942</b>	<b>\$29,950,796</b>	<b>\$64,683,739</b>	<b>5.6%</b>
<b>High FHSZ</b>					
Loyalton	0	\$0	\$0	\$0	0.0%
Eastern Sierra County	298	\$96,711,231	\$51,547,322	\$148,258,553	31.6%
Western Sierra County	0	\$0	\$0	\$0	0.0%
<b>Total</b>	<b>298</b>	<b>\$96,711,231</b>	<b>\$51,547,322</b>	<b>\$148,258,553</b>	<b>12.8%</b>
<b>Very High FHSZ</b>					
Loyalton	0	\$0	\$0	\$0	0.0%
Eastern Sierra County	383	\$127,193,570	\$68,777,988	\$195,971,558	41.8%
Western Sierra County	812	\$263,820,530	\$192,639,902	\$456,460,432	98.5%



Planning Area	No. of Buildings Exposed	Structure Value	Contents Value	Total Value	% of Total Value
<b>Total</b>	1,195	\$391,014,100	\$261,417,890	\$652,431,990	56.2%

All exposure in FHSZs within Sierra County lie outside of the City of Loyalton. A total of 1,195 structures with a total value of \$391 million are considered to be exposed to some degree of wildfire risk based on this mapping. This represents approximately 56% of the total assessed value for the County.

### 14.2.4 Impact on Community Lifelines

Wildfires frequently damage community infrastructure, including highways, communication facilities, power lines, and water delivery systems. Restoring basic services is a top priority, and many agencies and organizations incur significant restoration costs after a fire. State transportation departments’ efforts to restore roads and highways include the costs of maintenance and damage assessment teams, field data collection, and replacement or repair of roads, guardrails, signage, electrical supply, culverts, and landscaping.

Direct impacts to water supply may occur through contamination of ash and debris during the fire, destruction of aboveground delivery lines, and soil erosion or debris deposits into waterways after the fire. Potable water managers must address water supply impacts, and the potential costs associated with changes in quantity and quality. Utilities and communications repairs are also necessary for equipment damaged by a fire. This includes power lines, transformers, cell phone towers, and phone lines.

Refer to Table 14-4 for a summary of community lifelines located in Sierra County that are in the moderate, high, and very high fire severity zones.

Table 14-4. Community Lifelines in Wildfire Severity Zones

Planning Area	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Water Systems	Total
<b>Moderate Fire Severity Zone</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	5	0	1	1	0	2	2	0*	11
Western Sierra County	0	0	0	0	0	0	0	0*	0
<b>Total</b>	5	0	1	1	0	2	2	0*	11
<b>High Fire Severity Zone</b>									
Loyalton	0	0	0	0	0	0	0	0*	0
Eastern Sierra County	8	0	0	3	0	3	5	0*	19
Western Sierra County	0	0	0	0	0	0	0	0*	0



<b>Total</b>	8	0	0	3	0	3	5	0*	19
<b>Very High Fire Severity Zone</b>									
<b>Loyalton</b>	0	0	0	0	0	0	0	0*	0
<b>Eastern Sierra County</b>	5	0	1	0	0	4	7	0*	17
<b>Western Sierra County</b>	5	1	5	7	1	15	23	0*	57
<b>Total</b>	10	1	6	7	1	19	30	0*	74

Note: \*Spatial data for analysis of Water Systems is not currently available for Sierra County

### 14.2.5 Impact on the Economy

Wildfires can have both positive and negative effects on local economies. Positive effects come from economic activity generated in the community during fire suppression and post-fire rebuilding. These may include forestry support work, such as building fire lines and performing other defenses, or providing firefighting teams with food, ice, and amenities such as temporary shelters and washing machines. However, local economies only experience positive effects if fire suppression spending and contracting is done locally. In addition, future benefits are only possible if the fire stimulates, rather than stops, economic development efforts associated with recovery and forest restoration.

Tourism is a major economic force in Sierra County, supporting local employment, small businesses, and community development. Many communities are located within or near the Tahoe National Forest, making the preservation of forests, watersheds, wildlife, and recreational opportunities not only an environmental priority but also an economic necessity. The damage and potential destruction of scenic areas, closures of trails and parks, and degradation of air and water quality can deter visitors and reduce the appeal of the region as a vacation spot. In the aftermath of major fires, recovery may take years, during which tourism-dependent businesses such as lodges, restaurants, and local shops may experience decline in revenue due to reduced foot traffic and visitor spending. Small businesses are particularly vulnerable, as they often lack the finance to withstand economic downturns. The cascading impacts can extend throughout the community, impacting employment, public services, and overall quality of life. For residents and visitors alike, the loss of access to outdoor spaces and recreational activities diminishes the livability of Sierra County. Depending on the severity and location of a wildfire, post-disaster recovery can come with a considerable price tag.

### 14.2.6 Impact on Historic and Cultural Resources

Sierra County has substantial cultural and natural resources located throughout. The impact to historic cultural resources from direct and indirect exposure to fire and fire-related activities may be swift and detrimental. Wildfires can rapidly engulf historic buildings, archaeological sites, and culturally significant landscapes, leading to irreversible loss of heritage. Many historic and cultural assets are irreplaceable, serving as a reminder of the gold rush era. The loss of such resources would not only erase tangible connections to the past but also diminish the cultural richness and historical continuity of Sierra County.

### 14.2.7 Impact on Ecosystems and Natural Resources

Wildfires present a serious threat to Sierra County because of its vast forested areas and dry grasslands, which become highly flammable during the hot, dry summer months. Dense vegetation in meadows and canyons can accelerate fire spread, intensifying the risk to wildlife habitats, and causing long-term



ecological damage. These impacts include increased soil erosion, degradation of water quality, and disruption of natural regeneration processes.

In addition to ecological harm, wildfires jeopardize several critical natural resources. Watersheds are particularly vulnerable, with fires potentially reducing water supply reliability and compromising water quality through increased sedimentation and runoff. Air quality also deteriorates significantly during and after fire events, affecting both human health and environmental conditions.

The aesthetic and recreational value of Sierra County is another major concern. Large-scale fires can scar scenic landscapes, diminishing the visual appeal that draws tourists and outdoor enthusiasts. Key assets at risk include recreational areas, wildlife habitats, rangelands, and timber resources. The loss of these resources would have profound ecological and economic consequences.

### 14.2.8 Change in Vulnerability Since 2012 HMP

Wildfire vulnerability may have increased slightly due to prolonged drought conditions and increased fuel loads, but not due to population or development changes. Sierra County’s population has remained stable, and there has been little expansion into the wildland-urban interface. However, climate-driven changes in fire behavior could elevate risk despite the static human footprint. The expansion of seasonal and single-family homes into forested or wildland-urban interface areas increases the number of structures at risk. Climate change has intensified wildfire behavior, with longer fire seasons and more extreme fire weather. The high housing vacancy rate of over 52% seasonally, as of 2020, means that many homes may be unoccupied during fire events, complicating evacuation and response efforts.

## 14.3 MITIGATION OPPORTUNITIES

Table 14-5 presents a range of potential opportunities for mitigating the wildfire hazard.

Table 14-5. Potential Opportunities to Mitigate the Wildfire Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>Clear potential fuels on property such as dry overgrown underbrush and diseased trees</li> </ul>	<ul style="list-style-type: none"> <li>Clear potential fuels on property such as dry overgrown underbrush and diseased trees</li> </ul>	<ul style="list-style-type: none"> <li>Clear potential fuels on property such as dry overgrown underbrush and diseased trees</li> <li>Implement best management practices on public lands</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>Create and maintain defensible space around structures and provide water on site</li> <li>Locate outside of hazard area</li> <li>Mow regularly</li> <li>Use fire-resistant building materials</li> </ul>	<ul style="list-style-type: none"> <li>Create and maintain defensible space around structures and infrastructure and provide water on site</li> <li>Locate outside of hazard area</li> <li>Use fire-resistant building materials</li> <li>Use fire-resistant plantings in buffer areas of high wildfire threat</li> </ul>	<ul style="list-style-type: none"> <li>Create and maintain defensible space around structures and infrastructure</li> <li>Locate outside of hazard area</li> <li>Enhance building code to include use of fire-resistant materials in high hazard area</li> <li>Use fire-resistant plantings in buffer areas of high wildfire threat</li> <li>Consider higher regulatory standards (such as Class A roofing)</li> <li>Establish biomass reclamation activities</li> <li>In high-risk areas, use heat-resistant materials like welded steel, and avoid heat-</li> </ul>



Community Scale	Organizational Scale	Government Scale
		susceptible materials like polyvinyl chloride and high-density polyethylene
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• Employ techniques from the National Fire Protection Association’s Firewise Communities program to safeguard home</li> <li>• Identify alternative water supplies for firefighting</li> <li>• Install/replace roofing material with non-combustible roofing materials</li> </ul>	<ul style="list-style-type: none"> <li>• Support Firewise community initiatives</li> <li>• Create/establish stored water supplies to be utilized for firefighting</li> </ul>	<ul style="list-style-type: none"> <li>• More public outreach and education efforts, including an active Firewise program</li> <li>• Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas</li> <li>• Identify fire response and alternative evacuation routes</li> <li>• Seek alternative water supplies</li> <li>• Become a Firewise community</li> <li>• Use academia to study impacts/solutions to wildfire risk</li> <li>• Establish/maintain mutual aid agreements between fire service agencies</li> <li>• Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development</li> <li>• Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions</li> <li>• Provide incentives for existing structures to be hardened against wildfire</li> <li>• Use tools to detect, forecast, and take action ahead of wildfire</li> </ul>
<b>Nature-based Opportunities</b>		
<ul style="list-style-type: none"> <li>• Manage invasive species that are susceptible to increased wildfire risk</li> <li>• Create riparian corridors in wildfire hazard areas as fire breaks</li> <li>• Incorporate nature-based wildfire risk reduction buffers into existing ecosystem-friendly land uses (e.g., green space, trails, or parks)</li> </ul>		



Figure 14-3. Loyalton Fire from Chilcoot



*(Photo Credit: LeTina Vanetti)*



# 15. WINTER STORMS

## 15.1 HAZARD PROFILE



### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(i)

*Include a description of the type, location, and extent for the identified hazards of concern and include information on previous occurrences of hazard events and the probability of future hazard events.*

### 15.1.1 Description of the Hazard

Winter weather consists of storm events in which the main types of precipitation are snow, sleet, or freezing rain. California experiences its rainiest season during the winter, making winter precipitation more likely to occur (Kenedy 2025).

Winter storm includes snow, ice, blizzard conditions, and extreme cold. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns.

Figure 15-1. Sierra Buttes in the Winter



(Photo Credit: Steve Folsom)



### ***Defining the Hazard***

The NOAA National Severe Storms Laboratory (NSSL) defines a winter storm as an event in which the main types of precipitation are snow, sleet, or freezing rain (NOAA NSSL n.d.). The main types of winter storms include blizzards, ice storms, and lake effect storms.

Blizzards are dangerous winter storms that are a combination of blowing snow and wind resulting in very low visibilities, typically categorized as strong winds (over 35 mph) with snow and blowing snow, reducing visibility to 1/4 mile or less for at least 3 hours. While heavy snowfalls and severe cold often accompany blizzards, they are not required. Sometimes strong winds pick up snow that has already fallen, creating a ground blizzard.

An ice storm is a storm which results in the accumulation of at least 0.25 inch of ice on exposed surfaces. They create hazardous driving and walking conditions. Tree branches and power lines can easily snap under the weight of the ice.

Lake effect storms are not low-pressure system storms. As a cold, dry air mass moves over the Great Lakes regions, the air picks up lots of moisture from the Great Lakes. This air, now full of water, dumps the water as snow in areas generally to the south and east of the lakes.

### ***Cause of the Hazard***

Winter storms are caused by a combination of atmospheric conditions coming together (NOAA NSSL n.d.): cold air, moisture, and lift. Cold air is necessary to ensure that precipitation falls as snow or ice rather than rain. Moisture, often sourced from large bodies of water like oceans or the Great Lakes, provides the water vapor needed to form clouds and precipitation. Lift is the mechanism that causes the moist air to rise and cool, leading to cloud formation and eventually precipitation. This lifting can be caused by weather fronts, low-pressure systems, or terrain such as mountains.

### ***Summary of Potential Impacts***

Winter storms can cause a wide range of impacts that disrupt daily life and pose serious risks to safety. Impacts include severe travel conditions due to snow and ice-covered roads, power outages from downed lines or ice accumulation, and limited access to emergency services. Schools and businesses may close, supply chains can be delayed, and vulnerable populations face heightened health risks like hypothermia and frostbite. Additionally, the weight of heavy snow can damage roofs and trees, while freezing rain can create dangerously slick surfaces and strain utility systems.

### ***Cascading Hazard Impacts***

Winter storms may trigger cascading hazard impacts that extend the duration and severity of the event. Prolonged power outages during extreme cold may lead to heating failures, increasing the risk of carbon monoxide poisoning from unsafe heating methods. Melting of snow and ice may overwhelm drainage systems, causing localized flooding, especially if the ground is still frozen.

## **15.1.2 Location**

Depending on the elevation of a given area, winter storms are some of the most common weather events that occur in Sierra County due to its mountainous terrain and high elevations. Areas above 6,500 feet,



such as those near Yuba Pass and along the crest of the Sierra, frequently experience intense snowfall and blizzard conditions during the winter months

### 15.1.3 Extent

Extreme cold and freeze events occur on regional basis. Extreme cold can occur in any location of the County. All portions of the County are at risk to winter storms, with the upper elevation in the western part of the county frequently more impacted.

#### Measuring Intensity

NWS primarily uses the Winter Storm Severity Index (WSSI) to measure and communicate intensity of winter storms (NWS, Winter Storm Severity Index n.d.). The tool combines meteorological data with impact-based modeling to provide a more comprehensive picture of storm severity. Figure 15-2 outlines the scale for WSSI. Key components of the WSSI include snow amount, snow load, ice accumulation, blowing snow, ground blizzard, and flash freeze. The index does not depict official warnings; rather, it is used in context with official NWS forecast and warning.

Figure 15-2. Winter Storm Severity Index (WSSI) Index

Potential Winter Storm Impacts	
	<p><b>No Impacts</b> Impacts not expected.</p>
	<p><b>Limited Impacts</b> Rarely a direct threat to life and property. Typically results in little inconveniences.</p>
	<p><b>Minor Impacts</b> Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.</p>
	<p><b>Moderate Impacts</b> Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.</p>
	<p><b>Major Impacts</b> Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.</p>
	<p><b>Extreme Impacts</b> Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.</p>

Figure 15-3. Sperry-Piltz Ice Accumulation (SPIA)

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
<b>0</b>	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
<b>1</b>	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
<b>2</b>	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
<b>3</b>	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
<b>4</b>	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
<b>5</b>	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

The Sperry-Piltz Ice Accumulation (SPIA) Index predicts the projected footprint, total ice accumulation, and resulting potential damage from incoming ice storms. The SPIA Index, shown on Figure 15-3,



is based on three parameters: storm total rainfall, converted to ice accumulation; wind; and temperatures during the event period (SPIA Index n.d.).

### **Warning Time**

Winter weather related warnings, watches and advisories are issued by local NWS offices. Descriptions of warnings, watches, and advisories are listed below (NWS 2025):

- **Blizzard Warnings:** issued for frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for 3 hours or more. A Blizzard Warning means severe winter weather conditions are expected or occurring.
- **Winter Storm Warnings:** issued for a significant winter weather event including snow, ice, sleet or blowing snow or a combination of these hazards.
- **Ice Storm Warnings:** issued for ice accumulation of around 1/4 inch or more.
- **Wind Chill Warnings:** issued for a combination of very cold air and strong winds that will create dangerously low wind chill values. This level of wind chill will result in frostbite and lead to hypothermia if precautions are not taken.
- **Lake Effect Snow Warnings:** issued when widespread or localized lake induced snow squalls or heavy showers are expected to produce significant snowfall accumulation. Lake effect snow usually develops in narrow bands and impacts a limited area.
- **Winter Storm Watches:** issued when conditions are favorable for a significant winter storm event (heavy sleet, heavy snow, ice storm, heavy snow and blowing snow or a combination of events.)
- **Wind Chill Watches:** issued when there is the potential for a combination of extremely cold air and strong winds to create dangerously low wind chill values.
- **Winter Weather Advisories:** issued when snow, blowing snow, ice, sleet, or a combination of these wintry elements is expected but conditions should not be hazardous enough to meet warning criteria.
- **Wind Chill Advisories:** issued when low wind chill temperatures are expected but will not reach local warning criteria. Extremely cold air and strong winds will combine to generate low wind chill readings.
- **Lake Effect Snow Advisory:** issued for widespread or localized lake effect snowfall accumulation and blowing snow remaining below warning criteria. Expects lake effect snow showers and assume travel will be difficult in some areas.

### **Worst-Case Scenario**

A worst-case winter storm scenario in Sierra County would lead to an Extreme Impact on the WSSI. A powerful and prolonged atmospheric river event slamming into the Sierra Nevada could result in extreme snowfall totals of 4 to 8 feet or more in higher elevations like the Sierra Buttes or Yuba Pass over a short span of time. Snowfall rates could exceed 2 inches per hour. Accompanying the heavy snow, blizzard conditions would likely develop, with sustained winds over 35 mph and gusts surpassing 60 mph, reducing visibility to less than 1/4 mile for several hours. In lower elevations, the storm could bring significant ice accumulation, impacting power lines, and roads, leading to widespread power outages and infrastructure damage.



As temperatures plummet behind the storm, a flash freeze could occur, turning slushy roads into sheets of black ice and compounding travel hazards. The immense weight of new snow on unstable snowpack would also elevate the risk of avalanches in steep terrain, threatening backcountry areas and mountain communities. Such a storm would likely shut down major routes like Highways 49 and 89, isolate rural communities, and delay emergency services. The combination of extreme snowfall, high winds, ice, and avalanche danger would make this a paralyzing and potentially life-threatening event for Sierra County residents.

### 15.1.4 Previous Occurrences

The following sections provide a review of previous winter storm occurrences in Sierra County.

#### Declarations

##### Federal Declarations

Between 1954 and 2024, Sierra County experienced four winter storm-related major disaster (DR) or emergency declarations (EM).

Table 15-1. Federal Winter Storm Disaster Declarations

Disaster Number	Incident Period	Declaration Date	Description
DR-979	January 5, 1993 – March 20, 1993	February 3, 1993	Severe Winter Storms, Mudslides, Landslides, and Flooding
DR-1046	February 13, 1995 – April 19, 1995	March 12, 1995	Severe Winter Storms, Flooding, Landslides, and Mudflow
DR-4301	January 3, 2017 – January 12, 2017	February 14, 2017	Severe Winter Storms, Flooding, and Mudslides
DR-4699	February 21, 2023 – July 10, 2023	April 3, 2023	Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides

Source: OpenFEMA Datasets ([OpenFEMA Data Sets | FEMA.gov](https://openfema.fema.gov/))

##### State Declarations

Between 2012 and 2024, California declared that Sierra County experienced four disasters related to winter storms.

Table 15-2. State Winter Storm Disaster Declarations

Disaster Number	Declaration Date	Description
2017-01	January 23, 2017	January 2017 Storms
2017-03	March 7, 2017	February 2017 Storms
2022-03	December 30, 2021	December 2021 Storms
N/A	March 1, 2023	Late February – Early March 2023 Winter Storm

Source: (Cal OES 2025)



**USDA Declarations**

Between 2012 and 2024, the USDA declared that Sierra County experienced two disasters related to winter storms.

Table 15-3. USDA Winter Storm Disaster Declarations

Disaster Number	Incident Period	Description
S5229	February 21, 2022 – February 28, 2022	Freeze disaster approved for USDA declaration on July 1, 2022.
S5332	April 11, 2022 – April 12, 2022	Freeze disaster approved for USDA declaration on November 4, 2022.

Source: (USDA 2025)

**Summary of Significant Events**

Outside of the Federal, State, and USDA declarations, no other significant events were noted within Sierra County.

**Recent Events**

According to the NOAA Storm Events Database, Sierra County lies within the West Slope Northern Sierra Nevada and Lassen-Eastern Plumas-Eastern Sierra Counties zones. Between 1950 through 2024, 238 events were reported. Events describing communities in Sierra County are outlined in Table 15-4.

Table 15-4. Recent Winter Storm Hazard Events

Date (s) of Event	Disaster Declaration	County Included	Description
March 9, 2021	951381	Sierra County	The Bowman Lake, Calaveras Big Trees, Cherry Valley Dam, Downieville, Pacific House, and Strawberry Valley COOP sites respectively reported 16 inches, 11 inches, 10 inches, 6 inches, 8 inches, and 18 inches of storm total snow accumulation.
December 17, 2010	276514	Sierra County	Areas SW of Susanville received 10 to 20 inches below 7000 feet, with an estimated 2 to 4 feet (based on precipitation gauges and SNOTELS) above 7000 feet. Elsewhere, much less fell with only up to 6 inches reported. In addition to snow, gusty winds of 30 to 45 mph were widespread on the 19th. A local wind gust to 83 mph was reported just west of Loyalton.
December 7, 1997	5626778	Sierra County	14 inches of snow accumulated during a 24-hour period over Yuba Pass (Highway 49) in Sierra County.

**15.1.5 Future Conditions**

Future hazard conditions, including frequency and severity of future events, is discussed in the sections below.

**Probability**

Extreme cold and freeze are likely to continue to occur annually in the County, equating to a likelihood of future occurrences being considered highly likely. The probability of winter storms occurring in this region is relatively high during the colder months, typically from November through April.



## Climate Change

Throughout the state of California, the fast transition from one extreme weather event to another, known as weather whiplash, is an increasing pattern (Sierra Nevada Conservancy 2024). These transitions are becoming more common due to a warming climate, which adds more moisture to the atmosphere and disrupts traditional weather patterns. While Sierra County may still experience heavy winter storms, they are becoming less predictable and more extreme.

## Potential Future Impacts

Potential future conditions are expected to increase and vary from heavier snowfall to more intense storms, increased risk of avalanches, and complication in snow removal. At the same time, warmer temperatures during some storms could lead to rain-on-snow events, which rapidly melt snowpack and heighten the risk of flash flooding and landslides.

## 15.2 VULNERABILITY ASSESSMENT

### Local Plan Requirement B1 – 44 CFR Part 201.6(c)(2)(ii)



*The plan must include a description of the jurisdiction's vulnerability to the hazards of concern and include an overall summary of the hazard's impact on the community. The impacts need to include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard areas, and estimate of potential dollar losses to vulnerable structures, and a description of land uses and development trends.*

### 15.2.1 Summary of Vulnerability

Winter storms are the most frequent severe weather event in Sierra County. All areas in the county are susceptible to impacts from winter storms. The western part of the county is much more frequently impacted due to the higher elevations, as evidenced by record and average temperatures. The county's mountainous terrain and rural character further compound vulnerability by limiting access and slowing emergency response during storm events.

### 15.2.2 Impact on Life, Health, and Safety

Prolonged exposure to cold temperatures can lead to hypothermia, frostbite, and cold-related fatalities, especially among individuals without adequate shelter or heating. Storm-related traffic accidents, slips and falls on icy surfaces, and carbon monoxide poisoning from improper heating methods are also common health risks.

### Socially Vulnerable Populations

Populations with limited resources—such as the elderly, individuals with disabilities, low-income households, and those living in remote or poorly insulated housing—are at heightened risk. These groups may lack access to reliable heating, transportation, or emergency services. Power outages and road closures can further isolate vulnerable individuals, making it difficult to obtain food, medicine, or medical care. According to FEMA's National Risk Index, Sierra County has a relatively low Social Vulnerability score (28.10), but localized vulnerabilities still exist and must be addressed in preparedness planning.



### 15.2.3 Impact on General Building Stock

Winter storms can cause direct and indirect damage to buildings. Heavy snow loads may exceed structural limits, leading to roof collapses, especially on older or poorly maintained buildings. Ice dams can form on roofs, causing water intrusion and interior damage. Frozen pipes can burst, resulting in water damage and repairs. Prolonged power outages may also compromise heating systems. While modern structures built to code are generally resilient, older homes and unreinforced buildings are more susceptible to damage.

### 15.2.4 Impact on Community Lifelines

All community lifelines within the County are exposed to direct and cascading impacts from winter storms, particularly transportation, emergency services, and utility infrastructure. Heavy snowfall, ice accumulation, and freezing temperatures can render roads impassable, delay emergency response, and disrupt access to essential services such as healthcare, food distribution, and fuel supply.

Transportation systems are especially vulnerable. Snow and ice can lead to hazardous driving conditions, road closures, and increased accident rates. Long winter storms may overwhelm snow removal operations, further delaying recovery and mobility. Public transit systems may also be suspended or limited, isolating residents.

Emergency services face increased demand during winter storms due to weather-related accidents, hypothermia cases, and power outages. Their ability to respond may also be hindered by blocked roads or downed communication lines.

Utility systems are also vulnerable. Ice accumulation can damage power lines and transformers, leading to extended outages. Frozen pipes can disrupt water supply and cause costly damage to buildings and public facilities.

### 15.2.5 Impact on the Economy

Transportation delays affect the movement of goods and services, increasing costs for businesses and consumers. Tourism may suffer from road closures, hazardous conditions, and cancellations. Local governments may exhaust spendings for snow removal, emergency response, and repair. Long power outages and business closures can lead to lost revenue and productivity, particularly for small businesses and seasonal operations that rely on foot traffic.

### 15.2.6 Impact on Historic and Cultural Resources

Historic buildings and cultural resources are particularly vulnerable to winter storm damage. Heavy snow loads and ice accumulation can compromise the structural integrity of older buildings, especially buildings designed for extreme winter weather conditions. Burst pipes in buildings can damage irreplaceable materials and artifacts, if not managed well. Access to remote historic sites may be restricted during storms, delaying preservation efforts and increasing the risk of long-term deterioration.



### 15.2.7 Impact on Ecosystems and Natural Resources

Winter storms play a natural role in shaping Sierra County’s ecosystems. Snowpack accumulation is critical for water supply, soil moisture, and wildlife habitat. However, extreme storms can stress flora and fauna. Heavy snow and ice can damage trees, disrupt animal migration patterns, and limit food availability for wildlife. Additionally, increased use of road salt and chemicals to de-ice can lead to soil and water contamination, affecting aquatic ecosystems and drinking water sources. Forested areas may also experience increased risk of treefall and erosion following intense winter storm conditions.

### 15.2.8 Change in Vulnerability Since 2012 HMP

Vulnerability to winter storms remain consistent since 2012. The county’s population has not grown, and infrastructure remains largely unchanged. While winter storms continue to pose challenges, especially in remote areas, the lack of significant development or demographic shifts means that overall vulnerability has not increased. While the permanent population is declining, the county’s aging infrastructure and changing climate patterns, such as more intense snowstorms or ice events, could slightly elevate vulnerability.

## 15.3 MITIGATION OPPORTUNITIES

Table 15-5 presents a range of potential opportunities for mitigating the winter storm hazard.

Table 15-5. Potential Opportunities to Mitigate the Winter Storm Hazard

Community Scale	Organizational Scale	Government Scale
<b>Manipulate the Hazard</b>		
<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
<b>Reduce Exposure and Vulnerability</b>		
<ul style="list-style-type: none"> <li>• Insulate residential and non-residential structures</li> <li>• Provide redundant heat and power</li> <li>• Plant appropriate trees near home and power lines (“Right tree, right place” National Arbor Day Foundation Program)</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate critical infrastructure (such as power lines) underground</li> <li>• Reinforce or relocate critical infrastructure such as power lines to meet performance expectations</li> <li>• Install tree wire</li> </ul>	<ul style="list-style-type: none"> <li>• Harden infrastructure such as locating utilities underground</li> <li>• Trim trees back from power lines</li> <li>• Designate snow routes and strengthen critical roads and bridges</li> <li>• Use the best available technology to enhance the warning systems for all severe weather events</li> </ul>
<b>Build Local Capacity</b>		
<ul style="list-style-type: none"> <li>• Develop and practice a household evacuation plan</li> <li>• Trim or remove trees that could affect power lines</li> <li>• Promote 72-hour self-sufficiency</li> <li>• Obtain a NOAA weather radio</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and practice a corporate evacuation plan</li> <li>• Inform employees through corporate sponsored outreach</li> <li>• Trim or remove trees that could affect power lines</li> <li>• Create redundancy</li> </ul>	<ul style="list-style-type: none"> <li>• Support programs such as “Tree Watch” that proactively manage problem areas through the use of selective removal of hazardous trees, tree replacement, etc.</li> <li>• Establish and enforce building codes that require all roofs to withstand snow loads</li> <li>• Increase communication alternatives</li> <li>• Enhance public awareness campaigns to address actions to take during severe weather events</li> </ul>



Community Scale	Organizational Scale	Government Scale
<ul style="list-style-type: none"> <li>Obtain an emergency generator</li> </ul>	<ul style="list-style-type: none"> <li>Equip facilities with a NOAA weather radio</li> <li>Equip vital facilities with emergency power sources</li> </ul>	<ul style="list-style-type: none"> <li>Coordinate winter storm warning capabilities and the dissemination of warning among agencies with the most capability</li> <li>Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors</li> <li>Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines</li> <li>Provide NOAA weather radios to the public</li> <li>Consider the probable impacts of climate change on risk associated with the winter storm hazard</li> <li>Evaluate and revise, as needed, building codes to address winter weather impacts on residents</li> </ul>
Nature-based Opportunities		
<ul style="list-style-type: none"> <li>None identified</li> </ul>		

Figure 15-4. Winter Snowfall, Sierra Valley



(Photo Credit: LeTina Vanetti)



## 16. OTHER HAZARDS OF INTEREST

After reviewing the previous plan and considering options for other hazards of interest to address, the HMSC selected a limited number of hazards of interest to include in this update of the Sierra County Multi-Jurisdictional Hazard Mitigation Plan. The sections below provide short profiles of each hazard of interest, including a qualitative discussion of their potential impact in the County. No formal risk assessment was performed, no mitigation actions have been developed to address them, and the hazards are not included in the risk ranking. However, all Planning Partners for this plan should be aware of these hazards and take steps to reduce the risks they present whenever it is practical to do so.

### 16.1 CYBERSECURITY

#### 16.1.1 Overview

A cyberattack is an intentional and malicious crime that compromises the digital infrastructure of a person or organization. Generally, attacks last minutes to days, but large-scale events and their impacts can last much longer. As information technology continues to grow in capability and interconnectivity, cyberattacks become increasingly frequent and destructive.

Cyberattacks can lead to loss of money, theft of personal information, and damage to personal reputation and safety. Motives range from the pursuit of financial gain to political or social aims. Attack types include using viruses to erase entire systems, breaking into systems and altering files, using someone's personal computer to attack others, or stealing confidential information. Such threats having a wide range of effects on individuals, communities, and organizations.

Computer systems can experience a variety of cyberattacks, from blanket malware infection to targeted attacks on system capabilities. Cyberattacks seek to breach information technology security measures designed to protect an individual or organization. Organizations are prone to different types of attacks that can be either automated or targeted.

#### 16.1.2 Identified Cybersecurity Hazards

Table 16-1 describes the most common cyberattack mechanisms faced by organizations today.

Table 16-1. Common Types of Cybersecurity Attacks

Type	Description
<b>Cross-Site Scripting</b>	An attack that sends malicious scripts into content from reliable websites.
<b>Denial of Service Attack</b>	An attack that focuses on disrupting service to a network in which attackers send high volumes of data until the network becomes overloaded and can no longer function.
<b>Internet of Things Attacks</b>	Internet connectivity across commonly used devices presents a growing number of access points for attackers to exploit. The interconnectedness of things makes it possible for attackers to breach an entry point and use it as a gate to exploit other devices in the network.
<b>Malware</b>	"Malware" refers to various types of attacks, including spyware, viruses, and worms. Malware uses a vulnerability to breach a network when a user clicks a planted dangerous link or email attachment, which is used to install malicious software inside the system.



Type	Description
<b>Man in the Middle</b>	Man-in-the-middle attacks mirror victims and endpoints for online information exchange. In this type of attack, the attacker communicates with the victims, who believe they are interacting with a legitimate endpoint website. The attacker is also communicating with the actual endpoint website by impersonating the victim. As the process goes through, the attacker obtains entered and received information from both the victim and endpoint.
<b>Password Attacks</b>	Passwords are the most widespread method of authenticating access to a secure information system, making them an attractive target for cyber attackers. By accessing a person's password, an attacker can gain entry to confidential or critical data and systems, including the ability to manipulate and control them.
<b>Phishing</b>	Malicious email messages that ask users to click a link or download a program. Phishing attacks may appear as legitimate emails from trusted third parties.
<b>Rootkits</b>	Rootkits are installed inside legitimate software, where they can gain remote control and administration-level access over a system. The attacker then uses the rootkit to steal passwords, keys, and credentials and retrieve critical data.
<b>SQL Injection</b>	This occurs when an attacker inserts malicious code into a server using server query language (SQL), forcing the server to deliver protected information. This type of attack usually involves submitting malicious code into an unprotected website comment or search box.
<b>Zero-day Exploit</b>	A zero-day exploit refers to exploiting a network vulnerability when it is new and recently announced—before a patch is released and/or implemented.

### 16.1.3 Past Events

Sierra County has not experienced a large-scale cybersecurity disruption, but small-scale attacks have been experienced by individuals residing in the County.

### 16.1.4 Location and Extent

This hazard is not geography-based. Attacks can originate from any computer to affect any other computer in the world. If a system is connected to the Internet or operating on a wireless frequency, it is susceptible to exploitation. Cybersecurity concerns have risen in recent years with the large number of people working remotely. Targets of cyberattacks can be individual computers, networks, organizations, business sectors, or governments. Financial institutions and retailers are often targeted to extract personal and financial data that can be used to steal money from individuals and banks. The most affected sectors are finance, energy and utilities, and defense and aerospace, as well as communication, retail, and health care. Both public and private operations are threatened on a near-daily basis by the engineered cyberattacks developed to automatically seek technological vulnerabilities.

Cybercrimes inflict damages in the trillions of dollars each year globally, which is much larger than the annual damage from natural disasters.



## 16.2 MASS GATHERINGS

### 16.2.1 Overview

A mass gathering is an event, where a large number of people assemble, which can strain the resources and infrastructure of the community. These events can include concerts, sporting events, religious gatherings, and political rallies.

### 16.2.2 Identified Mass Gathering Hazards

Mass gatherings can overwhelm local emergency medical services and law enforcement. Although Sierra County is rural and isolated, annual recreation and sporting events more than double the population of the entire County during the summer months and during special events. Sierra County publishes and distributes emergency information for visitors to assist with safety and mitigate some of the challenges of the large visitor influx in the summer (Figure 16-1). Emergency responders in Sierra County are often volunteers and may become overwhelmed by the increase in calls due to sports injuries or other medical situations.

Vehicle accidents may increase as the number of vehicles on Sierra County roadways can exceed 4,000 per day in the summer months. Medical care is very limited in Sierra County. As a result, most individuals with emergencies require an air lift to a neighboring county medical facility.

### 16.2.3 Location and Extent

Downieville hosts the largest single event in the County each year, the Downieville Classic Mountain Bike Race and Festival. Thousands of riders and spectators from around the world converge on the small town one weekend each August to race and to party. Parking congestion in Downieville during this event often disrupts community access. Throughout the summer and fall months, thousands of visitors looking

Figure 16-1. Visitor Emergency Information Flyer

**Welcome to Sierra County, CA**

As remote and sparsely populated as Sierra County is, we have a great volunteer base. Volunteer Fire Departments are located in Alleghany, Pike, Downieville, Sierra City, Sattley, Sierra Brooks, Calpine, Sierraville & Loyalton. Fire departments have ongoing training for firefighters and EMTs to keep current on their skills & certifications. At the sound of the siren, personnel leave their regular jobs and show up, seemingly out of nowhere, to take care of you. So while vacationing or visiting the area, play safe, but if faced with an emergency, rest assured, help is right around the bend. Use caution while navigating our narrow curvy scenic highways. **Remember when you see those emergency lights coming, get as far off the path as safely possible.**

**Personal Preparedness** goes a long way in avoiding meeting our trusty search and rescue volunteers. Let somebody know where you are going and when you expect to return. Do not count on your cell phone working. Carry basic first aid supplies, any required prescription medications, flashlight, jacket, blankets, bug repellent, sun-screen, snacks and water. Do not count on your GPS device working or being entirely accurate. **NOTE: Local stores will not be open in the evening.**

Should you need advanced medical attention while in Sierra County there is a high likelihood you will be transported by air. Many have discovered after receiving air transport, this service is not always covered by regular insurance. **Costs start at \$20,000.00 per trip.** Purchasing membership with a medical transport company in advance is a prudent option. For an annual fee averaging \$45- \$85 you can have peace of mind for you and your household. Some membership options:

- AirMedCareNetwork (Reach for life & Calstar) 1-800-793-0010 [www.airmedcarenetwork.com](http://www.airmedcarenetwork.com)
- Enloe Flight Care 530-332-7300 <http://www.enloe.org/>
- Care Flight 775-858-5745 <https://www.remsahealth.com/>

A few common hazards to be on the alert for are mountain lions, rapidly changing weather extremes, bears, rattle snakes, aggressive ground wasps, wildland fires, ticks and mosquitoes which can carry disease.

When swimming, fishing, or engaging in water sports, being a strong swimmer is not a good rationale for not wearing a life jacket. Besides buoyancy, a life jacket has additional safety purposes to consider. A life jacket will help protect a person against hypothermia, an important threat when a rescue might be slow in coming. Most life jackets are brightly colored assisting in rescue efforts. They can also absorb some of the impact of a fall and minimize injuries. Seeing adults wear a life jacket sets a positive example for children. **FREE Childrens Life Jackets @ Family Resource Center: Monday-Friday, 530-993-1110**

911 calls made from cell phones are often routed to larger dispatch centers then transferred back locally. This can cause a delay in getting assistance. Specify you are in Sierra County. In order to expedite the handling of an emergency call from your cellular phone you can program the direct dial number for Sheriff's Office Dispatch into your phone and use it instead of 911 while in Sierra County. **Dispatch: 530-289-3700**



for remote recreation opportunities stream to Sierra County to ride, hike, birdwatch, and camp (Figure 16-2).

Figure 16-2. Downieville Draws Riders from Around the World to its Mountain Bike Trails and Events



(Photo Credit: Brian Walker)



(Photo Credit: Big Boulder Adventures)

## 16.3 TRANSPORTATION HAZARDS

### 16.3.1 Overview

Winter driving conditions in Sierra County present transportation hazards due to excessive rain, snow, and ice on narrow, winding roads. Snow accumulation increases stopping distances and black ice can cause vehicles to lose control. Due to the remote nature of the roadways intersecting Sierra County and the County's capacity to clear roads quickly, these hazards become more significant than they would be in a more heavily developed area. The County maintains about 400 miles of paved roads, and there are another 100 miles of remote gravel and dirt roads throughout the County, including many US Forest Service roads. Limited broadband and cellular coverage can hinder real-time transit information and mapping (Sierra County Transportation Commission 2025).

### 16.3.2 Identified Transportation Hazards

Transportation hazards can be identified in the following three main categories:

- When in an accident due to hazardous road conditions, drivers of commercial and private vehicles cause road blockages and have to rely on limited emergency response capabilities.



- Backwoods recreational users are difficult to reach in an emergency when transportation routes are impacted by storms and snow accumulation.
- Visitors unfamiliar with the County rely on inaccurate GPS directions which often lead drivers on roads that are unsafe or impassible because they are not plowed in the winter.

Figure 16-3. Backwoods Recreation in Winter Months



(Photo Credit: Mary Davey)

### 16.3.3 Location and Extent

Transportation hazards are most common in the western part of Sierra County, but they can occur across the County when the weather causes dangerous driving conditions. Dozens of search and rescue efforts are conducted each year on roads that are recommended by GPS directions. Motorists have been stranded for up to a week before being rescued by helicopter (Associated Press 2021).

## 16.4 WILDLIFE & HUMAN INTERACTIONS

### 16.4.1 Overview

California is home to a large diversity of wildlife. Human-wildlife conflict can occur when humans and wild animals interact in an unwanted or unsafe way. In California, habitat loss and a changing climate have increased the frequency and type of wildlife incidents reported to the California Department of Fish and Wildlife. It has become more common for people to observe, encounter, and interact with wildlife



while recreating outdoors or living in an urban-wildlands interface as wild animals search for food and water (California Department of Fish and Wildlife 2025).

### 16.4.2 Identified Wildlife and Human Interaction Hazards

Wildlife and human interactions can present the following hazards in Sierra County:

#### **Wildlife-Vehicle Collisions**

Vehicle collisions with wildlife are an ongoing concern across Sierra County. Large animals such as deer, bears, mountain lions, and wolves cross rural roads, often at dawn and dusk (Sierra County Transportation Commission 2025). Vehicle drivers on narrow winding roads may encounter wildlife with little to no time to avoid an accident.

Figure 16-4. Wildlife Signage on Highway 49 Increases Driver Awareness



(Photo Credit: Megan Brotherton)

#### **Wolf Attacks**

Sierra County has issued emergency declarations for the devastating economic toll wolves are having on ranchers in the eastern part of the County. Wolves have demonstrated abnormal behavior, often attacking livestock without feeding on them. Between January and May 2025, the Sierra County Sheriff's Office have reported more than 21 wolf attacks in the County (Kennedy 2025). Ranchers are not allowed to shoot at or around the wolves because of their protection under the California Endangered Species Act. Deterrent measures such as electric fencing and full-time riders in the herds have not been proven to be feasible or cost-effective.



## **Bear Attacks**

In 2023, the first documented case of a deadly black bear attack on a human in California occurred in Downieville. Records indicate that a bear entered the home of a 71-year-old woman in downtown Downieville, mauled her to death, and fed on her remains (CNN 2024). According to the Sierra County Sheriff's Office, bears are a weekly nuisance in the spring, summer, and fall, but they are not a public safety issue. Visitors and residents can mitigate the hazard by properly storing food and trash so as not to attract bears.

### **16.4.3 Location and Extent**

Wildlife and human interactions can take place anywhere in the County. The extent of these interactions ranges from peaceable viewing at a distance, but can also include deadly encounters for pets, livestock, and people.

Figure 16-5. Mule Deer in Sierra Valley



(Photo Credit: LeTina Vanetti)



## 17. HAZARD RANKING

The prioritization and categorization of identified hazards for Sierra County is based principally on the Priority Risk Index (PRI), a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI was used to assist the Planning Partnership in identifying hazards that pose the most significant threat to the County.

The PRI results provide a numerical value for each hazard, allowing hazards to be ranked against one another (i.e., the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and climate change.

Each degree of risk has been assigned a value (1 to 4) and a weighting factor.

To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

$$PRI\ VALUE = [(PROBABILITY \times .30) + (IMPACT \times .30) + (SPATIAL\ EXTENT \times .20) + (WARNING\ TIME \times .10) + (CLIMATE\ CHANGE \times .10)]$$

According to the weighting scheme applied, the highest possible PRI value is 4.0. Table 17-1 shows the weighting schemes for each category. The assigned weighting factors are typical for hazard mitigation planning efforts. The Planning Partners had the option to amend these values if desired if additional factors should be considered for their individual hazard rankings. The final rankings for each Planning Partner are included in the jurisdictional annexes in Volume II. By determining a value for each hazard that can be compared to other hazards threatening the planning area, hazards can be ranked with greater ease.

Many of the PRI categories are described within the natural hazard profiles. A hazard risk ranking for each hazard of concern was assigned to the range of PRI values as follows:

- PRI Value 1 to 1.9 = Low Hazard Risk Ranking
- PRI Value 2.0 to 2.9 = Medium Hazard Risk Ranking
- PRI Value 3.0 to 4.0 = High Hazard Risk Ranking

The final PRI results, including the calculated values for each hazard in the County are found in Table 17-2.

Table 17-1. Priority Risk Index Scoring Criteria

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1% and 10% annual probability	2	
	Likely	Between 10% and 90% annual probability	3	



PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
	Highly Likely	90%+ annual probability	4	
Impact	Minor	Only minor property damage and minimal disruption to government functions and services. No shutdown of critical facilities.	1	30%
	Limited	Minor injuries to the total and socially vulnerable population are possible, more than 10% of buildings damaged or destroyed, temporary shutdown of critical facilities (less than 1 week).	2	
	Critical	Multiple deaths/injuries to the total and socially vulnerable population are possible, more than 25% of buildings damaged or destroyed, complete shutdown of critical facilities for more than 1 week.	3	
	Catastrophic	High number of deaths/injuries to the total and socially vulnerable population are possible, more than 50% of buildings damaged or destroyed, complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Limited to one specific area.	1	20%
	Small	Small areas affected.	2	
	Moderate	Large areas affected.	3	
	Large	All areas affected.	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Climate Change	Decreasing Risk	Climate change is likely to result in a decrease in the frequency and/or severity of hazard events.	1	10%
	No Impact	Climate change is not expected to impact frequency and/or severity of hazard events.	2	
	Risk Unknown	Not enough data currently exists to make accurate projections on the impact of climate change on hazard events.	3	
	Increasing Risk	Climate change is likely to result in an increase in the frequency/severity of hazard events.	4	

Table 17-2. Priority Risk Index Scoring Criteria

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI	Risk Ranking
Avalanche	.60	.60	.40	.40	.30	2.3	Medium
Dam Failure	.10	.30	.40	.40	.30	1.51.5	Low
Drought	1.2	.30	.80	.10	.30	2.7	Medium
Earthquake	.30	.60	.80	.40	.20	2.3	Medium
Extreme Heat	1.2	.60	.80	.10	.30	3.0	High
Flood	1.2	.60	.80	.10	.30	3.0	High



Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI	Risk Ranking
Landslide/Mass Movement	1.2	.60	.60	.40	.30	3.13.1	High
Volcanic Activity	.30	.30	.80	.10	.20	1.7	Low
Wildfire	1.2	.90	.80	.40	.30	3.6	High
Winter Storms	1.2	.60	.80	.10	.30	3.0	High



Deer Lake Sunrise (Photo Credit: LeTina Vanetti)

# Part 3

## Mitigation Strategy





# 18. MITIGATION STRATEGY

## 18.1 REVIEW OF PREVIOUS MITIGATION ACTIONS



### Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)

*The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.*

The 2012 HMP identified 38 recommended mitigation actions. For the Sierra County MJHMP Update, the actions were reviewed by the County, and the County provided a status update using the guidance below:

- No Progress – The mitigation action has not been completed.
- In Progress – Implementation of the mitigation action has begun but has not been completed.
- Ongoing Capability – The mitigation action has been implemented and will be completed on an annual or regular basis (for example, maintenance activities, annual outreach, etc.). These actions were removed from the updated mitigation strategy and included as capabilities in the Sierra County HMP Update.
- Completed – The mitigation action has been fully implemented and was removed from the updated mitigation strategy.

Actions that were in progress or had no progress were evaluated to determine if they should be discontinued or included in the Sierra County HMP update. Reasons for discontinuing an action include that the action has been evaluated as being duplicative, impractical, unfeasible, or undesirable, or if the problem that the action was originally developed for is no longer present. Actions that were identified for inclusion in the updated mitigation strategy received additional evaluation to determine if the action should be revised to reflect any new information obtained as part of the plan update process (for example, changes in risk, capabilities, lead agency, or available funding sources).

### 18.1.1 Mitigation Accomplishments Since 2012

- Road crews in the County have received flood fighting training which includes performing routine inspections and maintenance of levees (certified levee in Downieville) and conducting erosion control.
- The County installs and maintains debris deflectors and debris screens on culverts to prevent debris from entering the culverts. This helps keep the culverts clear which allows them to function properly during periods of heavy rain and reduce flooding because of clogged culverts.
- The County has access to federal and state weather sensors (e.g., stream, river, etc.) and uses those when preparing for hazard events and issuing emergency alerts.



## 18.2 MITIGATION GOALS AND OBJECTIVES



### Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(i)

*The mitigation strategy must include a description of mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards.*

Mitigation goals represent broad statements that are consistent with the hazards identified in the HMP and achieved through the implementation of specific mitigation actions. The Steering Committee established a set of goals for the Sierra County HMP Update that were based on the effectiveness of the goals from the previous plan. The goals from the 2012 HMP are as follows:

- Goal 1: Promote a flood safer community.
  - Objective 1.1: Develop and improve the countywide flood surveillance and early warning system.
  - Objective 1.2: Support the completion of the flood control project.
- Goal 2: Promote an earthquake safer community.
  - Objective 2.1: Train communities to be earthquake ready.
  - Objective 2.2: Ensure the ability of emergency response unites to communicate in a post-earthquake environment.
  - Objective 2.3: Improve post-earthquake survivability of public and private assets.
- Goal 3: Promote a fire safer community.
  - Objective 3.1: Develop a defensible space program to minimize impact of wildland-urban interface fires.
  - Objective 3.2: Cerate a sustainable public private partnership on building a safer community in the interface zone.
  - Objective 3.3: Develop a program to reduce shared threat in the interface zone.
  - Objective 3.4: Maintain quality of watershed by managing fuel and fire as part of the water quality environment.
- Goal 4: Promote an all-hazards safe community.
  - Objective 4.1: Increase survivability from technological hazards including terrorism.
  - Objective 4.2: Train and educate the public to increase individual and household readiness.

The Steering Committee reviewed the goals from the previous HMP and identified the following opportunities for modifications. The goals for the 2025 MJHMP update are as follows:

- **Goal 1.** Protect lives and reduce hazard-related injuries.
- **Goal 2.** Minimize or reduce current and future changing conditions that may cause damage from natural hazards to property, including critical facilities and the environment.
- **Goal 3.** Develop and implement long-term, cost-effective mitigation projects that foster resilience for the whole community.
- **Goal 4.** Maintain, enhance, and restore the natural environment’s capacity to deal with the impacts of natural hazard events.



- **Goal 5.** Improve emergency management preparedness, collaboration, and outreach within the planning area.

Goals are directly linked to the mitigation actions identified in each jurisdictional annex in Volume 2.

## 18.3 MITIGATION ALTERNATIVES



### Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)

*The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

A range of potential mitigation opportunities is included in each hazard risk assessment in Chapter 6 through Chapter 15. The potential actions are categorized by the following:

- Who may implement the action:
  - Community scale (individuals or groups)
  - Organizational scale (businesses, non-profits, community-based organizations)
  - Government scale (any government agency that has permit authorities and police powers within the planning area)
- What the alternative would do:
  - Manipulate the hazard (actions to prevent hazard events from occurring)
  - Reduce exposure and vulnerability (actions to safeguard people, property, and the environment from the impacts of the hazard)
  - Build local capacity (actions to improve abilities to mitigate and respond to hazard events)
  - Use nature-based solutions (actions that use green solutions to mitigate the hazard and provide additional environmental services)

## 18.4 DEVELOPING MITIGATION ACTIONS



### Local Plan Requirement C3 – 44 CFR Part 201.6(c)(3)(ii)

*The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

### Local Plan Requirement C3 – 44 CFR Part 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.*

Each jurisdiction reviewed the results of the risk and capability assessments, previous mitigation strategy, mitigation goals, catalogs of mitigation alternatives and selected actions to be included in their mitigation strategy in their jurisdictional annexes.



## 18.5 PRIORITIZING MITIGATION ACTIONS



### Local Plan Requirement E2 – 44 CFR Part 201.6(d)(3)

*The plan must document how the plan was reviewed and revised to document changes in development, progress in mitigation efforts, and changes in priorities.*

### Local Plan Requirement C3 – 44 CFR Part 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.*

A broad range of potential mitigation actions were considered in the 2012 HMP. Tables were developed to rank the mitigation projects using the following criteria: each project was assigned a priority rank, an approximate cost, a time horizon, whether the project requires Board of Supervisors regulatory action, and an assumption as to whether the project would be subject to CEQA or Federal EIR requirements. Actions were then prioritized based on community needs and concerns.

For this MJHMP, Sierra County followed the same prioritization method used in the 2023 California State HMP.

## 18.6 MITIGATION ACTION CATEGORIZATION

The identified mitigation actions are classified by the following action types.

### 18.6.1 Prevention

Preventive activities are intended to keep hazard problems from getting worse and are typically administered through programs or regulatory actions that influence the way land is developed and assets are built. In the context of this plan, prevention measures also include security initiatives. Prevention measures are particularly effective in reducing a District's future vulnerability, especially in areas where development has not occurred, or capital improvements have not been substantial. Examples of preventive activities include the following:

- Planning and zoning
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvement programs
- Riverine / fault zone setbacks
- Security measures

### 18.6.2 Property Protection

Property protection activities involve the modification of existing buildings, district assets, and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include the following:

- Acquisition
- Relocation
- Asset and building elevation
- Structural retrofitting
- Safe rooms, shutters, shatter-resistant glass



### 18.6.3 Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include the following:

- Outreach projects
- Speaker series and demonstration events
- Hazard map information
- Library materials
- School-age educational programs
- Hazard expositions
- Social media campaigns

### 18.6.4 Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, and steep slopes:

- Floodplain protection
- Watershed management
- Riparian buffers
- Habitat preservation
- Erosion and sediment control
- Wetland preservation and restoration
- Slope stabilization
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Green infrastructure

### 18.6.5 Emergency Services

Although not typically considered a “mitigation” technique, emergency service activities do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include the following:

- Warning and communication systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection

### 18.6.6 Structural Projects

Structural mitigation activities are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by District Operations and Engineering staff. Examples include the following:

- Reservoirs
- Dams, levees, dikes, and floodwalls
- Diversions, detention, retention
- Channel modification
- Stormwater infrastructure expansion
- Water and sewer infrastructure improvements



### 18.6.7 Climate Resiliency

Climate resiliency actions incorporate methods to mitigate or adapt to the impacts of the changing climate. Examples include the following:

- Aquifer storage and recovery
- Incorporating future conditions projections in planning and project design
- Actions that specifically address District climate change risks such as drought and extreme heat

### 18.6.8 Community Capacity Building

These actions increase local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences of hazards. Examples include the following:

- Staff training
- Memorandums of understanding
- Development of plans and studies
- Monitoring programs



Sierra Valley Lily Pads (Photo Credit: Mary Davey)

# Part 4

## Maintaining the Plan





# 19. ADOPTING AND MAINTAINING THE MITIGATION PLAN

## 19.1 PLAN ADOPTION



### Local Plan Requirement F1 – 44 CFR Part 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.*

DMA compliance and its benefits can only be achieved after the Plan is adopted. For multi-jurisdictional plans, each jurisdiction requesting approval must document that it has been formally adopted. This plan will be submitted for a pre-adoption review to Cal OES and FEMA Region 9 prior to adoption. Once pre-adoption approval has been provided, all Planning Partners will formally adopt the plan. Copies of the FEMA approval and Planning Partner resolutions adopting this plan can be found in Appendix F of this volume.

## 19.2 PLAN MAINTENANCE

This section describes a formal plan maintenance process to ensure that the hazard mitigation plan remains an active and relevant document. Sierra County OES will take the lead on monitoring, evaluating, and updating the MJHMP over the 5-year performance period. Table 19-1 summarizes this plan maintenance strategy. The sections below further describe each element.

Table 19-1. Plan Maintenance Matrix

Approach	Timeline	Lead Responsibility
<b>Plan Monitoring</b>		
Track the implementation of plan actions	Continuous	All Planning Partners will report annually or in alignment with potential grant opportunities to Sierra County OES on action implementation. Points of contact are listed in Volume 2.
<b>Plan Evaluation</b>		
Review the status of previous actions; assess changes in risk; evaluate success of integration	Upon initiation of hazard mitigation plan update, comprehensive General Plan update, or major disaster	All Planning Partners
<b>Grant Notification</b>		
The County will notify Planning Partners of grant funding opportunities to fund actions identified in this plan	Continuous, as grants become available	Sierra County OES



Approach	Timeline	Lead Responsibility
<b>Plan Update</b>		
Initiate the process to comprehensively update the plan at least every 5 years.	At the end of year 3, coordinate with the Planning Partners, and work to identify grant funding opportunity for update. Obtain grant funding by the end of year 4.	Sierra County OES will lead the plan update. All Planning Partners will support the effort.
<b>Integration into Other Planning Mechanisms</b>		
Create a linkage between the hazard mitigation plan and individual jurisdictions' general plans the Community Wildfire Protection Plan or similar plans identified in the core capability assessments	Continuous	All Planning Partners
<b>Continuing Public Involvement</b>		
Maintain and update the County's website with relevant hazard mitigation information and public participation opportunities.	Continuous	Sierra County OES will lead continuing public participation. All Planning Partners will support the effort.

### 19.2.1 Integrating the Plan

**Local Plan Requirement D3 – 44 CFR Part 201.6(c)(4)(ii)**

*The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*

The Planning Partners will integrate this MJHMP into relevant decision-making processes, plans, or mechanisms, where feasible. This includes integrating the requirements of the HMP into other planning documents, processes, or mechanisms, such as strategic planning initiatives, general plans, local capital improvement plans, stormwater plans, emergency plans, and other future plans. Opportunities to integrate the requirements of this plan into other planning mechanisms shall continue to be identified through future planning efforts. The Planning Partnership outlined the following mechanisms underway and under consideration:

- Ensuring that the goals and mitigation actions of new and updated local planning documents are consistent, or do not conflict with, the goals and actions of the HMP, and will not contribute to increased hazard vulnerability in the planning area.
- Integration of the HMP will be considered on a case-by-case basis and identified at the onset of plan development.
- Integration of the HMP into the capital improvement program scoring criteria (e.g., does the project advance mitigation) will be implemented if deemed feasible.

### 19.2.2 Implementing the Hazard Mitigation Plan Through Existing Programs

To successfully reduce future losses, implementing the actions within this plan is highly recommended. The Planning Partners involved a wide range of staff in the plan development process and many departments, divisions, or other partners participating in the Plan are responsible for implementing



specific mitigation actions identified by each jurisdiction. Every proposed action listed in the mitigation action plan is assigned to a specific “lead” department or partner in order to assign responsibility and accountability and increase the likelihood of implementation.

In addition to the assignment of a local lead department or partner, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. The Planning Partners will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, specific potential funding sources have been identified for proposed actions listed in the mitigation action plan.

The Planning Partnership will meet once annually during the 5-year performance period of this Plan. This frequency of meeting will also assist in implementation, as meetings will be coordinated with the strategic planning process. A key agenda item will be to determine which actions are being implemented by members of the Planning Partnership

### 19.2.3 Ongoing Public Involvement



#### Local Plan Requirement D1 – 44 CFR Part 201.6(c)(4)(iii)

*The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.*

Public participation is an integral component to the mitigation planning process and will continue to be essential as this plan evolves over time. Public involvement procedures were reviewed as part of the 2025 MJHMP development process. Significant changes or amendments to the plan shall require an opportunity for public comment prior to any adoption procedures by the Planning Partners. The County also maintains a hazard mitigation planning website that can be used to provide updates and post the most current version of the plan:

<https://www.sierracounty.ca.gov/818/Hazard-Assessment-Plans>

By keeping the plan available on the County website with an invitation and instructions on providing feedback, public awareness will be maintained on a continuous basis. Public comment opportunities will be provided during any process to revise or update the plan, prior to jurisdictional approval and/or adoption. Other efforts to involve the public in the maintenance, monitoring, evaluation, and revision process will be made as necessary. These efforts may include the following:

- Posting minutes from Planning Partnership meetings to the County hazard mitigation website.
- Utilizing available Planning Partner communication channels to update the public on any maintenance and/or periodic review activities taking place.
- Keeping a current version on the HMP at Planning Partner facilities and on the County web page.

Additionally, continued public involvement will be accomplished through implementation of mitigation actions.



## 19.2.4 Monitoring the Plan



### Local Plan Requirement D2 – 44 CFR Part 201.6(c)(4)(i)

*The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a 5-year-cycle.*

Periodic revisions and updates of the Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal and state regulations. Periodic monitoring and evaluation of the plan will also ensure that specific mitigation actions are being reviewed and carried out according to the mitigation action plan. Monitoring refers to tracking the implementation of the plan over time. Evaluating refers to assessing the overall effectiveness of the plan intent and goals.

The Planning Partnership shall meet once annually to monitor and evaluate the progress attained and to revise, where needed, the activities set forth in the plan. The Sierra County OES Coordinator will be responsible for reconvening the Planning Partnership for these reviews. Plan maintenance meeting agenda templates are included in Appendix E.

The annual meetings provide the Planning Partnership with an opportunity to perform the following:

- Review plan goals.
- Document hazard occurrences that occurred during the prior year and their impacts on the planning area.
- Document mitigation action implementation or status.
- Evaluate the mitigation actions that have been successful.
- Discuss why mitigation actions were not completed.
- Revise the action plan if new timelines need to be established for projects (e.g., changing a long-term project to a short-term project due to funding availability).
- Consider recommendations for new mitigation projects.
- Review new funding options, including grant opportunities, and determine if contract grant-writing support is needed to pursue the opportunities.
- Document potential losses avoided due to the implementation of specific mitigation measures or other planning programs, if feasible.
- Identify any new or additional vulnerabilities that may be faced by the County and may need to be addressed in a future update of this plan.
- Update the hazard mapping and impact tool to reflect new or revised hazard data.

Any findings or recommendations made during the annual review shall be documented in the form of a memo that can be shared with the governing bodies of the participating jurisdictions and interested stakeholders, including the public, through the County's website. Further, mitigation action progress can be monitored (i.e., tracked) in an Excel version of the mitigation action plan. The Planning Partnership will also meet following any disaster event warranting a reexamination of the mitigation actions being



implemented or proposed for future implementation. This will ensure that the plan is continuously updated to reflect changing conditions and needs within the County.

## 19.2.5 Updating the Plan

### Updating



#### Local Plan Requirement D2 – 44 CFR Part 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 5-year cycle.*

The Sierra County HMP will be thoroughly reviewed by the Planning Partnership every 5 years in alignment with federal regulations to ensure its consistency with these requirements. This update is also used to determine whether there have been any significant changes in the planning area that may, in turn, necessitate changes in the types of mitigation actions proposed, goals, or priorities. New development in identified hazard areas, an increased exposure to hazards, an 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 plan. The Sierra County OES Coordinator will be responsible for reconvening the Planning Partnership and conducting the 5-year review. In general, the plan update development process begins approximately 2 years prior to plan expiration. First, resources to develop the plan must be obtained, such as obtaining a planning grant. This will be followed by the plan update process, led by the Core Planning Team and Steering Committee. Upon completion of the review and update/amendment process, the Sierra County Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer at Cal OES for a compliance review in accordance with 44 CFR 201. The plan will then be reviewed by FEMA Region 9. Once an “approved pending adoption” status has been issued by FEMA Region 9, the Planning Partnership can then review, approve, and adopt the plan. The Planning Partnership review consists of final approval by the Sierra County Board of Supervisors during a public meeting.

### Disaster Declaration

Following a federal disaster declaration, the Sierra County Hazard Mitigation Plan may be revised as necessary to reflect lessons learned, or to address specific issues and circumstances arising from the event. It will be the responsibility of the Sierra County OES Coordinator to reconvene the Planning Partnership and ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

### Plan Amendment Process

Unique circumstances, such as availability of critical data or an omission, may necessitate a plan amendment. Upon the initiation of the amendment process, Sierra County will forward information on the proposed change(s) to all interested parties including, but not limited to, all directly affected departments, community partners, and customers. Information will also be forwarded to Cal OES and FEMA. This information will be disseminated in order to seek input on the proposed amendment(s) for no less than a 45-day review and comment period (unless circumstances necessitate a shorter review). At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will



be forwarded to the Planning Partnership for final consideration. The Planning Partnership will review the proposed amendment along with the comments received from other parties, and if acceptable, the Planning Partnership will submit a recommendation for the approval and adoption of changes to the plan. In determining whether to recommend approval or denial of a plan amendment request, the following factors may be considered by the Planning Partnership:

- There are major errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan.
- New or previously unknown issues or needs have been identified which are not adequately addressed in the Plan.
- There has been a change in information, data, or assumptions from those on which the Plan is based.

If the Planning Partnership opts to move forward with the amendment, the revised plan must be reviewed and approved by Cal OES and FEMA. The Planning Partners will also need to approve the revised plan. Prior to adoption, the County shall post the updated plan to the County website for public comment. Each participating jurisdiction will review the recommendation from the Planning Partnership (including the factors listed above) and comments received from the public. Following that review, the governing bodies will take one of the following actions:

- Adopt the proposed amendments as presented.
- Adopt the proposed amendments with modifications.
- Refer the amendments request back to the Planning Partnership for further revision.
- Defer the amendment request back to the Planning Partnership for further consideration and/or additional hearings.



*Downie River and North Yuba River Confluence in Downieville (Photo Credit: Brian Walker)*



# APPENDIX A. PUBLIC OUTREACH



## APPENDIX B. HAZARD SELECTION

Refer to the table below for a complete comparison of hazards included in the 2023 California State Hazard Mitigation Plan, the 2012 Sierra County Hazard Mitigation Plan, and this update.

Table B. Hazard Comparison—State and Sierra County

2023 California State Hazard Mitigation Plan	2012 Sierra County Operational Area Local Hazard Mitigation Plan	2025 Sierra County Multi-Jurisdictional Hazard Mitigation Plan	Comment
Air Pollution	Not included	Wildfire	Air pollution from wildfire smoke is a concern for the County and is discussed in the Wildfire chapter
Civil Disorder	Not included	Not included	Addressed in other plans
Cyber Threats	Not included	Cybersecurity	This local hazard aligns with the State
Dam Failure	Dam Failure	Dam Failure	This local hazard aligns with the State
Drought	Drought	Drought	This local hazard aligns with the State
Earthquake	Earthquakes	Earthquake	This local hazard aligns with the State
Electromagnetic Pulse Attack	Not included	Not included	Not a concern for the County
Energy Shortage	Not included	Not included	Addressed in other plans
Epidemic/Pandemic/Vector-Borne Disease	Not included	Not included	Addressed in other plans
Extreme Cold or Freeze	Severe Weather – Winter Storms	Winter Storms	Discussed in the Winter Storms chapter
Extreme Heat	Not included	Extreme Heat	This local hazard aligns with the State
Geomagnetic Storm	Not included	Not included	Not a concern for the County
Hazardous Materials Release	Not included	Not included	Addressed in other plans
Invasive and Nuisance Species	Not included	Not included	Addressed in other plans
Landslide, Debris Flow, and other Mass Movements	Not included	Landslide/Mass Movement	This local hazard aligns with the State
Levee Failure	Not included	Not included	No levees in the County
Natural Gas Pipeline Hazards	Not included	Not included	No pipelines in the County
Oil Spills	Not included	Not included	Not a concern for the County
Other Potential Long-Term Electrical Outrages	Not included	Not included	Addressed in other plans
Public Safety Power Shutoff	Not included	Wildfire	Discussed in Wildfire chapter
Radiological Accidents	Not included	Not included	Not a concern for the County



2023 California State Hazard Mitigation Plan	2012 Sierra County Operational Area Local Hazard Mitigation Plan	2025 Sierra County Multi-Jurisdictional Hazard Mitigation Plan	Comment
Riverine, Stream, and Alluvial Flood	Flood	Flood	This local hazard aligns with the State
Sea-Level Rise, Coastal Flooding and Erosion	Not included	Not included	Inland area; not a concern for the County
Severe Wind, Weather, and Storms	Severe Weather – Winter Storms	Winter Storms	This local hazard aligns with subsections in the HMP
Snow Avalanche	Avalanche	Avalanche	This local hazard aligns with the State
Subsidence	Not included	Landslide/Mass Movement	Discussed in the Landslide/Mass Movement chapter
Terrorism	Not included	Not included	Addressed in other plans
Transportation accidents Resulting in Explosions or Toxic Releases	Not included	Not included	Not a concern for the County
Tree Mortality	Not included	Wildfire	Discussed in the Wildfire chapter
Tsunami and Seiche	Not included	Not included	Inland area; no large bodies of water that could impact people or development
Urban Structural Fire	Not included	Not included	Not a concern for the County
Volcano	Volcano	Volcanic Activity	This local hazard aligns with the State
Well Stimulation and Hydraulic Fracturing	Not included	Not included	Does not occur in the County
Wildfire	Wildland Fires	Wildfire	This local hazard aligns with the State
Not included	Not included	Mass Gatherings	This is a concern for the County due to the large population increase for special events
Not included	Not included	Transportation Hazards	This is a concern for the County due to blocked access on critical roadways
Not included	Not included	Wildlife & Human Interactions	This is a concern for the County due to wolf, bear, cougar, and other wildlife interactions



## APPENDIX C. MEETING DOCUMENTATION



# APPENDIX D. FEDERAL AND STATE AGENCIES, PROGRAMS, AND REGULATIONS



## APPENDIX E. PLAN MAINTENANCE AGENDAS



# APPENDIX F. FEMA APPROVAL AND PLANNING PARTNER ADOPTION