Mono County and the Town of Mammoth Lakes

HAZARD MITIGATION PLAN

Public Review Draft

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1. INTRODUCTION

This document contains the Multi-Jurisdictional Hazard Mitigation Plan (MJHMP or Plan) and the Community Wildfire Protection Plan (CWPP) for Mono County (County) and the Town of Mammoth Lakes (Town), California. The MJHMP is an update from the 2006 adopted MJHMP. The MJHMP establishes strategies to reduce multiple hazard impacts affecting the county and the town. The CWPP, presented in Chapter 7, provides a comprehensive analysis specific to wildfire-related hazards and risks in the Wildland-Urban Interface (WUI) areas of the county.

This chapter provides an overview of each plan's purpose and authority, and describes how the MJHMP and CWPP were adopted and how they are to be used, as well as hazard mitigation plan goals, the planning process, a description of how the public was involved, and the plans, studies, and other resources used for analysis.

Figure 1.1: Disaster Response Cycle

1.1 Plan Purpose

Different types of hazards cause different impacts, occur in different locations, and happen with varying degrees of severity. However, all have the potential to severely harm human health and safety, private and public property, ecosystems, and services. Like many other communities, Mono County and Mammoth Lakes could face substantial damage, injury or loss of life, interruptions to critical services, and other major challenges due to natural hazard impacts.

There are four phases of emergency management, as illustrated in **Figure 1.1**.

1. **Response**: Taking action to save lives, limit injury, and prevent further damage of infrastructure in a disaster.

2. **Recovery**: Returning actions to normal conditions directly following a disaster.

3. **Mitigation**: Establishing strategies to prevent future disasters and/or to minimize their impacts.

4. **Preparedness**: Preparing to save lives and critical infrastructure and to help response and rescue operations in and directly following a disaster.

This Plan focuses on the mitigation component of the cycle shown in **Figure 1.1**. Hazard mitigation plays an important role in reducing the impacts of disasters by identifying effective and feasible actions to reduce the risks posed by potential hazards. This Plan develops mitigation actions to strengthen community resilience, which helps ensure coordinated and consistent hazard mitigation activities across Mono County and Mammoth Lakes. The benefit of this process (and the Plan) is the development of a more unified strategy and increased coordination with federal, state, and local land-owning agencies. The County and the Town have developed this Plan to be consistent with current standards and regulations, ensuring that the understanding of hazards facing its communities reflects best available science and current conditions. This Plan is also consistent with Federal Emergency Management Agency (FEMA) requirements, and the mitigation measures included in the Plan are grounded in best practices and available resources.

1.2 Authority

1.2.1 Federal

The federal Robert T. Stafford Disaster Relief and Emergency Act (the Stafford Act), as amended by the Disaster Mitigation Act of 2000 (DMA 2000) and supported by various pieces of regulation, directs hazard mitigation planning activities such as this Plan. The Stafford Act requires state, local, and tribal governments that wish to be eligible for federal hazard mitigation grant funds to submit a hazard mitigation plan that outlines the processes for identifying the natural and man-made hazards, risks, and vulnerabilities of the jurisdiction (United States Code [USC] Title 42, Section 5156[a]). FEMA has promulgated Code of Federal Regulations (CFR) Title 44, Part 201 to carry out the hazard mitigation planning requirements in the Stafford Act. These regulations direct the planning process, plan content, and FEMA approval for hazard mitigation plans.

This MJHMP complies with the Stafford Act and DMA 2000, along with the appropriate sections of Title 44 of the CFR, including Parts 201, 206, and 322.

1.2.2 State

The state of California passed Assembly Bill (AB) 2140 in 2006, enacting California Government Code Sections 8685.9 and 65302.6. These sections concern federal requirements mandating that jurisdictions have a valid hazard mitigation plan to be eligible for certain grants. Specifically, Section 8685.9 limits the state of California to paying no more than 75 percent of disaster relief funds not covered by FEMA to a local community, unless the affected community (1) has a valid hazard mitigation plan that is consistent with DMA 2000 and (2) has adopted the hazard mitigation plan as part of its general plan. If this is the case, the state may pay for more than 75 percent of the disaster relief funds not covered by

FEMA. Section 65302.6 authorizes local communities to adopt hazard mitigation plans as part of their safety element or a comparable section of their general plan.

This MJHMP includes information required by relevant sections of the California Government Code.

1.3 Plan Adoption

Both the County and the Town will adopt this updated MJHMP following Plan approval by FEMA. The County will adopt the MJHMP through a resolution of the Board of Supervisors, while the Town will adopt the MJHMP through a resolution of the Town Council. This Plan will go into effect for each individual community upon adoption by the respective organization. **Appendix A** contains the adoption resolutions for this Plan.

1.4 Plan Use and Organization

The MJHMP objectives include the following:

- Establish and foster a basis for coordination and collaboration among County and Town agencies, other public organizations, private organizations and companies, and other key stakeholders.
- Work in conjunction with other planning efforts, including the County's and the Town's General Plans.
- Increase community awareness and empowerment.
- Meet the requirements of federal assistance grant programs, including FEMA's Hazard Mitigation Grant Program and Pre-Disaster Mitigation funding.
- Reduce the risk of loss and damage from hazard events, especially repetitive loss and damage.
- Coordinate hazard mitigation planning activities between Mono County and the Town of Mammoth Lakes and in concert with resource management, land use planning, and emergency operation activities.

The MJHMP is made up of the following chapters:

- **Chapter 1 – Introduction**: Describes the background and purpose of this Plan, its goals and priorities, and the planning process used to develop it.
- **Chapter 2 – Community Profile**: Provides the history, physical setting, land use, and demographics of Mono County and Mammoth Lakes.

- **Chapter 3 – Hazards Assessment**: Identifies, describes, and prioritizes the hazards that threaten Mono County and Mammoth Lakes. This chapter discusses past events, risks of future events, and the effects of climate change for each type of hazard.
- **Chapter 4 – Risk Assessment**: Describes the risks posed by each hazard type to county and town residents, particularly those who are more likely to be socially vulnerable, and to critical facilities.
- **Chapter 5 – Mitigation Actions**: Lists mitigation measures to reduce the risks from hazards facing Mono County and Mammoth Lakes. This chapter also provides an overview of the County's and the Town's existing capabilities to reduce vulnerability to hazard events.
- **Chapter 6 – Plan Maintenance and Capabilities**: Describes the process for implementing, monitoring, and evaluating the MJHMP, and opportunities for continued public involvement.
- **Chapter 7** – Contains the Community Wildfire Protection Plan, including how the plan meets the requirements of the Healthy Forest Restoration Act; analysis of wildfire-related hazards and risks in the WUI; identifying ongoing and planned fuel management projects; and mitigation measures designed to prevent and/or reduce the damage associated with wildfire to WUI assets, also known as values.

The MJHMP allows the County and the Town to "show their work" and illustrate compliance with FEMA guidelines. The Plan is supplemented by a Hazard Mitigation Implementation Handbook, which provides clear direction to the agency staff and elected leaders who are responsible for implementing this Plan.

1.5 Mitigation Goals

The County and the Town created goals as part of the Plan development process. There are 15 general goals for this Plan:

- GOAL 1. Avoid exposure of people and improvements to unreasonable risks of damage or injury from earthquakes and other geologic hazards.
- GOAL 2. Avoid exposure of people and improvements to unreasonable risks of damage or injury from flood hazards.
- GOAL 3. Avoid exposure of people and improvements to unreasonable risks of damage or injury from fire hazards.
- GOAL 4. Avoid exposure of people and improvements to unreasonable risks of damage or injury from avalanche hazards.

- GOAL 5. Avoid exposure of people and improvements to unreasonable risks of damage or injury from dam failure hazards.
- GOAL 6. Avoid exposure of people and improvements to unreasonable risks of damage or injury from disease and pest hazards.
- GOAL 7. Avoid exposure of people and improvements to unreasonable risks of damage or injury from drought hazards.
- GOAL 8. Avoid exposure of people and improvements to unreasonable risks of damage or injury from volcano hazards.
- GOAL 9. Avoid exposure of people and improvements to unreasonable risks of damage or injury from hazardous materials.
- GOAL 10. Avoid exposure of people and improvements to unreasonable risks of damage or injury from severe weather and snow hazards.
- GOAL 11. Avoid exposure of people and improvements to unreasonable risks of damage or injury from wind hazards.
- GOAL 12. Reduce the risks from natural hazards by planning for safe development, increasing public awareness of the natural hazards in Mono County, and providing an integrated multiagency approach to emergency response.
- GOAL 13. Prepare for changing climate conditions in Mono County.
- GOAL 14. Keep Mono County and the Town of Mammoth Lakes a safe place to live, work, and play.
- GOAL 15. Maintain adequate emergency response capabilities.

1.6 Hazard Mitigation Planning Process

This Plan is the result of a process involving County departments, Town departments, stakeholder agencies, residents, businesses, and the general public. FEMA guidance suggests that the planning process meet the following objectives:

- Determine the planning area or areas, and the resources they contain.
- Establish the planning team.
- Create an outreach time.
- Review the communities' capabilities.

- Prepare a risk assessment.
- Develop a mitigation strategy.
- Keep the plan current.
- Review and adopt the plan.
- Create a safe and resilient community.

In keeping with FEMA recommendations, the County and the Town created a Multi-Jurisdictional Hazard Mitigation Planning Team (the Planning Team) composed of representatives from both jurisdictions and other key stakeholders, although not all representatives were able to attend every meeting. The Planning Team also invited various additional stakeholders, through email and follow-up phone calls to join these meetings or participate in stakeholder interviews. Participants included representatives from the following agencies, departments, and local organizations:

Mono County

- Wendy Sugimura, Interim Director – Mono County Community Development Department
- Michael Draper, Planning Analyst – Mono County Community Development Department
- Tony Dublino, Assistant County Administrative Officer – Mono County
- Ingrid Braun, Sheriff-Coroner – Mono County Sheriff Office
- Bob Rooks, Chief – Mono County Emergency Medical Services
- Louis Molina, Environmental Health Director – Mono County Health Department
- Gerry Le Francois, Principal Planner – Mono County Community Development Department
- Fred Stump, Mono County Supervisor

Town of Mammoth Lakes

- Al Davis, Chief of Police – Mammoth Lakes Police Department
- Grady Dutton, Public Works Director – Town of Mammoth Lakes
- Haislip Hayes, Engineering Manager – Town of Mammoth Lakes
- Pam Kobylarz, Assistant to the Town Manager – Town of Mammoth Lakes

Other Organizations

- Thom Heller, Fire Marshal – Mammoth Lakes Fire Protection District

- Frank Frievalt, Fire Chief – Mammoth Lakes Fire Protection District
- Mike Curti, Fire Chief – Antelope Valley Fire District
- Taro Pusina, Interagency Fire Management Officer – Inyo National Forest Supervisor's Office
- Matt Edmiston – Cal Fire
- Sagar Fowler – Cal Fire, San Bernardino Unit, Battalion 4
- Temple Fletcher, Director – REMSA Care Flight
- Shannon Anderson, Chief of Fire and Emergency Services – Marine Corps Mountain Warfare Fire Department
- Rodney Allen, S-7 Mission Assurance Director – Marine Corps Mountain Warfare Fire Department
- Brett D. Hawn, Chief of Police – Marine Corps Police Department, Marine Corps Mountain Warfare Training Center
- Doug Toskin, S-7 Emergency Manager – Marine Corps Mountain Warfare Fire Department
- Karen Farrel-Ingram – Wheeler Crest Fire Safe Council
- Bruce Woodworth – Antelope Valley CERT
- Chris Weibert, HR/Risk Analyst – Mammoth Community Water District
- Austin West, Transportation Planner – Caltrans District 9
- Greg Miller, Maintenance Manager – Caltrans District 9
- Lieutenant William “Bill” Boyes – Bridgeport CHP
- Karla Benedicto – Cal OES
- Andy Selters, President – Pine Glade Association, Inc.
- Steven Butler, Construction Manager – Los Angeles Department of Water and Power
- Ben Butler, Operations – Los Angeles Department of Water and Power
- Greg Loveland, Electrical/Waterworks Engineer – Los Angeles Department of Water and Power
- Bob Stiens, Public Affairs Liaison – Southern California Edison

The Planning Team held four meetings during the plan development process. At these meetings, team members talked about the MJHMP objectives, identified hazards that threaten Mono County and Mammoth Lakes, and prepared and reviewed the mitigation measures to improve community resiliency to hazards. The following meetings were held:

- **Kickoff meeting** – June 15, 2017. Planning Team members discussed the goals and objectives of the project, outlined the Plan development process and requirements, determined the public outreach approach, and identified relevant hazards.
- **Meeting #2** – September 29, 2017. The Planning Team discussed an overview of the project and sought input on the goals, past and current efforts, current limitations, and information sources for the content of the MJHMP.
- **Meeting #3** – December 13, 2017. Planning Team members discussed the draft hazard profiles and the results of the hazard risk assessment and vulnerabilities, including impacts to critical facilities and social vulnerability.
- **Meeting #4** – January 25, 2018. Planning Team members discussed and revised the draft hazard mitigation measures.

At these meetings, the Planning Team and stakeholders were given presentations on the purpose, process, risk and vulnerability analysis results, and draft measures. The Planning Team and stakeholders reviewed the accuracy of community capacity and characteristics data, which were corrected as necessary; raised specific issues of concern, which were addressed in various sections of the MJHMP; and identified a list of twenty priorities for the next 5 years as well as many additional lower priority measures. **Appendix B** shows copies of meeting materials and notes with details on comments from these meetings.

Regional Planning Advisory Committee (RPAC) Meetings

As part of the planning process, advisory meetings were conducted with the Mono County RPACs, listed below, for input and feedback throughout Plan development. Members of the plan development team presented to six of the RPACs over the course of the planning process, shown in bold. Mono County RPACs are:

- **Antelope Valley**
- Benton/Hammil
- **Bridgeport Valley**
- Chalfant

- **June Lake Citizens Advisory Committee**
- **Long Valley**
- **Mono Basin**
- **Paradise**
- Wheeler Crest

RPAC meetings occur on a regular monthly schedule, are open to the public, and post both agendas and meeting notes on their respective websites. These meetings were conducted alongside the four Planning Team meetings listed above.

RPAC members and any members of the public at these meetings were given short presentations on the process, and risk and vulnerability assessment results and comments were incorporated into the MJHMP.

Public Survey

The County and the Town prepared a public outreach and engagement process to give community members the opportunity to learn about the Plan and contribute to its development. This process included a web page hosted on the County website and survey, distributed through listservs as a PDF and available online through SurveyMonkey, for community members to offer input about hazard-related outcomes and actions to improve preparations for hazard events. Approximately 130 people responded to the survey. The key outcomes of the survey are discussed below, and a more detailed summary of the survey and its findings are included in **Appendix B**.

- Approximately 40 percent of respondents had been affected by a disaster in their current residence. Severe weather, fire, drought, and flooding were the most common disaster events.
- Earthquakes, severe weather, and flooding were the hazards of greatest concern to survey respondents.
- Nearly all respondents felt the County and Town should provide emergency notifications. A smaller number felt the jurisdictions should provide multiple other services such as training and education on how to reduce future damage and community outreach regarding emergency preparedness.
- Most respondents felt their homeowner's insurance was adequate for potential hazards.

Public Review Draft

[Note: to be completed upon completion of public review]

Planning Commission

[Note: to be completed upon completion of public review]

FEMA Review

[Note: to be completed upon completion of FEMA Review]

Integration into other Plans and Regulatory Documents

Upon complete of the draft of the updated MJHMP and CWPP, and as part of the same project and process, the Planning Team assessed and reviewed the County's Safety Element as well as the Town's Public Health and Safety Element for consistency and to integrate any new measures specific to those documents. Red-line changes were made to these documents and adopted by the County Board of Supervisors and Town Council. Other regulatory changes to the County and Town Municipal Code and other operational plans will be made as studies are completed and updates to those documents are triggered by other updates and requirements.

1.6.1. Plans, Studies, and Technical Reports Used to Develop the Plan

The Planning Team relied on numerous plans, studies, technical reports, databases, and other resources to develop hazard discussions and mapping. **Table 1.1** shows the key resources used for different sections of the Plan. The **Sources** section at the end of the main body of the Plan contains a more extensive list.

Table 1.1: Key Resources Used to Develop the MJHMP

Section	Key Resources
Multiple hazards	Cal-Adapt California Climate Adaptation Planning Guide California Multi-Hazard Mitigation Plan
Dam failure	California Department of Water Resources dam database US Army Corps of Engineers National Inventory of Dams
Disease/pest management	Owens Valley Mosquito Abatement Program
Drought	US Drought Monitor Tri-Valley Groundwater Management District
Flood	Federal Emergency Management Agency flood maps
Geologic hazards	US Geological Survey volcano database
Hazardous materials	California Department of Toxic Substances Control EnviroStor database State Water Resources Control Board cleanup sites database State Water Resources Control Board underground storage tanks database
Seismic hazards	California Geological Survey Fault Activity Map of California US Geological Survey ShakeMaps
Severe weather	California Environmental Protection Agency and California Department of Public Health extreme heat preparation materials California Contingency Plan for Extreme Cold/Freeze National Oceanic and Atmospheric Administration severe weather database files National Weather Service watch/warning/advisory records Western Regional Climate Center
Wildfire	California Department of Forestry and Fire Protection FRAP Mapping and Fire Hazard Severity Zones 2009 FlamMap Assessment

2. COMMUNITY PROFILE

The Community Profile chapter provides an overview of Mono County and Mammoth Lakes, including the physical setting, history, land use, and demographics. This information describes the conditions in the planning area and helps inform the hazard mitigation actions presented in **Chapter 7.**

2.1 Physical Setting

Mono County is located on the eastern slope of the Sierra Nevada, south of Lake Tahoe. Mono County is part of the Basin and Range province of North America, characterized by an alternating parallel series of mountain ranges and flat arid valleys. The county is a long, narrow strip of land—108 miles at its greatest length and 38 miles in average width—bounded to the west by the Sierra crest and to the east by the Nevada state line. In total, the county comprises 3,132 square miles of land area. Several mountain ranges, most notably the Sierra Nevada, as well as Mono Lake, the largest and oldest natural lake entirely within California, are located in the county. The ranges generally run north–south along the western side of the county and drop sharply off into the Long Valley Caldera and arid flatter stretches known as the Great Basin. Although dominated by a largely arid landscape, Mono County has numerous water sources, including hundreds of streams that drain into Mono Lake, the Walker River, or the Owens River. **Figure 2.1** identifies the location of Mono County and prominent geographic features.

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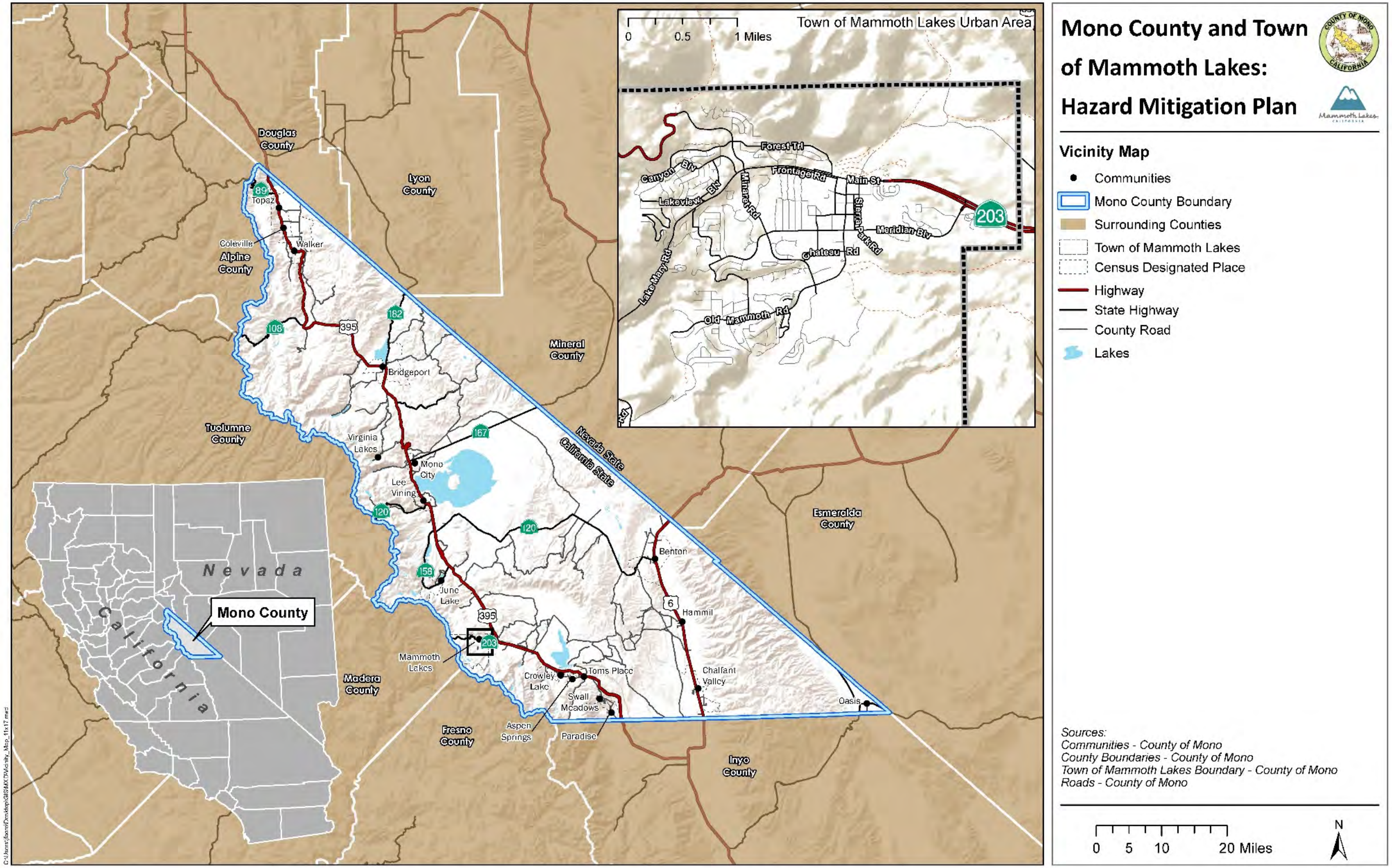
Figure 2.1: Mono County Vicinity Map



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2.1.1 Mono County

The geography and climate of the county make life in the County challenging and isolated. Mono County is rural and sparsely settled. According to the 2010 Census, the population of Mono County was 14,202 people. Despite its isolation, the county also attracts over 1.5 million visitors annually to places such as Mammoth Lakes and Mammoth Mountain and June Lake resorts, generating an estimated $451 million. Access remains limited to one main transportation route, US 395, which runs through the county along the foot of the Sierra for approximately 120 miles. US 6 also serves as main access to the Tri-Valley region of the county, which includes the communities of Chalfant Valley and Benton. Most of the resident population, as well as visitor housing and services, are located in small communities of 300 or less along this main roadway corridor.

By car, Los Angeles is six to seven hours south on US 395; Reno is three hours north on US 395; and the San Francisco Bay Area is six to seven hours west on various routes connecting to US 395. Two additional highways, open seasonally, run through the county connecting to Yosemite National Park and Nevada. The county also has three small public airports.

Approximately 94 percent of the land in the county is publicly owned; much of it is managed by the U.S. Forest Service and the Bureau of Land Management. Publicly owned land includes two national forests, the Inyo National Forest and the Humboldt-Toiyabe National Forest, as well as three wilderness areas, the Hoover Wilderness, Ansel Adams Wilderness, and John Muir Wilderness. The Los Angeles Department of Water and Power also owns large parcels of land in the southern portion of the county. Mono County is adjacent to other mountainous counties with low and dispersed populations including Alpine, Tuolumne, Mariposa, Madera, Fresno, and Inyo Counties in California and Douglas, Lyon, Mineral, and Esmeralda Counties in Nevada.

Mammoth Lakes

Over half of the county's population lives in the Town of Mammoth Lakes, the only incorporated community in the county. The other half lives in a number of small communities scattered throughout the county. Mammoth Lakes is on the southwest side of the county, accessed by State Route (SR) 203 from US 395. The municipal boundary of the town is roughly 25 square miles, with approximately 4 square miles in the urban growth area that makes up the developed area. It lies along the edge of the Long Valley Caldera, which is geologically active and contains numerous hot springs. SR 203 continues west to provide access to Mammoth Mountain Ski Area and the Devils Postpile National Monument. Lake Mary Road, Old Mammoth Road, Minaret Road, and Meridian Road are primary corridors that loop around the town. The Mammoth Yosemite Airport is located approximately 8 miles southeast of Mammoth Lakes along US 395. The airport is owned and operated by the Town. Mammoth Lakes is bordered by the Ansel Adams and John Muir Wilderness Areas. The eastern entrance of Yosemite National Park, visited by nearly 4 million people each year, is located 32 miles north of town. The town's resident population is roughly 8,000, based on 2016 Census American Community Survey population estimates; however, the number of people in the town can more than double during peak days of tourist seasons in the winter skiing months and summer recreation months, and reach nearly 40,000 during a holiday weekend.

2.2 History

2.2.1 Mono County

The region of Mono County was settled as early as 12,000 years ago, according to archaeological evidence. Early residents are believed to have initially been mobile hunter-gatherers. Starting around 4,000 to 8,000 years ago, the people of this region settled into more permanent sites. As with modern-day county residents, most native peoples lived in the Great Basin from north of Mono Lake to Owens Lake in Inyo County. The native residents included four tribes: the Owens Valley Paiute (also called the Eastern Mono), the Western Shoshone (also called the Panamint or Koso), the Southern Paiute, and the Kawaiisu (also called the Nuwa). The native peoples of the Inyo County region first came into contact with Europeans in the early 1800s, when fur trappers began to operate in the area.

Mono County was formed in 1861 from parts of Calaveras, Fresno, and Mariposa Counties. Mining was an extensive activity in early Mono County. Bodie—now a protected ghost town—became a boom town in 1876 after the discovery of gold, which attracted thousands of new residents to the town as well as to Mammoth Lakes, Bridgeport, Lee Vining, and other communities that remain populated today. Ranching followed mining as an important draw for residents and outlasted mining as a major economic driver into the early 1900s. The early 1900s also saw the exploitation of other natural resources in Mono County, when the City of Los Angeles controversially purchased large tracts of land in Mono County and neighboring Inyo County in order to divert water from Mono Lake and the Owens River into the Los Angeles Aqueduct, which was completed in 1913.

US 395, which is still the major route into and out of the county along with the limited access provided by US 6, was completed in the early 1930s. Tourism became an increasingly strong economic force in the following decades. Today, the county's economy is driven heavily by tourism, government, and land management activities. Natural resource obtainment (including renewables) and ranching continue to play important supporting roles.

Mammoth Lakes

Mammoth Lakes was initially founded by those interested in mining projects, like most other communities in the county. However, Mammoth's life as a mining town was short-lived and relatively unprofitable, and by the end of the first quarter of the twentieth century, tourism became the region's number one industry. The town has grown steadily due to its popularity as a center for outdoor recreation, and as a stop-off on the way to Yosemite National Park.

2.3 Community Profile

Demographic information and community members' daily activities, travel habits, and level of knowledge about the area can help inform mitigation planners about potential vulnerabilities as well as about which public education-related mitigation actions will be most effective.

Demographic conditions in Mono County and Mammoth Lakes are provided below. Most data is provided for 2015; in cases where such recent data is not available, the year is included for reference. Information is drawn primarily from the 2011–2015 American Community Survey 5-Year Estimates and California Department of Finance 2010–2017 population estimates. It should be noted that modern-day Mono County and Mammoth Lakes remain tourism destinations with much of the economy and infrastructure shaped around this industry. Consequently, many residences and services are only used part of the year, and visitors may alter the population and jobs counts drastically over the course of the year; part-time residents are typically not captured in census or other common demographic survey data.

Table 2.1 identifies the basic demographic makeup of Mono County and the Town of Mammoth Lakes including age, household characteristics, income, race, and educational attainment, all of which can influence vulnerability in disaster events.

Table 2.1: Basic Demographics (2015)

Category	Mono County	Mammoth Lakes
Total population	14,146	8,104
Median age	38.5 years	32.6 years
Elderly population (65+ years)	1,881 (13.3%)	557 (6.9%)
Foreign-born population	2,364 (16.6%)	672 (8.3%)
Number of households	4,906	2,693
Average household size	2.82	2.95
Median household income	$56,944	$55,799
Rental households	1,987 (34.4%)	1,444 (43.7%)

Race/Ethnicity	Mono County		Mammoth Lakes	
	Population	Percentage	Population	Percentage
White	12,379	87.5%	6,938	88.4%
Black or African American	140	1.0%	44	0.5%
American Indian and Alaska Native	485	3.4%	59	0.7%
Asian	345	2.4%	267	3.3%
Native Hawaiian and Other Pacific Islander	28	0.2%	0	0.0%
Some other or multiple race	1,291	9.1%	799	9.9%
Hispanic or Latino (of any race) *	3,862	27.3%	2,972	36.7%

* The US Census does not count Hispanic or Latino persons as a separate racial or ethnic category. Therefore, the Hispanic or Latino population reported here is also included in the other racial or ethnic categories.

Educational Attainment (25+ years)	Mono County		Mammoth Lakes	
	Population	Percentage	Population	Percentage
Less than 9th grade	890	6.2%	650	8.0%
9th grade to 12th grade (no diploma)	575	4.1%	275	3.4%
High school graduate or equivalent	1,626	11.5%	963	11.9%
Some college (no degree)	2,690	19.0%	1,230	15.2%

Associate's degree	777	5.5%	433	5.3%
Bachelor's degree	2,243	15.9%	1,238	15.3%
Graduate or professional degree	889	6.3%	444	5.5%
Note: Due to rounding, the totals presented in this table may not equal the sum of all rows. Sources: US Census Bureau, American Community Survey (2011–2015)				

2.3.1 Mono County

As shown in the table above, over half of Mono County's population resides in Mammoth Lakes. Most of the remaining residents live within unincorporated communities of fewer than 300 full-time residents. Although the approximate number of permanent residents is listed below for each community, communities with a strong recreational attraction may have double or more the listed population from visitors on peak summer and winter tourist days. Unincorporated communities in the county include:

- **Topaz**: The northernmost town in Mono County, Topaz has a residential population of 50 but is a popular recreational destination for gambling, fishing, and water sports. The town abuts Topaz Lake and has moderate hillsides directly to the east along US 395. Topaz is part of Antelope Valley.
- **Coleville and Walker**: Also part of Antelope Valley, and running alongside the Walker River and US 395, the neighboring communities of Coleville and Walker have their history in ranching, with populations of 495 and 721, respectively. Ranching and farming remain an important activity today along with tourist attractions such as water sports and horseback riding. The areas near the river and adjacent to these towns include riparian vegetation, irrigated farmland, and grasses, while the hills to the west have rocky slopes, dry chaparral, and dispersed coniferous trees.
- **Bridgeport**: The county seat, Bridgeport, has a population of 575. It is located in the relatively lush and green Bridgeport Valley surrounded by grasses and farmland.
- **Mono City**: This is a small community of 172 residents located just north of Mono Lake. It is in a relatively flat landscape and is adjacent to Mill Creek, which runs into Mono Lake.
- **Lee Vining**: Located on the southwest side of Mono Lake and near the intersection of US 395 with SR 120, Lee Vining is a frequent shopping point for visitors headed to Yosemite in summer months. The community at the mouth of Lee Vining Creek sits at the foot of several steeply sloped mountains.

- **June Lake**: This community of 629 residents is spread alongside the tall Carson Peak and SR 158. SR 158, also known as the June Lake Loop, provides access to the scenic lakes including June Lake, as well as June Mountain Ski Area and numerous hiking trailheads.
- **Chalfant (or Chalfant Valley), Hammil, and Benton**: These three communities, often referred to as the Tri-Valley area, are home to over 900 residents. US 6 runs north–south through the three communities and into Nevada, while SR 120 connects Benton to US 395. Located in a series of flat valleys, this area forms the largest agricultural basins in the county. While primarily an agricultural community, dramatic landscapes and several hot springs bring many recreational visitors to the area.
- **Crowley Lake/Aspen Springs/Hilton Creek and McGee Creek**: The communities of Crowley Lake/Hilton Creek and the much smaller McGee Creek are located adjacent to each other. On the south side of US 395, Aspen Springs can only be accessed via Crowley Lake Drive. Crowley Lake is a popular recreational destination for fishing and other water sports. With 45 miles of shoreline, Crowley Lake offers a marina, RV sites, boat rentals, and shops. Together the communities have a resident population of just over 1,000, making up the largest urbanized population in the unincorporated county. Immediately south of the communities are prominent mountain peaks, including Mount Baldwin and Mount Morgan.
- **Tom's Place and Sunny Slopes**: Continuing south along Crowley Lake Drive from Aspen Springs are the small communities of Tom's Place and Sunny Slopes, located on Forest Service-owned land. Tom's Place is surrounded by dense coniferous forest and primarily made up of cabins, stores, and other facilities that make up Tom's Place Resort. Although the bulk of development is directly adjacent to US 395, several residences in Sunny Slopes are located on the other side of US 395 along Rock Creek Road, which follows Rock Creek for close to 10 miles before dead-ending at the Mosquito Flat trailhead in Inyo County.
- **Swall Meadows and Paradise**: Swall Meadows, and its smaller southern neighbor Paradise, have roughly 220 and 150 residents, respectively. They are residential communities partway up the sloping Sherwin Grade with no commercial development, and surrounded by juniper and sub-alpine vegetation. These communities can only be accessed via a single roadway, Lower Rock Creek Road to Swall Meadows Road.
- **Oasis:** The county's southernmost community, and located within 3 miles of the Nevada border along SR 168 where it intersects NV 266, Oasis is isolated from other Mono County communities. With a permanent population of approximately 20, it is also one of the county's smallest communities. Oasis is located in Fish Lake Valley and is surrounded by flat land with dry and bushy vegetation.

Many county residents do not work in the community in which they live. Many residents in the Antelope Valley commute to work in Bridgeport and in Gardnerville, Minden, and Carson City in Nevada; residents of the Tri-Valley area commute to work in Bishop, in Inyo County; and residents of Long Valley, June Lake, and Benton commute to work in Mammoth Lakes. Bridgeport is the only unincorporated community with a large portion of its residents working in the community. Development and rising housing prices in Mammoth Lakes are forcing many residents of Mammoth Lakes to move elsewhere (Crowley Lake, June Lake, Bishop, Chalfant) and commute to jobs in Mammoth Lakes.

Mono County also has many second homes and seasonal use homes. The county had a vacancy rate of nearly 65 percent in 2015 according to 5-year American Community Survey census data (source 2011–2015 DP04). This unusually high rate reflects the large number of vacation homes and seasonal use units in the area, many of which remain vacant for the majority of the year.

Development in most unincorporated Mono County communities is primarily residential, supported by small-scale commercial uses serving local and tourist/recreational needs. Limited light industrial uses, such as heavy equipment storage and road yards, occur in some communities. Most communities also have some public facilities such as schools, libraries, community centers, and parks and ballfields, and some support government offices (i.e., Bridgeport).

Mammoth Lakes

The town is a four-season resort community with a small permanent population and many seasonal or one-time visitors. Vacation residences and lodging facilities accommodate a substantially larger population of second homeowners and visitors than the town's 8,000 permanent residents. The local economy is based primarily on tourism, especially during summer and winter months when visitation rates are highest. Winter conditions support skiing, snowboarding, and other outdoor recreational uses. In the summer, hiking, fishing, camping, bicycling (mountain and road), golfing, and sightseeing are popular resident and visitor activities. Since the town's economy is tourist-driven, much of the resident population works in the service industry; other large employers include government and Mammoth Hospital.

Mammoth Lakes is located close to US 395, but can only be accessed via SR 203 and, except in heavy snowstorms, via Mammoth Scenic Loop. Southern portions of the city, notably Old Mammoth, the Bluffs, Valentine Reserve, and Lake Mary area, can only be accessed via Old Mammoth Road and Lake Mary Road. The town is located on the lower slopes of Mammoth Mountain with dense coniferous forest.

2.4 Land Uses

2.4.1 Ownership

For the purposes of this Plan, understanding land ownership is important for developing mitigation actions and policies that are both appropriate and within the jurisdictional control of the County and Town. These are the areas the Plan will most directly be able to impact. Lands owned by the state or federal government have separate governing bodies that are responsible for ensuring appropriate mitigation of both natural and human-caused hazards. **Figure 2.2** identifies broad categories of ownership for the County and Town. **Table 2.2** shows the acreage distribution of these categories of ownership. While the entire county was analyzed regarding hazard and risk, lands identified as local and private are the focus of the mitigation actions in this Plan. **Table 2.3** shows similar ownership patterns within the Town of Mammoth Lakes' municipal boundary alone, also divided between public and private lands.

Table 2.2: Mono County Land Ownership

Owner	Acres	Percentage
Federal	1,720,939	85.54%
State	83,966	4.17%
Private	128,385	6.38%
Utilities	67,081	3.33%
County	2,266	0.11%
Town of Mammoth Lakes	*215*	*0.01%*
Right of Way	8,960	0.45%
Unknown	109	0.01%
Total	**2,011,921**	**100**

Mono County

Land uses in Mono County are dominated by open space and natural resource areas owned by various federal agencies. The state of California and the City of Los Angeles (as the Los Angeles Department of Water and Power, or LADWP) also own considerable amounts of land, which is generally used for open space, or water conveyance. Federal agencies, including the Humboldt-Toiyabe, Inyo National Forest, and BLM Bishop, own much of the remaining land, and parts of the county are also under the jurisdiction of tribal governments, which is calculated under the federal land category. Southern California Edison and other utilities own lands for dams, power conveyance, water storage, and similar uses. Private entities and individuals make up the remainder of land ownership in the county for agriculture and ranching, residential, industrial, and commercial uses. Most privately-owned land is contained within unincorporated community areas.

Mammoth Lakes

In Mammoth Lakes, most land is dedicated to residential uses, leisure and recreation facilities (particularly ski-related facilities), public and semipublic institutional uses, open space, industrial uses, Mammoth Yosemite Airport, and other commercial uses. The Town's 25-mile municipal boundary includes large swaths of land within National Forest and BLM, while most land within the town's growth boundary is owned by private entities or individuals.

Figure 2.2: Land Ownership in Mono County

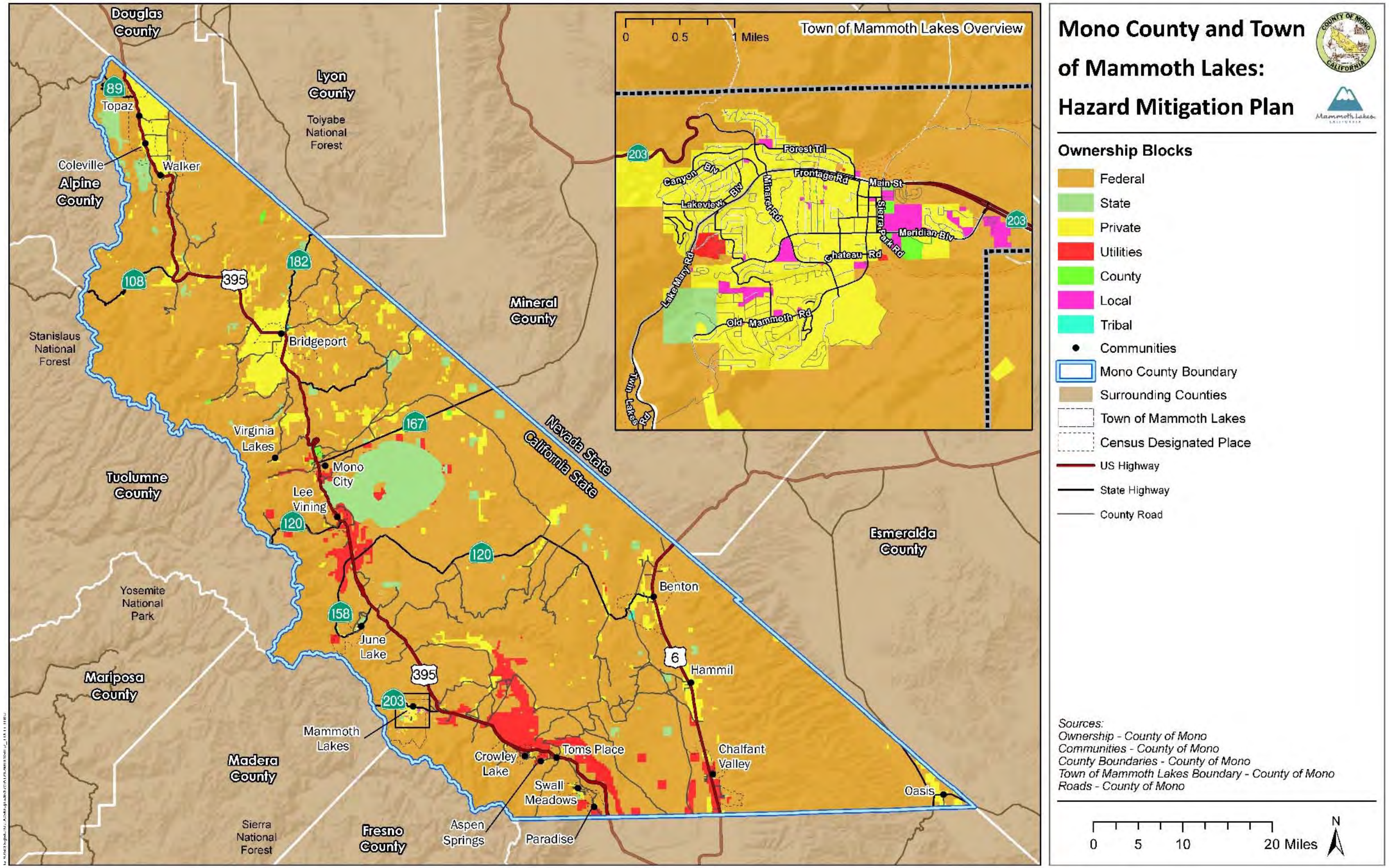

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Table 2.3: Mammoth Lakes Land Ownership within Municipal Boundary

Owner	Acres	Percentage
Federal	12,832	80.06%
State	2	0.01%
Private	2,387	14.89%
Utilities	37	0.23%
County	44	0.27%
Local	189	1.18%
Right of Way	537	3.35%
Total	**16,027**	**100.00**

Note: Due to rounding, the totals presented in this table may not equal the sum of all rows.
Source: Mono County 2017

2.4.2 Land Use Designations

Figure 2.3 identifies locations of various types of planned land uses in Mono County and the Town of Mammoth Lakes.

Mono County

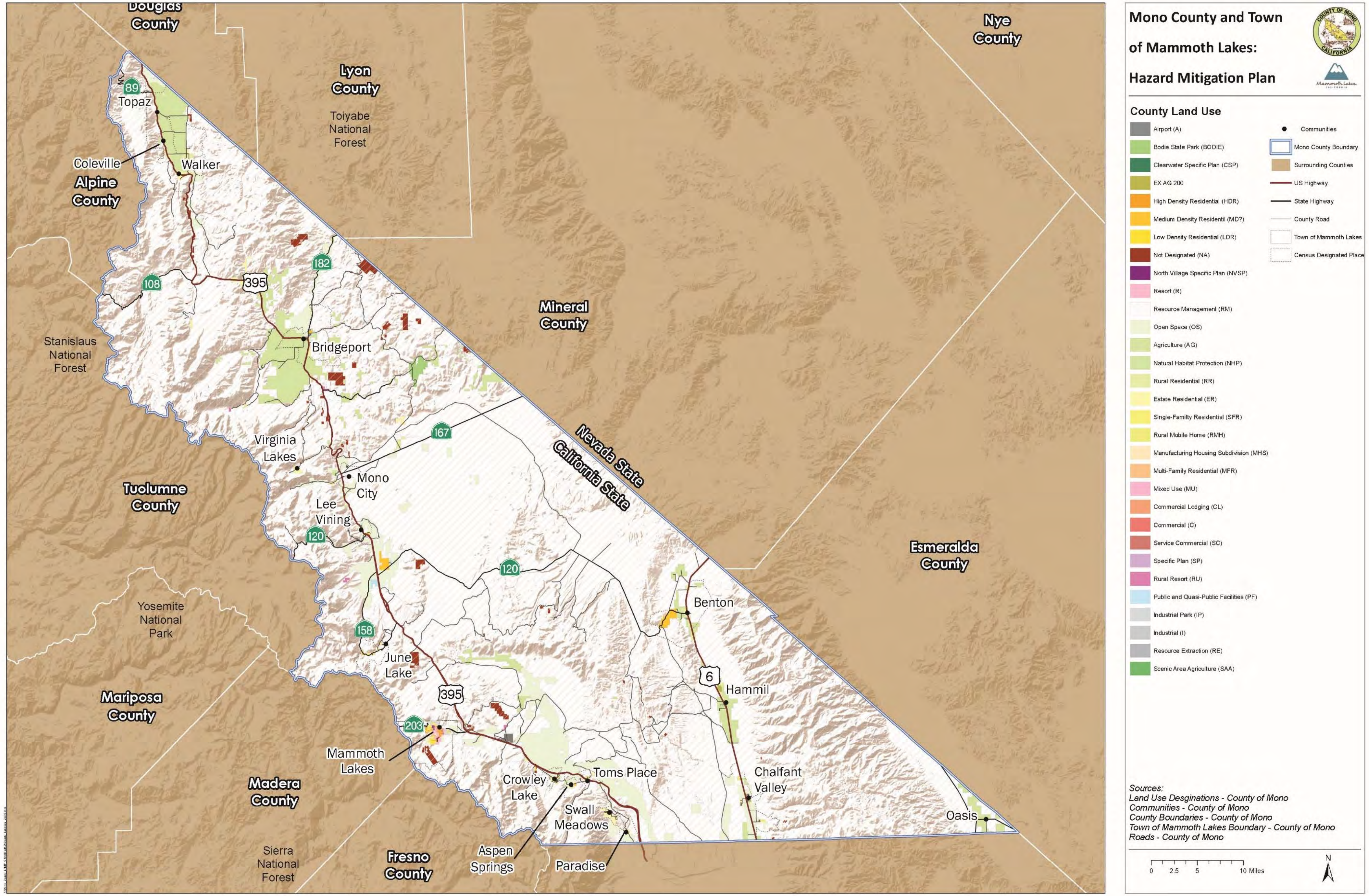
The Mono County General Plan assigns a land use designation to all land located in the unincorporated areas of the county, including land that is not under the County's jurisdiction. No land may be developed or used in the county except in the manner permitted by its assigned designation. The General Plan also requires that potential development of land be evaluated in terms of potential natural hazards and available infrastructure, access, and public services and response, as described in the Land Use Designation Criteria section of the General Plan Land Use Element. Relevant portions of the County's Zoning Code, which provides more specific development requirements, are incorporated into the General Plan. **Table 2.4** shows land uses in the unincorporated areas and examples of uses permitted within those designations.

Table 2.4: Unincorporated Mono County Land Use Designations

Land Use Category	Example Land Uses
Agriculture	Cattle rangeland, croplands
Commercial	Department stores, banks, offices
Commercial Lodging	Hotels, motels

Land Use Category	Example Land Uses
Estate Residential	Single-family dwelling on large lot
Industrial	Manufacturing plant, heavy vehicle storage
Industrial Park	Office park, laboratory
Mixed Use	Book store + townhome, dental office + restaurant
Multi-family Residential	Condos, 4+ unit apartment building
Natural Habit Protection	Wildlife habitat, wetland
Open Space	Equestrian trail, cross-country ski touring
Public and Quasi-Public Facilities	Public utility building, airport
Resource Extraction	Mine, solar power plant
Resource Management	Avalanche-prone area, water conservation area
Rural Mobile Home	Mobile home on large lot, small-scale agriculture
Rural Residential	Single-family dwelling unit w/ancillary rural uses
Rural Resort	Single-family dwelling unit, small-scale agriculture, adult-oriented businesses
Scenic Area Agriculture	Agricultural use consistent with the Mono Basin National Forest Scenic Act
Service Commercial	Car sales lot, plumbing services shop
Single-Family Residential	Single-family dwelling unit on 8,000 sq. ft. lot, single-family dwelling unit on quarter-acre lot
Specific Plan	Planned development in areas outside existing communities complying with a specific plan
Source: Mono County General Plan	

Figure 2.3: Mono County Land Use Map



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Community Planning Areas

In addition to the countywide Land Use Element and land use designations, land use in unincorporated communities is further guided by area plans. Area plans possess the same regulatory authority as countywide land use policies, serving to further refine those policies to address the needs of a community or area. Each community area also has identified opportunities and constraints, many of which relate to access, infrastructure, and vulnerability to hazards. While the entire county was analyzed regarding hazard and risk, the focus of many mitigation actions in this Plan will be upon needs and actions for specific community areas defined by the sixteen area plans. Large portions of the county are not located within any planning area; most of these portions are federal land with little or no population or development.

Regional Planning Advisory Committees

Regional Planning Advisory Committees (RPACs) cover one or more planning areas and were established by the Board of Supervisors to assist the Planning Department in developing and updating planning and development decisions. RPACs were established for Antelope Valley, Bridgeport, Mono Basin (including Mono City and Lee Vining), and Long Valley. In addition to the RPACs, the County established other community planning advisory committees. The Board of Supervisors created the June Lake Citizens Advisory Committee to review and comment on planning issues in June Lake. Residents of the Upper Owens area met to develop land use policies for that area; similarly, landowners in the Benton Hot Springs area met to develop land use policies for their valley. **Table 2.5** identifies key summary information about the planning areas. The planning areas with area plans are identified in **Figure 2.4**.

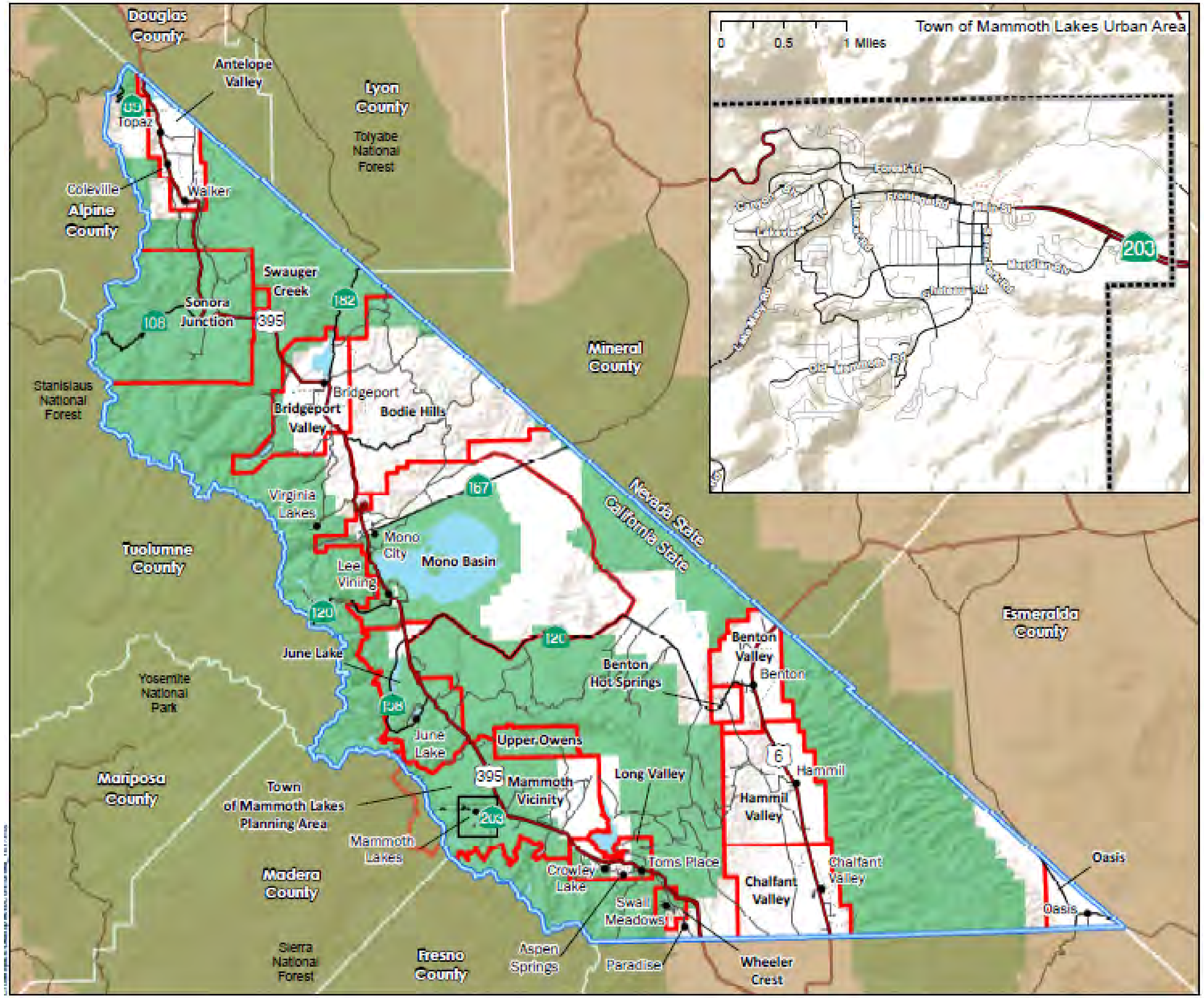
Table 2.5: Community Planning Areas Summary

Community Planning Area	Communities	Community Advisory Body	Topography	Land Uses	Assumed Buildout (units)
Antelope Valley	Topaz, Coleville, Walker	Antelope Valley RPAC	Flat valley; gentle and steep slopes valley floor; several running waterways	Predominantly residential; limited commercial, lodging, agriculture, public uses	1,586

Community Planning Area	Communities	Community Advisory Body	Topography	Land Uses	Assumed Buildout (units)
Benton Valley	Benton Valley	Benton/ Hammil Community Meetings	Flat valley; rolling hills; hot springs	Predominantly residential; limited commercial, lodging, public uses	729
Bodie Hills	Dispersed properties	Inactive	Low mountain range; steep valley floors	Low density residential; agriculture	317
Bridgeport	Bridgeport	Bridgeport Valley RPAC	Flat valley; steep slopes; adjacent to Mono Lake	Mixed density residential; commercial; lodging; entertainment; public facilities	3,166
Chalfant	Chalfant	Chalfant Valley RPAC	Flat valley		542
Hammil Valley	Hammil Valley	Benton/Hammil Community Meetings	Flat valley	Low density residential; limited commercial; agriculture	285
June Lake	June Lake, Crestview	June Lake Citizens Advisory Committee	Gentle and steep slopes several water bodies	Predominantly residential; limited commercial, lodging, public uses	3,011
Crowley	Crowley Lake/Hilton Creek, Aspen Springs, Sunny Slopes, Tom's Place, McGee Creek	Long Valley RPAC	Gentle and steep slopes, valley floor; several water bodies	Predominantly residential; limited commercial, lodging, public uses	1,839
Mammoth Vicinity	Dispersed properties	None	Flat valley; gentle slopes	Low density residential; agriculture	17

Community Planning Area	Communities	Community Advisory Body	Topography	Land Uses	Assumed Buildout (units)
Mono Basin/Mono Basin North	Mono City, Lee Vining	Mono Basin RPAC	Low slopes, adjacent to Mono Lake	Predominantly residential; limited commercial, lodging, public uses	880
Oasis	Oasis	Direct property owner contact	Flat valley	Limited residential; agriculture	102
Paradise	Paradise	Paradise Community Meetings	Flat valley adjacent to running water bodies and steep slopes	Limited residential; agriculture	199
Sonora Junction	Marine Corps Mountain Warfare Training Center	None	Gentle and steep slopes; high peaks; several small waterways	Low density residential; military; public facilities	138
Swauger Creek	Dispersed properties	Inactive	Gentle and steep slopes; high peaks; several small waterways	Wildlands	8
Upper Owens	Dispersed properties	Direct property owner contact	Flat valley; gentle and steep slopes	Low density residential; agriculture	52
Wheeler Crest	Swall Meadows	Wheeler Crest Community Meetings	Gentle and steep slopes	Low density residential; limited commercial; agriculture	389
Outside Planning Area	Virginia Lakes; Dispersed properties	None	Flat valley; gentle and steep slopes; high peaks; valley floor; several running waterways	Low density residential; limited commercial; agriculture; wildlands	670

Figure 2.4: Community Planning Areas



Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan

Communities

- Communities
- Community Planning Areas
- Mono County Boundary
- Surrounding Counties
- Town of Mammoth Lakes
- Census Designated Place
- National Forest
- Highway
- State Highway
- County Road
- Lakes

Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono

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Mammoth Lakes

The Town includes areas within the town's current 25-square-mile municipal town boundary, which includes both developed areas that make up the urban growth boundary and areas that are primarily federally owned open spaces with highly dispersed development and limited or no services provided. The Town's planning area extends beyond its municipal boundaries and encompasses some land in the Mammoth Vicinity Community Planning Area in unincorporated Mono County, extending from the Whitmore Recreation area on the east to the Mammoth Scenic Loop on the north, in which the Town does not have jurisdiction but provides some municipal services. The planning area also includes Inyo National Forest lands (located in Madera County) that have their sole vehicular access through the Town of Mammoth Lakes and for which the Town reviews and issues construction permits.

The Mammoth Lakes General Plan assigns a land use category to all land located within existing town boundaries. For the planning area outside the city boundary that is within the Town's sphere of influence, but the area is directly guided by County land use designations.

The Town's General Plan organizes land development and design and growth standards through specific districts within the town. Mammoth Lakes is composed of approximately twelve districts and four mountain portals, which are further defined by specific, master, and district plans. District boundaries are defined by existing development, patterns of vegetation, topographic features, circulation patterns, and the pattern and relationships of land uses. Consequently, certain mitigation actions in this Plan may focus on or refer to specific districts or mountain portals, shown in **Figure 2.5** below. The districts are: Main Street, Old Mammoth Road, and Shady Rest; Gateway; North Village; Sierra Star; Snowcreek; Juniper Ridge; Meridian; Knolls; Mammoth Slopes; Old Mammoth; Sierra Valley; and Majestic Pines. The mountain portals are: Eagle Lodge; Canyon Lodge; Main Lodge; and Village.

The mix and composition of land uses, housing, employment, lodging, and amenities are subject to the character and objectives for the underlying district or portal. The Town's plan incorporates 14 distinct land use designations that guide development. **Table 2.6** shows land use designations and examples of uses permitted within those designations, and **Figure 2.6** identifies land use distribution in the Town.

Table 2.6: Mammoth Lakes Land Use Designations

Land Use Category	Example Land Uses
Low Density Residential 1	Single-family detached home on one-half acre
Low Density Residential 2	Single-family detached home on one-quarter acre
High Density Residential 1	3-unit condominium, 4-unit apartment complex
High Density Residential 1	8-unit apartment complex, boutique hotel
Commercial 1	15-unit apartment, main street shop
Commercial 2	40-room hotel
Resort	Ski resort
Institutional Public	School, hospital
North Village Specific Plan	Visitor-oriented entertainment retail consistent with specific plan
Industrial	Auto repair shop, manufacturing plant
Airport	Mammoth Yosemite Airport, airport-serving lodging
Open Space	Neighborhood park, community center
National Forest	National Forest
Clearwater Specific Plan	Pedestrian-oriented mixed-used development consistent with specific plan

Figure 2.5: Town of Mammoth Lakes Districts and Portals

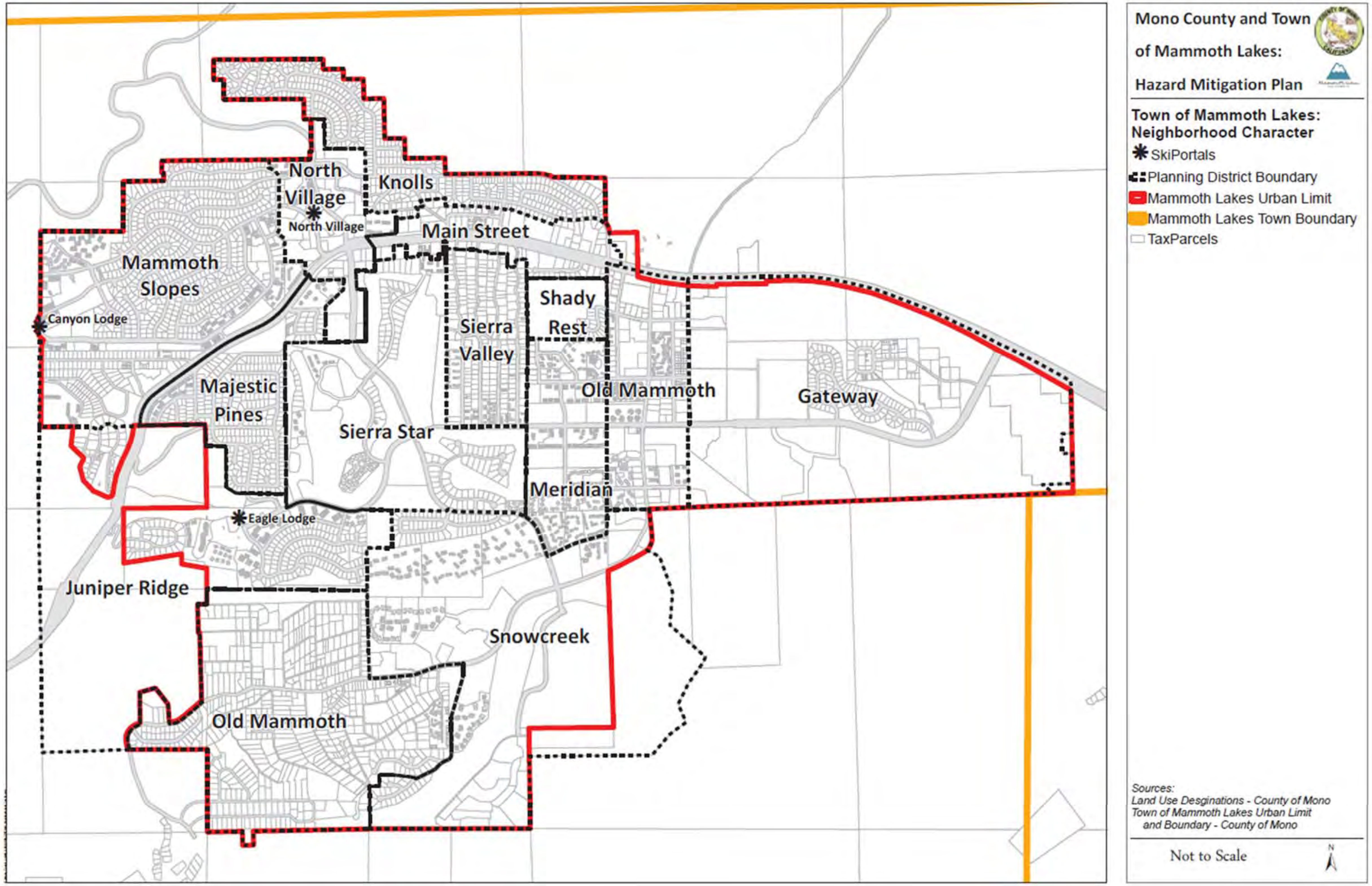

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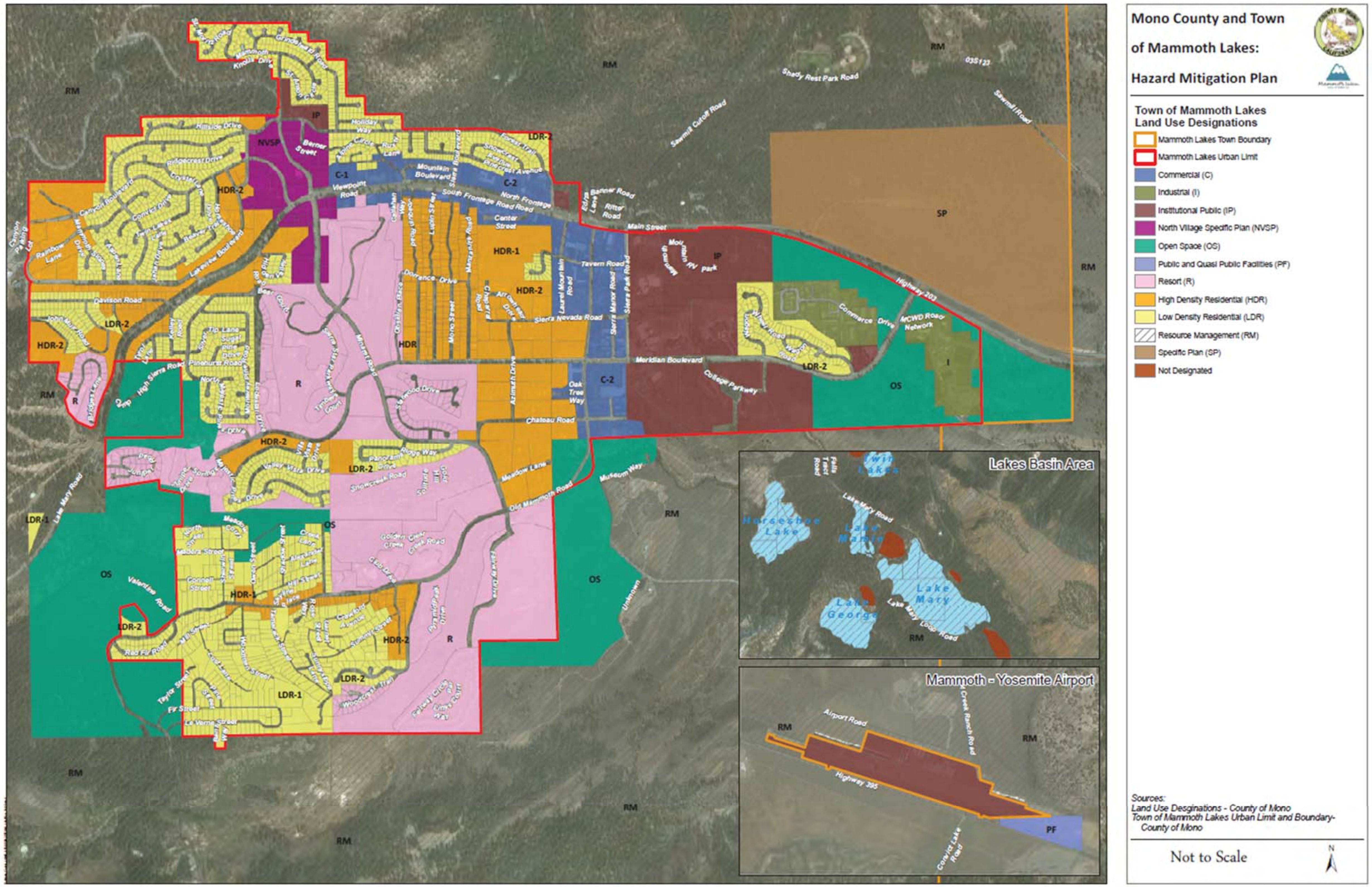
Figure 2.6: Town of Mammoth Lakes Land Use Map



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2.4.3 Agricultural Lands

Loss of agriculture and farmland to urban development can exacerbate natural hazards and vulnerabilities as well as impact other aspects of the county's economic, cultural, and environmental well-being. Consequentially, agricultural land uses are evaluated in this Plan and may be specifically addressed in mitigation actions. The 2012 Census of Agriculture reported that there were 72 farms in the county, a slight increase from the total of 63 farms reported in the 1997 Census of Agriculture. Total farmland acreage, however, decreased by more 12,427 acres in 1997 to 56,386. The value of Mono County agricultural production also fell from $18.3 million in 1997 to $17.9 million in 2012. This is consistent with statewide trends of loss of agricultural and farmland acreage and productivity.

Prime Farmland is defined as "land that has the best combination of physical and chemical characteristics for the production of crops." Numerous specific criteria relating to water availability, water table, soil chemistry, flooding, erodibility, and physical soil characteristics must be met for land to be considered Prime Farmland. The Soil Conservation Service (SCS—now the National Resource Conservation Service, NRCS) has mapped most of these characteristics for Mono County, but Mono County has not yet been included in the Farmland Mapping and Monitoring Program (NRCS 2017). Mono County has included a number of these attributes in an online geodatabase (https://www.bistatesagegrouse.com/general/page/geodatabase).

2.5 Development Trends and Future Development

2.5.1 Mono County

As previously discussed, nearly 94 percent of the county's 3,132 square miles are publicly owned and used mostly for resource conservation or open space due to a high percentage of lands under public ownership. Most developed property in the unincorporated county is located within 16 community areas, and roughly half of the population and economic activity occurs within the incorporated Town of Mammoth Lakes. The countywide growth rate over the next 20 years as projected by the California Department of Finance is between 0.55 percent and 0.80 percent annually. The unincorporated area will probably continue to house slightly less than half of the total county population (42 percent in 2010), although the population distribution among the unincorporated areas may shift over that time frame. A County staff report prepared for the Mono County Housing Authority in 2016 indicates that the County issued between 15 and 20 permits each month between 2010 and 2015, which included new development, replacement structures, and remodels or alterations. The County issued a total of 303 permits in the calendar year of 2015, representing the first time that total permits issued reached above the 300 mark since the housing boom years of 2006–2008. Staff attributed some of this increase to replacement and rebuilding efforts after the 2015 Round Fire. Most permits were for individual or small batch residential units, with a small number of additional permits for commercial or restaurant uses. This development pattern is not anticipated to change, due to the small scale of communities in Mono County and the lack of employment opportunities in most communities.

The County's General Plan Land Use Element contains policies that focus future growth in and adjacent to existing communities. Substantial additional development outside of existing communities is limited by environmental constraints, the lack of large parcels of private land, and the cost of providing infrastructure and services in isolated areas. Land use policies for unincorporated community areas focus on sustaining the livability and economic vitality of existing community areas. The General Plan also specifically allows for expansion and development at the Bryant Field and Lee Vining Airports and in the area surrounding each airport.

Since growth that has occurred since the last MJHMP update in 2006 has been limited and largely only occurred within existing communities, the only major changes in risk and vulnerability relate to density of development. This Plan identifies vulnerabilities of the few new areas that have been developed since 2006, and reemphasizes areas in currently developed areas where development should be discouraged or prohibited.

Mammoth Lakes

The Town of Mammoth Lakes maintains an urban growth boundary, as established in its General Plan. An overarching principle of the community is to maintain the town's compact urban form, protect natural and outdoor recreation resources, and prevent sprawl. The Town's urban growth boundary limits the area available for future development to achieve these principles. Because of this, as well as the fact that the area outside the urban growth boundary is predominantly federal land, all new development will likely occur only within those boundaries.

Vacation residences and lodging facilities in town accommodate a substantially large population of second homeowners and visitors. Overall, the town is prone to large fluctuations in the total non-resident population because of the seasonal nature of its tourism-dependent economy. During the winter tourist season, the community and ski area require a large number of seasonal employees (more than can be filled by the full-time resident community) to meet peak service demands. As a result, the resident population increases by approximately 3,000 during the peak tourism season in addition to the influx of tourists.

Accordingly, the Town considers the development needs of nonresident and visitor populations at peak tourist season as well as resident populations when planning for future growth. The Town's General Plan anticipates that, at buildout, the projected number of residents, visitors, and workers on a winter weekend will grow to over 53,000; it thus establishes a policy of a total peak population of residents, visitors, and employees of 53,091 people. The General Plan anticipates that the permanent population will grow at a rate of between 1.4 percent and 2.4 percent per year.

To accommodate growth, the Town anticipates the development of a number of planned developments within the urban growth boundary. The bulk of this development will be a mix of resort-style development and new housing. The General Plan also anticipates that most new commercial development will take place in the Resort, North Village, and Commercial 1 and 2 land use designations. Industrial development will be limited primarily to the Industrial designation, although there will be a small amount of industrial development in other designations. The total amount of industrial development at buildout is anticipated to be approximately 500,000 square feet.

Between 2009 and 2014, very little new development occurred. In 2015, several new multifamily structures and a handful of new single-family homes were built in the Snowcreek neighborhood. The Town has a number of specific plans and large development master plan projects under review or entitled as of 2016. Most of these potential development areas are infill. Major projects approved or planned as of 2016 are described in **Table 2.7**.

Table 2.7: 2016 Major Development Plans

Development Name	Description
Snowcreek VIII Master Plan	790 dwelling units, 400 hotel rooms, 20,000 sq. ft. commercial
Juniper Ridge Master Plan	106 dwelling units, 80,000 sq. ft. commercial (day lodge and other)
Lodestar at Mammoth Master Plan	500 hotel rooms, 82 dwellings units, 80,000 sq. ft. of commercial
Mammoth Crossings	742 hotel rooms total, 40,500 sq. ft. of commercial
Canyon Lodge Redevelopment	Reconfiguration of lodge and new skier service facility
Ritz Carlton Site	93 condominium units with lock-offs totaling 225 keys, 5,000 sq. ft. restaurant
Inn at the Village	67 hotel rooms, a spa, pool terrace
Sierra Star Area 2	210 dwelling units
Old Mammoth Place	487 resort hotel rooms, 40,000 sq. ft. of commercial, 9,500 sq. ft. of conference center use
Shady Rest Parcel	55 single family residential units, 117 multifamily apartment units, dedication of 6 acres for open space
DSES Wounded Warrior Center	Two-story mountain lodge with up to 38 full-time residents, flexible shared common space

This MJHMP update recognizes specific areas and neighborhoods that have expanded in the Town of Mammoth Lakes and identifies key infrastructure improvements and development requirements that are necessary in these areas.

2.6 Infrastructure Systems and Critical Facilities

Much of the County and Town's ability to mitigate for, as well as prepare for and respond to, disaster relies on critical facilities. Most critical facilities in the county are provided either by the County, by the Town, or by special districts such as those for fire protection or public utilities. Critical facilities are typically focused on properties that are of specific value to the community. They include many key infrastructure systems: the transportation network including roads, airports, and helipads; communications including telephone, radio, and internet; lifeline utilities including electricity service, gas and propane service, water and sewer service facilities, and snow removal equipment; and hazardous materials disposal sites such as landfills. These systems are described in greater detail below. They also include emergency services facilities directly used by emergency responders such as police stations, fire stations, and paramedics stations. Additionally, critical facilities encompass public facilities that can act as emergency operations centers, such as community centers; county or town offices; and facilities that meet community needs, provide community gathering places and staging areas, and support vulnerable populations, such as medical facilities (e.g., hospitals, clinics), schools, and senior living centers.

Infrastructure systems, most notably roads and electricity lines, stretch across the entire county and are not itemized below, although overpasses, power stations, and substations are included. **Table 2.8** shows the number and values of different types of critical facilities for the County and Town. A full list of critical facilities by planning area is provided in **Appendix C**.

Table 2.8: Critical Facilities by Type

Facility Type	Unincorporated Mono County	Mammoth Lakes
Communications Facilities	9	6
Emergency Operations Center	8	4
Emergency Services	21	5
Hazardous Materials	10	0
Lifeline Utility Systems	47	8
Medical Services	2	3
Schools	6	5
Transportation Systems	9	1
Vulnerable Populations (senior living facilities)	5	0
Total	**117**	**32**

Most of these facilities are located along or very near US 395 or SR 6. The largest concentrations of facilities are in the county seat, Bridgeport (27 facilities) or Mammoth Lakes (29 facilities). **Figure 2.7** identifies the locations of critical facilities by category in the County and Town.

2.6.1 Communications

Telecommunications infrastructure and services are critical components of emergency response, as well as long-term growth and sustainability for the county, as they provide the basic resources necessary for businesses to operate and add to the quality of life for its residents. Communications services cross several major technologies and infrastructure components and include basic telephone, wireless telephone, radio, and broadband internet. Due to the isolated locality of the county, inadequate infrastructure and service across all these communication technologies are major challenges.

An Information Technological Strategic Plan, completed in 2015 and adopted by both Mono County and the Town of Mammoth Lakes, provides goals for improving communications operations and infrastructure.

General Response Protocol

Any call to 911 placed from a landline phone from within the county is routed directly to Mono County Dispatch in Bridgeport. Any 911 call placed via a cell phone is routed to the California Highway Patrol (CHP) in Bishop or to Mono County Dispatch, depending on the caller's location and device capabilities. If the call is routed to CHP, it is then transferred to Mono County Dispatch. If Mono County Dispatch is down for any reason, all calls are routed to Inyo County Dispatch. There is solid coordination between the agencies to ensure that all 911 calls are answered and properly routed.

Internet and Mobile Broadband

Historically, Mono County has suffered from a lack of quality broadband due to its rural nature and low population with dispersed community areas. Landline phone, internet, and TV service was, and still is for many communities, provided by only a few providers, including Frontier Communications and Verizon. Internet speeds with these services are typically very slow, and in some cases landline phone services are unreliable.

However, in 2013, a $120 million fiber optic project was completed which opened a new era of opportunity for the Eastern Sierra region. Known as Digital 395, the project completed an open-access network capable of delivering petabytes of data to Mono, Inyo, and eastern Kern Counties. The project encompassed 36 communities, six Native American reservations, two military bases, over 25,000 households, and 2,500 businesses. As of 2016, 85 percent of the households in Mono County have access to gigabit internet service at 50 percent of the cost per megabit (on a per capita basis), and installations are still ongoing. However, smaller communities located away from US 395, and which have so far not gone through the process to tap into the main line as part of the project, may still have limited to no internet access. To facilitate delivery of last-mile internet service off the Digital 395 backbone, Race Communications will install strand and fiber on existing utility poles and install fiber in existing underground conduit and newly proposed underground conduit, along with associated infrastructure (power vaults and distribution panels) in various Mono County communities. For these communities, final line connections may require long waits and the expense of several hundred to several thousand dollars. Some very small communities are not included in this project and may still not have broadband access after the project's completion.

Additionally, according to the Mono County General Plan, remaining issues include the data caps that are placed on customers, the overall cost of the service, and the typical requirement of a long-term contract to receive the service.

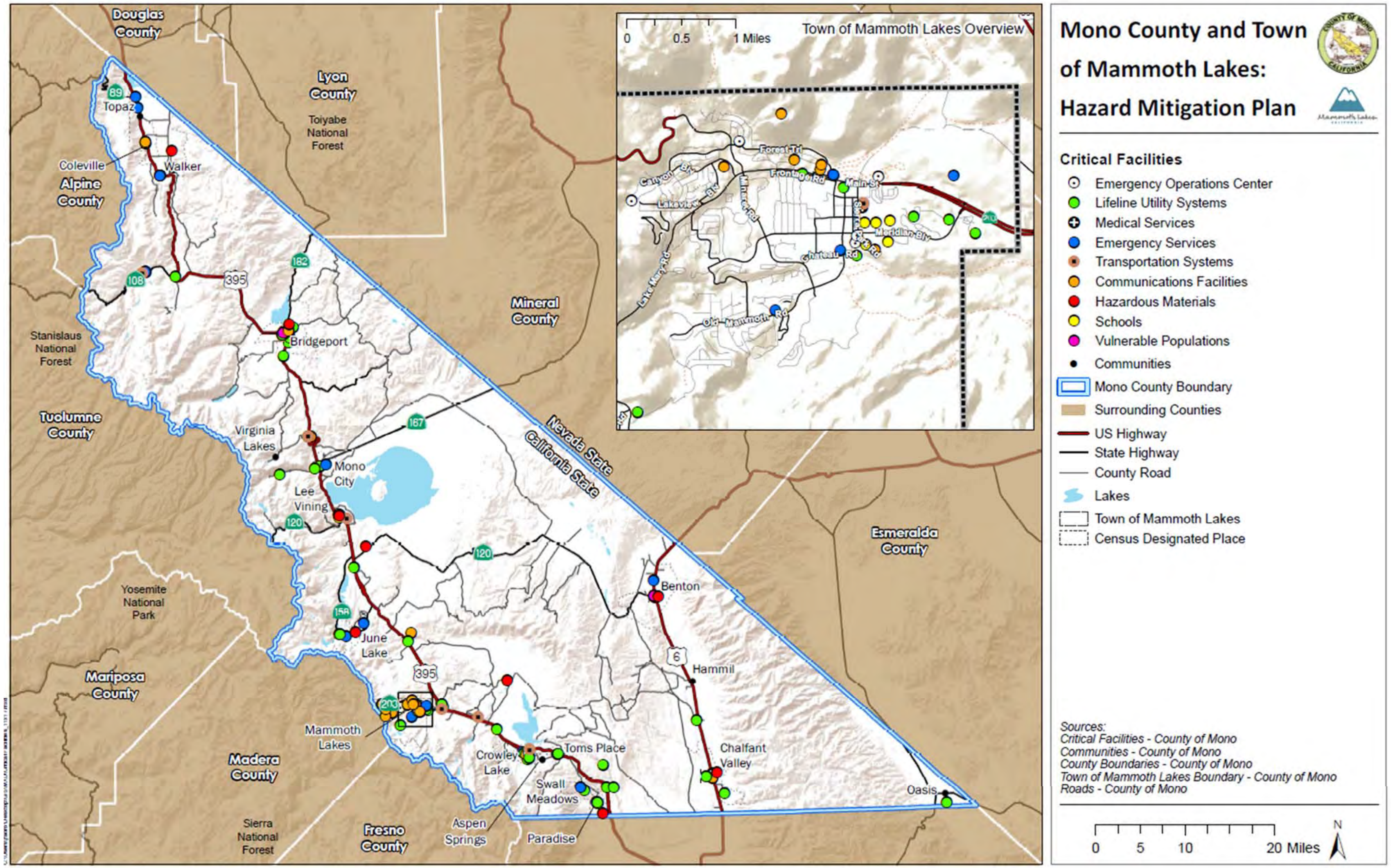
Cellular Service

Cellular coverage in the county is incomplete. Service in Mammoth Lakes and its mountain portals is generally reliable. For the most part, some form of cellular coverage also exists in almost every unincorporated community area; however, it is carrier-dependent. AT&T and Verizon are the two main carriers. Their coverage models overlap, but each carrier does not provide the same level of coverage in the same areas. Service in large portions of the county's primary highway corridors is spotty, and away from the main road and urbanized communities it is often unreliable or nonexistent.

Since the number of cell phone towers is limited and they are spread far apart, network capacity is also limited. Even in more developed areas with generally good service, network capacity may be quickly overloaded during an emergency event.

Cellular service is increasingly important as more and more households do away with landline connections, and with the increasing use of reverse 911 technology to reach community members during hazard events.

Figure 2.7: Critical Facilities



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Radio

Responders rely on the County's Public Safety Radio System to communicate with each another in the field, as well as with Dispatch while handling events. While this system is dated and in need of an upgrade, it is functional. Built into the system are several layers of redundancy which include multiple 'channels' at each communication site and backup links between sites. Occasionally sites or channels fail; however, dispatchers and responders are familiar with this scenario, and protocols exist when these situations arise which guide or direct users to alternate means of communication.

Two-way radio interoperability between agencies is critical to operations of emergency responders. Radio in Mono County utilizes both privately owned cellular towers and federal, state- and County-owned repeater stations. Town, County, and state emergency response staff indicate that in the past, radio communications have been especially challenging, with old or outdated handheld and car units. A contract authorized in 2015 with Delta Wireless to perform technical work to maintain, upgrade, and support the County's Public Safety Radio System has resulted in major improvements. However, radio capability is still often limited in mountainous areas of the county, as well as within specific community areas such as Antelope Valley, Tom's Place, and Sunny Slopes. In previous decades, radio was sometimes enhanced during critical periods through use of a cell-on-wheels (COW) device owned and operated by state emergency operators. However, COWs are no longer made available for the Eastern Sierra region due to limited supply and difficulty in transporting them.

2.6.2 Transportation

There are a limited number of major access roads in the county and these are critical for community mobility and emergency responders. Major access roads include the following:

- **US 395** is the major transportation route connecting the Eastern Sierra with Southern California and with the Reno/Tahoe region in northern Nevada. US 395 is also Main Street in Lee Vining, Bridgeport, Walker, Coleville, and Topaz. US 395 is, and will remain in the long term, the major access to and through Mono County. Most of the county's population resides in small communities of 300 or less along this main roadway corridor. By car, Los Angeles is six to seven hours south on US 395, Reno is three hours north on US 395, and the San Francisco Bay Area is six to seven hours west on various routes connecting to US 395. It is maintained and kept open throughout the year. However, various portions of US 395 are in hazard zones and closures due to winter storms, avalanche, landslide, and fire are not uncommon, as described in the risk and vulnerability sections of this Plan.

- **US 6**, from the Inyo County line north of Bishop to the Nevada state line, provides regional/interregional transportation connections. It is a trucking route between Southern California, Reno, and the western mountain states (Washington, Idaho, and Montana). US 6 is also Main Street in the Tri-Valley communities. Caltrans has identified that the route's primary purpose is to serve interregional traffic (largely trucks). The route is kept open year-round and is subject to limited exposure to hazards.
- **SR 89** provides access from US 395 to Monitor Pass and is closed in the winter.
- **SR 108** provides access from US 395 west to Sonora Pass and is closed in the winter.
- **SR 120** provides access from US 395 west to Tioga Pass and east to Benton. The western segment is closed in the winter and the eastern segment may also be closed briefly.
- **SR 158**, the June Lake Loop, provides access from US 395 to the community of June Lake and is Main Street through part of the June Lake Loop. A portion of SR 158 is closed in the winter.
- **SR 167** provides access from US 395 to the Nevada state line, north of Mono Lake, and access to the community of Mono City.
- **SR 168** provides access from US 395 at Big Pine in Inyo County north to Oasis in the southeast corner of Mono County.
- **SR 182** provides access from its junction with US 395 in Bridgeport northeast to the Nevada state line as well as main street access to a portion of the community of Bridgeport.
- **SR 203** provides access west from US 395 to the Mammoth Mountain Ski Area, Mammoth Lakes, turning in to the main street through town, and on to the Forest Road to Reds Meadow.
- **SR 266** provides access through Oasis in the southeast corner of the county.
- **SR 270** provides access east from US 395 to Bodie State Historic Park and is closed for a portion of the winter.

Mono County also has three small public airports. Two, Bryant Field and Lee Vining Airport, are operated by the County. The third, Mammoth Yosemite Airport, is operated by the Town of Mammoth Lakes. Several heliports, including the Marine Corps Mountain Ware Training Center Airport, are also present. Transportation and access routes are shown in **Figure 2.8**, below.

Evacuation and Emergency Access Routes

For most of Mono County, US 395 is the primary evacuation and emergency access route. The communities of Paradise, Swall Meadows, Lundy Lake, Virginia Lakes, and Twin Lakes, as well as portions of June Lakes, Crowley Lake, McGee Creek, and Chalfant Valley, all only have one access route. During evacuation and emergency response procedures, the lack of alternative routes could inhibit transportation in and out of most areas. For the Town of Mammoth Lakes, SR 203 is the primary access in and out of the community, and connects to US 395. The Mammoth Scenic Loop provides a secondary access route to US 395 when not closed during heavy storms in winter months. Certain neighborhoods in the southern portion of the town off Old Mammoth Road and Lake Mary Road do not have access to either SR 203 or US 395 and have no secondary access at all during the winter. **Figure 2.8** identifies communities and neighborhoods without secondary access to major access roads identified above. Many of these communities are threatened by one or more hazards, as will be detailed in Chapter 3 and Chapter 4, and thus secondary access for emergency situations is critical.

Developing secondary access routes is typically constrained by the presence of hazard zones and steep slopes, as well as procedural onus associated with establishing right-of-way on land owned by multiple private and public entities. Chapter 5 includes more detailed information, as well as specific opportunities and constraints, regarding secondary access routes in six neighborhoods or communities which have single access identified as the highest priority to address.

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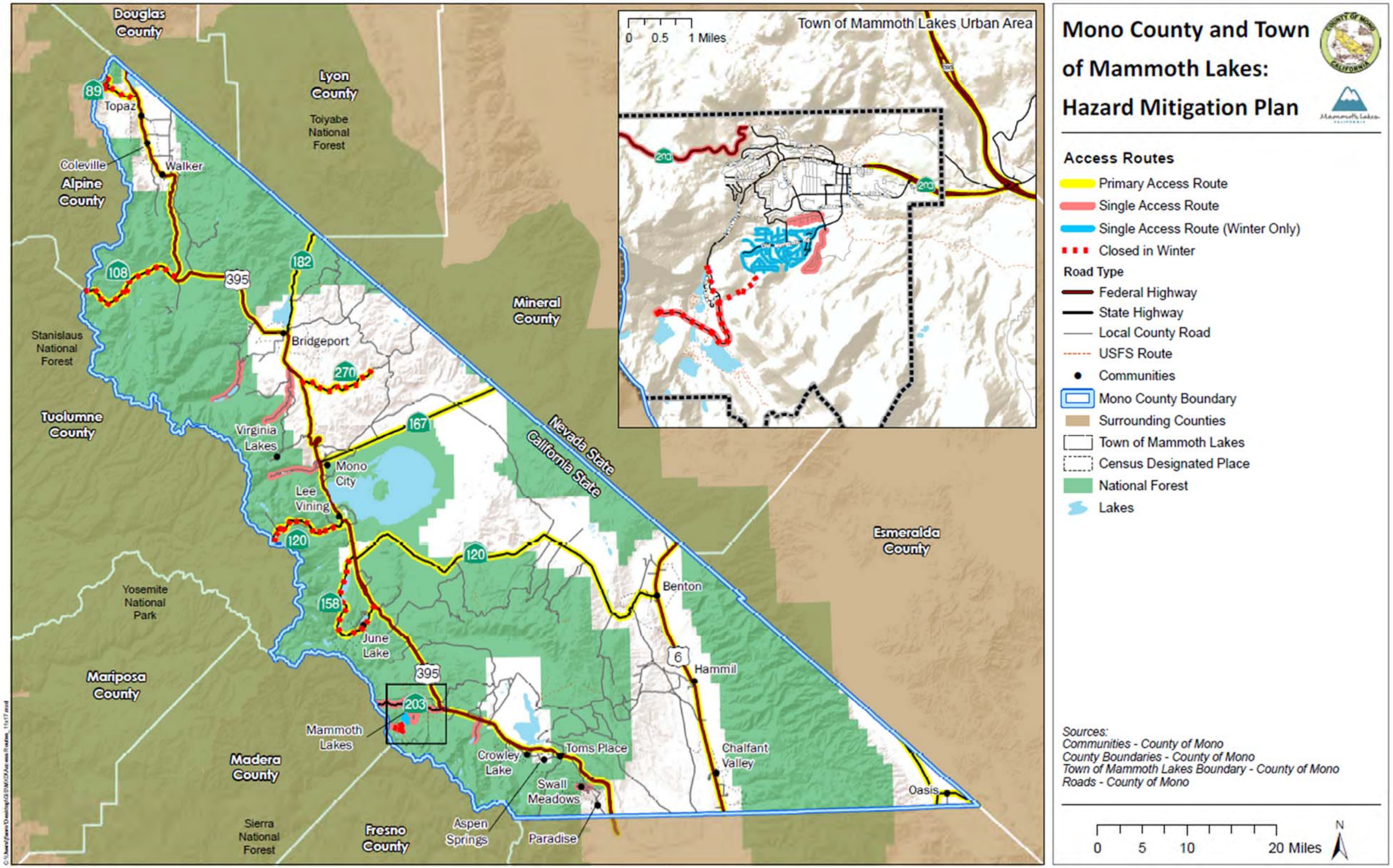
Figure 2.8: Transportation and Access for Mono County and Mammoth Lakes



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2.6.3 Water

Water and sewer services for unincorporated Mono County are provided by a variety of special districts and mutual water companies. Special districts for water distribution include June Lake Public Utility District, Lee Vining Public Utility District, and Bridgeport Public Utility District. Most of these districts depend primarily on groundwater wells or a mix of surface and groundwater wells for water supply. According to the Mono County General Plan, a number of these districts struggle to maintain aging piping and sewer treatment facilities, thereby threatening the quality and supply of water to their service areas.

Areas not served by these districts rely on private groundwater well systems and small septic systems. The LADWP has significant rights to surface water in the Mono Basin. The LADWP operates an extensive aqueduct system over thousands of acres of land; it diverts water that previously flowed into Mono Lake to the City of Los Angeles. All water coming out of the Mono Basin is heavily regulated by the state. In recent drought years, the lake's water levels have dropped precipitously, threatening the county's agricultural industry and the ecosystem of the basin.

The Mammoth Community Water District (MCWD) supplies water to the Town of Mammoth Lakes from two sources: diversions from Mammoth Creek, which spills from Lake Mary (in the Lakes Basin), and from various wells around the Town. The MCWD's 5.7-square-mile service area lies entirely within the Town of Mammoth Lakes' incorporated boundary; most of the service area is within the much smaller urban growth boundary, which spans approximately 4 square miles. There are approximately 2,500 acres of private land within the service area. Most of the lands outside of the Town urban growth boundary are publicly owned federal lands managed by the US Forest Service's Inyo National Forest.

The MCWD's existing sources of water include surface water, groundwater, recycled water, and savings from water conservation (demand management) measures. The MCWD stores and diverts Mammoth Creek surface water at Lake Mary. Groundwater supply comes from nine production wells within the Mammoth Groundwater Basin. Delivery of recycled water meeting Title 22 water standards for unrestricted irrigation use began in 2010. The MCWD operates three treatment plants and one wastewater/recycled water treatment plant (MCWD 2017).

2.6.4 Energy

Electricity infrastructure in Mono County is available in all community areas. The electricity network is critical for public health and safety, and the availability of electrical service is crucial after a disaster has occurred. This infrastructure may itself pose a hazard, such as the risk of downed power lines sparking a wildfire.

Electricity in Mono County is provided by three different agencies: Southern California Edison (SCE), a privately owned utility company, serves most of Mono County, including all of Mammoth Lakes, and all unincorporated community areas with the exception of Coleville and Walker. Coleville and Walker are provided electricity as well as other utility services by Liberty Utilities, which operates within a service area that includes a region surrounding Lake Tahoe, including portions of El Dorado, Alpine, and northern Mono Counties. The southeastern tip of Mono County is served by Valley Electric Transmission, a member-owned electric utility that primarily operates in Nevada.

All three electricity providers receive their power from a variety of sources, including renewable energy, fossil fuels, and hydroelectric facilities. Mono County has nine power plants as identified by the California Energy Commission's 2017 Annual Generation list. These include five hydroelectric facilities and three geothermal power plants. All of the hydroelectric facilities are fairly small, producing just over 21 megawatts of power, and are owned by SCE and LADWP. The geothermal operation, which includes three plant units near Mammoth Lakes in the unincorporated county, is owned by Mammoth Pacific LP.

Power is delivered through a network of power lines and facilities called substations. Mono County has three major power transmission lines, owned by SCE. One line runs parallel to US 395 in the southern half of the county. A second line connects from Nevada in mid-county and rounds south to meet the first. A third, smaller transmission line runs between and connects the two. There are 13 substations in Mono County, which convert high-voltage electricity carried by transmission lines to lower-voltage electricity that can be used by homes and businesses. Because of their remote location, Mono County and Mammoth Lakes rely on a limited electricity network. Any disruption to the two major power transmission lines or to the substations could cause a large and potentially countywide blackout. The loss of electric power due to failure of overhead power lines, as a result of natural hazards such as wildfire, wind, and avalanche, is one of the most frequent impacts on Mono County and Mammoth Lakes communities.

There is no natural gas service in the county and many households and businesses utilize propane for heat, cooking, and backup power generators. While propane is an adaptable and easily transportable power source, it may create new hazards in the county as accidents in transport, construction activities, heavy snow, or fires can cause propane leaks and related hazardous incidents such as intense fires near structures. A large number of residents also utilize wood stoves and pellet stoves for heating, which can also pose fire hazards.

3. HAZARDS ASSESSMENT

This chapter provides an overview of the types of hazard events in Mono County and Mammoth Lakes, including past hazard events and how these hazards may change in the future. This chapter also discusses the process used by Planning Team members to identify and prioritize hazards.

3.1 Hazard Analysis

3.1.1 Hazard Identification

FEMA's Hazard Summary Worksheet is a resource provided for communities in the agency's *Local Mitigation Planning Handbook* guidance document (FEMA 2013). The worksheet identifies 21 different hazards that local governments may wish to consider when conducting hazard mitigation planning efforts. Some of these events will not occur in Mono County or Mammoth Lakes because the necessary attributes for these events to occur are not present in the community (sea level rise, for example). The Planning Team reviewed a comprehensive list of hazards during its September 29, 2017, meeting, including the hazards in FEMA's guidance and additional hazards suggested by Planning Team members. This discussion resulted in identification of the hazards that pose a potential risk to Mono County and Mammoth Lakes. **Table 3.1** summarizes the Planning Team's discussion of each hazard and shows which hazards were identified for inclusion in this MJHMP. Wildfire is discussed in Chapter 7 as part of the Community Wildfire Protection Plan.

Table 3.1. Mono County and Town of Mammoth Lakes Hazard Identification

List of Hazards	In Hazard Area? Mono County	In Hazard Area? Town of Mammoth Lakes	Discussion Summary
Agricultural Pests	No	No	The 2014 *Crop and Livestock Report* does not mention any specific agricultural pests of note.
Avalanche	**Yes**	**Yes**	Avalanches occur in the mountainous areas of the county, affecting portions of Mammoth Lakes, several unincorporated communities, and several important access roads.
Coastal Erosion/Bluff Failure	No	No	Not applicable. Mono County and Mammoth Lakes are not coastal communities.
Coastal Storm	No	No	Not applicable. Mono County and Mammoth Lakes are not coastal communities.
Dam Failure	**Yes**	No	The county is susceptible to inundation caused by failure of dams owned by SCE, LADWP, and other private entities, and have experienced warnings of potential dam failure in the recent past.
Disease and Pest Management	**Yes**	**Yes**	Invasive pests have the potential to damage trees; mosquitoes have the potential to spread disease.
Drought	**Yes**	**Yes**	Mono County and Mammoth Lakes both depend on groundwater and surface water, which are susceptible to drought.
Earthquake and Seismic Hazards	**Yes**	**Yes**	Mono County and Mammoth Lakes are susceptible to earthquake ground shaking, and certain areas may also experience liquefaction, fault rupture, and tectonic subsidence.
Expansive Soils	No	No	Not applicable. Expansive soil issues are not prevalent in the county.
Extreme Heat	No	No	Extreme heat that could be life endangering is not an issue in the county due to its high elevations.
Flood	**Yes**	**Yes**	The town and the county have 100- and 500-year flood zones, as mapped by FEMA.
Hailstorm	No	No	The Planning Team did not identify any local hailstorms of note.

List of Hazards	In Hazard Area? Mono County	In Hazard Area? Town of Mammoth Lakes	Discussion Summary
Hazardous Materials	**Yes**	**Yes**	The county and the town contain properties and transportation corridors with the potential for hazardous materials spills. This hazard will be discussed in association with propane explosions, a related human-caused hazard.
Human-Caused Hazards	No	No	With the exception of human-caused hazards related to hazardous materials, this Plan focuses on natural hazards.
Hurricane	No	No	Not applicable. Mono County and Mammoth Lakes are not coastal communities.
Landslides (Geologic Hazards)	**Yes**	No	The conditions for landslides are present near the hills and mountains of the unincorporated county, but not near Mammoth Lakes.
Land Subsidence	No	No	Not applicable. There are no historical or expected occurrences of non-tectonic subsidence in the county. Tectonic subsidence is addressed in the Earthquake section.
Sea Level Rise	No	No	Not applicable. Mono County and Mammoth Lakes are not coastal communities.
Severe Winter Weather and Snow	**Yes**	**Yes**	Severe winter storms and heavy snow frequently block roads, lead to dangerously low temperatures, and can affect utility services. These are frequent impacts for both Mono County and Mammoth Lakes. This hazard will be discussed with other winter weather effects including extreme cold.
Tornado	No	No	There are no recorded tornado hazards in Mono County or Mammoth Lakes.
Tsunami	No	No	Not applicable. Mono County and Mammoth Lakes are not coastal communities.
Volcano	**Yes**	**Yes**	The county and the town are located in volcano hazard areas.
Wildfire	**Yes**	**Yes**	Wildfire hazards are a significant issue in this part of California.
Wildlife Collisions	**Yes**	**Yes**	Wildlife vehicle collisions are a common road hazard in the county, especially along US 395.

List of Hazards	In Hazard Area? Mono County	In Hazard Area? Town of Mammoth Lakes	Discussion Summary
Wind	**Yes**	**Yes**	The county and town are subject to high wind events, especially on exposed and high-altitude roadways, making travel hazardous, as well as downing power lines and causing electricity outages.
Windstorm	**Yes**	**Yes**	The county and town are exposed to high wind events. This hazard will be combined with wind.
Climate Change*	**Yes**	**Yes**	Climate change is not profiled as a distinct hazard, but rather a phenomenon that could exacerbate other hazards. Climate change will be considered as a factor for relevant identified hazards.

Some of the hazards addressed in this Plan combine multiple FEMA-identified hazards for organizational purposes. The Planning Team identified and prioritized 12 hazards that may impact Mono County and Mammoth Lakes, as shown in **Figure 3.1**.

Figure 3.1. Priority Hazards

3.1.2 Hazard Prioritization

The Planning Team used a Microsoft Excel–based tool to prioritize the identified hazards by assigning each hazard a ranking based on probability of occurrence and potential impact. These rankings were assigned based on group discussion, knowledge of past occurrences, and familiarity with the county's and town's infrastructure vulnerabilities. Four criteria were used to establish priority:

- Probability (likelihood of occurrence)
- Location (size of potentially affected area)
- Magnitude (intensity of damage)
- Secondary Impacts (severity of impacts to community)

A value of 1 (low) to 4 (high) was assigned by each team member for each hazard/criterion pairing. The four criteria were then weighted based on the Planning Team's opinion of each criterion's importance. **Table 3.2** presents the results of this exercise, and shows the average ranking for each hazard among the Planning Team members and reflects the team's rating of the relative importance of the identified hazards in order to focus mitigation efforts. The table sorts rankings from highest to lowest. As shown, wildfire, winter-weather related hazards, and earthquake-related hazards were highest rated, followed by volcano, climate change effects, and drought. The hazards in **Table 3.2** are consistent with the hazards identified as having potential to occur in the county and town, as shown in **Table 3.1**.

Table 3.2. Mono County Hazard Ranking Worksheet Outcomes

Hazard Type[1]	Probability	Impact			Overall Rank
		Location	Primary Impact	Secondary Impacts	
Wildfire	3.7	3.1	3.1	3.4	3.4
Severe Winter Weather & Snow	3.9	3.6	2.6	2.7	3.2
Earthquake & Seismic Hazards	2.6	3.0	2.9	3.0	2.9
Volcano	1.1	2.7	3.7	3.6	2.8
Climate Change	2.3	3.3	2.3	3.0	2.8
Drought	2.7	3.3	2.0	2.3	2.6
Severe Wind	2.9	2.6	2.3	1.9	2.4
Flood	2.6	2.4	2.1	1.9	2.3
Landslide	2.6	2.6	1.9	1.9	2.2
Avalanche	2.6	1.7	2.0	2.1	2.1
Dam Failure	1.1	1.7	2.4	2.9	2.0
Hazardous Materials	2.1	2.3	1.4	1.8	1.9
Disease/ Pest Management	1.0	2.0	1.7	1.7	1.6

1: Wildlife collisions were added as a priority hazard after the Planning Team completed the hazard ranking worksheet and are therefore not included in this table.

3.1.3 Climate Change Considerations

Climate change is expected to exacerbate existing hazards in the county and town. As such, the Planning Team determined that it would be best to discuss climate change considerations throughout all applicable hazard profiles.

3.2 Hazard Profiles

For each hazard, a hazard profile is established to provide a general description of the hazard. The profile will also describe what locations the hazard is likely to affect as well as the potential magnitude of hazard events. Location will be discussed in terms of the following:

Land Ownership: The ownership of land and development affected by a hazard is an important consideration for the County and Town in order to develop effective policies and mitigation measures. Measures for County-owned properties and facilities will be quite different than for those on private property or those under the jurisdiction of federal agencies with their own policies and procedures. A countywide snapshot of land ownership and locations is found in Chapter 2.

Planning Areas and Urban Communities: The specific urban communities and their unique geographic, economic, and political characteristics are important considerations for the County and Town in order to develop effective policies and mitigation measures. Planning areas and their urbanized communities will be identified and considered in the risk assessment. The locations and economic and political settings of the planning areas and urban communities are discussed in Chapter 2.

History: Historic events lead into understanding what locations are at risk and the magnitude of impacts likely to occur. Each profile thus includes a description of major hazard events in recent history, and, to the extent possible, a complete listing of hazard events by date and location.

Future Conditions: Changes to hazard area or magnitude may occur as the result of new development, new infrastructure, and, most significantly, climate change. How these changes could affect hazards is discussed briefly. A fuller analysis of potential changes in risk and vulnerability due to climate change can be found in the Risk Assessment, in Chapter 4.

Hazard profile information for wildfire is contained in Chapter 7 as part of the Community Wildfire Protection Plan (CWPP). For hazard description and climate change considerations, no meaningful difference exists between Mono County and Mammoth Lakes. For the remaining topics (location and magnitude, hazard history/past occurrences, and risk of future hazard), specific information is provided for both the county and the town.

3.2.1 Avalanche

Hazard Description

Avalanches consist of falling and sliding snow. There are two main types of avalanches: a surface avalanche and a full-depth avalanche. A full-depth avalanche is more severe than a surface avalanche because there is more snow involved and the snow slides over the ground.

Avalanches are a threat on moderately steep slopes in Mono County, particularly along the eastern face of the Sierra Nevada in areas that receive significant amounts of snow. Most avalanches begin on slopes of 25 to 35 degrees; very steep slopes do not accumulate enough snow to pose a threat. Numerous factors contribute to unstable snow conditions, including snowpack structure, snow density, temperature fluctuations, wind speed and direction, and precipitation intensity. Avalanches in Mono County may affect communities, residents, and visitors.

Location and Magnitude

Information on previous avalanche occurrences in Mono County is available from a variety of sources including NOAA's Storm Center Data, the Eastern Sierra Avalanche Center, and news archives. The Eastern Sierra Avalanche Center, which is staffed by hydrologists and supplemented by volunteers and guest posts to record recent and real-time observations, reports areas that appear to be at avalanche risk, predominantly in backcountry locations, throughout the year. Avalanches are very frequent in the backcountry as well as popular ski areas with recreational infrastructure and frequent visitors. There are two triggers for avalanches: natural triggers and artificial (human-initiated) triggers.

Mono County

In 1986, the County conducted a study using impact pressure criteria and return intervals for large avalanches to identify avalanche hazard zones near existing communities. The study identified specific areas at risk from avalanche runout, broken out into two categories, 'Moderate' and 'High.' These zones are identified on the County's General Plan maps, which are available online. Because of the age of the studies and advances in avalanche modeling, these studies may not be considered current or accurate. Nonetheless, the 1986 study along with NOAA's Storm Center Data and the Eastern Sierra Avalanche Center data can provide a strong indicator of areas that are likely to be affected by avalanches.

As identified in **Table 3.3**, avalanche hazards are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes. **Table 3.3** identifies the communities most affected by avalanche hazards. Mono County has many roads that cross under significant avalanche paths. Roadway sections historically threatened by avalanches include portions of Lower Rock Creek Road;

US 395 at the community of Long Valley northwest of McGee Creek, Wilson Butte, and north of Lee Vining; SR 158 entering June Lake; and several county roads entering eastern slope community areas. County equipment operators, residents, and tourists utilize these roads year-round. During winter months, significant snowstorms can create serious avalanche conditions which pose risks to communities in avalanche outflow zones, anyone traveling on sections of certain roads, and recreational users in ski areas or mountainous backcountry areas. No deaths from avalanches have been recorded in Mono County since 2006, according to Avalanche.org, an online database which consolidates data from professional forecast centers to provide real-time avalanche information. However, avalanches have caused numerous road closures, power outages, and damage to property.

Table 3.3. Avalanche Hazards by Community Planning Area

Community Planning Area	Avalanche Hazard
Antelope Valley	None Identified
Benton Valley	None Identified
Bodie Hills	None Identified
Bridgeport Valley	Yes; Twin Lakes Area
Chalfant Valley	None Identified
Hammil Valley	None Identified
June Lake	Yes; several areas
Long Valley	Yes; several areas
Mammoth Vicinity	Yes; several areas
Mono Basin	Yes; several areas
Oasis	None Identified
Sonora Junction	None Identified
Swauger Creek	None Identified
Upper Owens	None Identified
Wheeler Crest	Yes; Swall Meadows
Development Outside Community Planning Areas	Yes; Virginia Lakes, Lundy Canyon
Sources: Mono County LHMP 2006; NOAA 2017; Eastern Sierra Avalanche Center 2017	

Avalanches threatening developed community areas in Mono County originate on public lands managed by the US Forest Service. Mammoth Mountain Ski Area and June Mountain Ski Area each contain avalanche zones that are routinely monitored and controlled by the ski patrol. Although ski and backcountry avalanches are common, they are not the focus of this assessment due to minimal mitigation measures that are possible. Consequently, assessment focuses on urbanized areas.

Town of Mammoth Lakes

Portions of Mammoth Lakes are within avalanche outflow areas. In 1997, the Town adopted a Snow Deposition Design Zone where avalanche potential hazards have been found to exist. A survey of this area was conducted in 1995, triggered by a proposed development referred to as "The Bluffs," which indicated that the area is subject to naturally triggering avalanche. The southwest area of town, situated east and down slope of Mammoth Pass, was identified as being at high risk of avalanche due to the steepness, geologic shape, and orientation of the mountain as well as prevailing winds that create conditions that result in avalanches. Although no other specific avalanche studies have been conducted for outside of The Bluffs, avalanche hazards likely extend to much of the southwestern side of the town in proximity to Mammoth Pass and other similarly facing slopes.

Other areas known to be at risk from avalanche outflow from Mammoth Mountain and Mammoth Pass include the Knolls and Sherwin areas, and along much of the entire extent of Lake Mary Road. Much of the Mammoth Mountain Ski Area is also within the hazard area.

Hazard History

The information below addresses avalanches that occurred in or adjacent to developed areas. Most avalanches in the county occur far outside development areas, and most incidents involve skiers or hikers that travel into undeveloped mountainous areas. The information available is often limited and usually does not include details of the hazard event or monetary estimations of the economic damages.

Mono County

- **Mammoth Lakes:** An avalanche on March 3, 2018, occurred at the Mammoth Mountain Ski Resort. There were no missing persons or injuries, and the resort was reopened the next day.
- **Bridgeport Valley:** There have been at least 15 incidents of damage to buildings and other structures during the last 40 years, including 4 fatalities in the Twin Lakes Area. Destructive avalanches occurred in 1969, 1978, 1982, and 1986. In 1998, the Mono County Sheriff's Office reported that avalanches occurred in several places along US 395 near Bridgeport, resulting in highway closures. In 2005, a Sheriff's Department snow cat was destroyed in an avalanche. In 2006, three skiers were caught in a slab avalanche while crossing an open area on their way to Mt. Walt west of Twin Lakes; one of the skiers was killed in the accident.

- **June Lake:** Until North Shore Drive was constructed into June Lake as a secondary access route, SR 158, the main access into June Lake, was periodically closed due to avalanches, avalanche danger, or avalanche control; recent events occurred in 2014, 2016, and 2017. The community has also had to evacuate some parts of town following several big storms. According to the Eastern Sierra Avalanche Center, an avalanche was reported on Carson Peak in 2016 and on the slope between Hourglass and Negatives Bowls in 2017.
- **Long Valley and Crowley Lake:** Avalanches originating from McGee Mountain have extended across US 395. In 1992, an avalanche hit a barn, destroying the barn and killing two horses. On February 22, 2017, the Sheriff's Office reported an avalanche in Long Valley, in the area of Crowley Lake Drive north of McGee Creek. An avalanche in heavy snow storms of 2017 resulted in closure of US 395, damaged a house, and took out electrical power in Crowley Lake and the surrounding communities of Long Valley.
- **Wheeler Crest:** A major dry-snow avalanche occurred in 1969 in Swall Meadows. A number of avalanches have occurred in the Sherwin Range, near Swall Meadows, including in 1986 and 2005. The 2005 avalanche was in the Sherwin Range and set off by a backcountry snowboarder; there was one injury. Avalanche risk also exists on the Lower Rock Creek access road from a number of small east-facing paths that descend directly onto the road.
- **Mono Basin:** Several large avalanche paths are known to extend east of US 395 approximately 1 to 2 miles north of Lee Vining. In 2001, 2005, and 2006, the highway was closed due to avalanches; there were no injuries or fatalities. Discussion with local residents indicates that seven buildings were destroyed there during two separate avalanches in the 1960s and 1970s near Lundy Lake. According to the Eastern Sierra Avalanche Center, an avalanche was triggered by a skier in 2017 on the eastern slope of Mt. Olsen.
- **Outside of the Community Planning Areas:** Virginia Lakes is primarily a seasonal residential area and is not regularly used during winter when the access road is not plowed. Seven buildings on the north side of the Virginia Lakes access road were destroyed by a large avalanche in 1982. In 1986, a large avalanche extended its path through a forest on the flat bottom of the valley before stopping on the south edge of Virginia Lakes Road. Lundy Canyon, west of Mono City, is also prone to avalanches.

Town of Mammoth Lakes

The Town of Mammoth Lakes also has a history of multiple avalanches occurring nearby. During the winter of 1983, avalanches destroyed many cabins at Lake Mary, Mammoth Knolls, and in the Mammoth Lakes Basin. That same year, a mud and snow slide damaged two homes on Forest Trail near Canyon Lodge, forcing residents to evacuate. A large avalanche in 1986 involved the whole bluff area south of Tamarack Street. Although there was no documented damage, the slide was observed to stop just short of several residences. In 1992, an avalanche in Old Mammoth killed a snowboarder and a dog. According to the Eastern Sierra Avalanche Center, avalanches were reported in Mammoth Bowl in 2013; in 2017, an avalanche was triggered by a skier above Lake Mary Road.

Avalanches are also a major concern for the Mammoth Mountain Ski Area. The resort is extremely important for the town's economy and employs many of its residents. The last recorded death in the ski area occurred in 1980, but several other major avalanches since then have resulted in injuries and near fatalities. For example, in 2008, the *Mammoth Times* newspaper reported that an avalanche occurred at the Mammoth Mountain Ski Area during the early afternoon on Tuesday, December 16. The newspaper reported that the avalanche, in the Dragon's Tail area above Chair 9, was triggered by ski patrol performing avalanche control duties. According to the newspaper, a small, 2-foot crown broke above the ski patroller. As a result of the avalanche carrying him down the mountain and into a tree, the patroller suffered cracked or broken ribs. An avalanche triggered in March 2018 on Mammoth Mountain caused closure of both ski resorts and several rescue efforts, though there was no damage to property and only minor injuries sustained. While no major incidents have occurred in the area yet, the Sherwin area, with runout to Snow Creek V, could be a problem for future development identified as part of the Snowcreek Master Plan.

Risk of Future Hazards

Given the past avalanche events in Mono County and the Town of Mammoth Lakes and the expected continuation of winter storms, it is very likely that avalanches will continue to occur in the high mountain areas. The risk is higher in unincorporated county areas and mountainous areas than the incorporated town; however, vulnerable highways in all areas of Mono County will continue to be of primary concern. The factors that contribute to avalanches are unlikely to decrease to any substantial degree.

Climate Change Considerations

According to the National Snow and Ice Data Center (NSIDC 2016), 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. Although research on the topic is sparse, some have suggested that warmer temperatures and increases in early calendar year rainfall can increase the conditions under which avalanches are likely to occur (Bellaire, Jamieson, and Statham 2013).

3.2.2 Dam Failure

Hazard Description

Dam failure occurs when a dam structure or its foundation is damaged to such a degree that the dam partially or completely loses its ability to hold back water. When this happens, some or all of the water impounded by the dam is suddenly released, causing a very fast-moving flood downstream of the dam. Like other flash floods, dam failures can cause widespread injury or loss of life, extensive property damage, and displacement of large numbers of people in the flood's path. If the failed dam is part of a water supply network, a dam failure may also cause local and regional disruption to water service if there is no sufficient alternative supply.

Dams can fail for a variety of reasons. Seismic or geologic hazards, such as earthquake shaking or a landslide, may damage the dam or its foundations, causing it to weaken to the point of failure. During intense rainfalls, the dam itself or the surrounding rock can erode sufficiently to cause a failure. Additionally, the dam itself may be poorly sited, designed, or maintained, and so may collapse independent of any other hazard event. At times, these factors can work together, such as if a design flaw in a dam causes the floodwaters from an intense rainfall to erode parts of the dam and lead to a failure.

Location and Magnitude

Dam failure hazards are anticipated to affect unincorporated Mono County, but not the Town of Mammoth Lakes. The town is not located within the inundation zone of any dam, as shown in **Figure 3.2**.

Mono County

There are 22 dams in unincorporated Mono County. In addition, Rock Creek Lake Dam, in Inyo County, is located upstream of properties located in Mono County**. Table 3.4** lists these dams. None of the dams in the county is sizable enough to be considered a major dam.

Table 3.4. Mono County Dams

Name	Owner	Purpose(s)	Capacity (acre-feet)	Year Built
Agnew Lake	SCE	Hydroelectric	810	1916
Black Reservoir	Bently Family, LP	Water Supply	185	1905
Bridgeport	Walker River Irrigation District	Water Supply	44,100	1924
Gem Lake	SCE	Hydroelectric	17,228	1917
Grant Lake	LADWP	Water Supply	47,525	1940
Lake Mamie	USFS, Inyo National Forest	--	125	--
Lake Mary	USFS, Inyo National Forest	--	125	--
Lobdel Lake	Private Entity	Water Supply	640	1948
Long Valley	LADWP	Water Supply	183,465	1941
Lower Twin Lake	Centennial Livestock	Water Supply	4,011	1941
Lundy Lake	SCE	Hydroelectric	4,113	1911
Poore Lake Reservoir	Park Livestock Company	Water Supply	1,200	1900
Rhinedollar	SCE	Hydroelectric	490	1927
Rock Creek**	USFS, Inyo National Forest	--	--	--
Rush Creek Meadows	SCE	Hydroelectric	5,277	1925
Saddlebag	SCE	Hydroelectric	9,765	1921
Sardine	LADWP	Water Supply	385	--
Tioga Lake	SCE	Hydroelectric	1,254	1928
Topaz Lake	Walker River Irrigation District	Flood Control	59,600	1937
Twin Lakes	USFS, Inyo National Forest	--	150	--
Upper Gorge	LADWP	Other	26	1953
Upper Twin Lake	Centennial Livestock	Water Supply	2,070	1905
Walker Lake	LADWP	Water Supply	540	--

** Rock Creek Lake and Dam are located in Inyo County but would impact Mono County.
-- Information not available
Source: California Department of Water Resource's Division of Safety of Dams, September 2017

The majority of dams in Mono County are owned by public utility companies. Of the 22 dams in Mono County, five are owned by private entities. Based on the available records, dams in the county were built between 1900 and 1953 and have a capacity ranging from 26 to 183,465 acre-feet.

There are eight dam inundation areas in Mono County: Agnew Lake, Bridgeport Lake, Gem Lake, Grant Lake, Rhinedollar, Rush Creek Meadows, Saddlebag Lake, and Twin Lakes. Dam inundation hazard areas cover the following locations:

- **Agnew Lake:** The dam inundation hazard area runs northeast from the Agnew Lake Dam, covers Silver Lake and Grant Lake, and ends near Mono Lake.
- **Bridgeport Lake:** The dam inundation hazard area runs north along SR 182 to the edge of Mono County.
- **Gem Lake:** The dam inundation hazard area runs northeast from the Gem Lake Dam to Agnew Lake Dam, continues to cover Silver Lake and Grant Lake, and ends near Mono Lake.
- **Grant Lake:** The dam inundation hazard area runs north from Grant Lake Dam to Mono Lake.
- **Rhinedollar:** The dam inundation hazard area runs south of SR 120 through Lee Vining to Mono Lake.
- **Rush Creek Meadows:** The dam inundation hazard area covers Gem Lake and the stream between Rush Creek Meadows Dam and Gem Lake Dam.
- **Saddlebag Lake:** The dam inundation hazard area runs south from Saddlebag Dam to Rhinedollar Dam, then travels south of SR 120 through Lee Vining to Mono Lake.
- **Twin Lakes:** The dam inundation hazard area runs north from Lower Twin Lake Dam toward Bridgeport.

Figure 3.2 shows the dam inundation hazard areas in unincorporated Mono County.

Mammoth Lakes

There are no dam inundation hazard areas identified by existing inundation mapping in Mammoth Lakes. However, three dams, at Twin Lakes, Lake Mary, and Lake Mamie, all located in Inyo National Forest, do not have mapping of inundation modeling and analysis available from the Department of Water Resources. Mammoth Creek drains the Mammoth Lakes Basin, which contains more than a dozen lakes, including the three dammed lakes. Upon collecting water from the Sierra crest, the Mammoth Creek watercourse flows downstream through Lake Mary, Lake Mamie, and subsequently into Twin Lakes. Mammoth Creek exits the Mammoth Lakes Basin at the outlet of Twin Lakes and flows along the southern edge of the Town of Mammoth Lakes. Failure of any dam could result in significant flood inundation within the Town of Mammoth Lakes urban area, affecting many structures along the creekside.

Hazard History

Mono County

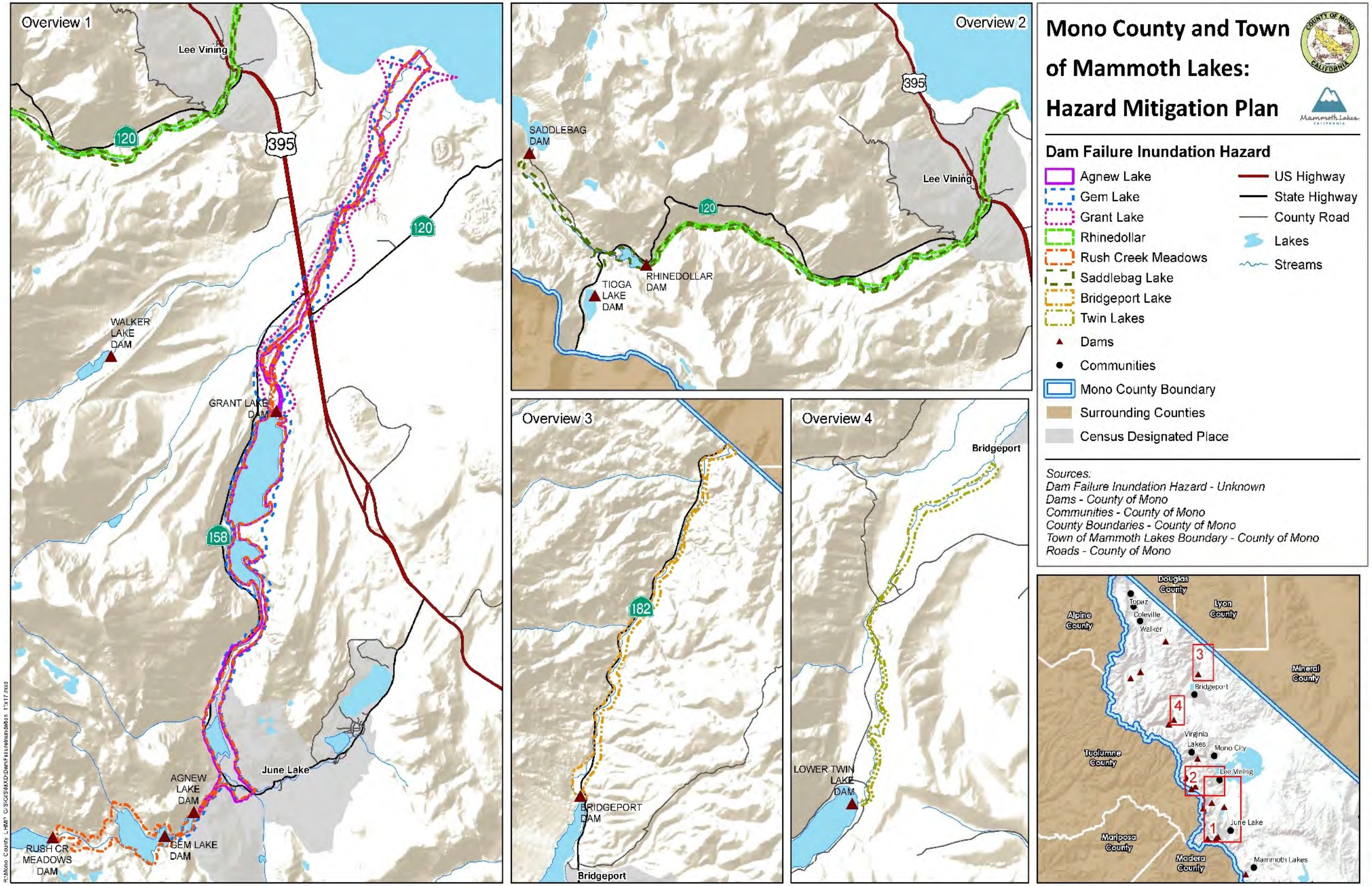
There have been no previous dam failures in Mono County. The significant snowpack over the 2016–2017 winter caused stress to the dams at Gem and Agnew Lakes. SCE installed a pump system at Agnew Lake to accommodate higher levels of water moving through the system to ensure that dams were maintained at safe levels.

According to the Mono County Emergency Operations Plan, seven dams—Lower and Upper Twin Lakes, Lundy Lake, Long Valley, Crowley Lake, Rush Creek Meadows, and Saddlebag—present some risk to downstream developed areas, anglers and recreation visitors, and people in campgrounds if dam failure were to occur. Overall, however, the dams in Mono County are not major threats.

Mammoth Lakes

There have been no previous dam failures affecting the Town of Mammoth Lakes.

Figure 3.2. Dam Inundation Hazard Areas in Unincorporated Mono County



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Risk of Future Hazards

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) maintains a database of dams in the state; critical dam safety status information includes certification, downstream hazard, and condition assessment. The condition assessment is based on definitions established by the National Inventory of Dams, as well as additional criteria identified by the DSOD. The condition assessment has five possible ratings based on the described criteria, as shown in **Table 3.5**.

Table 3.5. Dam System Condition Assessment Rating System

Rating	National Inventory of Dams Definitions	California DSOD Additional Criteria
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 applicable regulatory criteria or tolerable risk guidelines.	None
Fair	No existing dam safety deficiencies are recognized for normal loading 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.	• Dam has a long-standing deficiency that is not being addressed in a timely manner • Dam is not certified and its safety is under evaluation • Dam is restricted and operation of the reservoir at the lower level does not mitigate the deficiency
Poor	A dam safety deficiency is recognized for loading conditions that may realistically occur. Remedial action is necessary. A poor rating may also be used when uncertainties exist as to critical analysis parameters that identify a potential dam safety deficiency. Further investigations and studies are necessary.	Dam has multiple deficiencies or a significant deficiency that requires extensive remedial work
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution	None

Source: DSOS 2017

Table 3.6 shows the condition assessment result for dams evaluated in Mono County as established by the September 2017 DSOS report, "Dams Within Jurisdiction of the State of California." All rated dams were determined to be in fair or satisfactory condition, with the exception of Agnew Lake Dam, which was determined to be in poor condition, although SCE is currently working on improvements to bring this dam up to a satisfactory level. The dam inundation area for Agnew Lake Dam runs northeast from the Agnew Lake Dam, covers Silver Lake and Grant Lake, and ends near Mono Lake. Dam failure may result in impacts to Grant Lake Dam downstream.

Table 3.6. Dam Condition Assessment

Dam Name	Condition Assessment
Agnew Lake	Poor*
Black Reservoir	Satisfactory
Bridgeport	Satisfactory
Gem Lake	Fair
Grant Lake	Satisfactory
Lake Mamie	--
Lake Mary	--
Lobdel Lake	Satisfactory
Long Valley	Satisfactory
Lower Twin Lake	Fair
Lundy Lake	Satisfactory
Poore Lake Reservoir	Satisfactory
Rhinedollar	Satisfactory
Rush Creek Meadows	Fair
Saddlebag	Satisfactory
Sardine	--
Tioga Lake	Satisfactory
Topaz Lake	Satisfactory
Twin Lakes	Satisfactory
Upper Gorge	Satisfactory
Upper Twin Lake	Fair
Walker Lake	Satisfactory

Dam Name	Condition Assessment
Source: DSOS 2017 http://www.water.ca.gov/damsafety/docs/Dams%20by%20County_Sept%202017.pdf **-- Information not available** *Modifications to Agnew Dam completed in 2017 will result in the reservoir retaining less water. A new condition assessment completed at that time showed the dam could meet the criteria for a Satisfactory rating. As of December 2017, this information had been submitted to DSOD for re-classification.	

Mono County

The California Office of Emergency Services (Cal OES) maps dam inundation zones to identify the projected areas that would be subject to inundation if a dam were to fail. According to best available information, 7,025 acres are located in a dam inundation zone. **Table 3.7** shows the dam inundation area in the unincorporated county by land administration or ownership. Approximately 3,333 acres are federal lands, 2,547 acres are owned by a public utility, 523 acres are state-owned, 380 acres are privately owned, and 241 acres are unknown. While these estimates are based on the best available data, local conditions may alter the specific flood path of water from a ruptured dam. Lands in the private category are of greatest concern, as the County has land use authority over these areas. The Agnew Lake Dam Inundation Area includes approximately 105 acres of private land that could be affected by dam failure.

Table 3.7. Area of Dam Inundation in Mono County by Land Administration or Ownership

Land Administration or Ownership	Acres	Percentage of Total
Mono County		
Federal	3,333	47%
Private	380	5%
State	523	7%
Unknown	241	3%
Utility	2,547	36%
Total	**7,024**	**100%**
Mammoth Lakes		
None	--	--
Source: County of Mono 2017		

Table 3.8 shows dam inundation hazard areas by Community Planning Area. As shown, 36 percent of the dam inundation hazard areas are located outside of Community Planning Areas; 53 percent are located within the June Lake Community Planning Area, which includes the Agnew Lam Dam inundation area; 5 percent are located within the Bridgeport Community Planning Area; and 5 percent are located within the Mono Basin South Community Planning Area.

Table 3.8. Area of Dam Inundation in Unincorporated Mono County by Community Planning Area

Community Planning Area	Acres	Percentage of Total
Bridgeport	350	5%
June Lake	3,699	53%
Mono Basin	433	6%
Outside of the Community Planning Areas	2,543	36%
Total	**7,025**	**100%**
Source: County of Mono 2017		

Town of Mammoth Lakes

There are no dam inundation hazard areas in the Town of Mammoth Lakes.

Climate Change Considerations

Many of the factors that may affect dam inundation risk, such as seismic activity or a dam's structural soundness, are not affected by climate change. However, as discussed in the Flood section, there is some evidence that climate change may cause an increase in the number and/or severity of intense storms affecting Mono County, including rain-on-snow events that are known for causing flooding and infrastructure damage. The increase in water flow, combined with the potential for increased erosion or landslides resulting from storm activity, may increase the risk of dam failure. However, more studies are likely needed to determine the vulnerability of Mono County's dams from severe storms relative to other risks.

3.2.3 Disease/Pest Management

Because there is no distinguishable difference in magnitude of disease and pest hazards within the county, the following discussion applies to both Mono County and the Town of Mammoth Lakes.

Hazard Description

Disease and pest management hazards are caused by undesirable organisms such as insects, bacteria, and viruses that cause serious harm to plants, animals, or humans. These organisms can threaten human health by infecting people, flora, and fauna with a number of diseases, some of which are potentially fatal. Pathogenic or disease-carrying organisms may also cause widespread devastation to forests, creating safety hazards and causing both environmental damage and economic impacts. Many communicable diseases are regularly monitored by Mono County Public Health and the Centers for Disease Control and Prevention, but many are not well understood or tracked in California.

Due to the rural nature of Mono County, diseases that impact forests and those that are carried by wildlife are of particular concern, in addition to those affecting human health. Several insects and rodents can be considered hazardous in Mono County:

- **Mosquitoes** are one of the most prevalent carriers of harmful pathogens known as arboviruses, such as West Nile virus, Western equine encephalomyelitis, St. Louis encephalitis, and Zika virus. The rate of infection is extremely low in California, but the symptoms can be severe and deadly.
- **Rodents** such as squirrels and mice can be carriers of hantavirus and plague. Hantavirus is transmitted through deer mouse urine, saliva, or feces, while plague is hosted within some rodents and transmitted to humans by fleas.
- **Pandemic influenza** is caused by an outbreak of a new type of influenza virus that is different from the more common ones that can be vaccinated against. When variations in the virus occur, such as in previous avian and swine flu outbreaks, infection can spread quickly with widespread effects.
- **Fir Engraver Beetles and Jeffrey Pine Beetles**, while not a threat to human health, have infested forests throughout the Sierra Nevada. Pests of this variety inhabit trees, weakening and often killing them. Massive outbreaks of beetles can kill vast swaths of forests, which in turn can exacerbate fire hazards by increasing potential fuel sources.

Other species of insects such as ticks may also carry disease, but have not caused substantial outbreaks in Mono County.

Location and Magnitude

Disease and pest management hazards are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes, although there are no meaningful distinctions in distribution of the hazard between the two geographies. Thus, the two areas are discussed together below.

As many diseases are transmitted by mosquitoes, areas with high mosquito populations, such as bodies of water and humid environments, will be significantly more at risk. Mosquitoes are seasonal pests, typically appearing during warm months and disappearing during the winter. Invasive tree pests typically occur in the forested area, but can also affect street and private trees in the developed areas of the county. Rodent-borne diseases are more likely to be prevalent in rural areas and areas near the wildland-urban interface.

Hazard History

Cases of disease outbreak in Mono County have mostly been limited to small numbers of infections. In 2015, there was a single case of plague, with no additional infected humans or rodents found. Two cases of hantavirus also occurred in 2015, and infections in a single person occurred in 2006 and another single person in 2010.

Beetle infestations have been prevalent in the Sierra Nevada due to drought conditions, killing tens of millions of trees since 2010. These infestations are not uncommon during drought conditions, but have been significantly worse in the last several years. The magnitude and location of tree mortality as a result of beetles in combination with other factors is covered in greater depth in the Community Wildfire Protection Plan (Chapter 7).

Risk of Future Hazards

Despite ongoing abatement efforts, mosquitoes are expected to be prevalent in the warm and hot months through the foreseeable future. The county's trees and forests are also expected to be vulnerable to invasive beetles and other pests through the foreseeable future, especially as tree defenses are weakened by ongoing drought conditions.

Climate Change Considerations

Climate change is expected to substantially alter insect and disease vector habitat. Unusual climatic conditions are partly to blame for the boxelder bug infestation in 2015. Similarly, drought-stricken trees are less able to defend themselves against invasive and damaging beetles. Warmer weather and slightly milder winters may result in fewer insects dying during cold weather stints. With declining snowpack, there may be greater amounts of stagnant surface water. The combination of stagnant water and expected warmer temperatures could cause certain types of mosquitoes and other pests to become more abundant.

3.2.4 Drought

Hazard Description

A drought is a long-term water shortage caused by an extended period with below normal precipitation that can lead to a decline in available water supplies. Droughts may lead to increases in domestic water rates or the implementation of additional restrictions on water use. In severe cases, communities may not have enough available water to meet basic needs. Drought conditions can significantly harm agricultural operations, particularly in areas that grow water-intensive crops. Planted landscapes may become drought-stressed, causing them to weaken or die from lack of water. If drought conditions are severe enough, the lack of water may pose a human health risk.

Droughts also have many indirect impacts. The lack of precipitation can cause soil to harden and become less permeable so that when precipitation does eventually occur, the soil cannot absorb water as easily, potentially leading to increased flooding. Drier soil may become decompressed, increasing its susceptibility to sliding and eroding. Droughts may dry out wildland vegetation, potentially increasing the risk of fire. Water-stressed plants may also be more vulnerable to disease or pests.

Unlike most other hazards, droughts develop over a long period of time. It often takes multiple dry years to cause drought conditions, and these conditions may persist for years. Droughts are usually a region-wide hazard, and at times may extend statewide or cover multiple states. However, the location-specific impacts of a drought can depend on local conditions, including water supply systems, soil types, and land uses. As a result, two communities under similar drought conditions may experience different impacts. Droughts may also have a significant impact on communities not directly in the affected area. For example, if a community relies on imported water that travels a great distance, the community may be substantially impacted if a drought occurs at the source of the imported water, even if precipitation levels in the community itself are normal. Similarly, communities may face local drought conditions, but impacts may be minor if the community's water comes from a distant unaffected area.

Drought may also have significant impacts on groundwater supplies and quality. As droughts persist, groundwater levels may drop as recharge slows and communities withdraw more to counter the lack of surface supplies. Over time, this can result in serious impacts on the groundwater, including overdraft, subsidence, saline intrusion, and other water quality degradation.

Location and Magnitude

Drought hazards are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes. Droughts are regional in nature, although a large area such as Mono County with a wide variety of climates may experience significantly different drought conditions in different locations. No single part of Mono County, including Mammoth Lakes, is substantially more or less at risk of conditions that result in drought, although some areas may be more impacted by droughts than others.

There are multiple ways to measure the severity of different drought conditions. The US Drought Monitor Classification Scheme, shown in **Table 3.9**, combines many of these systems into a single index.

Table 3.9. US Drought Monitor Classification Scheme

Category	Description	Possible Impacts
D0	Abnormally dry	Slower growth of crops and pastures compared to normal activities.
D1	Moderate drought	Some damage to crops and pastures. Streams, reservoirs, or wells low. Some water shortages may be developing or imminent.
D2	Severe drought	Likely crop and pasture losses. Water shortages are common, leading to restrictions.
D3	Extreme drought	Major crop and pasture losses. Widespread water shortages.
D4	Exceptional drought	Exceptional and widespread crop and pasture losses. Emergency shortages develop.
Source: US Drought Monitor 2016a		

The DWR identifies 10 groundwater basins in the county: Adobe Lake Valley, Antelope Valley, Bridgeport Valley, Fish Lake Valley, Little Antelope Valley, Long Valley, Mono Valley, Owens Valley, Slinkard Valley, and Sweetwater Flat. The Long Valley basin underlies portions of Mammoth Lakes. Over the last decade (2007–2017), overall water levels in the basins have not changed significantly, although drops of 2 to 3 feet were shown for the shorter period of time between 2012 and 2016.

Hazard History

Droughts are a common feature of the climate in much of California, and many of the state's native plants and animals have evolved strategies to survive during drought conditions. The state also has an extensive water supply network that helps to reduce the impacts of droughts with the assistance of large storage reservoirs and pipes that can move water from regions with available supplies to drought-affected areas, although this system primarily benefits the urban areas of California.

Historic droughts in California occurred from 1976 to 1977, 1986 to 1992, and 2007 to 2009. The most recent drought in California lasted from 2011 to 2017 and was declared a state of emergency by Governor Jerry Brown on January 17, 2014. Near the end of the drought in 2016, nearly all of Mono County was in extreme (D3) drought, with parts in the western portion of the county, including Mammoth Lakes, in exceptional (D4) drought. A number of groundwater wells ran dry and new wells were dug during this time; four new wells were reported for Antelope Valley. Farmers in the Tri-Valley reported a drop of 5 to 6 feet in well water levels during this period.

Higher than average rainfall and snowpack in 2017 alleviated the most extreme conditions of the most recent drought, but it will take years for local water systems to fully recover.

Figure 3.3 shows statewide drought conditions in the most recent drought in 2016.

Figure 3.3. State Drought Conditions, 2016

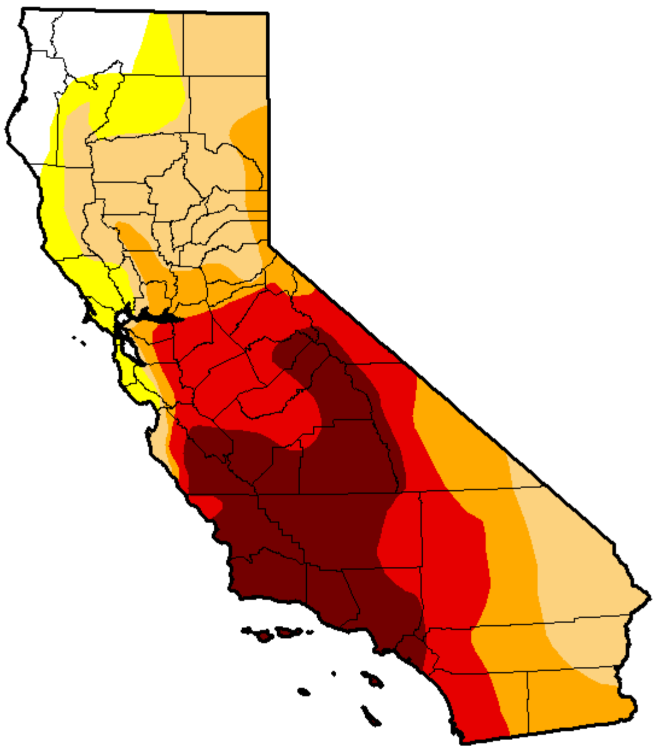
U.S. Drought Monitor

California

May 24, 2016

(Released Thursday, May. 26, 2016)

Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	5.50	94.50	86.39	61.00	42.99	21.04
Last Week 5/17/2016	5.50	94.50	86.39	63.57	42.99	21.04
3 Months Ago 2/23/2016	0.43	99.57	94.38	81.82	60.86	38.48
Start of Calendar Year 12/29/2015	0.00	100.00	97.33	87.55	69.07	44.84
Start of Water Year 9/29/2015	0.14	99.86	97.33	92.36	71.08	46.00
One Year Ago 5/26/2015	0.14	99.86	98.71	93.91	66.60	46.73

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Simeral
Western Regional Climate Center

http://droughtmonitor.unl.edu/

Figure 3.4 shows the impact of the most recent drought starting in 2013 year over year, and its recovery in 2017.

Risk of Future Hazards

As noted above, droughts are a regular feature in California. They are almost certain to continue to occur, with varying severity and duration. Mono County's numerous water systems, including community water systems and individual wells, rely on a combination of groundwater and local surface water. As a result, any local drought conditions may impact the water supply systems in Mono County and the Town of Mammoth Lakes, as there is no infrastructure to import water from elsewhere in California and, due to the location of the County in the upper portion of the watershed, there is little possibility to divert water from other areas without the cost of pipelines and pumping.

Mono County does export large amounts of water from the Mono Lake Basin and the Owens River. The Los Angeles Aqueduct supplies approximately one-third of the water for the City of Los Angeles, with the amount supplied being dependent on the amount of accumulated snow (snowpack) in the Eastern Sierra Nevada each year. In years of little snowpack, less water is delivered through the aqueduct and the City of Los Angeles must purchase additional water from the Metropolitan Water District. The LADWP 2015 Urban Water Management Plan projects 7 percent of the district's water to be obtained from Los Angeles Aqueduct deliveries in dry years, or 42 percent in average years. The California Water Code (Sections 10933 and 12924) requires the DWR to prioritize the overall importance of California's groundwater basins and sub-basins based on eight criteria, and to conduct groundwater basin assessments. The prioritization levels are very low, low, medium, high, or very high. The eight criteria are overlying population; projected growth of overlying population; public supply wells; total wells; overlying irrigated acreage; reliance on groundwater as the primary source of water; impacts on the groundwater, including overdraft, subsidence, saline intrusion, and other water quality degradation; and any other information determined to be relevant by the DWR. The DWR has determined that one groundwater basin underlying the county, the Owens Valley watershed, has a rating of medium. This basin runs alongside the White Mountains and underlies portions of the Tri-Valley communities. The other nine watersheds were ranked low or very low; this does not indicate that these basins are not at risk or that the communities they support are not vulnerable in drought conditions, only that they are not of highest priority to the state using the eight identified criteria.

Climate Change Considerations

Scientific evidence suggests that precipitation levels in California will generally decline as a result of climate change. In Mono County and the surrounding area, precipitation levels are expected to fall by up to one-third by 2100, although depending on the location in Mono County, this may translate to a decline of anywhere between 2 to 15 inches. Climate change is expected to impact the snowpack in the mountains, which normally melts slowly and provides a consistent supply of water during the summer and early autumn months before the rainy season returns. Decreases in precipitation are expected to reduce the size of the snowpack, which then also may melt faster as a result of warmer temperatures due to climate change. Overall, studies suggest that the snowpack in Mono County and surrounding areas may be reduced by more than 50 percent in some locations. Some recent studies found that the 2012–2016 drought was made worse by climate change and that climate change is likely to increase the risk of future extreme drought.

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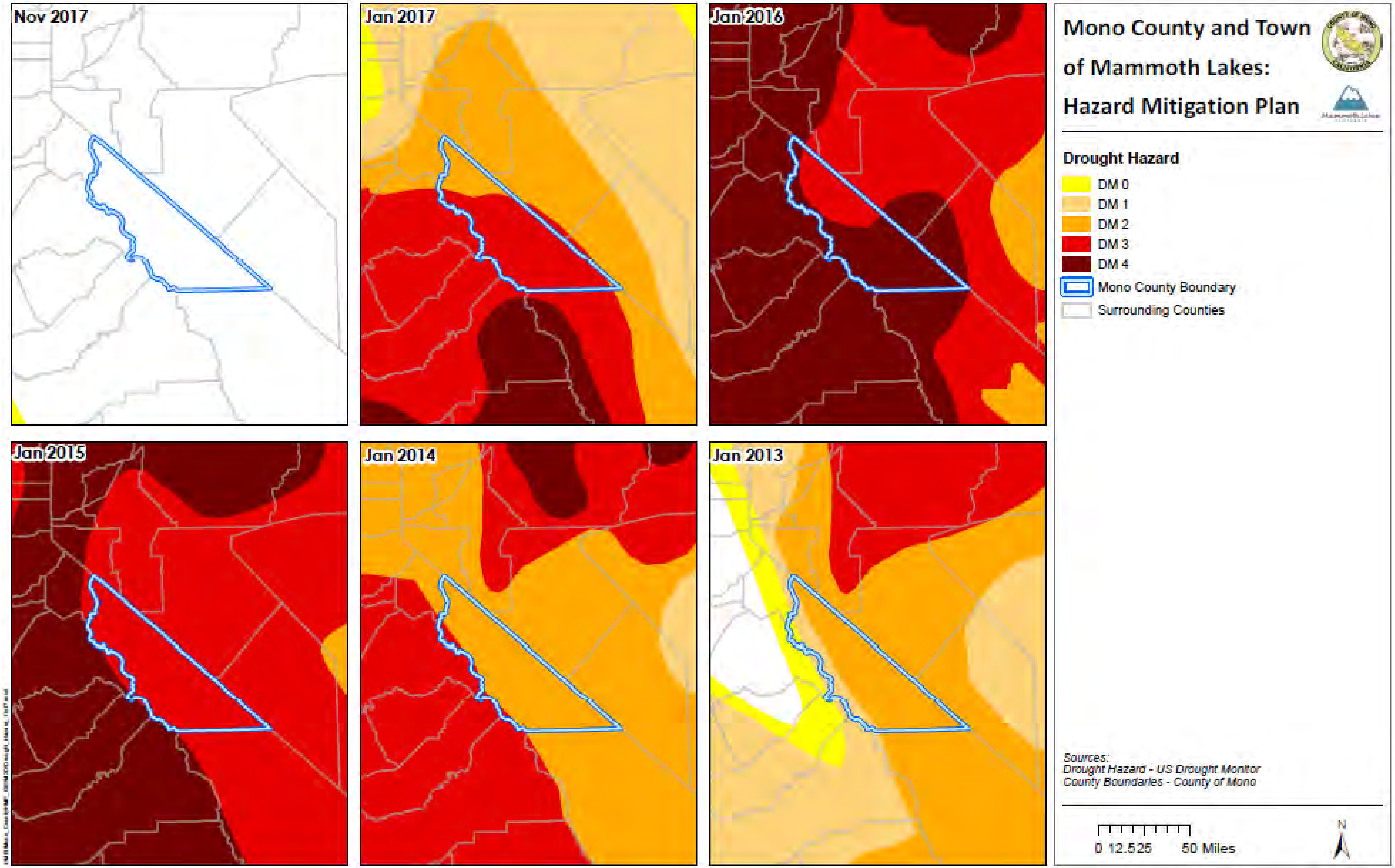
Figure 3.4. Mono County in the 2013–2016 Drought



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3.2.5 Earthquake and Seismic Hazards

Hazard Description

The category of seismic hazards includes four different but related hazard types—fault rupture, ground shaking, liquefaction, and tectonic subsidence—all of which are consequences of earthquakes. Earthquakes themselves are caused by the movement of large pieces of the earth's crust, called tectonic plates. As the tectonic plates move against each other, they can become stuck together, causing stress between the plates to build up until it eventually overcomes the friction holding them together. When this happens, the stress is released and the plates suddenly slip past each other, creating the shaking that is called an earthquake.

Earthquakes occur along boundaries called fault lines. These fault lines may be the actual border between plates, but they may also be borders between two sections of a single plate, created by the repeated process of accumulated and released stress. California sits on the boundary between the Pacific and North American tectonic plates. The motion between these plates occurs primarily on the faults of the San Andreas fault system and the Eastern California shear zone, a fault system that extends along the Eastern Sierra from Mono County south through Inyo County. About 10 millimeters per year of slip occurs on faults east of the Sierra Nevada. The eastern border of California from Mammoth Lakes heading north includes faults with poorly constrained or unknown slip rates with multiple fault strands distributed over a wide area.

Fault Rupture

Fault rupture is the actual movement of the ground's surface along a fault line when an earthquake occurs. This movement may be vertical, horizontal, or both, depending on the type of fault. Damage from fault rupture is limited to the area of the fault boundary itself, although depending on the amount of movement along the fault, the damage may be severe. Some earthquakes, known as blind thrust earthquakes, occur without causing visible surface rupture, although they may still cause substantial damage. The 1994 Northridge earthquake, one of the most damaging in California history, was a blind thrust earthquake.

Ground Shaking

Ground shaking is generally the most damaging of seismic-related hazards and is the specific hazard most commonly associated with earthquakes. The severity of ground shaking is affected by local geology, but in general it will be most severe closest to the site of the earthquake, and decrease with distance. Ground shaking may occur in an up-and-down, side-to-side, or rolling motion, depending on the type of seismic waves produced by the earthquake.

Liquefaction

Liquefaction occurs when loosely packed sand or silt is saturated with water and then shaken hard enough for it to temporarily behave like a fluid. This causes the soil to lose its strength, which may in turn damage structures built on or in it. Liquefaction risk depends primarily on the height of the groundwater table and the composition of the soil.

Tectonic Subsidence

Subsidence is when the earth's surface sinks. Fault movement is one possible cause of subsidence. As noted in the Mono County Master Environmental Assessment (MEA 2001), "The most dramatic tectonic subsidence occurs during earthquakes, when areas can drop suddenly." This type of subsidence has been observed in Mono County.

Mono County covers an area that is relatively young by geologic standards. It is located at a stress point where the earth's crustal plates are exerting opposite pressures against each other. This combination creates both "tectonic" earthquakes (e.g., land mass movement) and volcanic activity that can trigger earth shaking (e.g., magma chamber movement and lava dyke formations). Up-to-date information concerning earthquake activity in the county is available from the US Geological Survey (USGS) (www.usgs.gov). The primary seismic hazard in the county is strong to severe ground shaking generated by movement along active faults (MEA 2001).

Location and Magnitude

As identified in **Table 3.1**, earthquake hazards are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes.

Mono County

California began extensive mapping of earthquake faults with the Alquist-Priolo Earthquake Fault Zoning Act of 1972. Mapping associated with the act has identified 11 named fault zones in Mono County. These are the Fish Slough, Hartley Springs, Hilton Creek, Mono Lake, and Round Valley fault zones, as well as numerous unnamed faults in the Volcanic Tableland, within the Long Valley Caldera-Mono Lake area; the Antelope Valley and West Walker River fault zones in northern Mono County; the Robinson Creek fault zone in the Bridgeport area; the Silver Lake fault zone near June Lake; the White Mountains fault zone in the Tri-Valley area; and the Fish Lake Valley fault zone in the Oasis area. Additional faults, located outside the county, could still have impacts in the county. Taken together, these faults are capable of producing strong to severe ground shaking in virtually every populated area of Mono County. **Figure 3.5** shows Alquist-Priolo fault lines in Mono County. Note that there are other faults in Mono County that are not identified as Alquist-Priolo faults. While state law does not require these faults to be mapped, their exclusion from these maps does not mean they do not pose a risk. With the exception of the relatively small West Walker River and Silver Lake faults, all these fault zones have been analyzed as part of the Third Uniform California Earthquake Rupture Forecast (UCERF3), and the USGS has developed scenarios to explore the effects of a major earthquake on each fault.

The entire county, except for a small portion of the Sierra crest, is in an area where intense ground shaking is possible. **Figure 3.6** shows the likely affected area and intensity of shaking that would occur in the event of one possible epicenter within the county. Other USGS earthquake scenarios are discussed below.

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Figure 3.5. Mono County Alquist-Priolo Earthquake Faults and Historic Epicenters

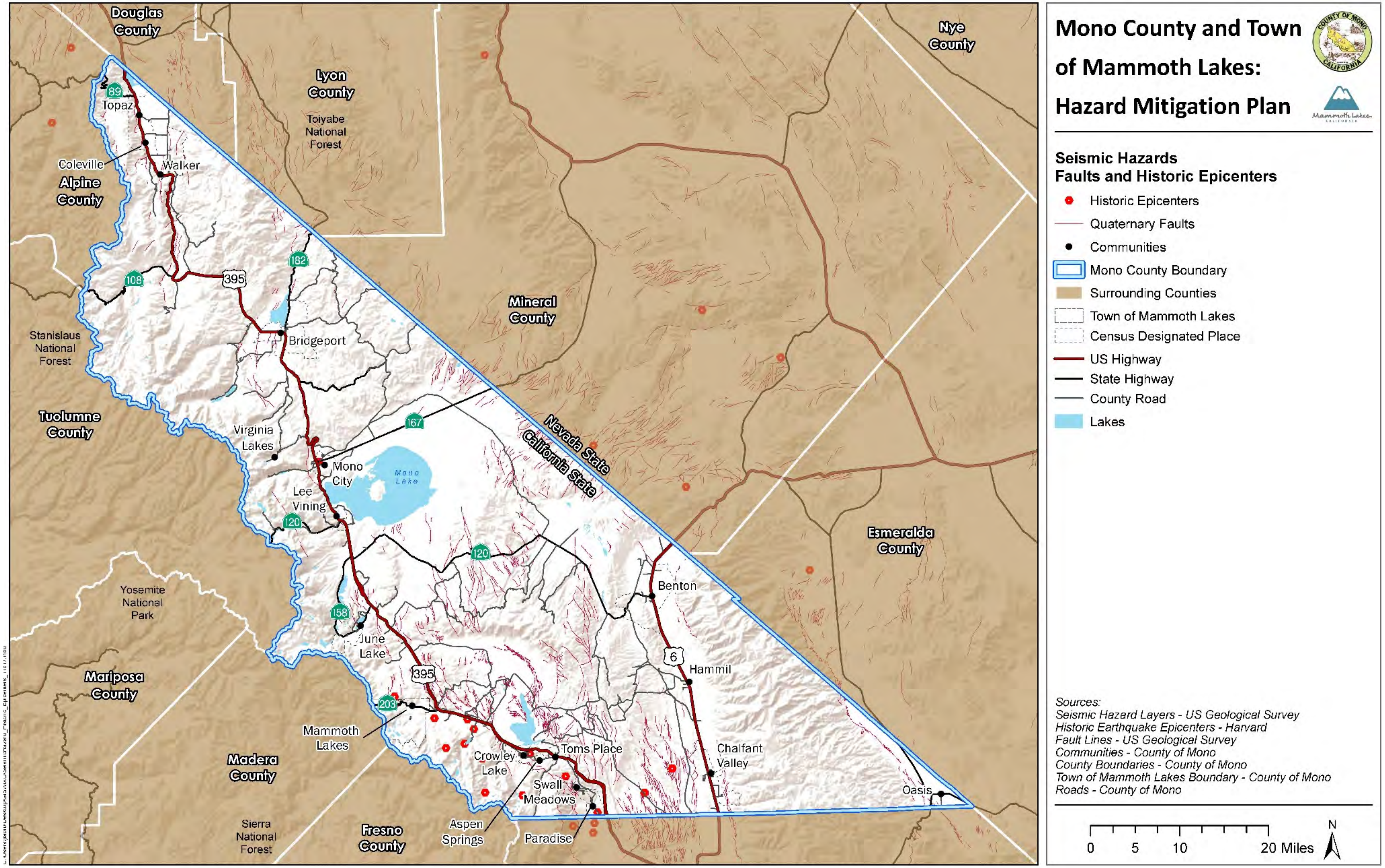

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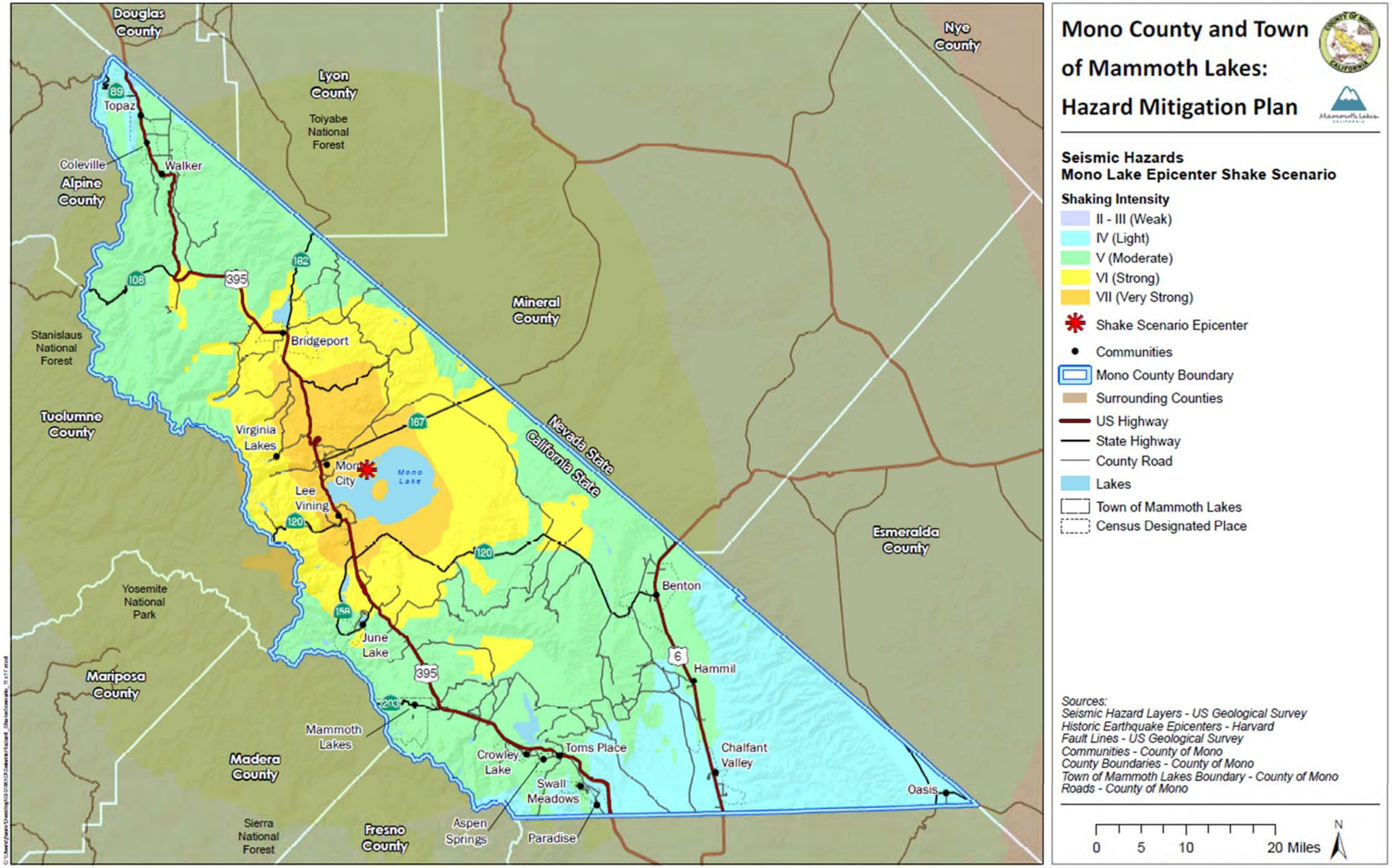
Figure 3.6. Mono County Shake Scenario



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The Mono County MEA includes the following details about where seismic hazards have been observed within the County:

- Groundshaking: "In addition to tectonic movement, the Long Valley-Mammoth Lakes region has experienced numerous earthquakes caused by the movement of magma below the earth's surface."
- Ground failure: "Ground failure induced by groundshaking includes liquefaction, lateral spreading, lurching, and differential settlement, all of which usually occur in soft, fine-grained, water-saturated sediments, typically found in valleys. During the 1980 Mammoth Lakes earthquake sequence, ground failure was prevalent at Little Antelope Valley, along margins of the Owens River in upper Long Valley, along the northwest margins of Lake Crowley, and along Hot Creek Meadow."
- Tectonic subsidence: "During the May 1980 sequence of earthquakes near Mammoth Lakes, there were several locations near the Hilton Creek Fault where the ground surface dropped about four inches on the northeast side of fractures. Along the 'Mammoth Airport fault zone,' up to 12 inches of vertical offset on the east side of ruptures was observed."

The area at risk of fault rupture is limited to areas in the immediate vicinity of a fault. **Table 3.10** shows the ownership and administration of lands affected by Alquist-Priolo fault zones in unincorporated areas of Mono County. In all, while the entire county is at risk from ground shaking, only about 56,846 acres are at direct risk of fault rupture from an Alquist-Priolo fault, or 2.8 percent of the entire county area.

Table 3.10. Areas at Risk of Fault Rupture in Unincorporated Mono County by Ownership

Land Ownership or Administration Category	Acres in Hazard Zone	Percentage of Total Ownership	Percentage of Total Mono County Area
County	13	0.6%	<0.1%
Federal	47,125	2.7%	2.3%
Private	4,993	3.9%	0.2%
State	618	0.7%	<0.1%
Utilities	3,538	5.3%	0.2%
Right of way, unknown ownership/ administration	559	6.2%	<0.1%
Total	56,846	2.8%	2.8%

Table 3.11 shows how much of the land within Alquist-Priolo fault zones lies within each of the planning areas defined by the Mono County General Plan.

Table 3.11. Areas at Risk of Fault Rupture in Mono County Planning Areas

Planning Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Antelope Valley	2,256	7.5%	0.1%
Benton Valley	1,235	3.1%	0.1%
Bodie Hills	0	0.0%	0.0%
Bridgeport	2,774	5.4%	0.1%
Chalfant Valley	20,525	34.1%	1.0%
Hammil Valley	1,745	2.6%	0.1%
June Lake	3,477	6.6%	0.2%
Long Valley	940	5.2%	<0.1%
Mammoth Vicinity	11,325	10.3%	0.6%
Mono Basin	1,070	0.5%	<0.1%
Oasis	1,591	9.8%	0.1%
Sonora Junction	371	0.3%	<0.1%
Swauger Creek	0	0.0%	0.0%
Upper Owens	207	1.3%	<0.1%
Wheeler Crest	772	13.4%	<0.1%

Mammoth Lakes

Parts of the Hartley Springs fault zone extend into the Town of Mammoth Lakes. In addition, the USGS earthquake scenarios discussed below show that a major earthquake on the Hilton Creek, Round Valley, or White Mountains faults could produce ground shaking in the town that results in slight to considerable damage.

Table 3.12 shows how much of the land within Alquist-Priolo fault zones lies within the Mammoth Lakes planning area.

Table 3.12. Areas at Risk of Fault Rupture in Mammoth Lakes

Planning Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Town Municipal Boundary	332	2.07%	0.02%
Town Urban Limit	6	0.24%	0.00%

Ground shaking is measured using either the moment magnitude scale (MMS, denoted as Mw or simply M) or the Modified Mercalli Intensity Scale. The MMS is a replacement for the Richter scale, which is still often referred to but is no longer actively used, as the Richter scale is not reliable when measuring large earthquakes (USGS 2014a). The weakest earthquakes measured by the MMS start at 1.0, with the numbers increasing with the strength of the earthquake. The strongest recorded earthquake, which struck Chile in 1960, measured 9.5 on the MMS (USGS 2015a). Like the Richter scale, the MMS is a logarithmic scale, meaning the difference in strength between two earthquakes is much larger than the difference in their measurements. For example, a 6.0 Mw earthquake is 1,000 times stronger than a 4.0 Mw earthquake and about 1.4 times as strong as a 5.9 Mw event.

The Modified Mercalli Intensity Scale is based on the damage caused by the earthquake and how it is perceived, rather than an actual measurement. When comparing multiple earthquakes, one event may have a higher Mercalli rating than another even if it released less energy, and thus was measured lower on the MMS. The Mercalli scale ranges from I (instrumental, rarely felt by people) to XII (catastrophic, total damage and lines of sight are distorted). **Table 3.13** shows a general comparison between the MMS and the Modified Mercalli Intensity Scale. Note that there is some overlap toward the higher end of the Mercalli ratings, with certain intensities produced by multiple ranges of magnitude measurements.

Table 3.13. Comparison of MMS and Modified Mercalli Intensity Scale

Magnitude (MMS)	Modified Mercalli Intensity Scale	
	Intensity	Description
1.0 to 3.0	I	Not felt except by very few persons under especially favorable conditions.
3.0 to 3.9	II	Weak: Felt only by a few persons at rest, especially on upper floors of buildings.
	III	Weak: Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

<table>
<tr><th colspan="2" rowspan="2">Magnitude (MMS)</th><th colspan="2">Modified Mercalli Intensity Scale</th></tr>
<tr><th>Intensity</th><th>Description</th></tr>
<tr><td colspan="2" rowspan="2">4.0 to 4.9</td><td>IV</td><td>Light: Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.</td></tr>
<tr><td>V</td><td>Moderate: Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.</td></tr>
<tr><td rowspan="2">5.0 to 5.9</td><td></td><td>VI</td><td>Strong: Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.</td></tr>
<tr><td rowspan="3">6.0 to 6.9</td><td>VII</td><td>Very Strong: Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.</td></tr>
<tr><td rowspan="5">7.0 and greater</td><td>VIII</td><td>Severe: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.</td></tr>
<tr><td>IX</td><td>Violent: Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.</td></tr>
<tr><td></td><td>X</td><td>Extreme: Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.</td></tr>
<tr><td></td><td>XI</td><td>Extreme: Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.</td></tr>
<tr><td></td><td>XII</td><td>Extreme: Damage total. Lines of sight and level are distorted. Objects thrown into the air.</td></tr>
<tr><td colspan="4">Source: USGS 2017</td></tr>
</table>

Hazard History

Earthquakes occur frequently in the Eastern Sierra, in Mono County, and particularly in the Long Valley area. The USGS Earthquake Catalog shows that earthquakes happen in the general vicinity weekly and almost daily, but most are under magnitude 3 and are not felt by people. There have been 145 earthquakes of at least magnitude 4.5 within 25 miles of Mono County since 1980, of which 94 had epicenters within the county borders. Of these, the largest measured magnitude 6.5 on May 25, 1980, during a sequence of earthquakes near Mammoth Lakes. Among the 46 earthquakes that measured at least magnitude 5.0, more than a third were related to the 1980 earthquake swarm and the 1986 Chalfant Valley earthquake, both of which are discussed below.

May 1980 Mammoth Lakes Earthquakes

McJunkin and Bedrossian (1980) noted the following in *California Geology* magazine concerning the 1980 earthquakes in Long Valley:

On May 25, 1980 at 0933 Pacific Daylight Time (PDT) a magnitude 6.0 earthquake (all magnitudes are from Caltech Seismological Laboratory) occurred approximately 10.5 km east-southeast of Mammoth Lakes, California (figure 1). During the next 16 minutes, four magnitude 4.1 - 5.0 shocks and one 5.5 shock occurred. This seismic activity was the beginning of an earthquake sequence that produced 72 magnitude 4.0 - 4.9 events, six magnitude 5.0 - 5.5 events and three events of magnitude 6.0 - 6.3 during the next 48 hours; thousands of magnitude < 3.9 earthquakes were generated during this same time period. The largest earthquake in the sequence was magnitude 6.3 and occurred at 1245 (PDT) on May 25. Seismic activity after this event was fairly continuous for the next three days; however, most events were less than magnitude 5.0.

Damage from earthquake shaking was most pronounced in the Mammoth Lakes community and surrounding local areas. After the first event on May 25, Mammoth Lakes was without power until noon; during this period vital community services operated from auxiliary power supplies. Most damage to buildings was nonstructural and included broken windows and water mains, cracked plaster, and fallen chimneys. Damage to shelf stock and fixtures was moderate to severe in many stores, restaurants, and motels; in addition, extensive destruction to breakable contents in homes was commonly reported. Hot Creek Fish Hatchery and Mammoth Elementary School, east of U. S. 395, also received considerable nonstructural damage from earthquake shaking. Initial damage losses to schools, other public buildings, and roads in the Mammoth Lakes region was estimated to be $2 million.

1986 Chalfant Valley Earthquake

In an interview for the previous Hazard Mitigation Plan update, Dave Hill of the USGS Long Valley Observatory noted the following concerning the Chalfant Valley earthquake in 1986:

"The Chalfant Valley earthquake (M=6.4) occurred on July 21, 1986. It was preceded by a month-long foreshock sequence that began M=2.6 earthquake on July 3 and built up to a M~5.8 (as I recall) earthquake just 24 hours before the mainshock. The area had shown virtually no previous earthquake activity (since the mid-1970s anyway). The aftershock sequence was also rather energetic including three M>5.5 earthquake (the largest was close to M~6). I think the associated damage was minimal aside from rock falls in the mountains and a number of mobile homes in the Chalfant area that were toppled from their (unstable) foundations." (Dave Hill, pers. comm.)

There has not been a significant earthquake centered in Mono County since September 18, 2004, when three 5.4 events were recorded about 15 miles east of Mono Lake within a 40-minute period. Since the last Hazard Mitigation Plan update, there have been two significant events with epicenters nearby in Nevada: February 13, 2013, in Esmeralda County, and December 28, 2016, in Mineral County.

Risk of Future Hazards

Seismologists do not know when a large earthquake will hit the Eastern Sierra again but do know that one will occur. The county's location on and near numerous faults, including several capable of causing significant earthquakes, means that the county will continue to face threats from earthquakes and related hazards.

The UCERF3 forecast, developed in 2014 by the Working Group on California Earthquake Probabilities and led by the USGS, provides estimates of the magnitude, location, and likelihood of fault rupture for more than 350 fault segments throughout the state. **Table 3.14** lists faults in the region included in UCERF3, showing the probability for earthquakes of a particular magnitude within the next 30 years. Because the faults have multiple segments in Mono County, with different probabilities for each section, the full range of probabilities is shown. Depending on the magnitude and location of the earthquake, all of Mono County, including Mammoth Lakes, may be within the substantially affected area. Three faults—Antelope Valley, Fish Lake Valley, and Hilton Creek—have a greater than 1 percent chance of causing a magnitude 6.7 or greater earthquake within the next 30 years. Faults not identified in the forecast are still capable of causing significant earthquakes.

Table 3.14. UCERF3 30-Year Earthquake Probabilities by Fault

Fault	30-Year Earthquake Probability		
	6.7+ Mw	7.0+ Mw	7.5+ Mw
Antelope Valley	1.9 to 2.4%	0.4%	-
Fish Lake Valley	2.3 to 2.7%	1.9 to 2.0%	1.7 to 1.8%
Fish Slough	0.3%	0.1 to 0.2%	< 0.1%
Hartley Springs	0.5 to 0.7%	0.2%	-
Hilton Creek	1.0 to 1.3%	0.4 to 0.6%	-
Round Valley	0.5 to 0.8%	0.6%	-
White Mountains	0.4 to 0.5%	0.2 to 0.4%	0.0 to 0.1%

Scientists have analyzed numerous earthquake scenarios for the Long Valley Caldera-Mono Lake area, which includes portions Mono County and all of Mammoth Lakes. A significant earthquake in this area would likely be widely felt throughout Mono County, and incur potentially serious impacts. A joint study by the California Geological Survey (CGS) and the USGS (USGS and CGS 2014) examined the potential consequences of significant earthquakes for the five faults in the area plus the nearby White Mountains fault, detailed below. Note that while this discusses potential impacts to Mono County through ground shaking, several faults are located in surrounding California counties or in Nevada:

- **Fish Slough Fault, magnitude 6.7**: Strong ground shaking in an area centered on Fish Slough but including parts of the Chalfant Valley (along U.S. 6) and northern Owens Valleys (along US 395 south of Bishop), extending up to 23 km from the fault trace (where the fault meets the ground surface). Severe perceived shaking and moderate to heavy potential damage limited to southern part of fault near Bishop and along U.S. Route 6 in Chalfant Valley. Maximum shaking in the Bishop area, where loose near-surface soil amplifies the shaking.
- **Hartley Springs Fault, magnitude 6.7:** Strong ground shaking in the Long Valley Caldera and the highlands between Long Valley and Mono Lake, extending up to 28 km from fault trace. Severe perceived shaking and moderate to heavy potential damage limited to small area northeast of June Lake Junction and smaller area near Mammoth Lakes.
- **Hilton Creek Fault, magnitude 6.5:** Strong ground shaking in the southern Long Valley Caldera and upper Rock Creek areas, extending up to 22 km from fault trace. Severe perceived shaking and moderate to heavy potential damage about 12 km from the fault in the hanging wall regions and 4 km in the footwall regions. Maximum shaking east of the fault and around Crowley Lake.
- **Mono Lake Fault, magnitude 6.7:** Strong ground shaking in the Mono Basin and Conway Summit areas, extending up to 32 km from the fault trace. Severe perceived shaking and moderate to heavy potential damage about 17 km from the fault in the hanging wall regions and 6 km in the footwall regions.
- **Round Valley Fault, magnitude 7.0:** Strong ground shaking in the southern Long Valley, Round Valley, and Bishop Creek areas, extending up to 35 km from the fault trace into the foothills of the White Mountains. Severe perceived shaking and moderate to heavy potential damage about 23 km from the fault in the hanging wall regions and 8 km in the footwall regions. Maximum shaking near the fault, particularly to the east.

- **White Mountains Fault, magnitude 7.35:** Strong ground shaking throughout the Chalfant and northern Owens River Valleys, extending up to 40 km from fault trace into the Long Valley Caldera and Mammoth Lakes. Severe perceived shaking and moderate to heavy potential damage about 15 km on either side of the fault. Maximum shaking extends farther on the western, valley side.

Full details for each of these scenarios are available in the joint report document.

In addition to the potential earthquake scenarios related to the Long Valley Caldera-Mono Lake area, scientists have analyzed the following scenarios for faults elsewhere in Mono County, as depicted on USGS Shakemaps:

- **Antelope Valley Fault, magnitude 7.0**: This rupture would produce severe perceived shaking (Mercalli intensity VIII) in Topaz, Coleville, and Walker, with strong shaking (Mercalli intensity VI) as far away as Bridgeport.
- **Fish Lake Valley Fault, magnitude 7.2:** This rupture would produce severe perceived shaking in Oasis, with strong shaking as far away as Chalfant Valley and Crowley Lake.
- **Robinson Creek Fault, magnitude 7.1:** This rupture would produce severe perceived shaking in Bridgeport, with strong shaking as far away as Mono Lake, Walker, and Coleville.

Climate Change Considerations

The likelihood, size, and severity of seismic events are not expected to be directly impacted by climate change. It is possible that anticipated changes to precipitation levels and storm intensity may affect groundwater aquifer levels, which could expand or contract areas of potential liquefaction in the planning area. Since the field of climate change science is dynamic, the Planning Team will review and summarize new research that occurs on this topic during the next update cycle.

3.2.6 Flood

Hazard Description

Flooding is a temporary condition in which dry land is partially or completely inundated. Flooding can happen in a variety of ways. The water levels in bodies such as streams, rivers, lakes, and reservoirs can exceed the water body's banks, causing water to overflow into nearby areas. Heavy precipitation can overwhelm the ability of soil to absorb water or of local storm drains to carry it away, causing water to build up on the surface. Flooding may also occur from infrastructure failure, such as a burst water tank or pipe. Dam inundation, a specific type of infrastructure failure flooding that occurs when a dam partially or completely collapses, is discussed separately under the Dam Failure hazard profile.

In Mono County, flooding is mainly the result of snowmelt and short, intense rainstorms when the ground is already saturated. Localized torrential rain during summer thunderstorms can produce sudden flash flooding, particularly in the Tri-Valley Area. This part of the south county is also subject to alluvial fan flooding, which occurs when runoff flows out of canyons and onto the adjacent, cone-shaped deposits of sediment. The rapidly moving water can pick up large boulders and other debris and then deposit them in runoff channels, blocking the flow of water. Flooding in alluvial fans often causes greater damage than clear-water flooding. A less common type of flooding that could potentially occur due to seiches, earthquake-generated waves within lakes and reservoirs; however, there is no evidence that seiches have occurred in Mono County in the past.

Regardless of the type of flood, a flood event can damage buildings and infrastructure both by debris carried along in the water or by the pressure of the water itself. Debris flows, which are a hazard of substantial concern in Mono County, are discussed under the Landslides profile. Floods can weaken foundations and wash away soils, increasing the risk of damage or destruction. According to California's Multi-Hazard Mitigation Plan, floods are the second most common disaster type in California, second only to fires (CNRA and Cal OES 2012). Flood severity is generally described in years, such as a 100-year event. This does not mean that such an event only occurs once every 100 years, but that the risk of such an event is 1 percent in any given year. Similarly, a 500-year flood event is one where the risk of such an event is 0.2 percent in any given year.

Location and Magnitude

Flooding is anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes.

Mono County

Mono County has three watersheds: the Owens River drainage, the Mono Lake drainage, and the Walker River drainage. Flooding can occur in all three drainages.

FEMA maps areas that are subject to a 100-year flood event as part of the National Flood Insurance Program. Mapping data for Mono County is incomplete, but does show that areas within these flood hazard zones include:

- **Antelope Valley** along the West Walker River—including the communities of Topaz, Coleville, and Walker—as well as the East Slough and much of the valley floor in between.
- **Pickel Meadow** along the West Walker River.
- **Bridgeport Valley**, along the East Walker River and creeks flowing into Bridgeport Reservoir, including the communities of Bridgeport and Twin Lakes.

- The **June Lake Loop** area, along Grant Lake and June Lake and the creeks that connect them.
- Throughout the center of the **Tri-Valley Area** on the valleys' flat floor, including stretches of U.S. 6 in Hammil Valley and Chalfant Valley.

Much of the development in the Tri-Valley along US 6 is subject to alluvial fan flooding and flash flooding from the surrounding mountains. Flows tend to be wide and shallow once they reach the valley floor due to the topography.

Table 3.15 shows the ownership and administration of lands within the 100-year and 500-year floodplains in Mono County. In all, about 75,327 acres have a 1 percent chance of flooding in any given year, while 86,616 acres have a 0.2 percent chance of flooding in any given year. In both cases, just over half of this land is owned or administered by the state of California.

Table 3.15. Areas at Risk of Flooding in Mono County by Ownership

	100-Year Flood Zone			100- Plus 500-Year Flood Zones		
Land Ownership or Administration Category	**Acres in Hazard Zone**	**Percentage of Total in Ownership Category**	**Percentage of Total Mono County Area**	**Acres in Hazard Zone**	**Percentage of Total in Category**	**Percentage of Total Mono County Area**
County	105	4.6%	< 0.1%	151	6.7%	< 0.1%
Federal	7,683	0.4%	0.4%	16,192	0.9%	0.8%
Local	7	3.1%	< 0.1%	9	4.4%	< 0.1%
Private	14,169	11.0%	0.7%	16,446	12.8%	0.8%
State[1]	45,725	54.5%	2.3%	45,730	54.5%	2.3%
Utilities	7,129	10.6%	0.4%	7,397	11.0%	0.4%
Right of way, unknown ownership/ administration	442	4.9%	< 0.1%	623	7.0%	< 0.1%
Unknown (other)	67	4.4%	< 0.1%	68	4.4%	< 0.1%
Total	75,327	3.7%	3.7%	86,616	4.3%	4.3%
1: A large portion of the state-owned acreage in the Hazard Zone is part of Mono Lake.						

Table 3.16 shows how much of the land in the 100- and 500-year flood zones is within each of the planning areas defined by the Mono County General Plan.

Table 3.16. Areas at Risk of Flooding in Mono County Planning Areas

Planning Area	100-Year Flood Zone			100- Plus 500-Year Flood Zones		
	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Antelope Valley	5,460	18.1%	0.3%	320	1.1%	< 0.1%
Benton Valley	1,983	5.02%	0.1%	8,001	20.3%	0.4%
Benton Hot Springs	260	3.9%	<0.1%	55	0.8%	0.0%
Bodie Hills	-	-	-	-	-	-
Bridgeport	5,892	11.4%	0.3%	-	-	-
Chalfant Valley	5,900	9.8%	0.3%	994	1.7%	< 0.1%
Hammil Valley	2,836	4.2%	0.1%	1,890	2.8%	0.1%
June Lake	2,039	3.9%	0.1%	-	-	-
Long Valley	152	0.8%	< 0.1%	-	-	-
Mammoth Vicinity	444	0.4%	< 0.1%	-	-	-
Mono Basin	45[1]	19.2%	2.3%	-	-	-
Oasis	-	-	-	-	-	-
Sonora Junction	356	0.3%	<0.1%	-	-	-
Swauger Creek	-	-	-	-	-	-
Wheeler Crest	-	-	-	-	-	-

1: A large portion of the Mono Basin acreage in the Hazard Zone is part of Mono Lake.

Mammoth Lakes

Flooding issues in Mammoth Lakes have been the result of shallow, overbank flooding. The Town's General Plan notes the town "has generally low flood hazards with the exception of Mammoth Creek which can carry significant volumes during peak 100-year flood conditions." FEMA flood maps likewise show areas adjacent to Mammoth Creek in the Old Mammoth area as within the 100-year flood zone. The floodplain includes portions of the Snowcreek Resort, which have been assigned a land use designation of "Resort" in the General Plan, allowing commercial mixed uses including visitor lodging, amenities, and services, as well as workforce lodging. The floodplain also passes through some areas that the General Plan designates as Low-Density Residential and High-Density Residential.

The most significant flood events tend to occur with rain on snow events, when snowmelt is compounded by rain. Rain runoff gets channelized through the snow instead of being directed into the proper runoff infrastructure. As drains are blocked by snow, roads become the primary pathway of water.

Table 3.17 shows the acreage and percentage of land in the 100- and 500-Year Flood Zones for the Mammoth Lakes Planning Area.

Table 3.17. Areas at Risk of Flooding in Town of Mammoth Lakes

	100-Year Flood Zone			100- Plus 500-Year Flood Zones		
Planning Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Town Municipal Boundary	382	2.38%	0.02%	-	-	-
Town Urban Limit	45	1.77%	0.00%	21	0.82%	0.0%

Figure 3.7 shows the flood hazard areas for Mono County.

Hazard History

A flood in January 1997, discussed in greater detail below, caused damage in the Town of Mammoth Lakes and the unincorporated communities of Coleville, Walker, Topaz, and Bridgeport. The flooding followed heavy rainfall, with 8 inches of rain over a 36-hour period reported in Mammoth Lakes. The USGS stream gauge below the confluence of the Little Walker and West Walker Rivers measured a discharge of 12,300 cubic feet per second and a peak height of 10.1 feet, about 8.5 feet more than normal. According to a U.S. Army Corps of Engineers report on the event, the stream gauges downstream and upstream of Walker washed out prior to the storm's peak flow, but the rate in Walker could have reached as much as 14,000 cubic feet per second. This is approximately double the estimates for the flow that would be generated by a 100-year event on the river. The crest was estimated at over 12 feet. During the same storm, the stream gauge on Hot Creek near Mammoth Lakes recorded its greatest discharge on record, with a flow of 433 cubic feet per second, and a peak height of 4.4 feet, about 3.4 feet above normal levels. Floodwater depths reached 2 feet in central Bridgeport.

Mono County

The flooding in January 1997 was the most significant event on record in Mono County. The floods were partially the result of two years of above-normal precipitation and a winter storm in December 1996 that deposited heavy snow in the Eastern Sierra. On January 1 and 2, an atmospheric river (or "Pineapple Express") brought a flow of warm, moist air from the subtropics, leading to heavy rainfall and snowmelt. Extensive damage occurred along the West Walker River in Walker River Canyon and Antelope Valley. The floods destroyed 111 homes and four businesses, at a cost of $25 million. Other damages included $5 million to public facilities and $48 million to the federal highway system, including a 12-mile stretch of US 395.

FEMA's 2012 Flood Insurance Study for Mono County reports that flash flooding occurred along US 6 in the Tri-Valley Area in 1978, 1984, 1986, and 1989. The worst of these events occurred on August 9 and 10, 1989, following a combined total of 3.15 inches of rain. Water coming down the alluvial fan slopes of the White Mountains created a mudflow that crossed Spring Canyon Creek, sending a wall of water down US 6 at 20 miles per hour. The flood caused $1.5 million in damage to crops and more than $400,000 in damage to federal, state, and county roads. As many as 50 homes and 20 mobile homes were damaged at a cost of $700,000, although none were destroyed. The *Los Angeles Times* reported that most residents of Chalfant Valley had to be evacuated.

A 1996 report to Congress on the Sierra Nevada Ecosystem Project notes that "particularly large snowmelt floods in the Sierra Nevada have been documented in 1906, 1938, 1952, 1969, 1983, and 1995" with volumes two to four times larger than average.

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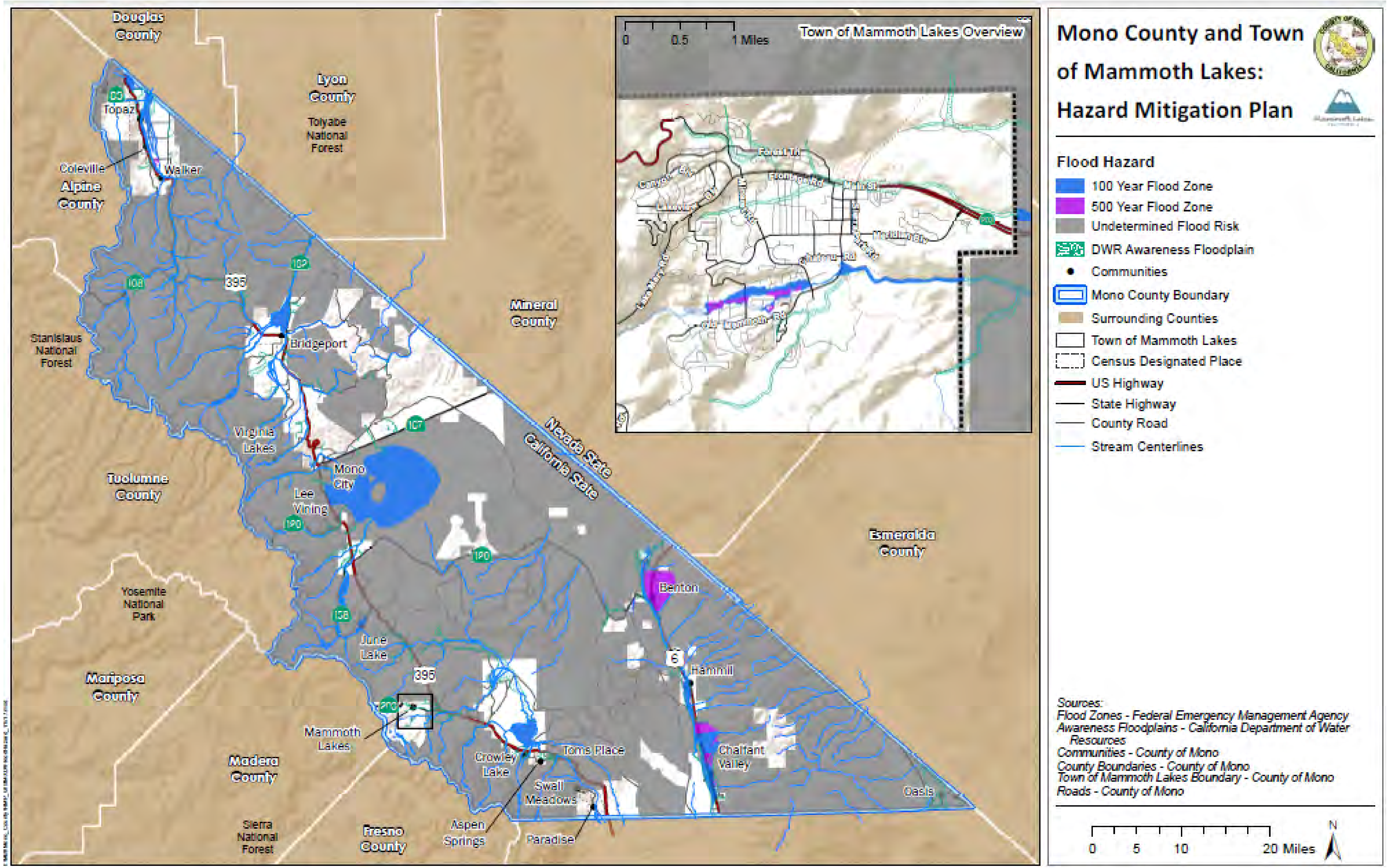
Figure 3.7. Mono County Flood Hazard Areas



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Other notable events include floods in February 1986 that closed roads and caused damage throughout the county, and in March 1995 that destroyed two homes and damaged roads and utilities. A series of subtropical storms in December 1996 and into early 1997 caused significant flooding that affected the entire state, including Mono County. Forty-eight counties were declared disaster areas due to the flooding.

Since the 1997 event, smaller floods and flash floods have damaged or closed roadways, trails, and campgrounds throughout Mono County on numerous occasions. At least two flash floods have resulted in damage to homes. In July 2013, a slow-moving thunderstorm with heavy rain caused water damage to eight homes along SR 182 in Bridgeport; one home ended up with several inches of water on the main floor. In October 2015, thunderstorms over the White Mountains flooded Chalfant Valley, closing US 6 and damaging 20 homes, at least 4 of them severely.

Heavy storms of both rain and snow in January 2017 ultimately led to a federal disaster declaration for storms and flooding. Mammoth Lakes received more than 12 inches of rain that combined with recent snow, clogging up drainage systems with debris and ice. US 395 was temporarily closed due to flooding in both directions.

Table 3.18 summarizes recent flood history in Mono County.

Table 3.18. Mono County Flood History, 2000–2017

Incident	Date	Location
Flood	8/30/2000	Oasis
Flash Flood	7/18/2002	Lee Vining
Flash Flood	7/30/2003	Southwest Mono County
Flood	5/19/2006 to 5/31/2006	West Walker River
Flash Flood	7/18/2006	Walker
Flash Flood	7/25/2007	Mammoth Lakes
Flash Flood	7/15/2010	Bodie State Historic Park
Flash Flood	7/16/2010	Walker
Flood	6/24/2011 to 6/30/2011	Benton Hot Springs, Bridgeport, Crestview, Lee Vining
Flash Flood	7/3/2013	Bridgeport
Flash Flood	9/1/2013	Benton Hot Springs
Flash Flood	10/18/2015	Chalfant Valley
Severe Winter Storms, Flooding, and Mudslides	1/18/17 to 1/23/17	Statewide
Severe Winter Storms, Flooding, and Mudslides	2/1/2017 to 2/23/2017	Statewide

Mammoth Lakes

The January 1997 flooding event caused $1.2 million of damage in Mammoth Lakes. The Mammoth Lakes Police Department was under 6 inches of water.

On July 25, 2007, a thunderstorm produced flash flooding in Mammoth Lakes and the Mammoth Mountain Ski resort. More than 2.5 inches of rain fell in a three-hour period. The town reported water flowing over roadways and flooding to a few houses.

The National Weather Service issued flood watches for Mammoth Lakes on several occasions during the winter storms of January and February 2017.

Recent flood history for the Town of Mammoth Lakes is summarized in **Table 3.18** above.

Risk of Future Hazards

Mono County

Areas within the flood hazard zones identified in **Figure 3.6** have a 1 percent chance of flooding in any given year. There is a 0.2 percent chance that a flood will occur in any given year in the 500-year floodplain areas indicated on the FEMA FIRM maps. Some flooding may occur annually but it may not be as severe as a 100-year event, and it may not occur within the identified 100-year floodplain area. Significant, widespread flooding is most likely to occur when melting snow combines with heavy rains.

The risk of flooding can increase significantly in areas that have been burned by wildfire. Fires alter terrain and ground conditions, eliminating vegetation that can absorb rainfall. Flooding is also often more severe, as ash and debris left from the fire can contribute to mudflows. It can take more than five years before an adequate layer of vegetation is restored, due to the harsh climate of the area. See the Wildfire section (Chapter 7) for locations in Mono County that have burned recently and are at increased flood risk.

Mammoth Lakes

In the Town of Mammoth Lakes, locations with a 1 percent chance of flooding in any given year are generally those parts of Old Mammoth along Mammoth Creek.

Climate Change Considerations

There is some evidence that climate change may result in more frequent intense storms, known as atmospheric river events. Some studies suggest that, statewide, more years will have an increased number of atmospheric river events and that the largest of these atmospheric river events will be more intense than they have been historically (Dettinger 2011). In general, Northern California is expected to see more frequent atmospheric river events, potentially up to twice as many by year 2100 as the region currently does, while Southern California is expected to see the same number of atmospheric river events but with each individual storm an average of 10 to 20 percent more intense. However, the specific impacts on Mono County and the Eastern Sierra/Basin and Range region are not yet known (Oskin 2014).

As noted in the Drought section, dry conditions cause soil to harden, making it less absorbent to precipitation and increasing the risk of flooding, particularly at the beginning of the rainy season. Since drought conditions are expected to increase as a result of climate change, there is also a greater risk of flooding from these drought-induced changes in soil characteristics. These impacts may already be felt; in July 2015, Lieutenant Governor Gavin Newsom, acting temporarily as governor, issued a disaster proclamation for large parts of Southern California due to flooding and related hazards due to severe storms. In the proclamation, Lieutenant Governor Newsom noted the drought's impact of drying out soil and increasing the risk of flash floods (Office of the Governor 2015).

3.2.7 Landslides

Hazard Description

For the purposes of this Plan, landslides include landslides, rockfalls, mudflows, slope failures, and shallow debris flows. Other seismic hazards are discussed in the Earthquake and Seismic Hazards subsection.

Landslides occur when the soils of a slope, such as a hillside or mountain, become unstable. When this happens, the soils slide down toward the base of the slope, damaging or destroying structures built on the moving soil or in its path. While landslides are often thought of as fast-moving events, some landslides may happen slowly over a long period of time.

The types of materials that compose a slope and the steepness of the slope help determine the overall risk of a landslide occurring. Soil stability and time also contribute to the risk of rockfall, which is a particular risk along roadways and trails where a path or highway has been cut into a hillside, exaggerating the angle of repose and increasing the likelihood of rockfalls.

Landslides may be triggered by other hazard events. The shaking from an earthquake or the loss of soil stability as a result of earthquake-induced liquefaction can cause the soil to slide. Alternatively, precipitation can result in saturated soil and a loss of stability, or flowing water may erode the base of a slope. The risk of a landslide is often exacerbated in areas recently burned by wildfire, as the fire burns vegetation that can absorb water and hold back soil. Without the vegetation to stabilize a slope and prevent runoff, sediment and debris are more susceptible to sliding.

Landslide hazards in Mono County are primarily associated with seismic activity and heavy rainfall. Landslides in areas of hilly and mountainous terrain can be triggered by ground shaking, heavy rains, or human activities such as road cuts, grading, construction removal of vegetation, and changes in drainage. Mudflows involve very rapid downslope movement of saturated soil, sub-soil, and weathered bedrock. The movement of soil and debris by mudflow and other landslides over time is evident in the large alluvial fans at the edges of valley areas.

Throughout the western United States' vast Basin and Range Province, which includes the White Mountains, slopes are susceptible to the specific type of moisture-induced debris flows that form alluvial fans. These flows usually occur as a result of flash floods, which create torrents of water flowing down a steep mountain canyon. Flash floods often carry sediments and other debris, including boulders and trees. When the water is free of the confined canyon, it spreads out across a wide area, depositing debris in a broad, shallow slope called an alluvial fan. The alluvial fans themselves may be susceptible to further landslides due to their loose composition (CGS 2015a). A type of landslide called lateral spreading can occur on alluvial fans and other liquefaction-prone soils when liquefied soils become sufficiently fluid to spread across fairly shallow slopes. Flooding associated with alluvial fans is described in the Flood profile.

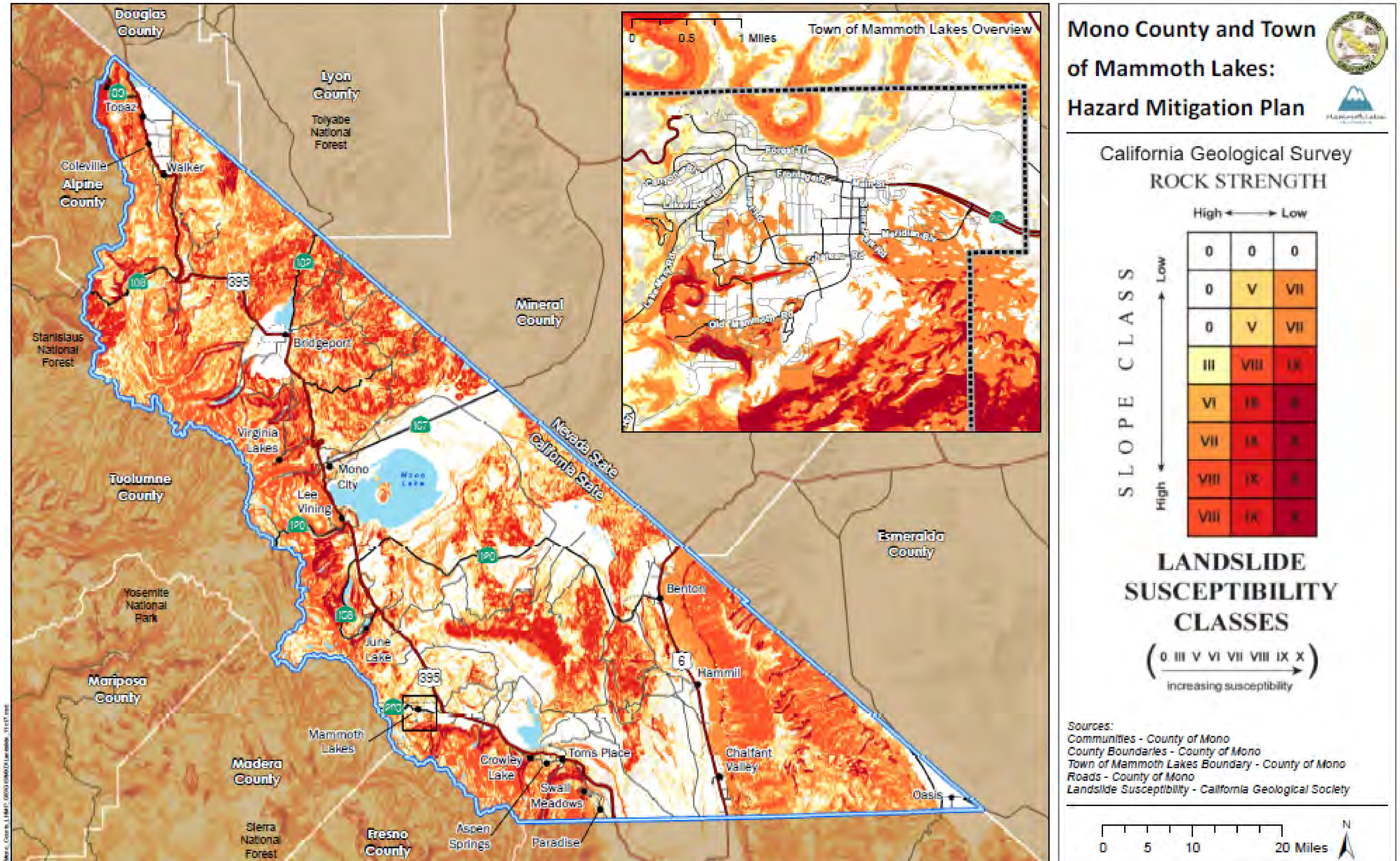
Location and Magnitude

As identified in **Table 3.1**, landslide hazards are anticipated to affect unincorporated Mono County, but not the Town of Mammoth Lakes.

Areas at risk for landslides are found throughout the county but mostly outside of populated community areas. The CGS has mapped areas at risk of deep-seated landslide. The map combines three classes of rock strength and eight classes of slope to create a matrix of susceptibility scores. **Figure 3.8** shows susceptibility scores for areas in Mono County. Areas with high levels of susceptibility include:

- Northeast boundary of the Long Valley Caldera, from Bald Mountain to Glass Mountain
- Many of the canyons along the eastern escarpment of the Sierra Nevada, from the county's southern border to the peaks north of Pickel Meadow
- Steep slopes north of Lee Vining
- Western slope of Slinkard Valley to the county border
- Slopes along Coyote Creek at the Nevada border
- Throughout the Bodie Hills area

Figure 3.8. Landslide Susceptibility



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Certain sections of key access roads are at high risk of rockfall and have historically experienced numerous rockfalls. These areas include:

- US 395 north of Lee Vining near Mono Lake
- US 395 north of Mono City near Conway Summit
- CA 120 from Lee Vining to Tioga Pass
- Walker Canyon Road in Walker Canyon
- Lower Rock Creek Road, from Swall Meadows Road northbound to Highway 395

Rockfalls and landslides are particularly common along the very steep slopes of the eastern scarp of the Sierra Nevada, where talus slopes provide evidence of abundant past rockfalls. During the winter and spring months, rockfalls can be lubricated with snow and ice and can become extremely fast-moving and destructive. The May 1980 earthquakes triggered numerous rockfalls, especially at Convict Lake and in McGee Canyon (Bryant 1980) and “spectacular rockfalls” were observed in Chidago Canyon and the White Mountains during the July 21, 1986, earthquake in Chalfant Valley, according to the Mono County MEA (Mono County 2001).

Fire has similarly caused rockfall hazards at burn scar locations on slopes, due to the destruction of vegetation that formerly acted as anchors for rock and soil. The June 2016 Marina Fire burned steep slopes along the western side of US 395 north of Lee Vining, leaving the slopes destabilized and requiring the construction of extensive rockfall protection system alongside the roadway.

Landslides can generate large amounts of debris. A CGS report on the 1980 earthquakes noted that several backcountry roads and trails were buried by debris that locally was more than 30 meters thick. Near Mammoth Lakes, a boulder the size of a one-car garage was dislodged and rolled 500 meters.

Large, destructive mud and debris flows associated with alluvial fans are a risk in the Tri-Valley Area. Locations near the bottom of confined canyons are at risk of these flows, which can cover multiple square miles and contain millions of cubic yards of debris.

CGS’s Landslide Inventory database does not include any data on landslides in Mono County, but it does offer a report on a 2008 event in neighboring Inyo County. Heavy rainfall on parts of the Oak Creek drainage that had previously been burned by wildfire caused large debris flows that deposited 2 million cubic yards of sediment over a 1.2-square-mile area. Surges moved at estimated speeds of 4.5 to 11 miles per hour and were 3 to 10 feet tall.

Hazard History

The most significant geological event in Mono County was the widespread landslides and rockfalls during the May 1980 earthquakes near Mammoth Lakes. The report on the earthquakes noted that rockfalls were common in the epicentral region in Convict and McGee Canyons, with debris partially or completely covering snowfields. Dust plumes were observed over the Sierra Nevada immediately following many quakes with magnitudes greater than 4.5. Outside of Mono County in Yosemite Valley, two hikers were severely injured by a rockfall during one quake (McJunkin et. al., 1980).

A flash flood on August 9 and 10, 1989, resulted in one of the county's largest mudflows. Water coming down the alluvial fan slopes of the White Mountains in the Tri-Valley Area picked up debris. The resulting mudflow crossed US 6, reached as far as Spring Canyon Creek, and caused further flooding in Chalfant Valley.

Heavy rains often result in debris flows that can shut down major roads. In March of 1995, rockfall and mudslides closed US 395 from the Nevada state line to Bridgeport.

The region immediately west of Mono Lake has seen several road closures in recent years due to mudslides, including Lundy Lake Road on July 17, 2014, and parts of Tioga Pass Road (SR 120) on July 6, 2015, and October 16, 2016.

Risk of Future Hazards

Rockfalls and mudflows are an annual occurrence in the Eastern Sierra. The probability of a geologic hazard occurring in any given area is unknown, although landslide risks are likely to remain highest in the areas identified as having a high susceptibility, and the risk of alluvial fan flows will persist along the base of the mountain ranges in the county. The geologic conditions in the county that have been responsible for past landslide events are not expected to change.

Climate Change Considerations

Climate change may cause an increase in the frequency and/or intensity of storms that affect California, which in turn could make moisture-related landslides more common, particularly alluvial fan related events. Warmer temperatures and periods of drought resulting from climate change may cause soil to become less cohesive, making the material more unstable and potentially increasing landslide risk. More frequent and extensive fires may leave more area of burn scars which are subsequently more prone to landslides.

3.2.8 Hazardous Materials

Hazard Description

Under California law, a hazardous material is a substance that either causes "an increase in mortality or an increase in serious, irreversible, or incapacitating illness" or poses "a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of, or otherwise managed" (DTSC 2010). Hazardous materials cover a wide range of substances and include flammable or explosive materials, corrosive substances such as acids, poisons, and infectious materials such as dangerous germs. Some materials are always hazardous, while others may only pose a danger under certain conditions (e.g., flammable materials can be inert and harmless until exposed to a spark or heat source). Hazardous materials are often thought of as human-made compounds, but they may also include naturally occurring substances, such as radon gas found naturally in some rock formations.

A hazardous material emergency usually occurs when the material leaks or escapes from its containment vessel, exposing people and objects in the vicinity to the material's harmful effects. This may occur because of another emergency, such as an earthquake or flood that breaks a hazardous material storage container. It may also happen because of human error or an equipment malfunction, or more rarely as a deliberate act. Hazardous materials may be released from a building such as a factory or storage facility, or from a vehicle such as a truck or train. US 395 is a major thoroughfare and carries hazardous and potentially hazardous materials through the communities of Mono County. Residents and visitors also frequently transport combustible fuel such as propane for personal use; when improperly stored or secured, leaks or explosions can occur. Hazardous materials in soils, either naturally occurring or accidental, may be washed into water bodies or groundwater basins during flood events, creating a potential risk of exposure. Other naturally occurring substances (e.g., radon) can filter up through the soil and into the air, and over long exposure cause health issues. Soils containing hazardous materials may also dry out and be blown by the wind, spreading the material over a potentially large area.

This section focuses on four forms of hazardous materials of particular concern to the county and town: 1) transport of hazardous material such as fuel; 2) stationary propane in tanks and underground lines; 3) naturally occurring gases (specifically, radon and carbon monoxide); and 4) large hazardous sites resulting from old industrial or mining waste filtering up through the soil and into the air. The location and magnitude and historical occurrences are discussed for each of these four categories.

Hazardous Material Transport

Location and Magnitude

Mono County

US 395, US 6, and SR 120 are designated for the transport of hazardous materials in and through Mono County. These routes can transport a variety of hazardous materials for personal and business use, and materials from one of Mono County's waste transfer stations to a permanent location outside of Mono County. This creates the potential for hazards during transport and in the event of a vehicle accident. It is difficult to identify exactly which materials, how much, and when hazardous materials move through the county, but likely frequently these include propane, gasoline, household chemicals, and waste. The exact nature of materials or timing of their transport is not tracked by any agency, although the US Hazardous Materials Transportation Act does regulate procedures and packaging for transport of certain materials. Additionally, the Mono County Integrated Waste Management Plan contains a Hazardous Waste Management Element, which provides policies for the siting and transportation of hazardous materials. Inspection points along US 395, including in Victorville and Big Pine, help ensure these materials are being carried properly, mainly performed by Caltrans staff because the state highways are at highest risk. However, these regulations are often not adequate to ensure safe transport on road and weather conditions that occur frequently in Mono County, such as high winds, ice, and snow. The location of hazardous materials release is most likely to occur in relation to these other hazards.

Mammoth Lakes

Because the Town does not have any interstate corridors running through its boundaries, the likelihood of an incident involving these materials is somewhat lower than in other areas of Mono County. However, a hazardous material release along US 395 could affect the town if gases or odors were carried by the wind, or if the release triggered other hazards such as fire, or resulted in blockage of key access into the town. Additionally, a smaller number of vehicles carry hazardous materials for use in the town, posing some risk.

Hazard History

There are records of two recent hazardous material incidents in Mono County, both of which occurred during transportation. In May 2013 and October 2014, accidents involving the transportation of freightliners occurred on US Highway 395. The May 2013 accident resulted in the death of the driver as the truck exploded. Both accidents required extensive hazardous material cleanup.

Propane

Location and Magnitude

Mono County

Propane is a colorless, odorless (although odor is often added for easier detection) liquified compressed gas frequently used for fuel by residents and visitors to Mono County. Propane is distributed by truck and sold at locations such as gas stations, hardware stores, and camping supply stores, and is often transported by personal vehicle and stored at the home or business. Hazards associated with propane use and transport include:

- **Inhalation**: Inhalation of propane in a closed environment can result in chronic health effects or, in extreme cases, suffocation.
- **Contact**: Direct contact with some liquefied propane can cause frostbite.
- **Explosion**: While propane tanks are typically stable and difficult to rupture, in the case of extreme concussions (e.g., major vehicle collision or earthquake) or extreme heat (e.g., wildfire), a boiling liquid expanding vapor explosion (BLEVE) can occur. A BLEVE occurs when the pressure in the tank exceeds that at which the safety relief valve can safely vent the excess pressure into the outside atmosphere. Relief valves are designed to vent tank pressure at a certain flow rate to the outside atmosphere once the pressure inside the propane tank reaches a certain level; they will close once the pressure in the tank falls below that level. Old or buried propane tanks can pose a special hazard, since the tank's systems degrade with age and because current landowners may not be aware of their location.

The dangers from propane leaks are aggravated in the county by winter weather, which freeze lines and valves, and heavy snow, which can disguise evidence of leaks for long periods of time as well as prevent access to tanks and lines by emergency responders. Although County and Town codes require residents to regularly check their tanks and to keep access clear during winter, these requirements can be difficult to enforce.

As propane is a commonly used fuel, proper storage and transport of propane cylinders is critical to prevent frequent hazards. While the tank types, maintenance, placement and storage of household or small business tanks are regulated by local and state codes, the location of all tanks is not currently tracked. Therefore, specific hazard zones from propane are not currently known. It is reasonable to assume that most parcels with habitable structures will have one or more propane tanks on-site.

Mammoth Lakes

In addition to small propane tanks on individual properties, Mammoth Lakes has an underground system of pipes that distribute propane to individual and group storage tanks in various parts of the community. The lines are owned and operated by AmeriGas. The lines are supplied by several large propane tanks both inside the town and near its perimeter. The Town does not have data on the exact locations or status of these underground pipelines, which can pose hazards in the event of construction or maintenance activities as well as in the case of natural disaster, such as an earthquake or fire.

Hazard History

There were two fatalities in 1992 due to a propane leak in Mammoth Lakes, which resulted in several modifications of requirements for use of propane within the town. In February 2012, such a leak resulted in a deadly explosion in a family housing complex in Coleville that serves marines assigned to the Mountain Warfare Training Center in Bridgeport. The explosion killed one person, injured several others, and forced the evacuation of 38 families. Close calls also occurred in Mammoth Lakes when Digital 395 workers severed a main propane line operated by AmeriGas in July 2013 because AmeriGas had made an improper determination on the gas line location. In addition to freightliners, propane and fuel trucks have been involved in transportation/delivery incidents.

Radon and Carbon Monoxide

Location and Magnitude

Radon is a commonly occurring radioactive gas that is derived from the natural decay of uranium located in most soils. Radon filters up through the soil and into the air, which can then be trapped in buildings or distributed by well water usage. Exposure to radon is the second largest cause of lung cancer, and the number one cause in nonsmokers. Radon should be tested for and prevented or mitigated in buildings through design features such as proper ventilation, soil barriers, or soil depressurization.

The Radon Act 51 was passed by Congress to set the natural outdoor level of radon gas (0.4 picocuries per liter [pCi/L]) as the target radon level for indoor radon levels. The US Environmental Protection Agency (EPA) has set an "action level" of 4 pCi/L, at which point the EPA recommends that people take corrective measures to reduce exposure to radon gas. There is no safe level of radon exposure, however (EPA 2016).

The EPA classifies radon levels by three zones:

- Zone 1: Counties with predicted average indoor radon screening levels greater than 4pCi/L.
- Zone 2: Counties with predicted average indoor radon screening levels from 2 to 4 pCI/L.
- Zone 3: Counties with predicted average indoor radon screening levels less than 2pCi/L.

All of Mono County, including Mammoth Lakes, is designated as Zone 2 for radon levels. Radon testing is recommended by Mono County for all homes.

Similar to radon, carbon monoxide is a naturally occurring compound formed during combustion (usually wood, goal, or other fuels) but can also be present as the result of volcanic activity. Exposure to carbon monoxide can cause headaches, nausea, and with especially high concentrations, death.

Hazard History

It is difficult to directly link any given mortality to radon, but the EPA estimates that, nationally, 21,000 lung cancer deaths are caused by radon each year. Since average indoor radon levels are higher in Mono County than in the US as a whole, the rate of health incident and mortality is likely higher. Consequently, Mono County pursued and received a grant which allows the county's Public Health Department to provide free radon test kits to property owners. According to the California Department of Public Health's most recent published data available, in 2010, a year after beginning the free testing, 32 radon tests had been done in the 93546 zip code (Mammoth Lakes and Crowley Lake); 10 of them (31%) resulted in radon levels above 4 pCi/L. In the nearby town of Bishop in Inyo County, 39 out of 111 tests (35%) had come back above 4pCi/L.

Volcanic vents in emitting carbon monoxide are present in small pockets throughout the Long Valley Caldera; while some areas are known, others may not yet be identified, and new output locations may occasionally form. At least one death in the county has been confirmed as a result of natural carbon monoxide inhalation, in 1998, when a man was found dead near Horseshoe Lake.

Hazardous Materials Cleanup Sites

Location and Magnitude

According to the California Department of Toxic Substances Control (DTSC), the Marine Corps Mountain Warfare Training Center in Bridgeport is the only location in Mono County designated as a hazardous materials release site. Mono County Department of Public Works is the only registered hazardous waste transporter in the county.

The State Water Resources Control Board (SWRCB) maintains a separate list of sites with hazardous materials that may contaminate groundwater supplies. Mono County Welfare is the only facility in Mono County that currently has an open SWRCB case due to diesel ground contamination. The Mountain Warfare Training Center and the Mono County Senior Center were previously listed, but cleanup has been completed at both locations and the cases have been closed.

Table 3.19 shows the number of these facilities in Mono County and their status.

Table 3.19. State Water Resources Control Board Cleanup Sites by Status in Mono County

Status	Description	Number of Facilities	
		Mammoth Lakes	Mono County
Completed – Case Closed	Cleanup activities have finished and formal case closure decision has been issued.	0	2
Open	Unspecified evaluation and/or cleanup activities are ongoing.	0	0
Open – Eligible for Closure	Cleanup activities have finished, although the case closure decision has not yet been issued.	0	0
Open – Inactive	There are no regulatory activities at the site.	0	0
Open – Proposed	Unspecified evaluation and/or cleanup activities are ongoing.	0	0
Open – Site Assessment	Evaluation activities are ongoing at the site.	1	0
Open – Verification Monitoring	Cleanup has finished, and monitoring activities are ongoing to ensure cleanup has been successful.	0	0
Total		**1**	**2**

Source: SWRCB 2016a

Risk of Future Hazards

The risk of hazardous material releases in the future is difficult to quantify. There is always some chance that another natural disaster, such as an earthquake or flood, may damage buildings or storage tanks and cause a release of hazardous materials. However, the occurrence of a natural disaster does not automatically result in a hazardous material release, and a hazardous material release may occur independently of any other natural disaster.

Considering the history of hazardous material incidents occurring during transport and that the number of transport trucks is increasing, another incident in the future is likely. In addition, propane is a significant portion of energy generation, and although strides are being made state- and countywide to increase renewable energy (a 2014 feasibility study examined the use of biomass as an alternative fuel), propane will remain a significant portion of fuel usage due to housing design, existing generators and equipment, and familiarity. Therefore, it is likely that incidents will continue to occur because of such personal use of propane.

Given the size and sparsely populated nature of Mono County, a hazardous material release may not necessarily pose a significant risk to human health if it occurs in an unpopulated area, although such events may result in environmental damage. Mammoth Lakes has a comparatively higher population density than the rest of Mono County, and any hazardous material release in or near Mammoth Lakes would likely pose a greater threat to human health and safety than elsewhere in the county.

Climate Change Considerations

Climate change is not directly linked to the frequency or severity of hazardous material releases. However, climate change may increase the frequency or severity of other hazards, such as severe storms or wildfires, which may in turn result in hazardous material releases.

3.2.9 Severe Wind

Hazard Description

Severe winds can occur as a consequence of an intense storm system or may happen independently of storms. Severe winds are generally winds above 47 miles per hour (mph), as this wind speed is usually the threshold for structural damage, although some property damage or minor injuries may occur at lower wind speeds. High winds may directly damage structures, can blow down trees or branches, and can create airborne debris which may cause further damage. Severe winds may also increase the risk of other hazards, particularly wildfires.

Location and Magnitude

As identified in **Table 3.1**, severe winds are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes.

Mono County

Severe wind events may occur virtually anywhere in Mono County, but they can be of particular concern near Crowley Lake, Coleville, Lee Vining, US 395, and US 6.

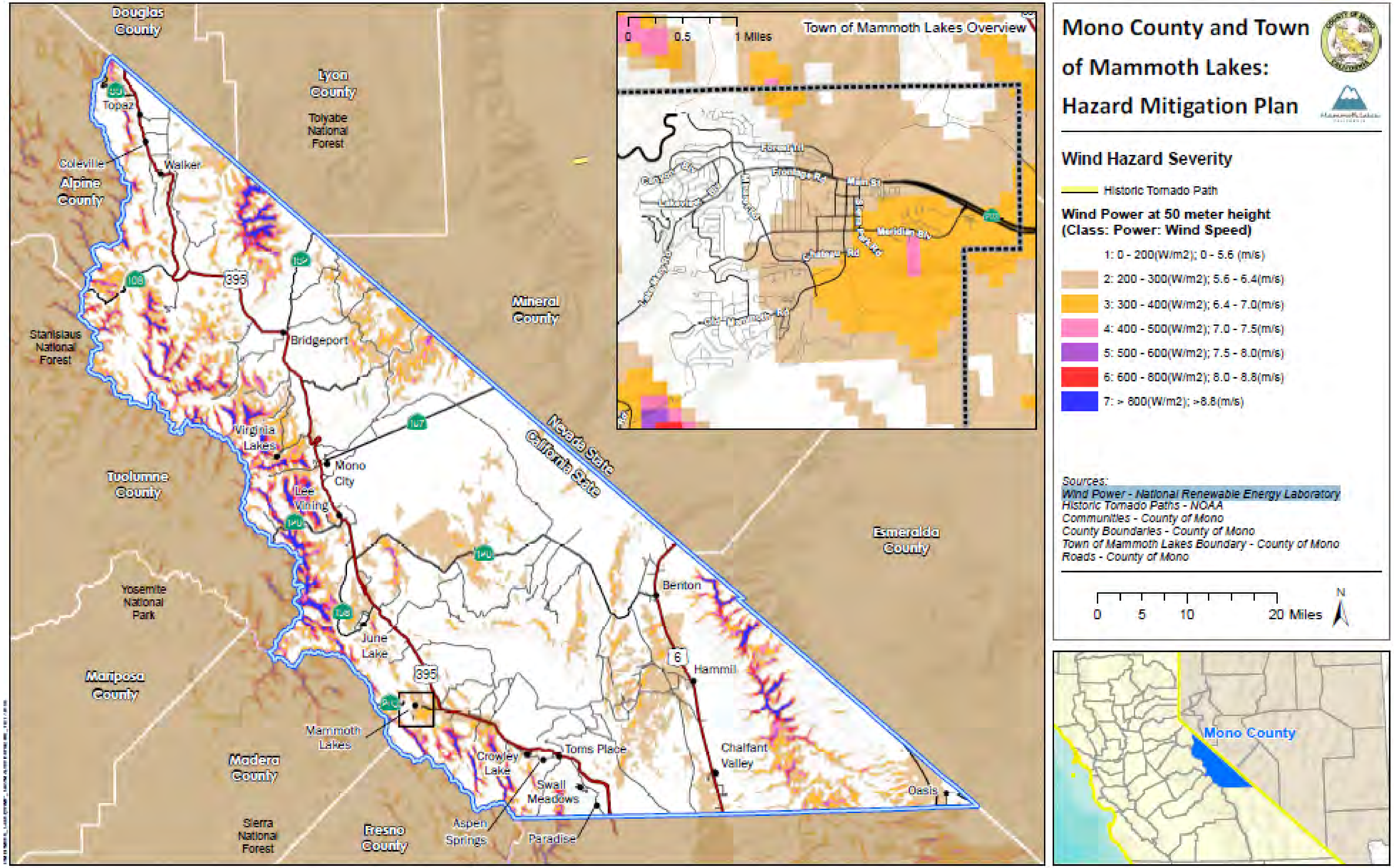
Severe winds can result in road closures and downed powerlines. One such event happened on February 6, 2015, when severe winds caused downed powerlines and igniting the Round fire. A state of emergency was declared for Mono County due to fires burning thousands of acres, destroying over 40 structures, including residences. Another severe wind event in Reds Meadow just over the Madera County border resulted in thousands of downed trees. Road closures along US 395 and US 6 due to high winds can severely limit mobility in the county.

Mammoth Lakes

Severe wind events in the town can result in road closures and downed powerlines and trees.

Figure 3.9 shows annual average wind power in the county and highlights locations where high winds are likely, based on wind resource assessments provided by the National Renewable Energy Laboratory. This national data estimates the annual average wind resource. The assigned wind power class represents the range of wind power densities, described as watts per square meter (W/m2), likely to occur at exposed sites, such as hilltops, ridge crests, mountain summits, large clearings, and other locations free of local obstructions. The wind resource assessment was based on surface wind data, coastal marine area data, and upper-air data, or, where data was not available, based on qualitative indicators such as topographic/meteorological indicators and state of existing vegetation.

Figure 3.9. Annual Average Wind Power



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Hazard History

Mono County has experienced 77 days of significant wind events since 1996. During November 2011, an unusually strong wind damaged thousands of trees in the eastern Sierras, including Reds Meadow and the Mammoth Lakes Basin. Wind speeds reported ranged from 43 knots (kts) to 100 knots. Seventeen of these events caused substantial reported damage or injuries, as shown in **Table 3.20** (NOAA 2017c).

Table 3.20. Significant Wind Events in Mono County, 1996–2017

Date	Top Wind Speed (kts)	Affected Area(s)
11/18/1996	n/a	Crowley Lake
01/21/1999	61 kts.	Highway 395 near Crowley Lake
12/19/1999	n/a	Highway 395 in Lee Vining
01/11/2000	60 kts.	Near the Mammoth airport
11/29/2000	73 kts.	Bridgeport Valley
02/06/2001	54 kts.	Crowley Lake
01/26/2002	52 kts.	Walker and Coleville
01/26/2002	61 kts.	Coleville
04/14/2002	60 kts.	June Lakes area
12/14/2002	100 kts.	Across the region
12/26/2006	56 kts.	Across the region
02/25/2007	70 kts.	Crowley Lake
03/29/2010	53 kts.	Across the region
05/31/2011	70 kts.	Across the region
11/18/2011	75 kts.	Bridgeport
11/30/2011	80 kts.	Mammoth Lakes
12/1/2011	Unknown	Mammoth Lakes area
02/15/2014	66 kts.	Across the region
12/11/2014	92 kts.	Lee Vining

Source: NOAA 2017

Risk of Future Hazards

Given the history of past significant wind events in Mono County and the expected continuation of winter storms, it is very likely that severe winds will continue to occur throughout the county. The factors that contribute to severe winds are unlikely to decrease to any substantial degree.

Climate Change Considerations

Climate change may cause an increase in the frequency and/or intensity of storms that affect California, which in turn could make severe wind events more common. The effects of climate change on winds not related to storms are as yet unknown.

3.2.10 Severe Winter Weather and Snow

Hazard Description

This section covers several issues relating to severe winter weather including extreme cold, hailstorms, and snow. Intense rainfall is discussed in the Flood profile; severe wind is discussed in the Severe Wind profile; and avalanches are discussed in the Avalanche profile.

Extreme Cold

Extreme cold events occur when the temperature drops well below historical averages. No specific definition exists for extreme cold, but an extreme cold even can generally be defined as temperatures at or below freezing for an extended period of time. However, in Mono County, freezing temperatures are a relatively normal event and residents are often prepared for these temperatures, making it less likely to result in risk until much lower temperatures occur. These events may occur as part of another severe weather event, such as a blizzard or ice storm, but can also happen during sunny days. Just as extreme heat is a factor of air temperature and humidity, extreme cold can be measured as a factor of air temperature and wind, known as wind chill. A temperature of 10 degrees Fahrenheit (°F) may have a wind chill of 1°F in 5 mph winds, but may feel close to -20°F in wind speeds of 50 mph or more. The primary health risks of extreme cold are frostbite (a freezing of body tissue) and hypothermia (an abnormally low body temperature) (Cal OES 2013b). Extreme cold may also damage or destroy crops, and damage water and gas pipelines.

Snow

Snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32°F), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into a snow crystal or snow pellet, which then falls to the ground. Excessive amounts of snow can cause roofs to collapse and people being stranded in their cars due to road closures.

Hail

Hail is a form of precipitation of rough spheres or lumps of ice. It occurs when water droplets are forced upward in a thundercloud by strong winds called updrafts. The water droplets are blown into areas where the air temperature drops below freezing, causing the drops to freeze and stick together, forming hailstones. Eventually the hailstones become too heavy for the updraft and they fall to the surface. The falling balls of ice can damage roofs, windows, and plants, including crops. In rare instances, large hail can cause more severe damage, and particularly massive hailstones can cause severe injury. Hail is distinct from sleet, which is much smaller balls of ice that form when snow melts and then refreezes, or from freezing rain, which is raindrops that have been cooled to temperatures below the freezing point but have not turned into ice.

Location and Magnitude

As identified in **Table 3.1**, severe winter storms and snow are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes. These conditions are regional in nature, although a large community such as Mono County with a wide variety of climates may experience significantly different conditions in different locations. No single part of Mono County, including Mammoth Lakes, is substantially more or less at risk of these conditions, although some areas may be more impacted by their occurrence than others.

Severe winter storms occur throughout Mono County but particularly along the eastern slope of the Sierra Nevada, in the western part of the county, and at higher elevations. Severe winter storms are classified as those that cause road closures, power outages, school closures, and associated avalanche hazards. They may include heavy snow, whiteout conditions, or ice storms. Developed areas may be subject to snow and ice shedding. When snow slides toward pedestrian areas, parking lots, or other structures, it poses a significant hazard. Excessive snowfalls and significant accumulations of snow can also block access to, and stress, propane lines and vents on roofs, which can result in dangerous carbon monoxide accumulations in structures.

Other winter storm hazards include excessive amounts of snow causing roofs to collapse and people being stranded in their cars due to road closures. Severe winter storms are a particular concern in Mammoth Lakes, especially when large numbers of visitors are present. Visitors are often unfamiliar with driving in snow, using woodstoves, and other potentially hazardous winter weather situations. In addition, if large numbers of visitors become stranded in Mammoth Lakes, the town's resources may become stressed.

Hazard History

Heavy snow, cold, and severe winter storms occur every year in Mono County. Since 1996, 160 heavy snow events have been recorded in the NOAA Storm Events Database, and 26 events characterized as severe winter storm events have been reported. Since many of these events affected both Mammoth Lakes and unincorporated areas of the county, these events are documented together in **Table 3.21**.

Table 3.21. Severe Winter Storm Events in Mono County, 1995–2017

Date	Affected Community Area(s)
03/21/1995	Mammoth Lakes and Bridgeport
12/21/1996	Mammoth Lakes
12/26/1996	Mammoth Lakes
01/12/1997	Mammoth Lakes
12/05/1997	Mammoth Mountain
12/07/1997	Mammoth Lakes and Crowley Lake
01/18/1998	Mammoth Mountain
03/03/2001	Mammoth Lakes, Lee Vining, and June Lake
03/09/2001	Mammoth Lakes and Walker
04/06/2001	Mammoth Lakes and Lee Vining
04/20/2001	June Lake
12/27/2004	Mammoth Lakes
01/06/2005	Mammoth Lakes
01/27/2008	Mammoth Lakes
12/12/2009	Bridgeport to Mammoth Lakes
01/18/2010	Lobdell Lake, Sonora Pass, Lee Vining, Bridgeport
01/20/2010	Mammoth Mountain and Lee Vining
02/26/2010	Mammoth Lakes
11/19/2010	Mammoth Lakes
12/17/2010	Mammoth Lakes
12/28/2010	Mammoth Mountain
02/16/2011	Mammoth Mountain
02/24/2011	Mammoth Mountain and June Lake
03/23/2011	Mammoth Lakes
12/21/2012	Mammoth Lakes and Crowley Lake
01/09/2017	Mammoth Lakes and Bridgeport

Sources: NOAA 2017; Mono County LHMP 2006

Eight instances of hail have been reported since 2000, including during 2000, 2001, 2004, 2007, 2008, and two incidences in 2014. Hail has been reported generally in the Mammoth Lakes and Bridgeport areas (NOAA 2017).

Risk of Future Hazards

Extreme cold events will almost certainly occur in the future, based on the past frequency of these events. Indications are that extreme cold events are likely to continue. Hail events are likely to continue to occur on rare occasions, given that the county has seen these events from time to time. Significant hail and thunderstorm events are also anticipated to continue to occur on occasion in Mono County.

Climate Change Considerations

As temperature increases as a result of climate change, the frequency of extreme cold events is likely to decline as annual average minimum temperatures increase. Between 1950 and 2005 the average annual temperature was 49.6°F, and the projected minimum temperature by 2075 is 54.2°F(CalAdapt 2017).

Climate change is expected to cause an increase in the number and/or severity of intense storms that affect California, which may in turn increase the frequency and/or intensity of thunderstorms, hail, and storm-related severe wind events that affect Mono County.

3.2.11 Volcanoes

Hazard Description

A volcano is an opening (or vent) in the earth's surface that erupts lava, ash, and gas stored deep within the planet. Volcanoes come in many sizes and shapes, from large mountains built up by layers of lava, to conical mounds of loose cinder, or low, crack-like fissures in the ground. Depending on the type of volcano and the nature of the materials it ejects, a number of potential hazards may occur. These are described in detail in the USGS California Volcano Observatory website (USGS 2017c) and are summarized in the California State Multi-Hazard Mitigation Plan. The information in **Table 3.22** describes the hazards that have typified past eruptions of California volcanoes.

Table 3.22. Hazards Associated with California Volcanoes

Name	Description
Pyroclastic flow	A sudden, fast-moving eruption of lava, ash, and gases. Pyroclastic flows can move down the sides of the volcano at speeds greater than 50 mph, faster than people can run. Damage occurs from the high temperatures of the material (400–1,300°F) and the fast-moving debris itself. Poisonous gases may also suffocate people or animals.
Slow-speed lava flow	A slow-moving lava eruption, usually less than 30 mph. The lava itself may be fluid or thick. People are usually able to move out of the way, but the lava may bury structures and the high temperatures often ignite fires.
Lahar	A volcanic debris flow, usually a slurry-like mixture of ash, rock, and water, traveling at speeds of 20 to 40 mph. They can be hot, though not as hot as a lava eruption, and may carry large debris such as boulders for great distances. The speed and temperature of a lahar may cause injury or death, and the debris itself may bury people or structures.
Volcanic flood	A type of flash flood that occurs when snow or ice on the surface of the volcano is melted by intense heat from the volcano, or when debris deposited from a volcano causes a river or stream to overtop its banks. The effects are generally similar to other types of flash floods.
Fine ash fall	A "rain" of small ash particles ejected from a volcano during an eruption, sometimes reaching hundreds of miles from the volcano itself. The ash can cause short-term respiratory problems, although it is generally nonlethal. Buildings may be damaged by the weight of the ash, and accidents can occur if ash sufficiently reduces visibility. Ash particles may also clog wastewater systems, damage electronics, and harm crops and livestock. Air traffic can be disrupted by ash fall.
Coarse air fall	An ejection of large, hot pieces of lava or rock. The force of the ejecta may cause damage or injury, and the high temperatures may ignite fires. These are generally the size of a softball or smaller, although some volcanoes may eject boulder-size pieces.
Phreatic eruption	An eruption of steam, caused when volcanic heat causes water underground or on the surface to flash-boil. The steam may erupt violently, carrying ash and pieces of rock. Damage may be caused by the intense heat, the materials ejected by the steam, or poisonous gases that can accompany the eruption.

Sources: Cal OES 2013a; USGS 2016

Table 3.22 does not include an exhaustive list of all possible hazards resulting from volcanoes; it is possible that an event not shown here may occur during an eruption of a California volcano.

Mono County contains the most significant volcanic center in California outside of the Cascade Range. The Long Valley-Mono Basin Region is dominated by two distinct but interrelated systems that have produced volcanic and seismic activity for millions of years. The region includes the Long Valley Caldera, a 20-mile-by-10-mile, oval-shaped depression formed about 760,000 years ago. This was one of the largest eruptions in the earth's history, ejecting more than seven times as much material as the famous Krakatoa explosion in 1883. A younger system, the Mono-Inyo Craters, runs from Mono Lake to Mammoth Mountain near the rim of the caldera. The chain has seen small to moderate eruptions, as recently as 250 to 350 years ago.

The impact of an eruption in the Long Valley area would depend on its location, size, and type as well as the wind direction. An eruption during the winter months could melt heavy snow packs, generating mudflows and locally destructive flooding. Smaller eruptions, similar to previous activity along the Mono-Inyo chain during the past 5,000 years, would typically begin with a series of steam blast explosions that can throw large blocks of rock and smaller fragments hundreds of feet in the air.

If magma reaches the surface, gases in it can escape explosively, hurling volcanic ash as high as 6 miles or more. Airborne volcanic ash would be carried downwind and the amount and size of the ash would diminish with distance from the eruption site. Accumulations of ash pose little threat to life or property but may close roads and seriously disrupt utilities and communications. The ash produced by explosive volcanic eruptions poses a special hazard to aircraft. A small to moderate explosive eruption can send ash to elevations exceeding 30,000 feet, posing a serious hazard to commercial aircraft on transcontinental routes that pass over Mono County.

The center is also capable of producing effusive (nonexplosive) basaltic eruptions (the type common in Hawaii). The resulting hot, relatively fluid lava flows, while not a direct threat to life, can pose serious problems for built infrastructure.

The release of hot volcanic gases can create deep cavities in the snow containing lethal concentrations of carbon dioxide. Such conditions have been blamed in the deaths of a cross-country skier in 1998 and three ski patrol members in 2006 at Mammoth Mountain Ski Area.

The Long Valley Volcanic Center is one of 18 "very high threat" volcanoes listed in a ranking developed in 2005 as part of the National Volcano Early Warning System (NVEWS). The USGS conducted a systematic assessment of volcanic threat for all U.S. volcanoes. Volcanoes were evaluated using 25 threat factors: 15 for hazard type (e.g., explosivity index, pyroclastic flows, lahars) and 10 for societal exposure to hazards (e.g., nearby populations, infrastructure, transportation corridors). The composite NVEWS score (sum of the hazard factors multiplied by the sum of the exposure factors) translates into a specific threat-level grouping that ranges from "very high threat" to "very low threat." The rankings are periodically reevaluated by the USGS as new scientific data becomes available and/or nearby infrastructure and populations change. An update to the 2005 ranking is currently under way.

It is important to note that the NVEWS threat rankings do not express the probability of an eruption occurring, only the level of threat posed should an eruption occur. **Table 3.23** shows the threat levels of Mono County volcanoes.

Table 3.23. Mono County Region Volcano NVEWS Scores

Volcano	NVEWS Score	Last Eruption
Long Valley Volcanic Center	Hazard score: 9/20 Overall threat ranking: 128 (Very High Threat)	16,000 to 17,000 years ago
Inyo Craters	Hazard score: 8/20 Overall threat ranking: 106 (High Threat)	600 years ago
Mono Craters	Hazard score: 8/20 Overall threat ranking: 89 (High Threat)	650 years ago
Mono Lake Volcanic Field	Hazard score: 5/20 Overall threat ranking: 55 (Moderate Threat)	250 years ago

Source: USGS 2005

Location and Magnitude

As identified in **Table 3.1**, volcanic-related hazards are anticipated to affect both unincorporated Mono County and the Town of Mammoth Lakes.

Mono County

Volcanic eruptions could occur in the Long Valley Caldera and along the Mono-Inyo Craters chain. Over the past 2,000 years, volcanic eruptions have occurred at an average rate of one per 100 years. Vents located along these chains are known to have produced explosive eruptions, resulting in pyroclastic flows or surges (violent eruptions of lava fragments) and tephra fall (solid material ejected during a volcanic eruption and transported through the air). USGS scientists estimate that pyroclastic flows and surges could travel as far as 10 miles from vents in the Long Valley Caldera's south moat area, which is located south of SR 203 between Mammoth Lakes and US 395. An explosion from the vents along the Mono-Inyo Craters chain could result in pyroclastic flows or surges traveling 7 to 8 miles to the east. To the west, those flows would be blocked by the high Sierra Nevada. Downwind deposits of ash produced by an explosive eruption could reach thicknesses of at least 8 inches at a distance of 22 miles from the eruption, 2 inches at 53 miles, and 0.5 inches at 185 miles. Significant ash fall could affect large portions of Mono County and surrounding areas, depending on the wind direction and size of the eruption.

Movement in the caldera has caused numerous earthquakes. Since 1974, the USGS has conducted ongoing monitoring of the caldera for volcano surveillance (earthquakes often serve as an early sign of volcanic unrest). Earthquake swarms occurred at Long Valley from 1978–1983, 1990–1995, 1996, and 1997–1998. The USGS indicates that the rate of earthquakes in recent years has been relatively low compared with the history since seismic monitoring started.

Figure 3.10 identifies the location of volcanoes, potential vent locations, and potential flow areas in the county.

Mammoth Lakes

The Town of Mammoth Lakes is near the southwest edge of the Long Valley Caldera. Within the town boundaries, six volcanic vents have been active in the last 10,000 years, with additional vents nearby. In addition, an area of potential future volcanic vents, inferred based on seismic activity, extends into the town's east side. The entire town is within hazard areas for pyroclastic flows and tephra fall, as shown in **Figure 3.10**.

Hazard History

Since the Long Valley Caldera's formation 760,000 years ago, clusters of smaller volcanic eruptions have occurred in the caldera at roughly 200,000-year intervals. About 100,000 years ago, one of these eruptions along the caldera's ring fault resulted in the formation of the Mammoth Knolls, low hills just north of the Town of Mammoth Lakes. The most recent eruption within the topographic basin occurred 16,000 to 17,000 years ago on the mafic chain along the west rim.

The Mono-Inyo chain has erupted at intervals of 700 to 250 years over the last 3,000 years. Mammoth Mountain was formed by numerous eruptions 220,000 to 50,000 years ago. Mono and Inyo Craters were created between 400,000 and 5,000 years ago, and the latest eruptions took place about 600 years ago. The most recent eruptions in the chain occurred with the formation of Mono Lake's Paoha Island about 250 years ago.

Risk of Future Hazards

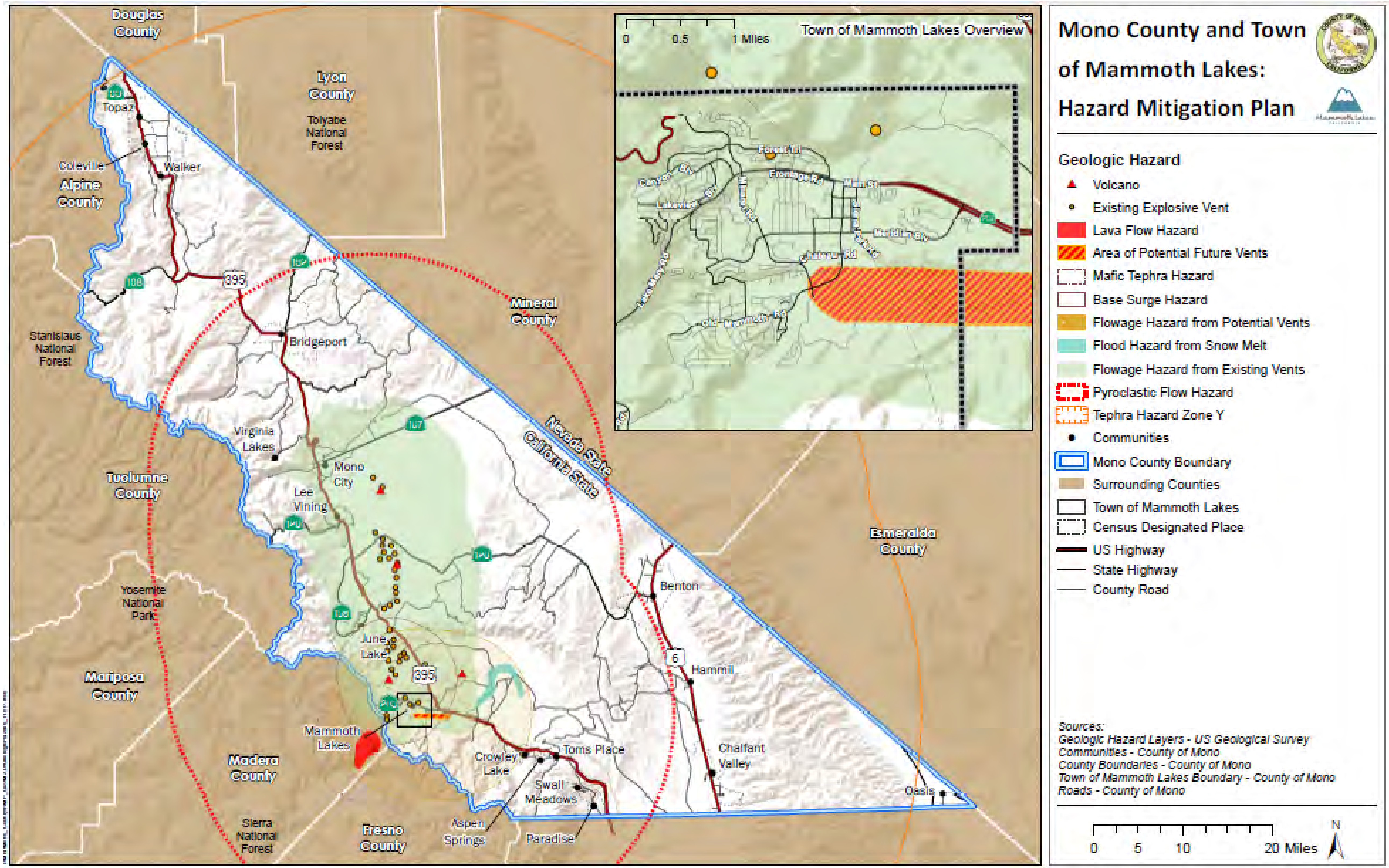
Volcanoes have been active in the area for millions of years and future eruptions are certain to occur. The pattern of volcanic activity suggests that future eruptions are more likely to occur along the Mono-Inyo volcanic chain than within the caldera. In general, the probability of such an eruption occurring in any given year is less than 1 percent, comparable to the odds for a great (magnitude 8) earthquake along the San Andreas fault in coastal California. The odds of a small eruption having a significant impact on any specified place along the chain in any given year is one in 1,000, or 0.1 percent. Future eruptions are likely to be explosive in style but small to moderate in size. Larger eruptions are possible but less likely. Scientists see no evidence pointing toward the possibility of a massive eruption along the lines of the one that formed the caldera 760,000 years ago.

Geologic unrest—including earthquake swarms, ground deformation, gas emissions, and fumarole activity—can signal a change in the likelihood of an eruption, depending on the nature, intensity, and location of the unrest. A period of ongoing geologic unrest in the Long Valley area began in 1978 with a magnitude 5.4 earthquake centered 6 miles southeast of the caldera. Since then, earthquake activity has increased. The most intense swarms occurred in May 1980 and included four strong magnitude 6 earthquakes. Between 1979 and 1980, the center of the caldera rose almost a foot, after decades of stability. The swelling continues, and to date totals more than 2.7 feet, indicating there is new magma rising beneath the caldera. During the early 1990s, trees began dying at several places on Mammoth Mountain at the southwest edge of Long Valley Caldera. Studies showed that the trees were being killed by large volumes of carbon dioxide gas seeping up through the soil from the magma below. Such tree mortality could have implications for other hazards such as wildfire and landslides.

Climate Change Considerations

There is no known or suspected connection between climate change and volcanic activity. Eruptions can trigger other hazards, such as landslides, that are affected by climate change.

Figure 3.10. Volcano Hazard Zones



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Wildlife Collisions

Hazard Description

Wildlife collisions are frequent in rural areas and in the wildland-urban interface of a developed area. Collisions can cause vehicle damage, driver injuries, and loss of vehicular control; they are generally most common during early morning and evening hours, when animals are active yet road visibility is low. Deer are the most common animal to be involved in a wildlife collision in Mono County.

Location and Magnitude

In Mono County, wildlife collisions are most common on US 395. Figure 3.11 shows the rate of deer mortality due to vehicular collisions on each of the county's major highways between 2002 and 2015.

Figure 3.11. Mono County Deer Mortality 2002–2015

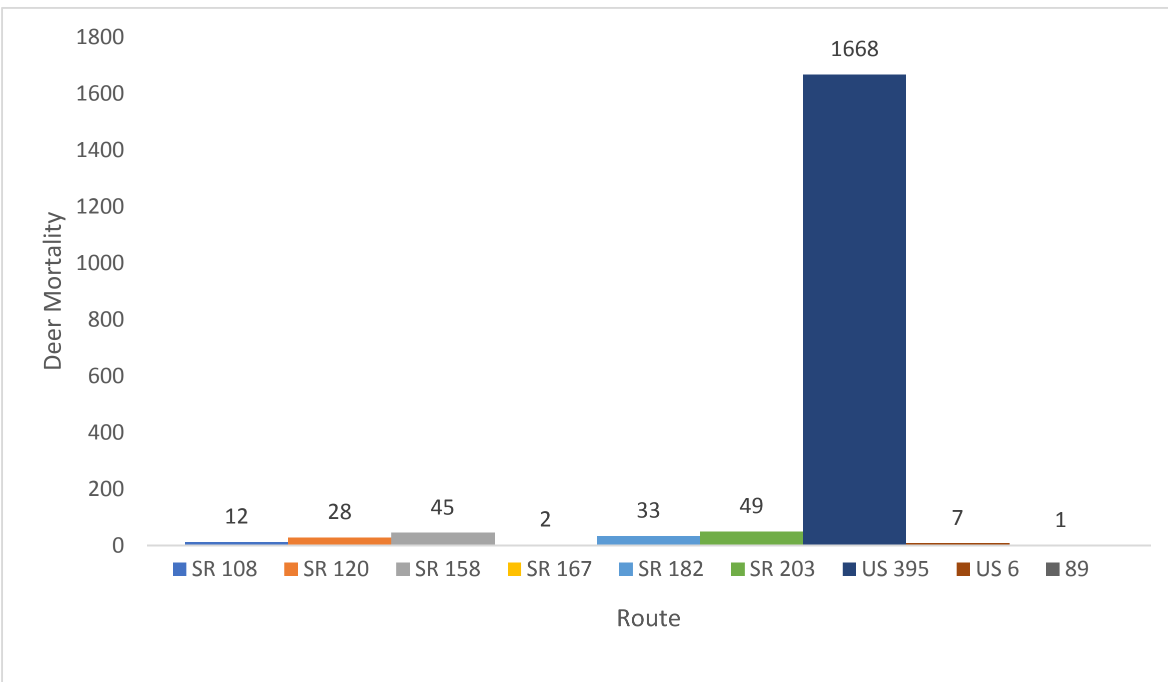
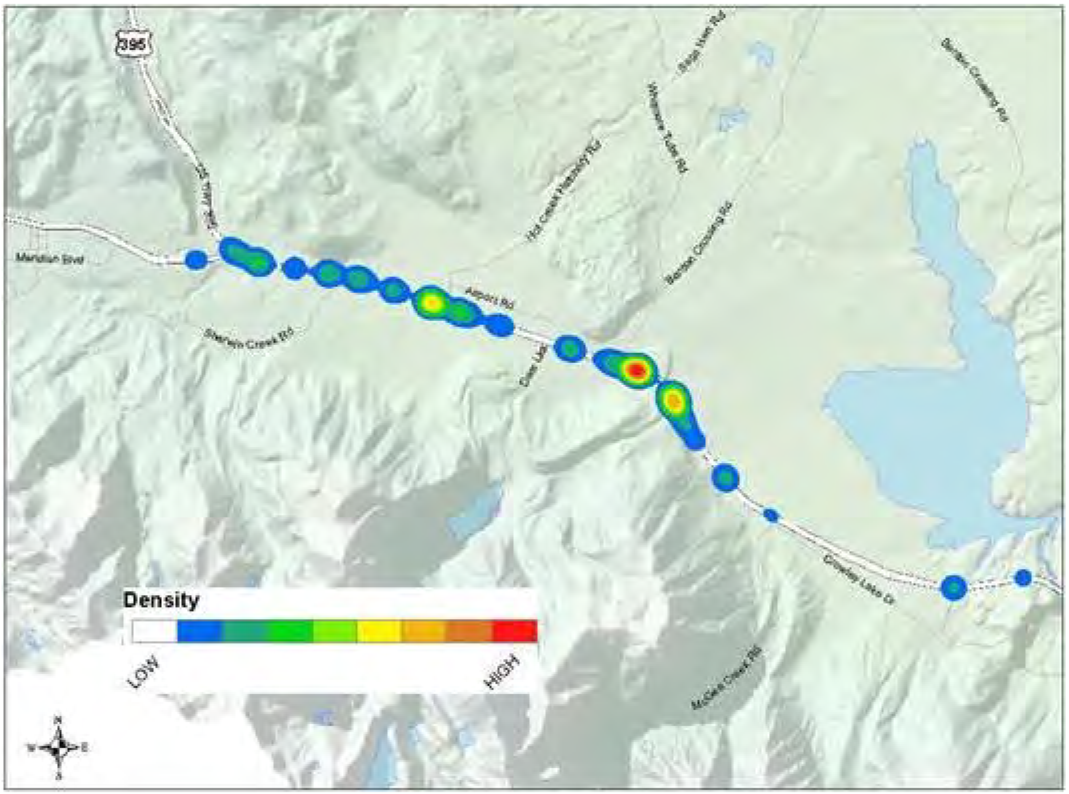


Figure 3.12 is a heat map of the wildlife collision hot spots along US 395 near Mammoth Yosemite Airport, where a study was conducted to assess problem areas and potential solutions for high-collision areas. Most collisions occur south of Benton Crossing Road and the area directly in front of the airport (Caltrans, 2015).

Figure 3.12. Deer Collision Hot Spots



Mono County

Most Mono County highways with high collision risk are in unincorporated areas, but are under the jurisdiction of Caltrans. Unincorporated Mono County has higher risk of wildlife collisions due to the rural nature of the county.

Mammoth Lakes

The risk of wildlife collisions for Mammoth Lakes is significantly less than the unincorporated area due to its more developed nature and lower speed limits. SR 203 has shown the highest risk for collisions, with 49 deer mortalities between 2002 and 2015.

Hazard History

Wildlife vehicle collisions are common occurrence in the County. According to a Feasibility Study Report prepared by Caltrans assessing the number and location of wildlife vehicle collision reduction options on US-395 near Mammoth Lakes, between 2002 and 2015 there were over 1,845 collisions with deer and 33 collisions with bear in the County on US-395. The rates were nearly 10 times higher than on the similar roadways in surrounding counties. While such incidents occurred throughout the county, higher incidence of collisions occurred near intersections with SR-203, at McGee Creek Road, at Hot Creek Hatchery Road, and near Benton Crossing Road.

Risk of Future Hazards

Because vehicle traffic on risk likely to remain an inherent component of residential and commercial development and vehicle traffic are likely to remain a major part of the way of life in Mono County and potentially expand in areas, conflict between wildlife and vehicle traffic will continue to occur.

Climate Change Considerations

Climate change will not directly affect wildlife collision hazards. However, changing weather patterns will most likely affect animal propagation rates, migration patterns, and foraging range.

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4. RISK ASSESSMENT

The hazards described in **Chapter 3** vary in terms of past severity and in the likelihood and intensity of future events. However, the frequency and severity of future hazard events is, by itself, insufficient to describe Mono County's and Town of Mammoth Lakes' vulnerabilities to these hazards. A risk assessment is necessary to prepare a more accurate view of the threats that the county and the town face due to the hazard events which may occur in the area. Risk was evaluated for all hazards, although more detailed assessments were possible for seismic-related hazard, dam failure, flood, and wildfire, as these have established geographic zones identified as being at risk. Wildfire risks are discussed in the Community Wildfire Protection Plan in **Chapter 7**.

4.1 Risk Assessment Method

The risk assessment focuses on the vulnerability of specific community assets for the areas that each hazard could impact. They include the following:

Social Vulnerability: A single hazard event can cause substantially different impacts for different individuals, even if the intensity of the hazard was the same for the entire community. Certain groups of people may be more vulnerable to natural hazards due to physical condition, socioeconomic status, or other factors. For example, elderly residents may have less physical capacity to maintain a safe internal body temperature in very hot weather, which may make them more vulnerable to heat waves. In other instances, individuals with lower incomes may be less able to renovate their homes to be more resilient to hazards, meaning that they can face a higher likelihood of their home being damaged or destroyed if a hazard event occurs. A countywide snapshot of demographics that indicate social vulnerability is provided in **Chapter 2**. The social vulnerability assessment looks at the following metrics for different hazard zones:

Topic	Indicators
Median HH Income	Median household income
Poverty	Households at or below 2x federal poverty level
Linguistic Isolation	Households where no one over age 14 speaks English well
Elderly	Households with member over 65
Disability	Households with a disabled member
Total Population	Total population

Social vulnerability data was drawn from the US Census American Community Survey, and was available at the block group level of geographical unit size.

The risk assessment includes a social vulnerability analysis for flooding, fault rupture, dam inundation, and fire. Other hazards, such as ground shaking, drought, and extreme weather, are not analyzed because these hazards can affect the entire community, and hazard zones are generally not limited to specific locations or for which location-specific data is not available.

The social vulnerability assessment compares the areas in the hazard risk zones to the entire community to determine if social vulnerability is higher within the hazard risk zone. However, even if residents in the hazard risk zone are no more or less vulnerable than the entire community, this does not mean that there are no social vulnerability concerns for the hazard. The absence of a difference in social vulnerability between the hazard risk zone and the entire community does not mean social vulnerabilities are completely absent. It is possible that the entire community faces a high degree of social vulnerability from the hazard (for example, if there is a high proportion of households under the poverty limit in the community). Additionally, even if only a small number of residents are considered socially vulnerable, it does not mean that local governments do not need to work on reducing social vulnerability; neither can governments ignore any special needs or considerations that are applicable to these residents.

Critical Facilities: As discussed in **Chapter 2**, critical facilities in the county are essential for emergency response and recovery and include a wide range of facilities and infrastructure. **Appendix C** contains the full list of critical facilities. To the extent possible, such facilities should be located outside hazard zones. This is frequently not feasible, since the functioning and effectiveness of facilities are often location-dependent. Consequently, facilities should be defended or hardened against the impacts of hazards that may occur in those locations.

Property and Building Exposure: The exposure of property and structures, primarily in the urbanized communities, are a primary focus of mitigation planning efforts. For two key hazards, flood and earthquake, HAZUS-MH, a software program and standardized methodology for estimating potential monetary losses from these hazards, was used to model an estimate of the worth of buildings in the county, broken down by occupancy type. **Table 4.1** shows the county (including the Town of Mammoth Lakes) building exposure estimate.

Table 4.1: HAZUS Total Building Exposure Estimate

Occupancy	Exposure ($1,000)	% of Total
Residential	$2,459,157	89.2%
Commercial	$190,438	6.9%
Industrial	$29,199	1.1%
Agricultural	$4,271	0.2%
Religion	$27,839	1.0%
Government	$23,498	0.9%
Education	$21,330	0.8%
Total	**$2,755,732**	**100.0%**

This was then used to evaluate potential losses as a result of particular flood or earthquake scenario that might occur in various parts of the county.

4.2. Hazard Risk Assessments

4.2.1 Avalanche

Although the avalanche risk area is generally limited to the national forests in the Sierra Nevada, there are communities and roadway sections at risk of property damage and loss of life due to avalanches.

Mono County

Communities at risk are:

- **Bridgeport Valley:** Twin Lakes has an area of concentrated residential development that is open for year-round use. The area experiences frequent, large avalanches. This area contains few permanently occupied homes but a number of seasonally occupied cabins, as well as recreational facilities such as boat docks, restrooms, stores, campground sites, parking lots, and trails. Few of these facilities are retrofitted in any way to help withstand or protect visitors in an avalanche event.
- **June Lake:** Portions of SR 158 are in the runout zone for avalanches, which would block the primary access route to neighborhoods and facilities along the June Lake loop, including more than 200 residential units and 500 permanent residents. Several dozen homes in the residential community are in the direct path of runout zones as well.

- **Long Valley:** Residential development in Long Valley is exposed to large avalanches originating from the northeast face of McGee Mountain and from slopes below Castle Rock, located directly above existing development. A portion of US 395 and residential, lodging, and commercial facilities in several small communities of the Crowley Lake area are directly in the outflow area of frequent avalanches from McGee Mountain.
- **Wheeler Crest:** A major dry-snow avalanche occurred in 1969 in Swall Meadows. Avalanche risk also exists on the Lower Rock Creek access road from a number of small east-facing paths that descend directly onto the road.
- **Mono Basin:** Several large avalanche paths are known to extend east of US 395 approximately 1 to 2 miles north of Lee Vining. While few structures are in the runout zone, an avalanche could shut down and damage US 395 as well as major power lines.

An area at the west end of Lundy Lake, which includes some private homes, is threatened by a large, steep avalanche path. At present, Lundy is not occupied continuously during the avalanche season, and the road from US 395 is closed in winter.

- **Outside of the Community Planning Areas:** Much of the development in Virginia Lakes is in a runout zone, as are several portions of the single access route to it—Virginia Lakes Road. This area is primarily a seasonal residential area, although a number of dispersed housing units are present. It is also frequented by recreational snowmobiles and backcountry skiers. It includes several dozen seasonal residence structures, as well as recreational infrastructure such as bathrooms, trailheads, and parking lots.

Critical facilities in these areas, including single-access routes, primary access routes, roads, and sub-stations and power lines, have an elevated risk of damage due to avalanches. There is insufficient data on the exact avalanche zone areas to accurately identify all critical facilities that could be at risk. A comprehensive on-site analysis and avalanche modeling through the internationally accepted RAMMS module AVALANCHE would provide more accurate and detailed data on avalanche risk areas and what critical facilities are at greatest risk.

Specific road segments of concern identified by the County for avalanche monitoring in 2017 are shown in **Table 4.2**.

Table 4.2: 2017 Road Segments at Risk of Avalanche Identified for Monitoring

Planning Area	Road	General Location
Bridgeport	Twin Lakes Road	South of Bridgeport
Long Valley	Crowley Lake Drive	At McGee Mountain
	Crowley Lake Drive	At Ojai Ridge
	Rock Creek Road Narrows	Near Tom's Place
June Lake	Lakeview Drive	Near June Lake
Mammoth Vicinity	Benton Crossing Road	Near Wildrose Summit
Mono Basin	Picnic Grounds Road	Near Lee Vining
Wheeler Crest	Mountain View Road, Foothill Road, and Swall Meadows Road	Swall Meadows
	Lower Rock Creek Road Narrows	North of Swall Meadows
Outside planning area	Virginia Lakes Road	Northwest of Mono City
	Lundy Lakes Road	Northwest of Lee Vining

Town of Mammoth Lakes

Avalanche damage to property is a risk in several areas of town, including homes in the Sherwin Range and Knolls neighborhoods. The Mammoth Mountain Ski resort contains no residential structures but does contain structures such as ski lifts and lodges; it is also at risk from outflow paths off Mammoth Mountain. Thousands of visitors may be on the slope at any given time, even when avalanche risk has been determined to be high.

The Town's Zoning Code contains a Snow Deposition Design Overlay Zone (SDD), which identifies areas of avalanche risk. It includes areas immediately above, adjacent to, or within 150 feet of the 30-degree point of an avalanche starting zone. All development within the SDD requires a use permit, as well as certification from an expert in the occurrence, force, and behavior of avalanches. The SDD does not guarantee the safety of homes within the zone, nor is the zone intended to be fully comprehensive regarding all areas that are at potential risk from avalanche.

4.2.2 Dam Failure

There are 22 dams in Mono County. The California DWR rates each dam based on the potential downstream impacts to life and property in the event of dam failure while operating with a full reservoir. These ratings do not reflect how likely the dam is to fail, only how severe the results will be if it does. The ratings are described in **Table 4.3**, and each dam in Mono County with their respective downstream hazard classification is listed in **Table 4.4.** As noted in **Chapter 3**, only eight dams have possible inundation zones that have been identified by the state; these dams are shown in bold.

Table 4.3: Downstream Hazard

Downstream Hazard Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner's property
Significant	None expected	Yes
High	Probable (one or more expected)	Yes, but not necessary for this classification
Extremely High	Considerable	Yes, major impacts to critical infrastructure or property

Source: California Department of Water Resources 2017

Table 4.4: Mono County Dam Classifications

Dam No.	National ID No.	Dam Name	Downstream Hazard
104.038	CA00454	Agnew Lake	High
538.000	CA00646	Black Reservoir	Low
70.002	CA00284	Bridgeport	Significant
104.037	CA00453	Gem Lake	High
6.033	CA00089	Grant Lake	High
539.000	CA00647	Lobdell Lake	Low
6.034	CA00090	Long Valley	Extremely High
531.002	CA00644	Lower Twin Lake	High
104.035	CA00451	Lundy Lake	High
540.000	CA00648	Poore Lake Reservoir	Low
104.041	CA00457	Rhinedollar	High
104.034	CA00450	Rush Creek Meadows	High
104.039	CA00455	Saddlebag	High
104.040	CA00456	Tioga Lake	High
70.003	CA01473	Topaz Lake	Significant
6.042	CA00095	Upper Gorge	Low
531.000	CA00643	Upper Twin Lake	High
6.035	CA0091	Walker Lake	Low

Source: California Department of Water Resources 2017

There are two dams under the jurisdiction of U.S. Army Corps of Engineers. These dams are under federal jurisdiction, and information on downstream hazard ratings is not available. These dams are Lake Mamie and Lake Mary.

Because these two dams are in the same watershed as the Upper and Lower Twin Lakes Dam, the downstream hazard may be assumed to be the same risk level, i.e., high.

Mono County

While there are close to two dozen dams in the county with varying conditions, no single dam failure would result in risk to residences or commercial structures. However, two critical facilities are located in dam failure inundation areas, both of which are lifeline utility systems, in the June Lakes Area. Critical roadway infrastructure is at greatest risk of closure as well as extensive damage. Dam failure inundation zones cross two sections of US 395, several sections of CA 120, large portions of CA 168, and much of CA 102.

Town of Mammoth Lakes

The Town of Mammoth Lakes, located downstream of the Twin Lakes, Lake Mamie, and Lake Mary Dams, has a number of residential and nonresidential structures at risk. Homes on Mammoth Creek often experience flooding problems during major precipitation events and would likely experience flooding damage in the event of dam failures.

4.2.3 Disease/Pest Management

Mono County

Disease and pest management hazards are present throughout Mono County and in Mammoth Lakes. Because disease often travels through animal or insect vectors, as well as human contact, the risk is similar anywhere in the county. Areas of increased contact with wildlife may be somewhat more susceptible, as well as areas with high populations of mosquitoes. In Mono County, cases of bubonic plague, hantavirus, and tick-borne relapsing fever have been reported, and there is a possibility, although remote, of West Nile virus occurring in the region. Common carriers for these diseases include rodents such as mice and squirrels, ticks, fleas, and mosquitoes.

Occurrences of these diseases are rare in Mono County and generally identified quickly, which reduces the risk of a significant outbreak. Loss of life is therefore minimal, and the chances of an epidemic are remote. Critical facilities are not impacted by diseases and are generally unaffected by pests, although wooden buildings may be damaged by wood-eating insects.

Town of Mammoth Lakes

Disease and pest management hazards in the Town of Mammoth Lakes are similar to that of the rest of the county, with such hazards present throughout its area. As a tourist destination, the town may be at higher risk from contagious diseases spread through human contact.

4.2.4 Drought

Mono County

The regional nature of drought hazards means that all of Mono County and Mammoth Lakes face an equal risk of drought, although the characteristics of a drought can vary widely across the region. While droughts typically do not pose a health or safety impact, in extreme cases normal water supplies may dry up and individuals may have to procure water from other sources, which may be difficult for lower-income residents. In addition, water is critical for activities that indirectly apply to human health, such as agriculture, livestock watering, and sanitation. There are also economic concerns, as skiing and the lakes in Mono County are a primary tourist attraction, and a decline in tourist activity can cause a sharp decline in revenue for local businesses and jurisdictions.

Much of the water used in Mono County comes from groundwater wells, which makes the water prone to both natural contamination such as metals and arsenic, and man-made contamination from pesticide and fertilizer runoff, and septic systems. In times of drought, the groundwater may not be recharged as quickly as water is extracted, potentially causing depletion of the groundwater. This results in lowering of the water table that can cause land subsidence, increased water costs, further reduced surface water supplies, and an increase in water quality concerns as contaminations become more concentrated.

The Owens Valley Groundwater Basin is considered a basin of medium importance by the DWR. The basin underlies the entire Owens Valley in neighboring Inyo County as well as the Tri-Valley area and communities of Benton, Hammil, and Chalfant. Like much of the rest of the county, these communities depend on groundwater as well as surface water supplies. These areas include agricultural activities, primarily alfalfa fields, which depend on groundwater. Per state law, the County is currently coordinating with neighboring jurisdictions to develop a Groundwater Sustainability Plan, which will identify needs for facilities, investigations, and management activities that should be undertaken to maintain and enhance sustainable groundwater management in the future.

Critical facilities are not physically affected by drought conditions, although droughts may have impacts for facility operations, such as water recreation facilities.

Town of Mammoth Lakes

As stated above, drought risks in Mammoth Lakes are consistent with risk throughout the county.

4.2.5 Seismic Hazards

As discussed in **Chapter 3**, seismic hazards include four related hazards: fault rupture, shaking, liquification, and tectonic subsidence. Faults are the only hazard where location-specific information is available. An earthquake centered at any one of these faults could result in strong shaking in much of the entire county, and potentially pose major risks to life and property throughout.

Consequently, this risk analysis focuses on fault locations, while acknowledging that seismic hazards are present throughout Mono County and the Town of Mammoth Lakes.

Mono County

Faults exist throughout Mono County. The parts of the unincorporated county at risk of fault rupture generally do not face a higher social vulnerability to this hazard than the rest of the unincorporated area.

Town of Mammoth Lakes

There is no calculated population within the fault rupture hazard zone for Mammoth Lakes. **Table 4.4** shows the social vulnerability of unincorporated Mono County to fault rupture.

Table 4.5: Social Vulnerability to Fault Rupture in Unincorporated County

Social Vulnerability Metric	Fault Rupture Hazard Zone	Entire Community
Population	413	6,042
Number of households	142	2,213
Median household income	$56,608	$59,386
Percentage of households under poverty limit	2.8%	5.1%
Percentage of elderly households	27.5%	35.2%
Percentage of adults with high school degree or higher	Unknown	87.9%
Percentage of adults with English competency	99.7%	95.5%
Percentage of households with a disabled member	12.7%	15.3%

HAZUS-MH, a software program and standardized methodology for estimating potential monetary losses from earthquake and select other hazards, was used to assess potential losses in Mono County. Three different earthquake scenarios, identifying several potential magnitude faults along specific faults in various locations in the county, were evaluated using the program's generalized estimates for the number and value of these structures in the county. One scenario evaluated an earthquake along the Hilton Creek fault, located in Long Valley west of Crowley Lake. The Temblor Seismic Hazard Rank along the Hilton Creek Fault, 32, is significant. The Mammoth Lakes area experienced four M≥6 shocks in the 1980s, which ruptured parts of the Hilton Creek fault (Bryant 1980). The scenario assumes a magnitude of 6.9 along the fault. HAZUS estimates that in such a scenario, about 922 buildings will be at least moderately damaged, 124 would be extremely damaged, and 15 damaged beyond repair. The quake would also damage more than 40 segments of highway and more than 40 bridges. The total economic loss estimated for this earthquake would be more than $159.2 million, which includes building and lifeline-related losses based on the region's available inventory. Full reports provided by HAZUS are located in **Appendix D**.

Faults like Hilton Creek exist throughout Mono County, with many faults and historic earthquake epicenters located near US 395, especially in the southern third of the county. Various faults also cross portions of SR 120 and SR 158. Because these corridors are primary evacuation routes for the county, earthquakes near them could considerably hinder evacuation efforts and leave the county isolated from outside assistance.

Primary earthquake hazards are ground shaking, landslides, surface rupture or displacement, and liquefaction. While no complete mapping is available for liquefaction risk, past events suggest that the valley areas face an elevated risk of liquefaction, particularly areas around dry lake beds. Other secondary hazards associated with ground shaking and liquefaction include:

- Flooding from broken dams
- Fire from broken gas lines and power lines
- Damage to buildings and infrastructure
- Avalanches
- Seiches in large lakes and reservoirs
- Injury and death from falling debris or secondary hazards

Much of the damage and risk to life from an earthquake is a result of these secondary hazards. Vulnerability to these events depends on the location and population of nearby settlements, the concentration and structural integrity of buildings, and public warning systems and preparedness. Population density and building intensity is generally low in Mono County; however, the lack of comprehensive transportation networks and the rural nature of the county means response times could be high and access to necessary services could be heavily impacted.

Ground shaking from earthquakes has the potential to affect all areas of Mono County and Mammoth Lakes; no critical facility is considered completely safe from this hazard. There are nine critical facilities located within the fault zone, as shown in **Table 4.6**.

Table 4.6: Types of Mono County Facilities in Fault Rupture Hazard Zones

Facility Type	Number of Facilities Not at Risk	At Risk – Mammoth Lakes	At Risk – Unincorporated Mono County
Communication	11	2	1
Emergency Operations Center	12	1	0
Emergency Services	26	0	1
Hazardous Materials	12	0	1
Lifeline Utility Systems	53	0	3
Schools	11	0	1
Transportation Systems	10	0	1
Total	135	3	8

4.2.6 Flood

Flooding is especially prevalent in the Tri-Valley area, which includes the communities of Benton, Hammil, and Chalfant. June Lake, Antelope Valley, and Bridgeport Valley also have areas of flood risk, with 18 percent of Antelope Valley and just over 11 percent of Bridgeport Valley located in the 100-year flood zone. Overall, more than 50 percent of state land and 11 percent of privately owned land is vulnerable to flood risk. No households are located in the Mammoth Lakes' 100-year flood zone, while 7 percent of county residents live in the 100-year flood zone and 2 percent live in the 500-year flood zone.

Table 4.7: Social Vulnerability for 100-Year Flood Hazard Zones – Unincorporated Mono County

Social Vulnerability Metric	100-Year Flood Hazard Zone	500-Year Flood Zone	Entire Community
Population	431	143	6,042
Number of households	182	70	2,213
Median household income	$44,817	$43,306	$59,386
Percentage of households under poverty limit	5.5%	5.7%	5.1%
Percentage of elderly households	28.6%	41.4%	35.2%
Percentage of adults with high school degree or higher	Unknown	Unknown	87.9%
Percentage of adults with English competency	98.8%	98.3%	95.5%
Percentage of households with a disabled member	22.5%	25.7%	15.3%

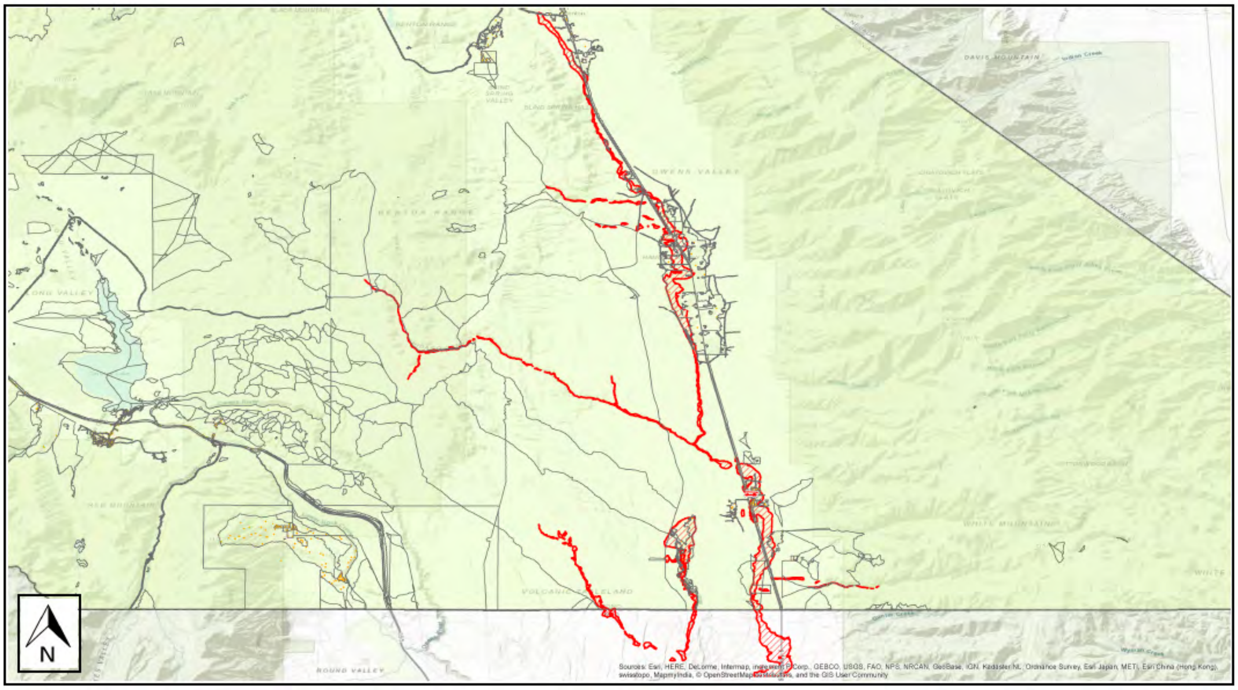
There are no critical facilities in flood zones in Mammoth Lakes. Mono County has five critical facilities in the 100-year flood zone and eight critical facilities in the 500-year flood zone, including three senior living facilities and one school. See **Table 4.8**.

Table 4.8: Types of Mono County Facilities in Flood Hazard Zones

Facility Type	100-Year Flood Zone	500-Year Flood Zone
Communications Facilities	2	-
Emergency Operations Center	1	-
Emergency Services	1	2
Lifeline Utility Systems	1	2
Schools	-	1
Vulnerable Populations	-	3

HAZUS-MH modeling was used to assess potential losses due to flood in Mono County. Twelve different flood scenarios, identifying possible storms from a 100-year flood event in various locations in the county, were evaluated using the program's generalized estimates for the number and value of these structures in the county. One scenario evaluated a flood event along US 6 in Hammil and Chalfant Valleys, an area that historically floods most frequently in the county, as shown in **Figure 4.1**.

Figure 4.1: HAZUS Flood Scenario in the Tri-Valley



Under such a scenario, HAZUS estimates that about 62 buildings would be affected; twenty buildings would be moderately damaged and 48 buildings would be destroyed. The total building estimated losses in this case would total more $15.6 million. HAZUS also estimates that 123 households would be displaced due to the flood. Full reports provided by HAZUS are located in **Appendix C**.

FEMA's National Flood Insurance Program

In 1968, the US Congress created the National Flood Insurance Program (NFIP). Participation in the NFIP by a community is voluntary; however, in order to receive flood hazard funding from FEMA, a community is required to participate in the program. Mono County has participated in the NFIP since 1985.

The Community Rating System (CRS) is a voluntary part of the NFIP that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum discounts. CRS ratings are on a 10-point scale (from 10 to 1, with 1 being the best rating), with community residents who live in FEMA's Special Flood Hazard Areas receiving a 5 percent reduction in flood insurance rates for every class improvement in the community's CRS rating. Neither Mono County nor the Town of Mammoth Lakes participates in the CRS (FEMA 2016).

Because eligibility for the NFIP is based on flood hazard mapping, statistics on participation in NFIP can indicate the flood risk in Mono County and the Town of Mammoth Lakes in addition to the social vulnerability and critical facilities assessment.

FEMA also operates a Severe Repetitive Loss (SRL) program. The primary objective of the SRL properties strategy is to eliminate or reduce the damage to residential property and the disruption to life caused by repeated flooding. Only one property has been identified as having multiple floods, a commercial property. FEMA identified no repetitive loss properties in the Town of Mammoth Lakes.

4.2.7 Landslides (Geologic Hazards)

There are no clearly defined landslide hazard zones in Mono County, and therefore precise figures on social vulnerability and impacts to critical facilities are not available. Any critical facilities located in areas near steep slopes or alluvial fans may be damaged by landslides, and individuals living in these areas face a higher social vulnerability to landslides than residents elsewhere in Mono County. The primary area of concern for landslide risk is along US 395 in the northern portion of the county and in the Lee Vining area, which are adjacent to steep slopes that are more susceptible to landslides that could block evacuation routes. The Town of Mammoth Lakes does not have any significant risk of landslide.

As indicated in the hazards assessment, volcano-related hazards that may affect Mono County for which there are clearly defined areas of elevated threats are pyroclastic flows and hazards from existing volcanic vents. The majority of Mono County, including the Town of Mammoth Lakes, is at risk of pyroclastic flows. Critical facilities in these areas may be damaged if ash is not cleared off roofs (particularly during wet weather), and the ash may harm a facility's mechanical or electrical systems. Similarly, residents in the hazard zone may face respiratory health risks or have their homes damaged by volcanic ash. Volcanic vents have the potential to release volcanic gases, and there have been deaths in Mono County caused by falls into a snow cavern around the vent.

4.2.8 Hazardous Materials

The primary risk from hazardous materials in Mammoth Lakes and Mono County are from radon, carbon monoxide, propane, and hazardous material transportation. Because radon and propane are widespread throughout the county, there are no clearly defined hazard zones and therefore no identified critical facilities. In addition, no social vulnerability analyses can be performed. For hazardous material transportation, the main highways will be at higher risk for accidents that have the potential to cause spills and explosions.

4.2.9 Severe Winter Storm and Snow

Most types of severe weather have a roughly equal chance of occurring anywhere in Mono County, so all critical facilities and residents are considered potentially vulnerable to severe weather hazards. As a result, there are no critical facilities with a greater chance of being affected and no social vulnerability analyses for severe weather. However, residents who typically have a greater social vulnerability to other natural hazards (elderly residents and persons with disabilities, lower-income individuals, persons with limited English competency, etc.) are likely to face higher social vulnerability to severe weather.

4.2.10 Severe Wind

Severe wind is possible almost anywhere in Mono County, although tops of slopes and open areas with few trees experience the greatest wind speeds. All critical facilities and residents are considered potentially vulnerable to severe wind. Since most newer structures are built to withstand 90 mile-per-hour gusts, old structures and vehicles on the open road are typically at the greatest risk. No critical facilities are at risk except the historic County Courthouse building, built in 1880. The building has been structurally retrofitted to better withstand severe wind and weather events.

Residents who typically have a greater social vulnerability to other natural hazards (elderly residents and persons with disabilities, lower-income individuals, persons with limited English competency, etc.) are also likely to face higher social vulnerability to severe wind if caught outside or in vehicles.

4.2.11 Wildlife Collisions

Wildlife collisions are a hazard in most places of the county, and along major highways in particular. Because collisions will generally only affect the animal and vehicle involved, critical facilities are not at risk, although property damage and injury may occur and wildlife movement patterns may be negatively affected. Vulnerable populations are not more or less affected by this than any other demographic in the county.

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5. MITIGATION MEASURES

Outlining clear strategies to reduce the impacts of these identified hazards on community members and critical infrastructure provides a clear path forward for Mono County and the Town of Mammoth Lakes to achieve the goals set forth in this Plan. This section of the Plan provides recommendations for action, including responsible agencies and departments, potential funding sources, and related policy documents. The findings from the vulnerability and risk assessments in Chapters 3 and 4 of this Plan were used to develop measures that reduce or possibly eliminate potential losses of life or property from the region's most pressing hazards.

5.1. Hazard Mitigation Overview

5.1.1 FEMA's National Flood Insurance Program

In 1968, the US Congress created the National Flood Insurance Program (NFIP). Participation in the NFIP by a community is voluntary; however, to receive flood hazard funding from FEMA, a community is required to participate in the program. The Town of Mammoth Lakes has participated in the NFIP since 1985, and Mono County has participated since 1978.

The Community Rating System (CRS) is a voluntary part of the NFIP that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum discounts. CRS ratings are on a 10-point scale (from 10 to 1, with 1 being the best rating), with community residents who live in FEMA's Special Flood Hazard Areas receiving a 5 percent reduction in flood insurance rates for every class improvement in the community's CRS rating. Neither Mono County nor the Town of Mammoth Lakes participate in the CRS.

5.1.2 Hazard Mitigation Goals

As presented in Chapter 1, Section 1.5, goals for Mono County and the Town of Mammoth Lakes cover the various priority hazards.

These goals outline and guide the development of policy choices that protect community members, critical facilities, infrastructure, property, and regional natural resources from hazards. These goals shape future actions to be taken by Mono County and the Town of Mammoth Lakes to reduce risk and minimize losses from disaster. These goals will continue to ensure that implementation of the MJHMP is aligned with the original intent, and can serve as checkpoints for responsible departments to monitor the progress of measures. The mitigation measures either fall under multiple hazards, and thus generally provide improvements that can reduce long-term risk for multiple or all hazards, or are categorized under a specific hazard.

5.1.3 Hazard Mitigation Prioritization

At the January 25, 2018, meeting of the Planning Team, draft hazard mitigation measures were revised and prioritized using data analysis of risk from each hazard as well as local knowledge about community members' priorities. Planning Team members were asked to confirm a list of 20 or fewer Highest Priority measures that deserve the greatest focus over the five-year life of the plan. The 2006 adopted MJHMP had far more measures identified as short-term and high priority, making it difficult for staff to truly prioritize action with limited funding. Limiting the total number of Highest Priority measures in this update will assist in addressing this issue. Notes from this discussion are located in **Appendix B**. Measures that were completed since the last update in 2006 are also documented in **Appendix B**.

5.2. Hazard Mitigation Strategy

The Planning Team used data from the hazard vulnerability assessment in Chapter 3, the risk assessment in Chapter 4, and the capabilities assessment in Section 5.3 of this chapter to inform the development of the following measures. Measures reflect the actions that the County and Town plan to take for preparedness, response, recovery, and mitigation. Mitigation measures that can provide for long-term reduction in risk to life and property are rows highlighted in blue; the intent of highlighting these measures is to assist staff in determining for which measures to apply for FEMA mitigation grant funding when it becomes available. Measures that are the Highest Priority for this MJHMP period are shown in **bold**.

Table 5.1 identifies the hazards, proposed mitigation measures, the responsible party for implementation, and the priority ranking as determined by the Planning Team.

Recognizing the federal regulatory requirement to prioritize by benefit-cost, and the need for any publicly funded project to be cost-effective, the Planning Team was asked to consider cost-effectiveness in selecting highest priority measures. The County and Town will pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in **Table 5.1**. Cost-effectiveness will be considered in additional detail when seeking FEMA mitigation grant funding for eligible projects identified in this plan. In general, the County and Town have limited existing funds to implement measures. Education and ongoing maintenance measures are part of existing emergency response personnel duties and also heavily depend on collaboration with Federal and State agencies. Measures relating to infrastructure and roadway improvements may draw upon CIP and Community Service Infrastructure allocated funds and may also be funded through Caltrans grants. For all other measures, the County and Town must depend on other funding sources including but not limited to FEMA Hazard Mitigation Grants and other federal monies.

Table 5.1: Plan Hazard Measure

Measure Number	Measure	Applicability	Responsible Department	Timeline
Multiple Hazards				
1.1	**Work with SCE to identify vulnerabilities and malfunctions in the local power grid, and coordinate on efforts to make the power grid more resilient to hazard events and reduce fire risk. Underground line segments, prioritized by feasibility, community vulnerability to power loss, and locational risk of fire.**	Mono County	Public Works	Short-term
1.2	**Study available alternative emergency communications technologies that may provide more reliable service than existing radio communications technology in use.**	Mono County	Information Technology	Short-term
1.3	**Require individuals, as well as companies, that provide home or accommodation rentals to clearly post available emergency evacuation routes for guests.**	Mono County, Town of Mammoth Lakes	Community Development	Short-term
1.4	**Collect parcel-specific information necessary to complete a more accurate "estimate losses" for inclusion in the next LHMP update. The County and Town should inventory existing development to obtain the following data: types of structures, construction type, building size, building footprints, structure value, and replacement value. Incorporate data into GIS and related databases.**	Mono County	Community Development	Short-term

Measure Number	Measure	Applicability	Responsible Department	Timeline
1.5	**Continue to work with state and federal agencies and wireless providers to expand and improve coverage and interoperability of cell and radio service throughout the county.**	Mono County, Town of Mammoth Lakes	Sheriff's Office, Police, Fire, and EMS	Short-term
1.6	**For communities with only one access route, develop, design, and implement a plan to provide an emergency access route, prioritized based on multi-hazard risk to existing access.**	Mono County, Town of Mammoth Lakes	Public Works	Short-term
1.7	Provide information to community members during emergencies through the following media: 1) coordinated through Public Information Officer (PIO); 2) local radio in English and Spanish; 3) reverse 911; 4) internet; and 5) local phone trees.	Mono County, Town of Mammoth Lakes	Sheriff's Office, Police, Fire, and EMS	Ongoing
1.8	Each department should have emergency supplies, including, at a minimum, drinking water and MREs (meals ready to eat) to support their personnel for 24-48 hours.	Mono County	Sheriff's Office	Short-term
1.9	Require applicants for major development projects to conduct hazard assessment studies and to design new or significantly retrofitted structures to be resilient to identified priority hazards in this plan.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
1.10	Develop procedures that allow public infrastructure and service personnel with appropriate identification to access areas affected by a hazard event that have been deemed safe in order to assist in response and early recovery activities. Incorporate procedures in the Emergency Operations Plan upon its next update.	Mono County, Town of Mammoth Lakes	Sheriff's Office, Police, Fire, and EMS	Short-term

Measure Number	Measure	Applicability	Responsible Department	Timeline
Wildfire				
2.1	**For communities and neighborhoods identified to be at highest fire risk, complete a parcel-level analysis. Incorporate into a GIS system, and use to prioritize parcel-level defensible space improvements. Upon completion of the analysis, update the Community Wildfire Protection Plan to incorporate information.**	Mono County, Town of Mammoth Lakes	Community Development	Short-term
2.2	**Create a countywide hazard coordinator position to coordinate development of mitigation and response plans; coordinate community group efforts and public outreach efforts; enable communications to and between volunteer fire and first-response departments; and pursue funding opportunities.**	Mono County	Sheriff's Department	Short-term
2.3	**Install more and higher visibility "fire awareness" signs for use along major highways to inform the public of the current fire danger and to promote fire prevention.**	Mono County, Town of Mammoth Lakes	Sheriff's Department, Public Works	Short-term
2.4	**In communities with outdated or inadequate water storage and pressure for firefighting, work with local fire departments to fund, site, permit, and install new tanks and related facilities.**	Mono County	Community Development	Short-term
2.5	Coordinate with Fire Safe Councils and community groups to promote fire prevention, fuels treatments, invasive species control, and defensible space in the wildland-urban interface and assist in identifying and pursuing funding opportunities to complete these activities.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Ongoing

Measure Number	Measure	Applicability	Responsible Department	Timeline
2.6	Develop community-level fire plans for all communities with the highest fire risk, utilizing resources and assistance from the California Fire Alliance.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Long-term
2.7	Educate homeowners about forest health, fire prevention, and home defense and distribute information on fire prevention resources.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Ongoing
2.8	Ensure that wildland fire hazards are disclosed during real estate transactions as required. Ensure that wildland fire hazards are disclosed during the building permit process.	Mono County, Town of Mammoth Lakes	Community Development, Public Works	Short-term
2.9	Require local landowners to participate in state and federal programs for fuel reduction on private property, such as the Cal Fire Vegetation Management Program, Cal Fire hazardous fuel reduction program, and Bureau of Land Management Wildland Urban Interface Grant Awards program.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Ongoing
2.10	Support efforts by the US Forest Service, the Bureau of Land Management, and other landowners to control or eradicate invasive and/or highly destructive forest pests. Support and implement measures and project priorities established in the Wheeler Crest Community Wildfire Protection Plan with the same force and effect as other measures established in this plan.	Mono County	Sheriff's Department, Fire, Police, and EMS	Short-term
2.11	Develop a grant program that provides residents who own older, non-compliant wildland-urban interface structures the opportunity to make the exteriors code-compliant.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
Severe Winter Weather and Snow				
3.1	**Maintain a list of the residences and needs of vulnerable persons, including elderly residents, socially isolated persons, and immuno-compromised individuals, that could**	Mono County, Town of Mammoth Lakes	Public Health, Sheriff's Office,	Short-term

Measure Number	Measure	Applicability	Responsible Department	Timeline
	require special emergency response resources during hazard events. Develop a response plan for vulnerable persons for use by emergency operators during hazard events.		Fire, Police, and EMS	
3.2	Secure additional snow equipment and materials necessary to maintain key roadway operations even without external resources or assistance.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
3.3	Educate community members about severe storm preparedness, including about home and vehicle supplies and public refuge locations.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Mid-term
3.4	Provide resources to landowners about irrigation efficiency and crops with reduced water requirements. Operate and make accessible public refuge locations during severe storm events within 10 miles of all urbanized communities. Each location should be heated and have on-site back-up generators, adequate parking, and supplies of food and water sufficient to serve vulnerable nearby residents and visitors.	Mono County	Sheriff's Department, Social Services	Ongoing
Seismic				
4.1	Conduct a comprehensive survey of the structural condition of all public buildings and critical facilities, including identification of unreinforced masonry and soft-story structures. Prioritize surveying buildings and facilities in earthquake fault zones. Retrofit or replace structures, as funding allows, identified as being at high risk of collapse in a seismic event.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
4.2	Continue to require new and retrofitted structures to meet minimum state seismic safety standards, and encourage property owners to exceed these standards.	Mono County, Town of Mammoth Lakes	Public Works	Ongoing

Measure Number	Measure	Applicability	Responsible Department	Timeline
4.3	Require property owners to locate new developments outside of known fault rupture hazard zones.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
4.4	Design Town- and County-owned infrastructure in fault rupture zones to resist damage from fault rupture, and encourage other agencies to use similar strategies. Use similar strategies outside of fault rupture zones to the extent feasible.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
4.5	Support fuels reduction, maintenance of treated areas, and broadcast burning in areas around the private land boundary.	Town of Mammoth Lakes	Fire, Police, and EMS	Mid-term
Volcano				
5.1	Distribute information regarding evacuation procedures in the event of potential volcanic alluvial flow and ash distribution.	Mono County, Town of Mammoth Lakes	Sheriff's Department, Fire, Police, and EMS	Mid-term
5.2	Support efforts to improve volcanic forecasting strategies.	Mono County, Town of Mammoth Lakes	Information Technology	Long-term
Drought				
6.1	Encourage retrofits of private homes and businesses for increased water conservation. Continue to educate about and promote the Property Assessed Clean Energy (PACE) programs in funding retrofits.	Mono County, Town of Mammoth Lakes	Community Development	Short-term
6.2	Support the Tri-Valley Groundwater Management District's efforts to improve groundwater management through education and program implementation.	Mono County	Community Development	Mid-term
6.3	Encourage private landowners to use plants that require no irrigation in new or retrofitted landscapes.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term

Measure Number	Measure	Applicability	Responsible Department	Timeline
6.4	Provide resources to local farmers about crop varieties that require little or no irrigation.	Mono County	Community Development	Mid-term
Severe Wind				
7.1	Install a real-time wind and visibility tracking system for key access road segments, and incorporate warnings into online notifications and the emergency notification system.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
7.2	Encourage project applicants to incorporate wind-resistant design features into new or significantly renovated buildings.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
Flood				
8.1	**Develop and implement a program to provide funding for residents with homes in the 100-year floodplain to retrofit structures and raise them out of the floodplain.**	Mono County	Community Development	Short-term
8.2	**Request FEMA to update the FIRM maps for the Walker River watershed communities, the June Lake Loop, and the Tri-Valley area. As maps are updated, conduct public outreach to affected communities regarding NFIP outcomes.**	Mono County	Public Works	Short-term
8.3	Document past flood events in the GIS system to identify historic flooding patterns that can be used to better understand where repetitive flooding hazards occur and enable the County and Town to minimize risks to existing development in those areas.	Mono County, Town of Mammoth Lakes	Community Development	Ongoing
8.4	Through an ongoing public education program, ensure that property owners are aware of flood hazards and practices necessary to diminish the impacts of those hazards. This program should include information on participation in the NFIP.	Mono County, Town of Mammoth Lakes	Community Development	Ongoing

Measure Number	Measure	Applicability	Responsible Department	Timeline
8.5	Develop a Comprehensive Flood Management Strategy for the county and town.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
Avalanche				
9.1	**Complete parcel-level avalanche mapping for the County's GIS system, including data for the Town of Mammoth Lakes. Upon completion of mapping, develop a zoning overlay that requires fair warning of avalanche for all permits and an avalanche risk assessment for all new residential development that recommends required construction standards.**	Mono County	Community Development	Short-term
9.2	Support efforts by the US Forest Service and organizations such as the Eastern Sierra Avalanche Center to post information about avalanche risks and current conditions at trailheads throughout avalanche-prone areas, in visitor centers, and online.	Mono County, Town of Mammoth Lakes	Public Works	Ongoing
9.3	Develop a map for the County website that identifies roadway segments at avalanche risk and educates communities about the risks, forecasting methods, and roadway operations within areas at avalanche hazard areas. As part of the countywide notification system, provide real-time avalanche conditions along the identified roadway segments.	Mono County	Public Works	Mid-term
9.4	Work with federal agencies to transfer privately owned properties in avalanche hazard zones that are adjacent to or on public lands into federal ownership or into the ownership of land conservation organizations, and restrict their use to permanent open space use.	Mono County, Town of Mammoth Lakes	Community Development	Long-term

Measure Number	Measure	Applicability	Responsible Department	Timeline
		Dam Inundation		
10.1	**Work with owners of dams in the county with a condition assessment of 'fair' or lower to identify project or operational improvements and funding necessary to complete the improvements.**	Mono County	Public Works	Short-term
10.2	Work with owners of dams in the county to update information on the potential impacts and inundation areas in the case of dam failure. Develop land use standards and emergency response standards based on that information.	Mono County	Community Development, Sheriff's Office	Mid-term
		Hazardous Waste		
11.1	Establish multiple sites for free or low-cost disposal of hazardous household wastes, including electronic waste.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
11.2	Support and publicize propane tank exchange and recycle programs.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
11.3	Support public information and enforcement of standards for proper installation and storage of propane tanks.	Mono County, Town of Mammoth Lakes	Community Development	Ongoing
11.4	In coordination with Caltrans, the California Highway Patrol, and community members, develop an emergency response plan for hazardous material releases occurring along US 6, US 395, and SR 120.	Mono County, Town of Mammoth Lakes	Public Works	Mid-term
		Disease and Pest Management		
12.1	Continue to monitor the status of infectious diseases in Mono County, and issue public health alerts for diseases that are new to the area or are becoming more widespread.	Mono County	Public Health	Ongoing

Measure Number	Measure	Applicability	Responsible Department	Timeline
12.2	Continue to monitor for agricultural diseases and pests, and take appropriate steps to contain or eradicate these diseases and pests.	Mono County	Inyo and Mono Agricultural Commissioner's Office	Ongoing
12.3	Practice Integrated Pest Management strategies on public landscapes, emphasizing a preventive approach and minimizing the use of chemicals.	Mono County, Town of Mammoth Lakes	Community Development	Mid-term
12.4	Conduct periodic educational campaigns through in-person events and various types of media to encourage community members to remove standing water and practice other mosquito prevention strategies.	Mono County, Town of Mammoth Lakes	Public Health, Police, Fire, and EMS	Mid-term
12.5	Support efforts by the US Forest Service, the Bureau of Land Management, and other landowners to control or eradicate invasive and/or abnormally active forest pests.	Mono County, Town of Mammoth Lakes	Community Development	Ongoing
Wildlife Collisions				
13.6	Work with Caltrans to conduct an analysis of frequent collision areas to determine type and placement of appropriate wildlife crossings. Seek funding to implement proposed wildlife crossing projects.	Mono County	Community Development, Public Works	Mid-Term
13.7	Work with Caltrans to construct fencing in areas of high collision that direct wildlife to safe crossing areas.	Mono County	Community Development, Public Works	Mid-Term
Climate Change				
14.1	Reevaluate changes to hazards and risks as a result of climate change every five years based on more current available information, and revise the LHMP to account for new information.	Mono County, Town of Mammoth Lakes	Community Development, Public Health	Short-term

Secondary Access Assessment

As discussed in Chapter 2 and Chapter 7 of this Plan, both the unincorporated County and the Town of Mammoth Lakes have a number of neighborhoods and entire communities that have only one access route connecting them to community amenities, emergency services, and primary roadways. **Figure 2.8** in Chapter 2 identifies all communities and neighborhoods without secondary access to major access roads. Many of these communities are threatened by one or more hazards. Developing secondary access routes is typically constrained by the presence of hazard zones and steep slopes, as well as procedural onus associated with establishing right-of-way on land owned by multiple private and public entities.

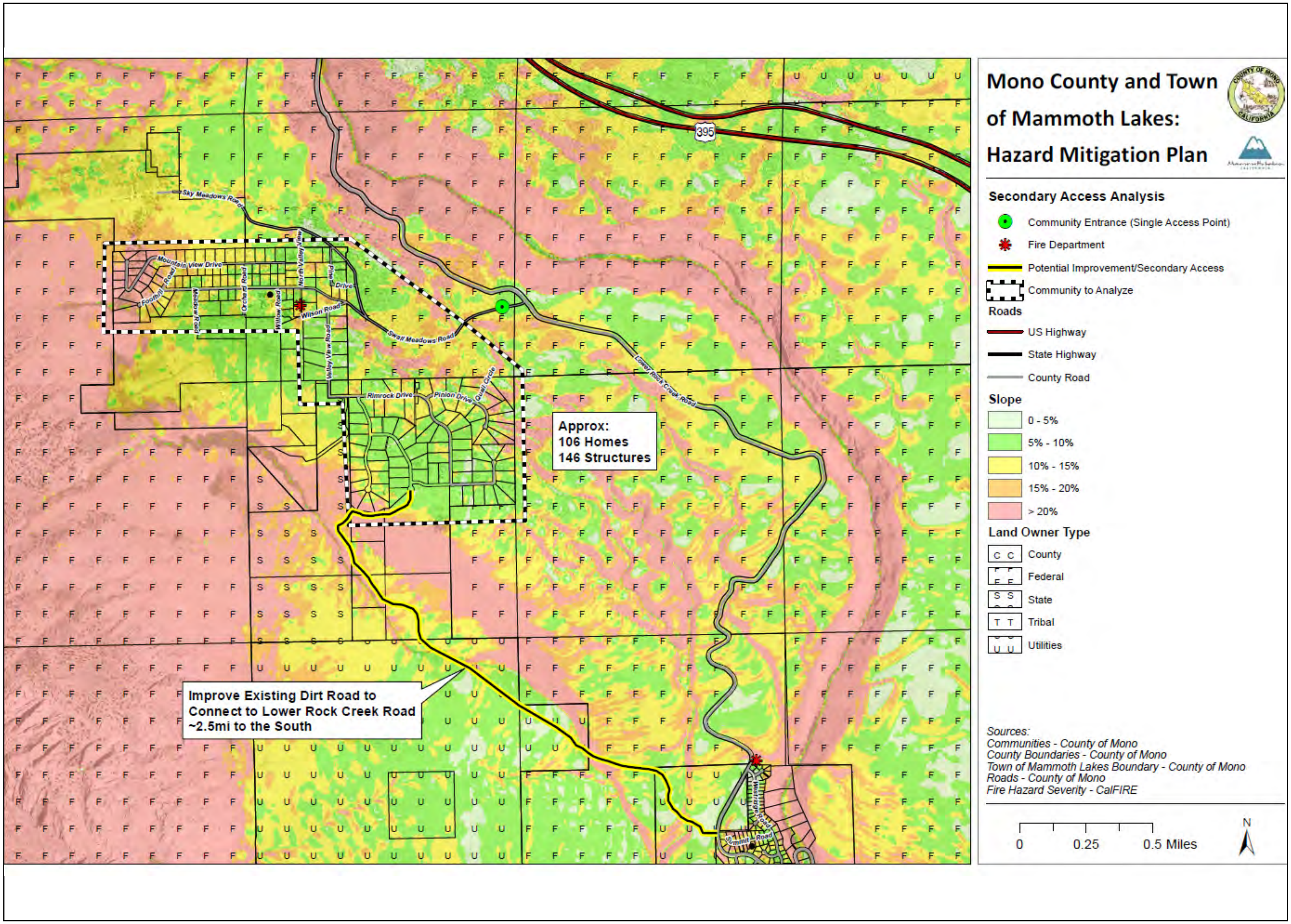
As a part of this planning process, the Planning Team identified six communities for which to conduct more detailed analysis in this Plan of opportunities and constraints in providing a secondary access route or other measures to reduce risk to these communities during a hazard event. These six communities and neighborhoods are:

- Swall Meadows; reached by Swall Meadows Road
- Crowley Lake; neighborhoods reached by Pearson Road (Lakeridge Ranch Estates)
- McGee Creek; neighborhoods reached by Gregory Lane
- June Lake; neighborhoods reached by Rainbow Street (Peterson Tract)
- Chalfant; neighborhoods reached by Chalfant Road
- Chalfant; neighborhoods reached by Tungsten Road (White Mountain Estates)

The following analyses in Tables 5.2 through 5.7 are intended to support implementation efforts of Mitigation Measure 1.6.

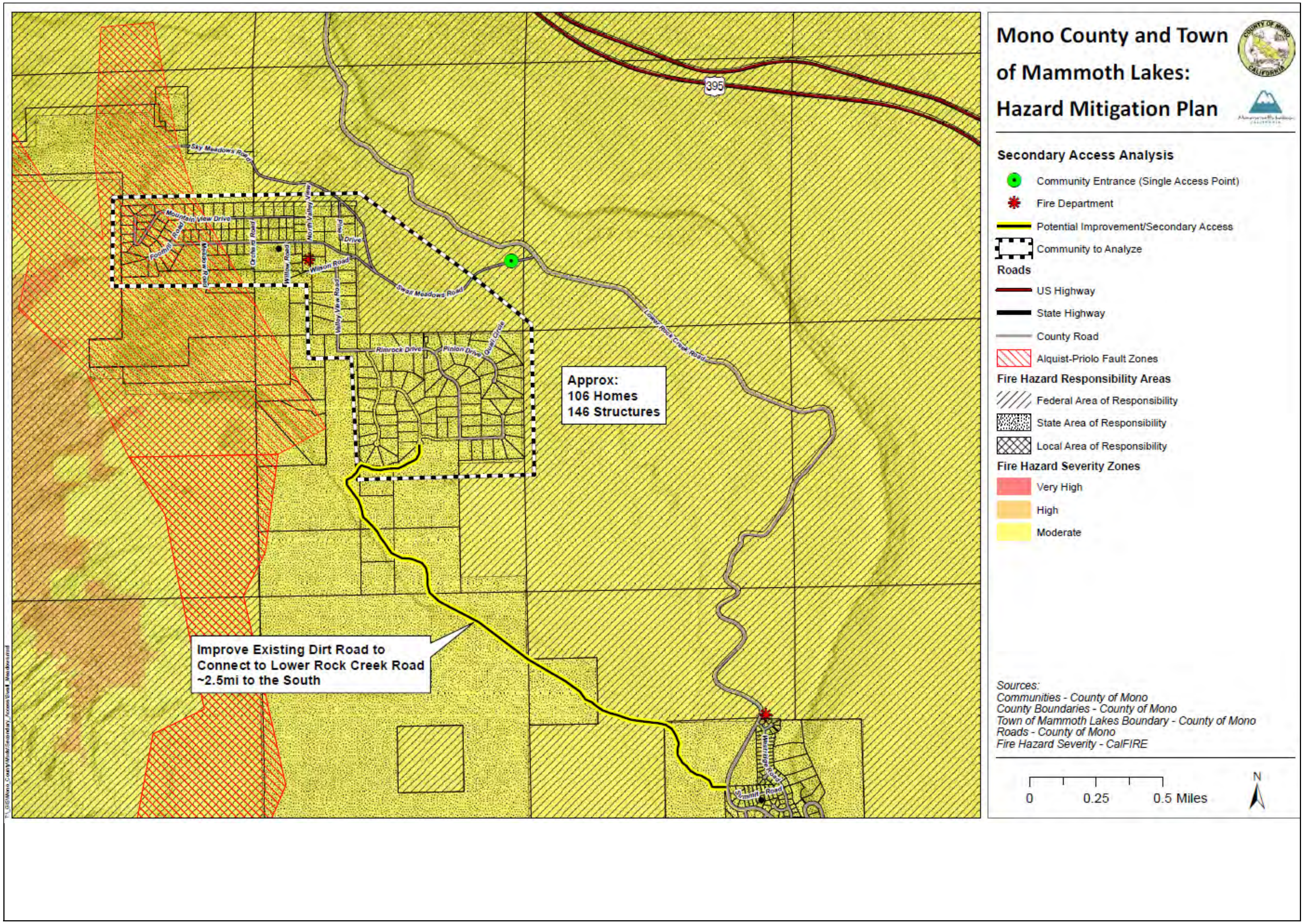
Table 5.2: Swall Meadows Access Assessment

Single Access: Swall Meadows Road
Existing Conditions
Swall Meadows is a residential community which includes second homes and a volunteer fire department, but no commercial development. Located in the Wheeler Crest Community Planning Area, it sits partway up the Sherwin Grade below the Wheeler Crest of the eastern Sierra Nevada. The community's single-access road is Swall Meadows Read, which in turn can only be accessed via Lower Rock Creek Road (aka Old Sherwin Grade Road). Lower Rock Creek Road connects to CA 395 to the north and to another small community, Tom's Place, and CA 395 to the south. The area contains approximately 106 homes and 146 structures. The population was reported as 194 in the 2016 American Community Survey 5-year estimates.
Land Ownership and Slope Conditions
Swall Meadows contains privately owned lots, most less than a quarter acre with single-family homes off of small cul-de-sacs. Land surrounding the community is owned by US Forest Service, Bureau of Land Management, and LADWP. Slopes surrounding the community vary from 5 percent to over 20 percent with the steepest grades to the west toward Wheeler Crest Peak and along Rock Creek, running northwest of the community and south of CA 395. See details in the map below.



Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Fire Department
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0 0.25 0.5 Miles
N
Approx:
106 Homes
146 Structures
Improve Existing Dirt Road to Connect to Lower Rock Creek Road ~2.5mi to the South
395
Sky Meadows Road
Mountain View Drive
Foothill Road
Meadow Road
Orchard Road
Willow Road
North Valley View
Wilson Road
Swall Meadows Road
Valley View Road
Rimrock Drive
Pinion Drive
Quail Circle
Lower Rock Creek Road

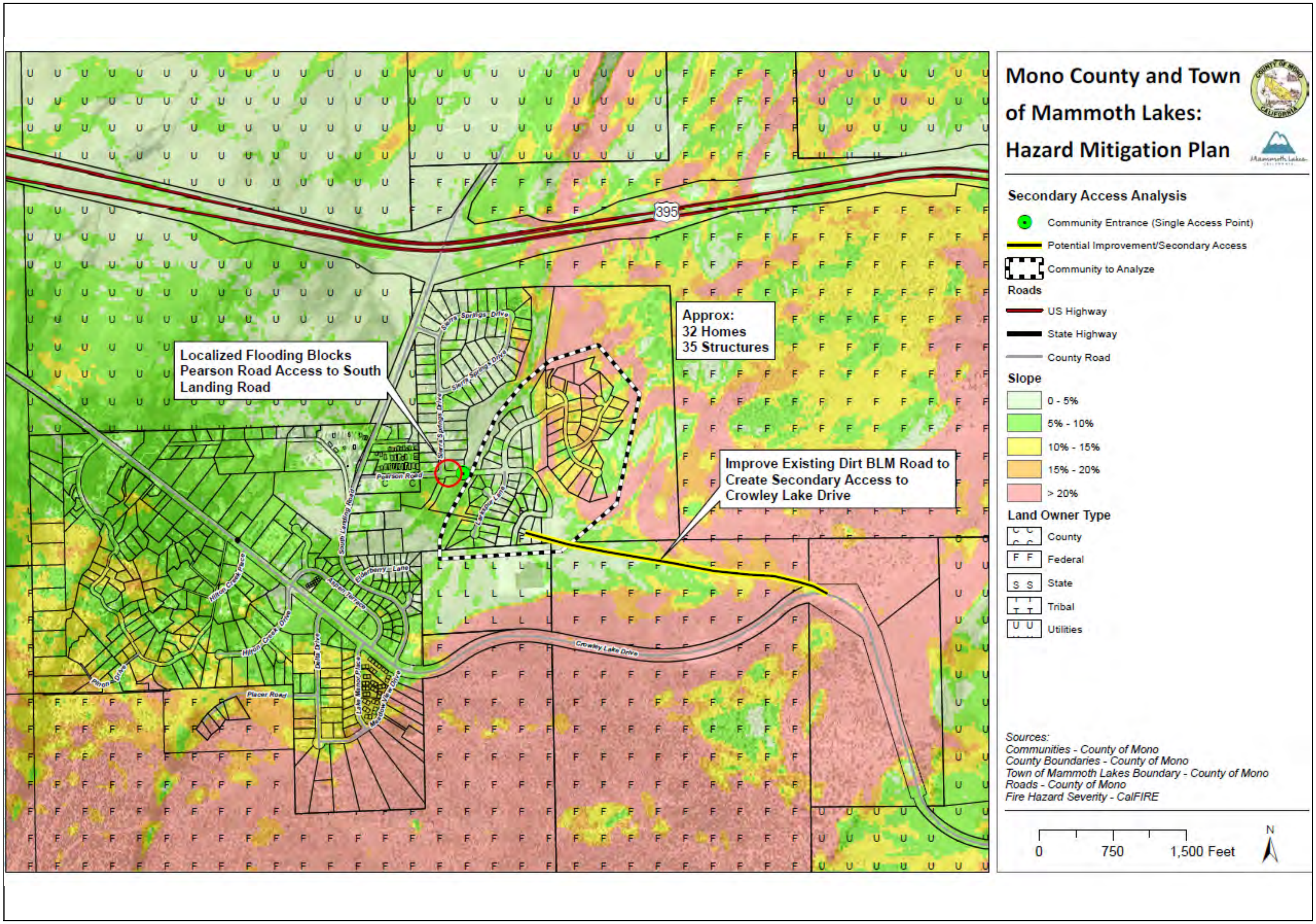
Hazard Conditions
The priority hazard posing greatest risk to the community is wildfire. The community itself is located in a Moderate Fire Hazard Severity Zone but is adjacent to High Fire Hazard Severity Zones. The community has also been threatened by a number of fires in the past and was directly in the path of the 2015 Round Fire, which burned 7,000 acres and many of the structures in the community. Portions of the community are also located within an Alquist-Priolo fault zone. Structures and infrastructure in the fault zone are at high risk of significant damage in the case of an earthquake. See details in the map below.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Fire Department
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Alquist-Priolo Fault Zones
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
0.25
0.5 Miles
N
Approx:
106 Homes
146 Structures
Improve Existing Dirt Road to
Connect to Lower Rock Creek Road
~2.5mi to the South
395
Sky Meadows Road
Mountain View Drive
Wilson Road
Swall Meadows Road
Rimrock Drive
Pinion Drive
Lower Rock Creek Road

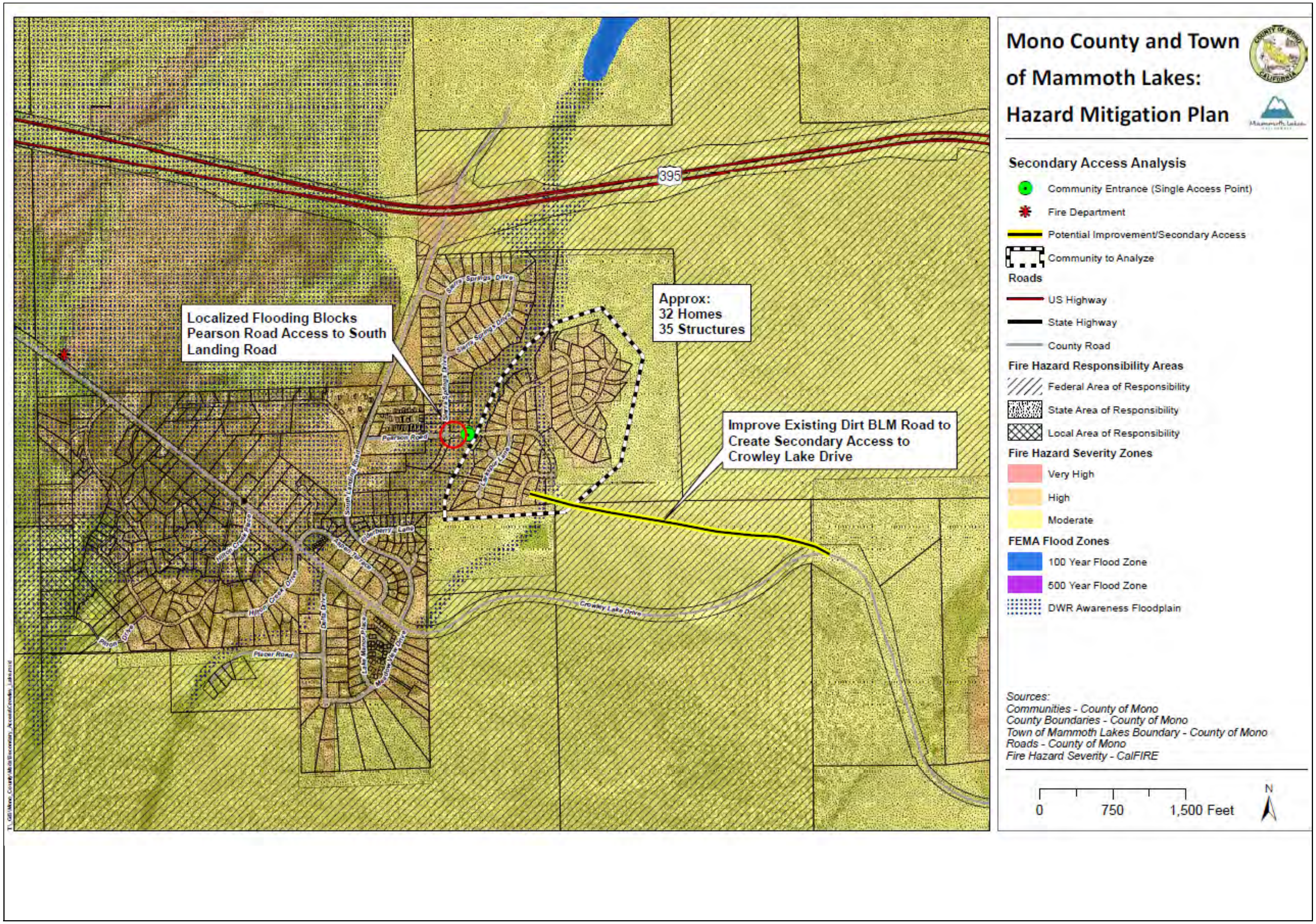
<table>
<tr><th colspan="2">Secondary Access and Risk Reduction Options</th></tr>
<tr><td colspan="2">A secondary access route could be developed by improving an existing dirt road that connects to a section of Lower Rock Creek Road farther south at Tom's Place. The access route would extend roughly 2.5 miles. Steep grades make additional roadway connections directly to CA 395 potentially difficult and costly.</td></tr>
<tr><th>Strengths</th><th>Constraints</th></tr>
<tr><td>By utilizing an existing dirt road, development of the secondary access route may be more cost effective and reduce impacts on the visual and natural resources of the immediate area.
The proposed route avoids steeper slopes that surround the area.
The proposed route does not require an easement or eminent domain process of private residential property.</td><td>The proposed secondary access route, which follows an existing dirt road connecting south to Lower Rock Creek Road, would require crossing both federal and utility land.
Although the proposed secondary access route avoids the steepest slopes in the area, it still must cross small sections with slopes greater than 20 percent.
Although the proposed route provides secondary access leading out from a separate area of the community, it does not connect back to CA 395, a primary access road, and still depends on access off Lower Rock Creek Road.</td></tr>
</table>

Table 5.3: Crowley Lake Access Assessment

Single Access: Pearson Road (Lakeridge Ranch Estates)
Existing Conditions
The Crowley Lake community is located 12 miles south of the Town of Mammoth Lakes and encompasses both a residential community and the Crowley Lake ballfields. Pearson Road is the sole access point to the easternmost neighborhood, located north of Crowley Lake Drive, south of CA 395, and east of Whisky Creek. There are 32 homes and 35 additional structures in the neighborhood with single roadway access.
Land Ownership and Slope Conditions
The single access neighborhood includes residences, accessory buildings, and the Crowley Lake ballfields. Land surrounding the community is federally owned. Slopes surrounding the community vary from 5 percent to over 20 percent with the steepest grades to the north, west, and south. See details in the map below.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
395
Approx:
32 Homes
35 Structures
Localized Flooding Blocks
Pearson Road Access to South
Landing Road
Improve Existing Dirt BLM Road to
Create Secondary Access to
Crowley Lake Drive
Pearson Road
South Landing Road
Crowley Lake Drive
Placer Road
Hilton Creek Drive

Hazard Conditions
The priority hazards posing greatest risk to the community are wildfire and local flooding. The community itself is located in a High Fire Hazard Severity Zone and is adjacent to Moderate Fire Hazard Severity Zones. Severe wind is also of concern in Crowley Lake, which can increase the magnitude of fires when they do occur. Portions of the community are located in a DWR Awareness Floodplain. Structures and infrastructure in the Awareness Floodplain have not been officially mapped under the FEMA NFIP, but could be at high risk of significant damage in the case of flooding. Localized flooding, which is not identified through FEMA's mapping program, is also known to affect portions of Pearson Road and inhibit access to South Landing Road. See details in the map below.

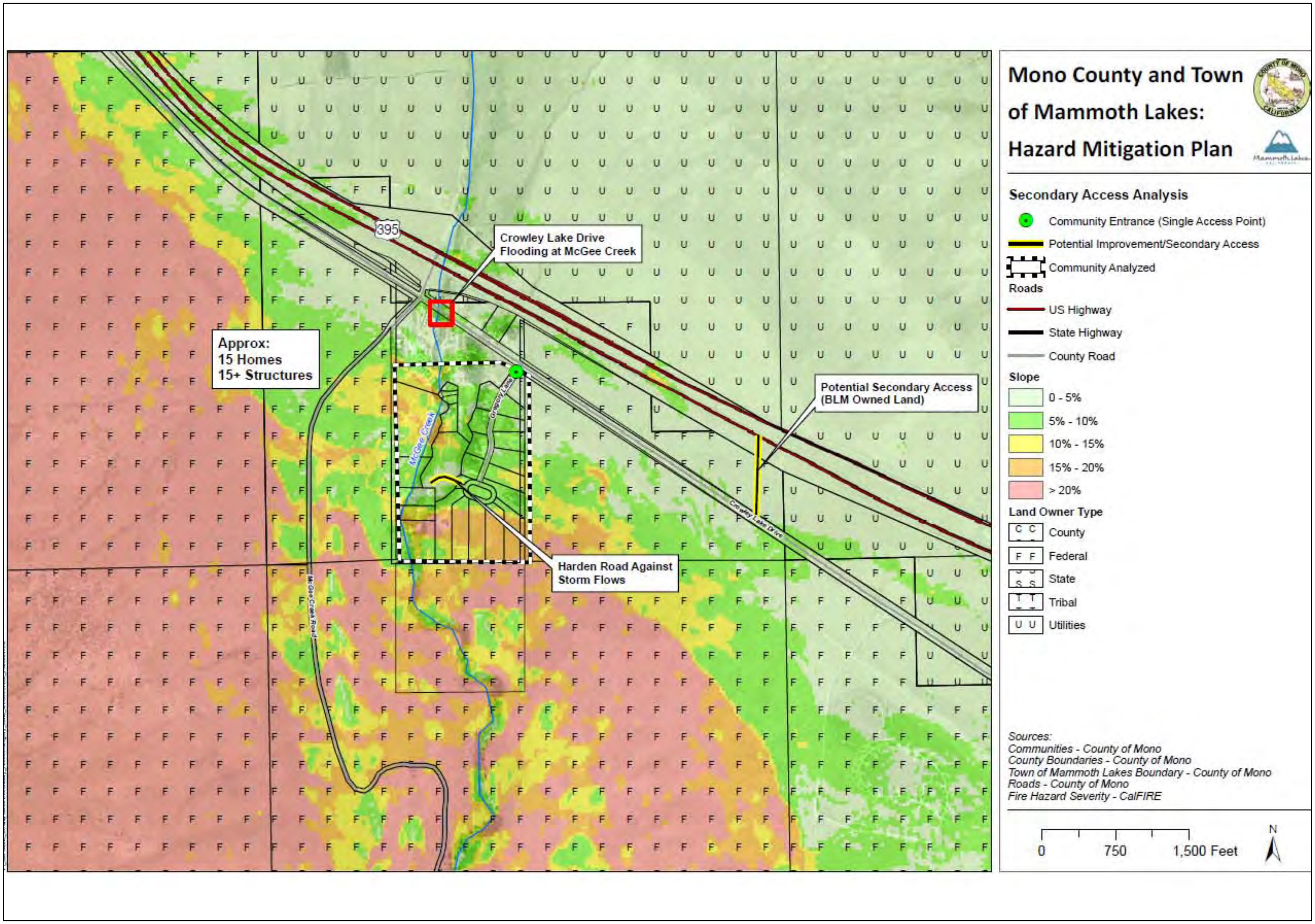


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Fire Department
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
FEMA Flood Zones
100 Year Flood Zone
500 Year Flood Zone
DWR Awareness Floodplain
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
395
Localized Flooding Blocks Pearson Road Access to South Landing Road
Approx: 32 Homes 35 Structures
Improve Existing Dirt BLM Road to Create Secondary Access to Crowley Lake Drive
Pearson Road
Crowley Lake Drive
Placer Road

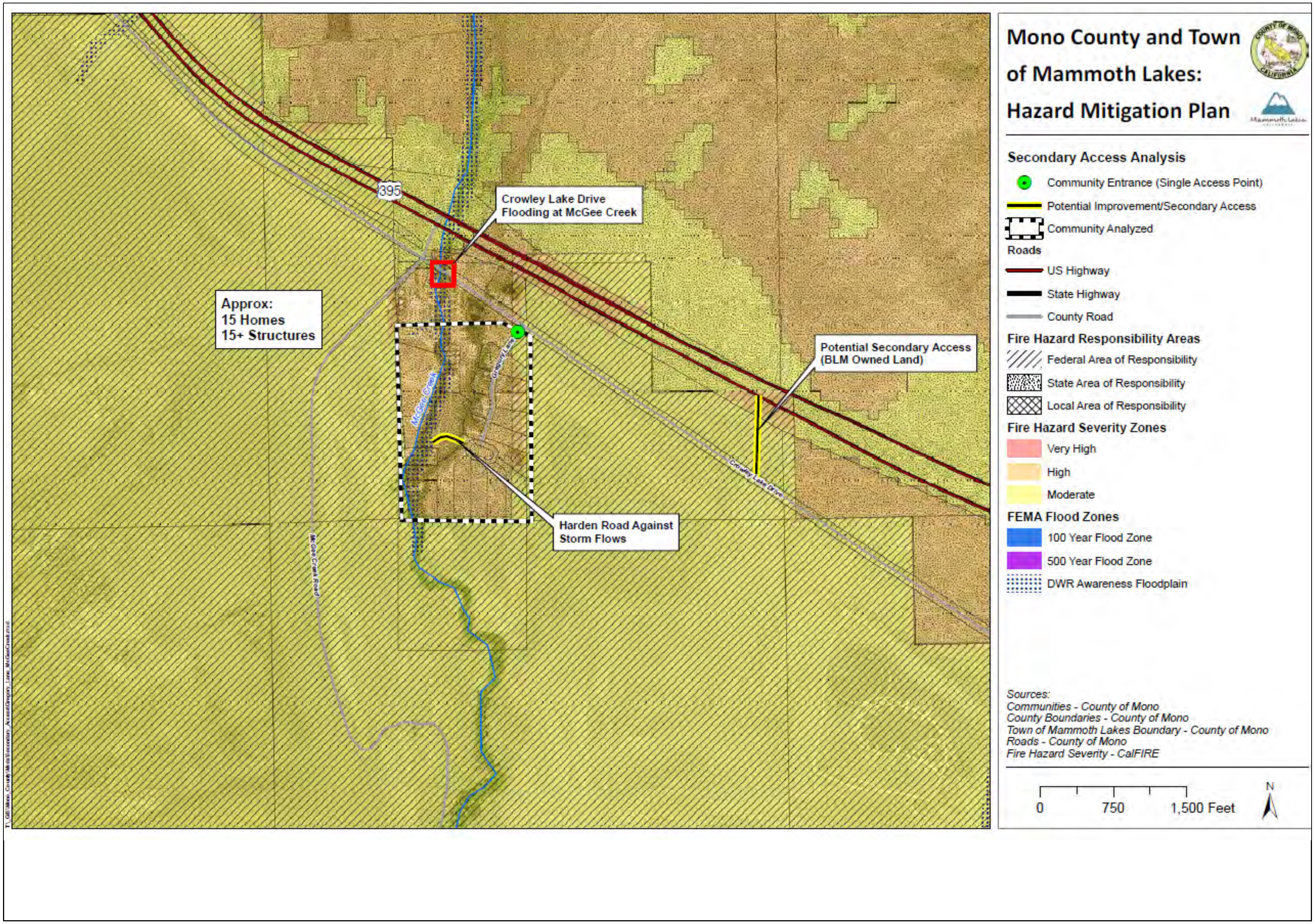
<table>
<tr><th colspan="2">Secondary Access and Risk Reduction Options</th></tr>
<tr><td colspan="2">A secondary access route could be developed by improving an existing dirt road utilized by the Bureau of Land Management, located north of Crowley Lake ballfields and connecting to Crowley Lake Drive to the east.</td></tr>
<tr><th>Strengths</th><th>Constraints</th></tr>
<tr><td>By utilizing an existing dirt road, development of the secondary access route may be more cost effective and reduce impacts on the visual and natural resources of the immediate area.
The proposed route avoids steeper slopes that surround the area.
The proposed route does not require an easement or eminent domain process of private property.</td><td>The proposed secondary access route, which follows an existing dirt road connecting south Pearson Road to Crowley Lake Road, would require crossing federal land.
Although the proposed secondary access route avoids the steepest slopes in the area, it still must cross small sections with slope greater than 20 percent.
Although the proposed route provides secondary access leading out from a separate area of the community, it does not connect back to CA 395, a primary access road.</td></tr>
</table>

Table 5.4: McGee Creek Access Assessment

Single Access: Gregory Lane
Existing Conditions
The McGee Creek community is located on the southwestern side of Lake Crowley, south of CA 395. The community's single-access road is Gregory Lane, which in turn can only be accessed via Crowley Lake Drive. Crowley Lake Drive connects to CA 395 via McGee Creek Road north of the Crowley Lake community. The neighborhood with sole roadway access contains 15 homes, which are all privately owned, as well as 15-plus structures.
Land Ownership and Slope Conditions
The Gregory Lane area contains privately owned lots, most less than a quarter acre with single-family homes off of small cul-de-sacs. Land surrounding the community is owned by the Bureau of Land Management. Slopes on the side of the community connected back to the primary access route of CA 395 are generally moderate and vary from 5 percent to 15 percent. Steeper grades are located at the southern portion of the community and northwest of McGee Creek. See details in the map below.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
395
Crowley Lake Drive Flooding at McGee Creek
Approx: 15 Homes 15+ Structures
Potential Secondary Access (BLM Owned Land)
Harden Road Against Storm Flows

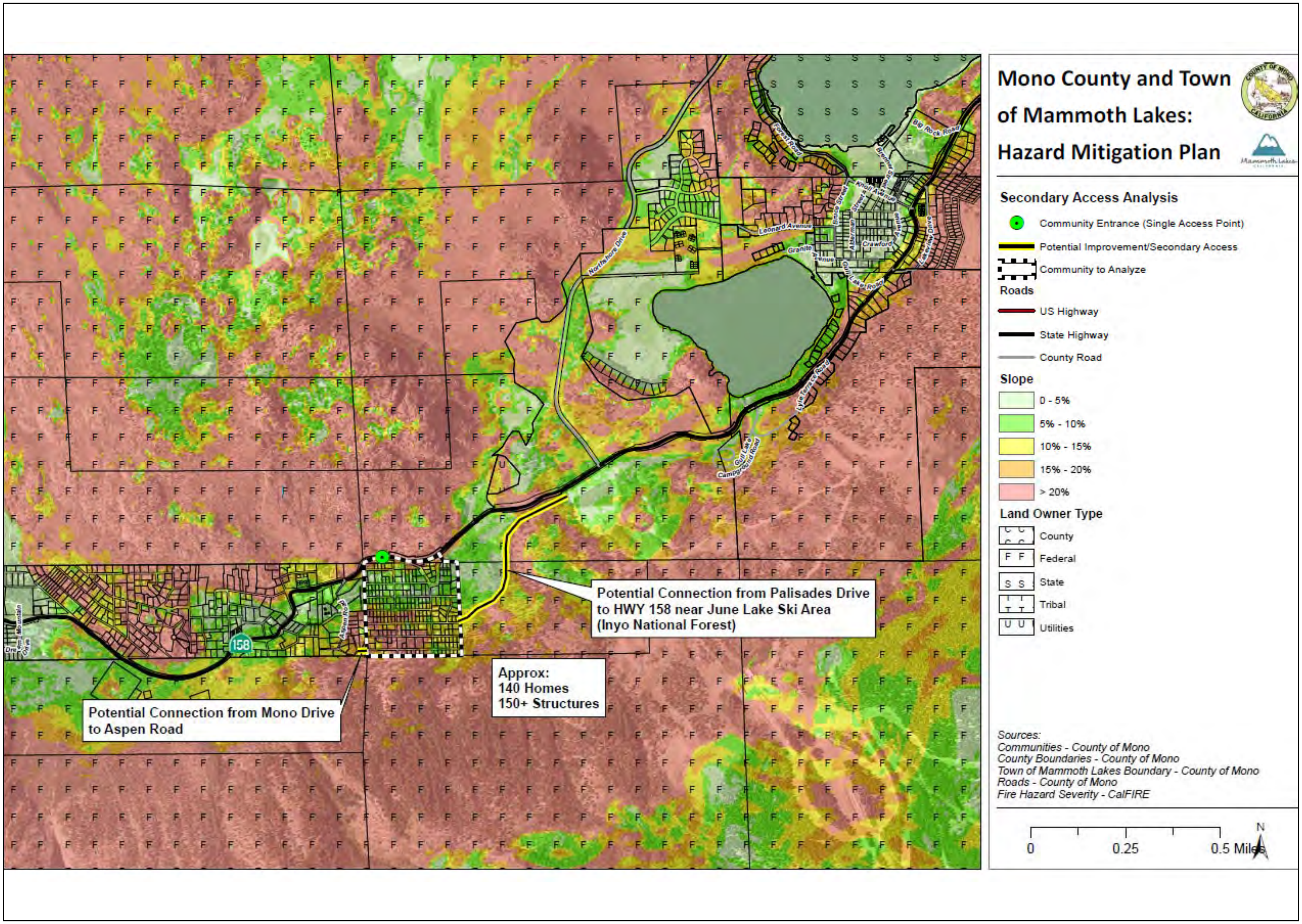
Hazard Conditions
The priority hazards posing greatest risk to the community are flood and wildfire. The community itself is located in a High Fire Hazard Severity Zone and is surrounded by Moderate Fire Hazard Severity Zones. Portions of the community are also located in a DWR Awareness Floodplain as well as the 100-year flood zone, including sections of Gregory Lane, which frequently floods and occasionally washes out, cutting off a number of residential properties from access to Crowley Lake Drive and CA 395. In severe flooding, Crowley Lake Drive could be entirely cut off from CA 395. Structures and infrastructure in the Awareness Floodplain have not been officially mapped under the FEMA NFIP, but could be at high risk of significant damage in the case of flooding.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
FEMA Flood Zones
100 Year Flood Zone
500 Year Flood Zone
DWR Awareness Floodplain
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
395
Crowley Lake Drive Flooding at McGee Creek
Approx: 15 Homes 15+ Structures
Potential Secondary Access (BLM Owned Land)
Harden Road Against Storm Flows
McGee Creek
McGee Creek Road
Crowley Lake Drive

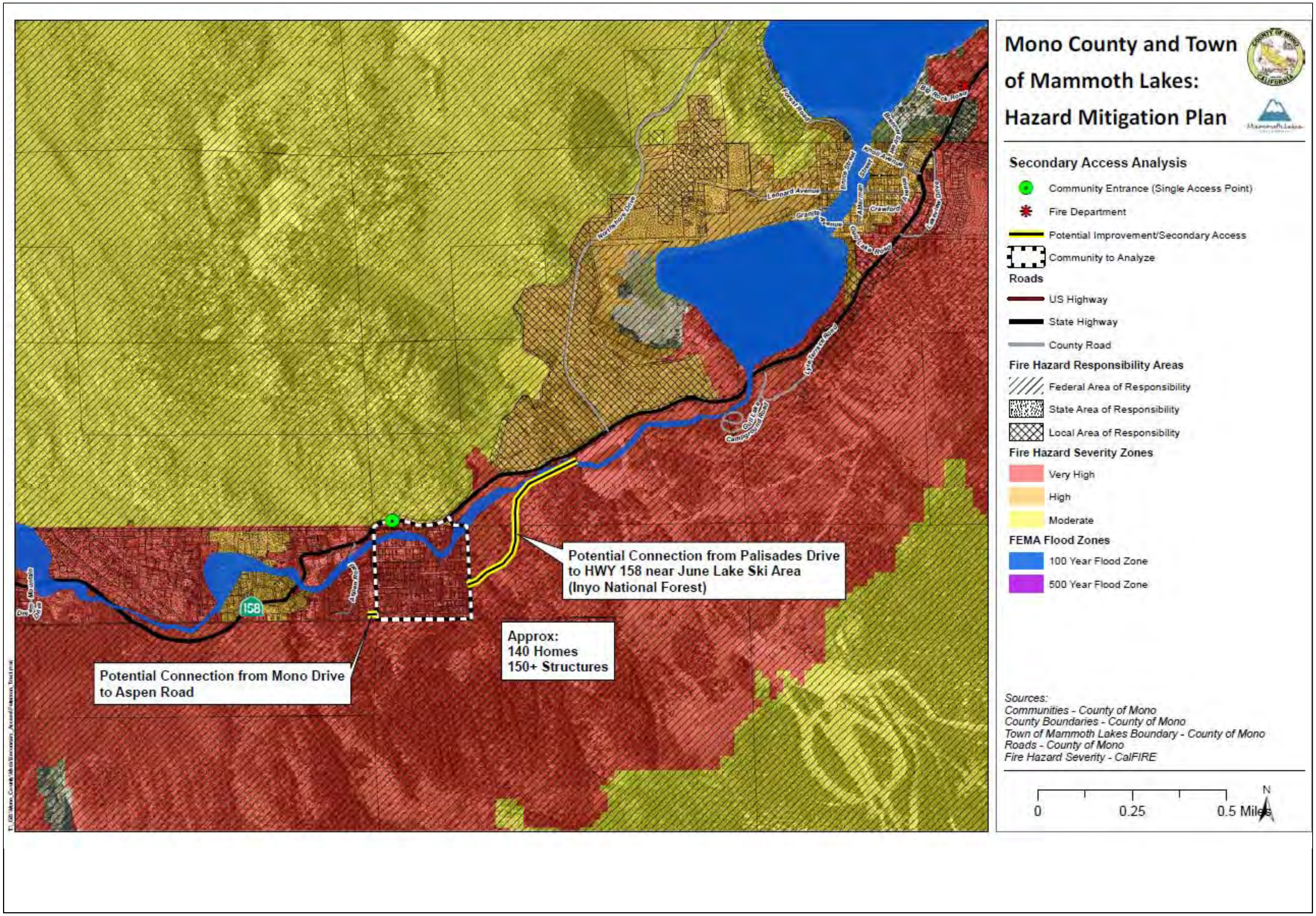
<table>
<tr><th colspan="2">Secondary Access and Risk Reduction Options</th></tr>
<tr><td colspan="2">A secondary access route could be developed on Bureau of Land Management land by improving an existing dirt road that connects Crowley Lake Drive to CA 395 southeast of Gregory Lane. Additionally, the portion of Gregory Lane connecting to American Way, the section most frequently affected by flooding, could be hardened by installing flood walls or by raising the entire section out of the flood awareness zone.</td></tr>
<tr><th>Strengths</th><th>Constraints</th></tr>
<tr><td>By utilizing an existing dirt road, development of the secondary access route may be more cost effective and reduce impacts on the visual and natural resources of the immediate area.
The proposed secondary route avoids steeper slopes.
The proposed secondary route does not require an easement or eminent domain process of private property.
The proposed secondary route provides access to CA 395 to the south even if Gregory Lane, American Way, and Crowley Lake Drive are all affected by flooding on the creek.
The proposed hardening of Gregory Lane does not require any easements or eminent domain process.</td><td>The proposed secondary access route, which follows an existing dirt road connecting south to Crowley Lake Drive, would require crossing federal land.</td></tr>
</table>

Table 5.5: June Lake Access Assessment

Single Access: Rainbow Street/Peterson Tract
Existing Conditions
The Peterson tract area is located south of CA 158 and west of the June Mountain Ski Area. There are 140 homes in this neighborhood, as well as a few commercial uses and an overnight lodge. The community's single access road is Rainbow Street, which in turn can only be accessed by CA 158.
Land Ownership and Slope Conditions
The single-access neighborhood is predominantly privately owned residential lots, with select commercial uses organized in a modified grid layout with some streets leading to dead-ends rather than connecting through. Land surrounding the community is federally owned. Slopes surrounding the community vary from 5 percent to over 20 percent with the steepest grades in the southwest corner of the neighborhood to the west of Jessie Street.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
0.25
0.5 Miles
N
Potential Connection from Palisades Drive to HWY 158 near June Lake Ski Area (Inyo National Forest)
Approx: 140 Homes 150+ Structures
Potential Connection from Mono Drive to Aspen Road
158

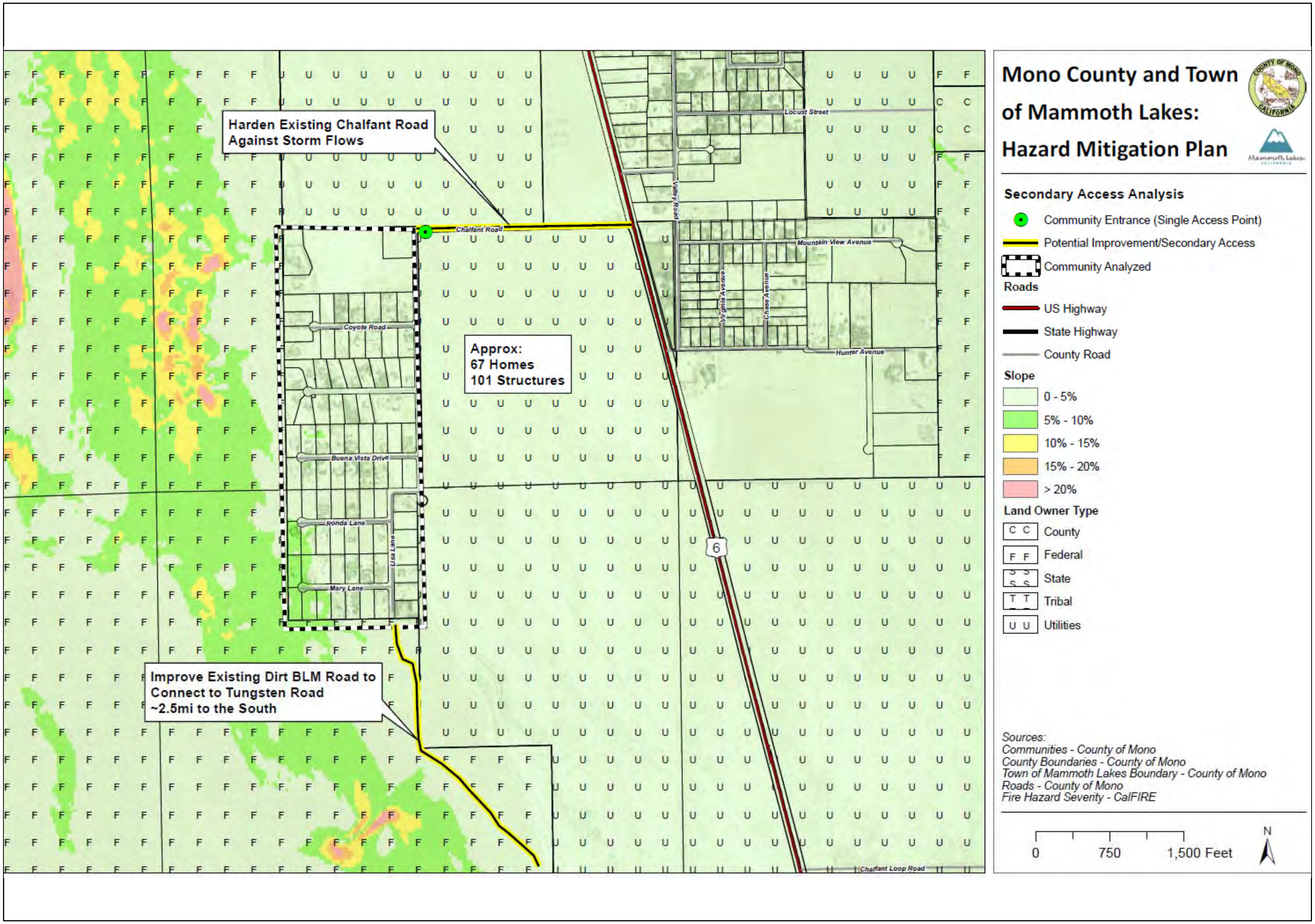
Hazard Conditions
The priority hazard posing the greatest risk to the community is wildfire. The community itself is located in a Very High Fire Hazard Severity Zone and is adjacent to Moderate Fire Hazard Severity Zones. Severe wind is also of concern in June Lake, which can increase the magnitude of fires when they do occur. The community also has several creeks running through that are within the 100-year flood zone. A 100-year flood event could cut off much of the subdivision from CA 158. The community is also located within an Alquist- Priolo fault zone. Structures and infrastructure in the fault zone are at high risk of significant damage in the case of an earthquake.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Fire Department
Potential Improvement/Secondary Access
Community to Analyze
Roads
US Highway
State Highway
County Road
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
FEMA Flood Zones
100 Year Flood Zone
500 Year Flood Zone
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
0.25
0.5 Miles
N
Potential Connection from Palisades Drive to HWY 158 near June Lake Ski Area (Inyo National Forest)
Approx: 140 Homes 150+ Structures
Potential Connection from Mono Drive to Aspen Road
158
Leonard Avenue
Forest Road
Knoll Avenue
Crawford
Lyle Terrace Road
Gull Lake Campground Road
Northshore Drive
Big Rock Road

Secondary Access and Risk Reduction Options	
Two secondary access routes could be developed for this neighborhood. The first could extend Mono Drive to connect with Aspen Road to the west, and the second could extend Palisades Drive to CA 158 near the June Lake Ski Area to the northeast. The Mono Drive connection would occur on County-owned land, and the Palisades Drive extension would occur on federally owned land. Both routes would need to be designed to be elevated above the 100-year floodplain at Reversed Creek.	
Strengths	**Constraints**
• The proposed routes run alongside, but generally avoid, steeper slopes that surround the area. • The proposed routes would provide two additional access routes to the southern portion of the community. • The proposed routes connect to CA 158 near the connection with Northshore Drive, which provides more direct exit from High and Very High Hazard Severity Fire Zones.	• The proposed secondary access routes does not follow any existing dirt rout and would require crossing federal land. • The proposed secondary access routes are not existing roads and therefore would require higher utilization of resources and have potential impacts to environmental and visual resources. • The proposed routes may require an easement or eminent domain process of private property.

Table 5.6: Chalfant (West) Access Assessment

Single Access: West Chalfant Road
Existing Conditions
The West Chalfant community is located near Chalfant Valley on the western side of CA 6. It includes 67 homes, as well as some small-scale agricultural uses. Chalfant Road is the sole access point for the community, connecting at the northeastern corner and running south before terminating.
Land Ownership and Slope Conditions
West Chalfant contains privately owned lots with single-family homes arranged in cul-de-sacs. Land surrounding the community is owned by federal agencies to the west and south, and LADWP to the north and east. Slopes surrounding the community are mild, with most being less than 5 percent. The southwestern corner has slopes of 5–10 percent.

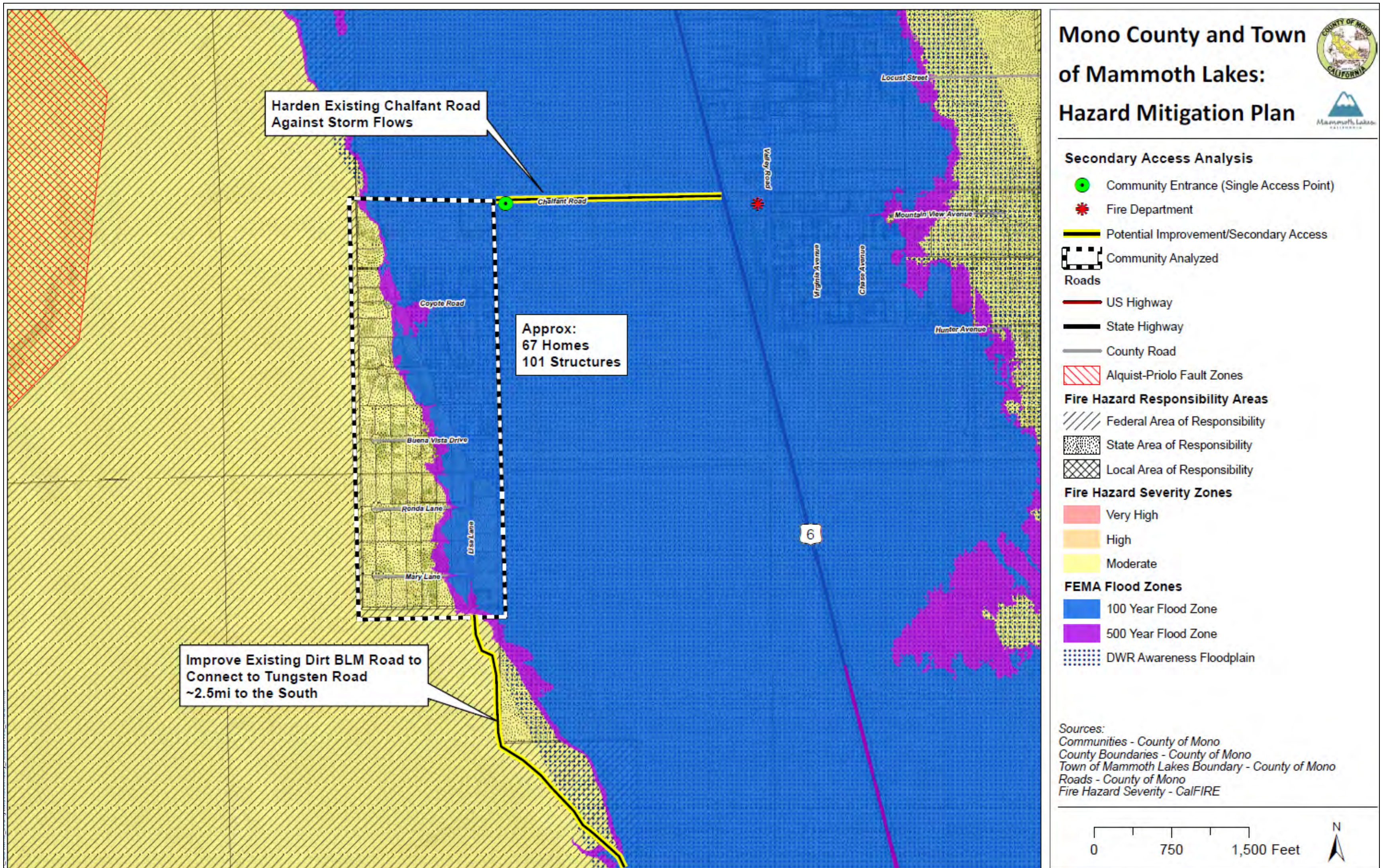


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
Harden Existing Chalfant Road Against Storm Flows
Approx: 67 Homes 101 Structures
Improve Existing Dirt BLM Road to Connect to Tungsten Road ~2.5mi to the South
Chalfant Road
Coyote Road
Buena Vista Drive
Ronda Lane
Mary Lane
Lisa Lane
Valley Road
Locust Street
Mountain View Avenue
Virginia Avenue
Chase Avenue
Hunter Avenue
Chalfant Loop Road
6

Hazard Conditions

The priority hazard posing greatest risk to the community is flooding. More than half of the community is located in the 100-year flood zone, and the rest is located in a DWR Awareness Floodplain.

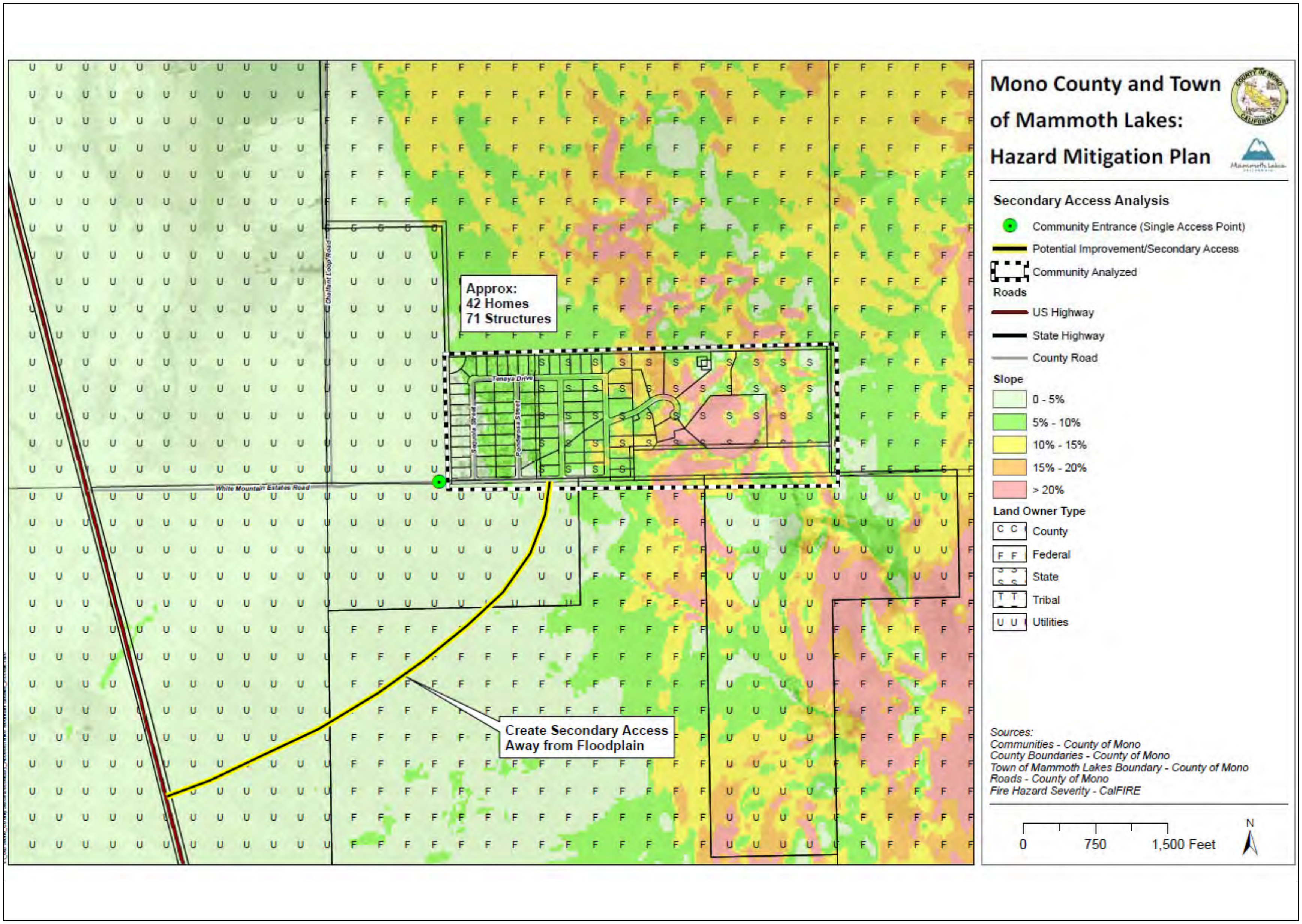
Small portions of the community are also located within the 500-year floodplain. Much of the primary emergency access road CA 6 is also located within the 100-year or 500-year floodplain within several miles of the community, and is subject to occasional closure from flooding and debris. In such events, access out of the community is entirely impractical and alternative methods of shelter in place options would be required.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Harden Existing Chalfant Road Against Storm Flows
Approx:
67 Homes
101 Structures
Improve Existing Dirt BLM Road to Connect to Tungsten Road ~2.5mi to the South
Chalfant Road
Coyote Road
Buena Vista Drive
Ronda Lane
Mary Lane
Valley Road
Mountain View Avenue
Virginia Avenue
Chase Avenue
Hunter Avenue
Locust Street
6
Secondary Access Analysis
Community Entrance (Single Access Point)
Fire Department
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Alquist-Priolo Fault Zones
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
FEMA Flood Zones
100 Year Flood Zone
500 Year Flood Zone
DWR Awareness Floodplain
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N

Secondary Access and Risk Reduction Options	
A secondary access route could be developed by improving an existing dirt road that connects to the southeastern corner of the community. The access route would extend roughly 2.5 miles to the south and connect to Tungsten Road. Additionally, Chalfant Road could be improved to better withstand flooding and storm surges.	
Strengths	**Constraints**
• By utilizing an existing dirt road, development of the secondary access route may be more cost effective and reduce impacts on the visual and natural resources of the immediate area. • The proposed route does not require an easement or eminent domain process of private property.	• The proposed secondary access route would require crossing land owned by LADWP. • Although the proposed route provides secondary access leading out from a separate area of the community, it does not connect back to CA 6, the primary access road. • In the event that Chalfant Road is flooded, it is possible that the primary access road, CA 6, would also be flooded.

Table 5.7: Chalfant (White Mountain Estates) Access Assessment

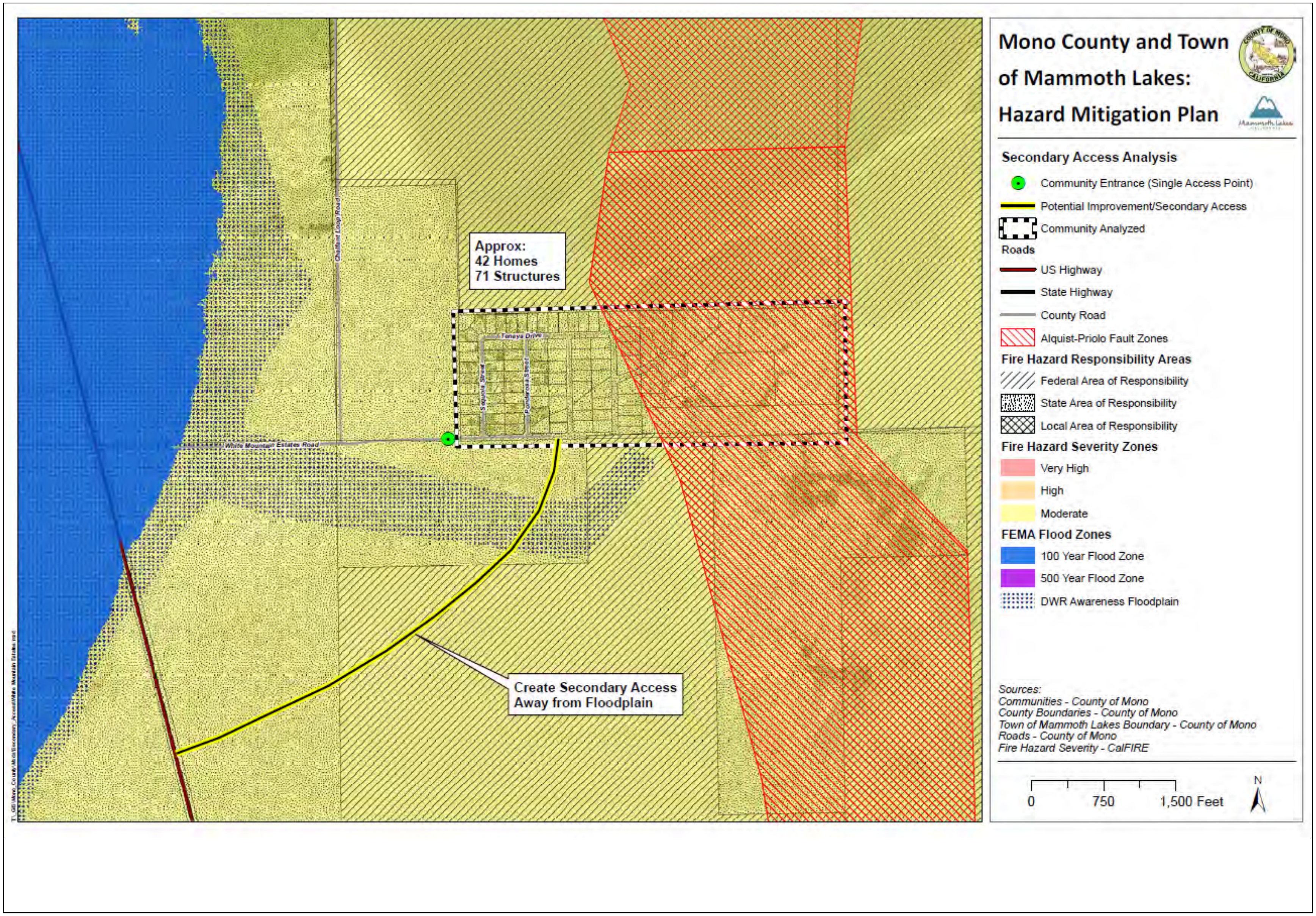
Single Access: Tungsten Road
Existing Conditions
White Mountain Estates is located east of CA 6, south of Chalfant Valley. It is composed predominantly of privately owned residential lots, with 42 homes.
Land Ownership and Slope Conditions
White Mountain Estates contains privately owned lots with single-family homes in the western one-third of the community. The eastern two-thirds of the community is state-owned land. Land surrounding the community is owned by federal agencies to the north, east, and south, and LADWP to the west. Slopes surrounding the community range from less than 5 percent to more than 20 percent, although slopes on the west side of the community connecting back to the primary access road, CA 6, are generally less than 5 percent. Steeper slopes exist in the eastern region near the mountain range.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Slope
0 - 5%
5% - 10%
10% - 15%
15% - 20%
> 20%
Land Owner Type
County
Federal
State
Tribal
Utilities
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
Approx:
42 Homes
71 Structures
Create Secondary Access
Away from Floodplain
White Mountain Estates Road
Chalfant Loop Road
Tenaya Drive
Sequoia Street
Ponderosa Street

Hazard Conditions

The priority hazard posing the greatest risk to the community is flooding. The community is located outside of any flood zone, but Tungsten Road, its single access route (aka White Mountain Estates Road), is located within the 100-year flood zone. In a 100-year flood event, the community could therefore be cut off from the primary emergency access route, CA 6.

Portions of the community are also located within an Alquist- Priolo fault zone. Structures and infrastructure in the fault zone are at high risk of significant damage in the case of an earthquake.


Mono County and Town of Mammoth Lakes: Hazard Mitigation Plan
Secondary Access Analysis
Community Entrance (Single Access Point)
Potential Improvement/Secondary Access
Community Analyzed
Roads
US Highway
State Highway
County Road
Alquist-Priolo Fault Zones
Fire Hazard Responsibility Areas
Federal Area of Responsibility
State Area of Responsibility
Local Area of Responsibility
Fire Hazard Severity Zones
Very High
High
Moderate
FEMA Flood Zones
100 Year Flood Zone
500 Year Flood Zone
DWR Awareness Floodplain
Sources:
Communities - County of Mono
County Boundaries - County of Mono
Town of Mammoth Lakes Boundary - County of Mono
Roads - County of Mono
Fire Hazard Severity - CalFIRE
0
750
1,500 Feet
N
Approx:
42 Homes
71 Structures
Create Secondary Access
Away from Floodplain
White Mountain Estates Road
Tenaya Drive

<table>
<tr><th colspan="2">Secondary Access and Risk Reduction Options</th></tr>
<tr><td colspan="2">A secondary access route could be developed on the south side of the community, connecting to CA 6 to the southwest. This route would pass through a DWR Awareness Floodplain but would be entirely outside the 100-year floodplain.</td></tr>
<tr><th>Strengths</th><th>Constraints</th></tr>
<tr><td>The proposed route does not require an easement or eminent domain process of private property.
The proposed route connects directly to CA 6 primary evacuation route.
The proposed route would pass through areas of little to no slope.
The proposed access route utilizes, in part, an existing dirt road.</td><td>The proposed secondary access route would require crossing both federal and utilities land.
The proposed route would pass through a DWR Awareness Floodplain.</td></tr>
</table>

5.3. Capabilities Assessment

The capabilities assessment identifies existing local and regional agencies, personnel, plans, public policy, and programs that can support the hazard mitigation measures in this Plan. This assessment (**Table 5.8** and **Table 5.9**) helps determine the ability of Mono County and the Town of Mammoth Lakes to reduce damage from hazard events, providing a foundation to develop, consider, and prioritize future hazard mitigation measures. Each table presents both personnel that are able to execute various aspects of the plan and regulation which enable and enforce action. The County has applicable Building Codes, General Plan policies, Subdivision Regulations, Capital Improvement Plan, and other regulatory development guidelines which enable it to provide specific support and expand upon and improve hazard mitigation activities throughout the County and in each of the un-incorporated communities.

Mono County and the Town of Mammoth Lakes also participate in the National Flood Insurance Program (NFIP). Additionally, the County and Town General Plans, Multi-jurisdictional Emergency Response Plan, and Disaster Recovery Plans provide additional authority. Since the publication of the previous plan, the County and Town have enforced floodplain management with the following actions:

- Incorporating into the Safety Element of the Mono County General Plan, and Public Health and Safety Element of the Mammoth Lakes General Plan, including updated flood area mapping and goals to reduce the potential for injury, property damage, and environmental damage from flooding.
- Providing a webpage and specific FEMA flood mapping information for the Tri-Valley area, where flooding is most frequent and communities most vulnerable. As part of this effort, community members have been encouraged to obtain a parcel-specific Floodplain Determination or inquire about existing Floodplain Determinations by contacting the County's Engineering Division.
- Upon receipt of updated digital Flood Insurance Rate Maps (FIRMS) from FEMA, Mono County notified residents affected by any changes to the designation of flood-prone areas or Special Flood Hazard Areas (SFHAs).

The County and Town will continue to work with appropriate local, state and federal agencies in maintaining the most current flood hazard and flood plain information to ensure continuing participation in the National Flood Insurance Program.

Table 5.8: Mono County MJHMP Capabilities Assessment

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Personnel	Mono County (Community Development Department--Building, Planning, Code Enforcement)	Overall knowledge of planning process and planning documents in Mono County, Mono County GIS system.
Personnel	Benton-Paiute Reservation	Cooperative planning for Benton-Paiute Reservation lands.
Personnel	Bridgeport Indian Colony	Cooperative planning for Bridgeport Indian Colony lands.
Personnel	Lahontan Regional Water Quality Control Board	Knowledge of water resource issues in the county.
Personnel	US Forest Service, Inyo National Forest, Humboldt-Toiyabe National Forest	Information on lands managed by National Forest in Mono County and on particular resource issues, e.g., wildland fires, avalanche control.
Personnel	Mono County Assessor	Information on property values and past property losses.
Personnel	Mono County Department of Social Services	Information on emergency housing and Red Cross response in Mono County.
Personnel	Mono County Emergency Services Department (Sheriff's Office)	Knowledge of emergency planning and preparedness and hazards mitigation.
Personnel	Mono County Information Technology (IT)	Knowledge of Mono County's GIS system.
Personnel	Mono County Office of Education	Information on county schools and impacts of hazards on them.
Personnel	Mono County Public Health Department	Information on provision of health care services and emergency preparedness, GIS system.
Personnel	Mono County Public Works Department	Knowledge of hazards mitigation on county roadways, floodplain management in the county, county property including airports, Mono County GIS system.
Personnel	Mono County Risk Manager	Knowledge of risk assessment planning and procedures.
Personnel	Inyo Mono Advocates for Community Action (IMACA)	Cooperative planning for emergency services for elderly and disabled citizens.
Personnel	Eastern Sierra Transit Authority	Cooperative planning for emergency transit services.

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Personnel	Local fire protection districts and Fire Safe Councils	Cooperative planning for fire protection and suppression throughout Mono County.
Personnel	Local utility providers (water and sewer districts, etc.)	Cooperative planning for emergency preparedness and hazards planning for utilities.
Personnel	Southern California Edison (SCE)	Electrical utility system in the county.
Personnel	Walker River Irrigation District (WRID)	Cooperative planning for hazards mitigation on the facilities owned and operated by the WRID (Bridgeport Reservoir, E. Walker River, Topaz Lake)
Plan	Mono County Emergency Operations Plan	Describes the responsibilities, roles, and resources of local agencies before, during, and directly after an emergency.
Regulation	Mono County Land Development Regulations (Revised Land Use Element)	Development regulations are included in the Land Use Element of the General Plan to guide the form and design of development to ensure safety and resiliency.
Plan	Mono County General Plan	Identifies overarching policies and programs that affect land use, public services, housing, natural resources, and safety, among other items. The General Plan can be updated to include information and mitigation measures identified in this Plan.
Regulation	Floodplain Regulations (Chapter 21 of the Land Development Regulations)	The floodplain regulations establish special development regulations for those areas of the county subject to inundation.
Regulation	Fire Safe Regulations (Chapter 22 of the Land Development Regulations)	The fire safe regulations establish basic wildland fire protection standards for Mono County.
Regulation	Land Clearing, Earthwork and Drainage Facilities (Chapter 13.08 of the Mono County Code)	The grading ordinance establishes regulations for slopes (including driveways), cut and fill, and erosion control to minimize disturbances from geologic hazards.

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Regulation	Emergency Services (Chapter 2.60 of the Mono County Code)	The emergency services ordinance provides for the preparation and implementation of plans to protect people and property during an emergency in Mono County. It also requires the coordination of emergency services provided by the Town with those provided by all other public agencies, corporations, organizations, and private persons.
Program	Mutual Aid Agreements	The County maintains mutual aid agreements with the Town of Mammoth Lakes, Mono County, the US Forest Service, and the Bureau of Land Management to support each other in emergencies. In addition, all the fire protection organizations in the county (local fire protection districts, US Forest Service, Bureau of Land Management, California Department of Forestry and Fire Protection, US Marine Corps Mountain Warfare Training Center) are trained and ready to cooperate with each under mutual aid agreements.
Regulation	Avalanche Conditional Development Areas	Avalanche Conditional Development Areas are established in the Mono County General Plan. Conditional Development Areas are private properties that have previously experienced avalanche activity. Policies in the General Plan Safety Element limit development in Conditional Development Areas, promote seasonal rather than year-round use of those areas, and require the exploration of land trades or purchases for private property identified as being impacted by avalanches. General Plan policies also direct the County to work with the US Forest Service and Caltrans to mitigate the effects of avalanches that start on public lands and that affect public highways.

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Program	Avalanche Awareness Programs	There are a variety of active avalanche mitigation and awareness programs in Mono County, many of them aimed at backcountry skiers. The Mammoth Mountain Ski Patrol maintains a website with avalanche information (patrol.mammothmountain.com) and has instituted a ski patrol avalanche dog program to train avalanche search and rescue dogs. An Eastern Sierra Avalanche Bulletin is available at www.csac.org/Bulletins/Calif/e-sierra.html. Additional avalanche and weather information is available at www.esavalanche.org, www.sierrabackcountry.org, and at the NOAA weather forecast website (http://forecast.weather.gov).
Program	Mono County Public Health Department Special Needs Database	In order to prepare for emergencies, the Mono County Public Health Department maintains a database of special needs clients on a GIS file. The file contains the GPS coordinates of the participant's daytime and nighttime driveways and front door, a building outline, and the assessor's parcel number of the participant's parcel. Once this data is entered in the database, the Public Health Officer sends the participant a letter thanking them for being proactive in planning for emergency preparedness and stressing the need to continue to plan for emergencies or disasters. The letter also includes brochures from FEMA, the Red Cross, and OES on how to prepare for an emergency or disaster. The database is reviewed annually and revised as necessary.

Table 5.9: Town of Mammoth Lakes MJHMP Capabilities Assessment

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Personnel	Town of Mammoth Lakes (Community Development Department-- Building, Planning, Code Enforcement)	Overall knowledge of town's planning process and planning documents, Town GIS system.
Personnel	Mammoth Lakes-Yosemite Airport	Knowledge of Mammoth Lakes-Yosemite Airport and hazard mitigation planning.
Personnel	Mammoth Community Water District	Knowledge of town's water and sewer systems.
Personnel	Mammoth Hospital	Information on provision of emergency medical services in Mammoth Lakes.
Personnel	Mammoth Lakes Fire Protection District	Information on provision of fire protection and suppression activities in and around Mammoth Lakes.
Personnel	Mammoth Unified School District	Knowledge of school district facilities and emergency preparedness.
Personnel	Town of Mammoth Lakes Police Department	Information on emergency preparedness in and around Mammoth Lakes.
Plan	Town of Mammoth Lakes General Plan	Identifies overarching policies and programs that affect land use, public services, housing, natural resources, and safety, among other items. The General Plan can be updated to include information and mitigation measures identified in this Plan.
Plan	Town of Mammoth Lakes Emergency Operations Plan	Describes the responsibilities, roles, and resources of local agencies before, during, and directly after an emergency.

Supporting Resource Type	Supporting Resource Name	Ability to Support Hazard Mitigation Activities
Regulation	Snow Deposition Design Zone (Chapter 17.32, Special Purpose Zoning Districts, of the Town of Mammoth Lakes Municipal Code)	The intent of this zone is to minimize hazards related to avalanches in areas where avalanche potential has been found to exist after investigation and study.
Regulation	Land Clearing, Earthwork, and Drainage Facilities (Chapter 12.08 of the Town of Mammoth Lakes Municipal Code)	The grading chapter regulates grading and earthwork in order to minimize disturbances from geologic hazards, erosion, siltation and flooding.
Regulation	Floodplain Management (Chapter 12.10 of the Town of Mammoth Lakes Municipal Code	This chapter establishes regulations for development in floodplain areas to minimize public and private losses due to flood conditions.
Regulation	Emergency Services (Chapter 2.48 of the Town of Mammoth Lakes Municipal Code)	The emergency services ordinance provides for the preparation and implementation of plans to protect persons and property during an emergency in Mammoth Lakes. It also requires the coordination of emergency services provided by the Town with those provided by all other public agencies, corporations, organizations and private persons.

5.3.1 Spending and Budget

Local governments have the power to make expenditures in the public interest. Hazard mitigation principles can be made a routine part of all spending decisions made by the local government, including the adoption of budgets and a Capital Improvement Plan (CIP). A CIP is a schedule for the provision of municipal or county services over a specified period of time. The County maintains both a CIP and a Comprehensive Facilities Plan, which will incorporate priority measures relating to select infrastructure needs.

5.3.2 Financial

In order to achieve the goals and objectives of the Mitigation Strategy, one or more of the following funding sources could be utilized: federal and state entitlements and grants, general fund, sales and property taxes, infrastructure user fees, impact fees, and new development impact fees. All of the agencies studied have the necessary budgetary tools and practices in place to facilitate handling appropriate funds; however, funding sources are currently very limited.

5.4. Fire Protection Districts

There are 12 fire protection districts in Mono County, which generally serve the communities, as shown in **Table 5.10**. Each fire protection district generally has only one station, which is operated entirely by volunteers.

All land in the county is ultimately divided into local, state, and federal responsibility areas for providing fire protection. The majority of land in the county is federal land and therefore a federal responsibility area (FRA), is provided fire protection by the US Forest Service or Bureau of Land Management resources. Fires in structures/buildings located on National Forest/Bureau of Land Management /National Park lands are suppressed by the nearest Fire Protection District with assistance as needed. The volunteer fire departments do not have authority to suppress structure fires (training and equipment is not provided).

The Marine Corps Mountain Warfare Training Center, located several miles south of Walker, also operates the Mountain Warfare Fire Department, which defends the military-owned facilities and will respond in surrounding areas. State responsibility areas (SRA) are covered by the San Bernardino/Inyo/Mono Cal Fire Unit. With the exception of the Antelope Valley, and incorporated Town of Mammoth Lakes, all privately owned lands in Mono County are within the SRA. Mutual aid agreements between Mono County fire departments with surrounding counties in California and Nevada, as well as state and federal agencies involved in fire protection, allow for cooperation and pooling of resources when major fires occur. Much of the privately owned land in Mono County is outside of an existing fire district, and limited funding prevents expansion of service areas or the formation of new districts; these areas are protected, to the extent possible, by Cal Fire or the US Forest Service, and other fire districts through mutual aid agreements.

Table 5.10: Fire Districts by Community Area

Planning Area	Communities	Fire Districts
Antelope Valley	Topaz, Coleville, Walker	Antelope Valley Fire Protection District
Benton Valley	Benton	White Mountain Fire District
Bodie Hills	Dispersed properties	None - FRA/ SRA
Bridgeport	Bridgeport	Bridgeport Fire Protection District
Chalfant	Chalfant	Chalfant Valley Fire Department
Hammil	Hammil	White Mountain Fire District
June Lake	June Lake, Crestview	June Lake Fire Department
Long Valley	Crowley Lake, Aspen Springs, Sunny Slopes, McGee Creek, Tom's Place, Pine Glade	Long Valley Fire Protection District
Mammoth Vicinity	Dispersed properties	Long Valley FPD
Mono Basin	Mono City, Lee Vining	Mono City Fire District; Lee Vining Volunteer Fire Department
Oasis	Oasis	Big Pine Fire District; Fish Lake Valley Fire Protection District (NV)
Paradise	Paradise	Paradise Fire District
Sonora Junction	Marine Corps MWTC	Mountain Warfare Fire Department
Swauger Creek	Dispersed properties	None - FRA/SRA
Upper Owens	Dispersed properties	None - SRA
Wheeler Crest	Swall Meadows	Wheeler Crest Fire District
No Planning Area	Virginia Lakes, Lundy Lake	None - FRA/SRA

Mono County agencies have a mutual aid agreement that ensure cooperation and sharing of resources to provide fire protection and emergency services. This agreement does not require the participating agencies to provide aid, but provides a framework for requesting and responding to requests for aid or resources. The following agencies are part of the agreement:

- Antelope Fire Protection District
- Bridgeport Fire Protection District
- Chalfant Fire Protection District

- June Lake Fire Protection District
- Lee Vining Fire Protection District
- Long Valley Fire Protection District
- Mammoth Lakes Fire Protection District
- Mono City Fire Protection District
- Paradise Fire Protection District
- Wheeler Crest Fire Protection District
- White Mountain Fire Protection District
- Mono County Paramedics

In addition to the mutual aid agreement, agencies are improving communications interoperability to allow local, state, and federal agencies to coordinate emergency response radio systems, as well as external services through Verizon Wireless to improve communications in the event of an emergency. The system is still being tested and improvements are expected to be made.

Mammoth Lakes is a local responsibility area and is served by the Mammoth Lakes Fire Department. Governance is provided by a five-member Board of Fire Commissioners, and an appointed Fire Chief that serves at the will of the board. The department's boundaries are coterminous with the Town of Mammoth Lakes boundaries; the one exception is Mammoth Yosemite Airport, which is in the town but not the department's boundaries. The department has two stations and eight full-time staff in addition to a larger part-time and volunteer force.

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6. PLAN MAINTENANCE AND CAPABILITIES

In order to support lasting mitigation and safety efforts, it is imperative that this MJHMP remain up to date. Doing so ensures that Mono County and the Town of Mammoth Lakes are continually protected against changing hazards and that the communities remain eligible for federal and state funding. To keep the MJHMP living and active, this chapter describes the processes for updating this Plan to ensure it is usable, relevant, locally appropriate, and compliant with applicable state and federal requirements. The Plan's structure allows the County and the Town to update individual sections as information becomes available and needs arise, making it easier to keep the Plan current.

6.1 Coordinating Body

Maintaining and updating this Plan is the responsibility of the County Community Development Department, and the Town Public Works Department and Community and Economic Development Department, which includes the Planning Division. The primary department overseeing this process is the Mono County Planning Department, under the direction of its appointed MJHMP project manager. This individual will coordinate maintenance of this Plan, conduct the formal review process, and prepare updates. Beginning in summer of 2022, project manager will initiate the update process, establishing a timeline, funding source for the update, informing decision-makers, and contacting key members of both jurisdiction agencies to kick-off the process. The key County and Town departments on the team are listed below.

Mono County

- Mono County Public Health Department
- Community Development Department
- Public Works Department
- Sheriff's Office
- Antelope Valley Regional Planning Advisory Committee
- Bridgeport Valley Regional Planning Advisory Committee
- June Lake Citizens Advisory Committee

- Long Valley Regional Planning Advisory Committee
- Mono Basin Regional Planning Advisory Committee

Town of Mammoth Lakes

- Mammoth Lakes Fire Protection District
- Town of Mammoth Lakes Planning Division
- Town of Mammoth Lakes Police Department
- Town of Mammoth Lakes Public Works Department
- Town of Mammoth Lakes Risk Management Department

Other Organizations

- Mono and Mono Counties Agricultural Commissioner's Office
- California Department of Forestry and Fire Protection
- California Department of Transportation
- California Highway Patrol
- California Office of Emergency Services
- Eastern Sierra Transit Authority
- Los Angeles Department of Water and Power
- Sierra Tactical Training and Active Response Resources
- Southern California Edison
- US Forest Service
- US Geological Survey

The MJHMP project manager will facilitate the team meetings. This staff member will assign tasks, which may include collecting data, developing new mitigation actions, updating sections of the Plan, and presenting the Plan to other departments, stakeholders, and elected officials. Responsibility for implementation and evaluation of the Plan will be shared among all team members as appropriate.

6.2 Evaluation and Monitoring

When the Plan is not being updated, the Planning Team should meet at least once annually, as initiated by the County Community Development Department. During this period, the team should focus on timing of Plan implementation, evaluating the implementation of the actions identified in this Plan, determining whether they are successful, revising priorities, if necessary, and helping to incorporate the Plan's mitigation actions into other planning documents. These annual meetings will commence in 2018 and should be timed with overall departmental planning and budgeting (fourth quarter of the fiscal year) that occurs leading up to the Town and County's annual budget development. The accompanying implementation-monitoring tool can assist with identifying appropriate periods for convening the team. As part of this evaluation and integration process, members of the team should look at the following:

- Any hazard events that occurred during the previous year and the impact of these hazards on the community.
- Mitigation actions in the Plan that have been successfully implemented.
- Mitigation actions in the Plan that were scheduled for implementation but have not begun.
- The schedule of future mitigation actions, and whether it is feasible or appropriate to adjust the timeline.
- Issues not covered by existing mitigation actions that could be addressed by new mitigation actions.
- Potential or actual changes in new funding opportunities, including grants, which may be used on mitigation-related activities.
- New scientific or mapping data that could inform updates to the Plan.
- Any other planning programs or initiatives in the community that involve hazard mitigation.

The team will summarize the information from this review into an annual progress report, which will be distributed to County and Town department heads for review as well as to the Town of Mammoth Lakes Town Council and the Mono County Board of Supervisors. The progress report will also be used to track and monitor progress on implementation of the measures contained in Chapter 5, and will include a section that details efforts made on the Priority Measures.

The progress report will also be posted on the county and town's websites, with the ability for members of the public to provide comments, and will be distributed to local media, as appropriate.

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7. COMMUNITY WILDFIRE PROTECTION PLAN

The Mono County Community Wildfire Protection Plan (CWPP) is a comprehensive, scientifically based analysis of wildfire-related hazards and risks in the Wildland-Urban Interface (WUI) areas of Mono County, California. Prepared for Mono County (County) and the Town of Mammoth Lakes (Town) in concert with the Multi-Hazard Hazard Mitigation Plan (MJHMP), it is an incisive update to the 2009 Community Wildfire Protection Plan. The MJHMP and CWPP were prepared based on a countywide effort that included extensive stakeholder engagement, the compilation of existing documents and GIS data, scientifically based analyses of risk and vulnerability, confirmation of field data gathered in 2009, and recommendations designed to reduce the threat of wildfire-related damages to assets, also known as values, at risk.

This document incorporates new and existing information relating to wildfire which will be valuable to citizens, policy makers, and public agencies in Mono County. Participants in this project include the Bureau of Land Management (BLM), the United States Forest Service (USFS), Regional Planning Advisory Councils, Mammoth Lakes Fire Department, California Department of Forestry and Fire Protection (Cal Fire), the Los Angeles Department of Water and Power, the County's volunteer fire departments, Fire Safe Councils, and stakeholders. A more detailed description of the planning and stakeholder process is included in **Chapter 1** of the MJHMP. A detailed description of the planning area is included in **Chapter 2** of the MJHMP. This document meets the requirements of the federal Healthy Forest Restoration Act of 2003 for community fire planning.

7.1 Method

The assessment portion of this document is an evaluation and update of identified hazards and risks associated with wildland fire in proximity to communities; the assessment is based on stakeholder expertise, available state-level fire data, and recent growth patterns and fuel reduction activities. This information defines "areas of concern" for Mono County and allows for an updated prioritization of mitigation efforts. From the analysis of this data, solutions and mitigation recommendations are offered that will assist homeowners, land managers, and other interested parties in the process of developing short-term and long-term fuels and fire management plans. Wildfire hazard data is derived from Cal Fire Fire and Resource Assessment Program (FRAP) data and Wildfire Hazard Severity Zone maps, as well as fire behavior potential data developed in 2009 from BEHAVE and FlamMap fire behavior models.

The CWPP presents a two-fold evaluation of wildfire hazard, risk, and vulnerabilities. Section 7.3 presents a general hazard profile based on historic wildfire activity and wildfire hazard severity zones, as established by Cal Fire, and identifies vulnerable assets and populations located within high and very high wildfire severity zones. A detailed description of methodologies for the general hazard profile and vulnerabilities analysis is in **Chapter 3** of the MJHMP. Section 7.4 provides an assessment of potential fire behavior in the wildland urban interface, including flame length, rate of spread, and crown fire based on FlamMap modeling. It also identifies risk to communities in the WUI based on locations in hazard areas and potential fire behavior as well as infrastructure and development characteristics. Section 7.5 identifies changes since 2009 that affect fire behavior and community vulnerability, including updated development and infrastructure conditions, potential changes in fuel load that could lead to inaccuracies in existing state and local wildfire hazard mapping such as previous fires and tree mortality, completed and ongoing fuels reduction projects, as well as possible implications of climate change. Section 7.6 presents priority projects and a set of actions the County and Town plan to take that can increase preparedness, response, and education of the community in relation to wildfire threats. These actions supplement mitigation and related measures provided in **Chapter 5** of the MJHMP.

7.2 Background

7.2.1 National Fire Plan and the Healthy Forest Restoration Act (HFRA)

In the year 2000, more than 8 million acres burned across the United States, marking one of the most devastating wildfire seasons in American history. One high-profile incident, the Cerro Grande fire at Los Alamos, New Mexico, destroyed more than 235 structures and threatened the Department of Energy's nuclear research facility.

Two reports addressing federal wildland fire management were initiated after the 2000 fire season. The first report, prepared by a federal interagency group, was titled "Review and Update of the 1995 Federal Wildland Fire Management Policy" (US Department of the Interior, et al. 2001). This report concluded, among other points, that the condition of America's forests were continuing to deteriorate.

The second report, titled “Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000,” was issued by the BLM and the USFS. It became known as the National Fire Plan (NFP). This report, and the ensuing congressional appropriations, ultimately required actions to:

- Respond to severe fires
- Reduce the impacts of fire on rural communities and the environment
- Ensure sufficient firefighting resources

Congress increased its specific appropriations to accomplish these goals. 2002 was another severe season: more than 1,200 homes were destroyed and over 7 million acres burned. In response to public pressure, Congress and the Bush administration continued to designate funds specifically for actionable items such as preparedness and suppression. That same year, the Bush administration announced the HFRA initiative, which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic wildfires. In 2003, that act was signed into law.

Through these watershed pieces of legislation, Congress continues to appropriate specific funding to address five main subcategories: preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters. The general concepts of the NFP blended well with the established need for community wildfire protection in the study area, which encompasses the entirety of the Town of Mammoth Lakes and Mono County. The spirit of the NFP is reflected in the Mono County CWPP.

The requirements of the HFRA are met by:

1. Identifying and prioritizing fuels reduction opportunities across the landscape (see Fuels Modification Projects, Section 7.5.5).
2. Addressing structural ignitability (see Home Mitigation, Section 7.6, and Appendix F).
3. Assessing community fire planning, response, and suppression capabilities (see MJHMP, Chapter 5)
4. Collaborating with stakeholders (see MJHMP, Chapter 1, and Appendix B).

7.2.2 Outcomes

Intended outcomes from this project include the following:

1. Enhance life safety for residents and responders.

2. Mitigate undesirable fire outcomes to property and infrastructure.

To accomplish these goals, the following objectives have been identified:

1. Establish an approximate level of risk (the likelihood of a significant wildfire event in the study area).

2. Provide a scientific analysis of the fire behavior potential of the study area.

3. Group values at risk into "communities" that represent relatively similar hazard factors.

4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the values at risk (hazard levels).

5. Recommend specific actions that will reduce the vulnerability of the values at risk.

Other desired outcomes:

1. **To promote community awareness:** Quantifying the community's hazards and risk from wildfire will facilitate public awareness and assist in creating public action to mitigate the defined hazards.

2. **To improve wildfire prevention through education:** Community awareness, combined with education, will help to reduce the risk of unplanned human ignitions.

To facilitate and prioritize appropriate hazardous fuel reductions:

1. The identification of areas of concern will improve the focus and accuracy of pre-planning, and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

7.3 Hazard and Risk Assessment

7.3.1 Hazard Description

The term wildfire refers to any fire that starts in a rural, sparsely populated or largely undeveloped area. In many parts of the world, wildfires form part of the ecosystem and often burn at a safe distance from areas of human settlement. Under dry conditions and when fanned by strong winds, however, fires can spread into heavily populated districts, causing major damage to property. Buildings may be set alight by radiant heat, contact with the flames, or flying embers. Smoke can also cause property damage, and indirect losses can result from business interruption.

A complex interplay of natural anthropogenic (human-caused) factors influences the extent and magnitude of wildfires. Most significant factors include the type and dryness of vegetation, slope, and wind, and other climactic components such as temperatures and precipitation. Conflagration can result in many circumstances as the result of lightning, downed or arcing power lines, or man-made fires accidentally or deliberately spread. These changing anthropogenic and natural factors make wildfires a risk that is extremely difficult to quantify. Even if hazard zones can be clearly identified, fires can cause significant losses in unexpected locations under unique circumstances.

7.3.2 Location and Magnitude

With its sloped geography, vegetation, and climate, Mono County has many fire-prone landscapes, on both public and private lands. Wildfire burns indiscriminately across property boundaries, which means that the way potential fuels are managed on one piece of property can affect wildfire risk on neighboring lands. Public lands surrounding communities in the county contain highly flammable vegetation that in many cases has not been thinned in years. The area experiences high temperatures and high winds over mountainous terrain that makes firefighting difficult. Highway and air access to the area is limited, further increasing the difficulty of fighting wildland fires. Continued population growth into WUI areas, but unchanging relative isolation from resources, and an increasing frequency of elevated fire weather conditions present major challenges to county residents.

Cal Fire is required by state law to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as fire hazard severity zones (FHSZ), influence how people construct buildings and protect property to reduce risk associated with wildland fires. As required by law, the model evaluates hazard, but not risk. The model underlying FHSZ evaluates properties using characteristics that affect the probability of the area burning and potential fire behavior in the area. Many factors are considered such as fire history, existing and potential fuel, flame length, blowing embers, terrain, weather and the likelihood of buildings igniting. Fire hazard severity has two key components: probability of burning and expected fire behavior. The factors considered in determining hazard are: 1) how often an area will burn; and 2) when it does burn, what characteristics might lead to buildings being ignited?

Based on these factors, each area is assigned a zone, categorized as moderate, high, or very high. The FHSZ is intended to provide a broad-stroke understanding of level of wildfire hazard across the state and may not always reflect hazard from highly localized and fine-grained factors. A primer prepared by Cal Fire, contained in **Appendix G**, describes in greater detail the method and granularity of the FHSZ.

The FHSZ maps are the primary tool used to establish state and local rules and regulations governing building, infrastructure, and maintenance requirements. Consequently, **Table 7.1** of this analysis evaluates risk and vulnerability based on high and very high wildfire hazard zones of the FHSZ map. It is worth noting that current FHSZ maps were last prepared in 2003 or earlier. While Cal Fire is in the process of developing new models and analysis to develop new maps, as of early 2018, these were not yet available. Consequently, maps may not reflect recent changes to natural or developed conditions in the county. **Table 7.2** evaluates hazard and risk analysis more tailored to the county and, within the WUI, recent changes to community conditions and their effects on risk and vulnerability.

As identified in **Table 7.1**, high and very high wildfire zones are present in both unincorporated Mono County and the Town of Mammoth Lakes.

Mono County

Table 7.1 shows the ownership and administration of lands within the high and very high wildfire severity zones in Mono County. In all, 183,755 acres are in the high severity zone, and 31,766 acres are in the very high severity zone.

Table 7.1: Wildfire Severity Zones by Planning Areas

	High Wildfire Severity Zone			Very High Wildfire Severity Zone		
Land Ownership or Administration Category	Acres in Hazard Zone	Percentage of Total in Category	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total in Category	Percentage of Total Mono County Area
County	191	8.4%	<1%	138	6.1%	<1%
Federal	158,865	9.2%	7.9%	27,671	1.6%	1.4%
Town of Mammoth Lakes	115	53.3%	<1%	--	--	--
Private	8,874	6.9%	<1%	902	<1%	<1%
State	5,705	6.8%	<1%	2,565	3.1%	<1%
Utilities	8,434	12.6%	0.4%	126	<1%	<1%

Land Ownership or Administration Category	High Wildfire Severity Zone			Very High Wildfire Severity Zone		
	Acres in Hazard Zone	Percentage of Total in Category	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total in Category	Percentage of Total Mono County Area
Right of way/ administration	1,566	17.5%	<1%	361	4.0%	<1%
Other	6	<1%	<1%	2	<1%	<1%
Total	183,755	9.1%	9.1%	31,766	1.6%	1.6%

Table 7.2 shows the land within the high and very high wildfire severity zones in Mono County broken down by the planning areas defined in the Mono County General Plan. As shown, large percentages of Mammoth Vicinity, Swauger Creek, Mono Basin, and June Lake are in high wildfire severity zones. Significant portions of June Lake and Sonora Junction are also within very high fire severity zones.

Table 7.2: Wildfire Severity Zones by Planning Areas

Planning Area	High Wildfire Severity Zone			Very High Wildfire Severity Zone		
	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Antelope Valley	1,279	4.3%	<1%	-	-	-
Benton	-	-	-	-	-	-
Benton Hot Springs	-	-	-	-	-	-
Bodie Hills	-	-	-	-	-	-
Bridgeport	2,667	5.2%	<1%	333	<1%	<1%
Chalfant Valley	-	-	-	-	-	-
Hammil Valley	-	-	-	-	-	-
June Lake	12,613	23.8%	<1%	8,016	15.1%	<1%
Long Valley	3,649	20.2%	<1%	-	-	-
Mammoth Vicinity	42,216	51%	2.6%	1,514	1.6%	<1%
Mono Basin	4,428	2%	<1%	-	-	-
Oasis	-	-	-	-	-	-
Sonora Junction	7,419	6.5%	<1%	11,253	9.8%	<1%

Planning Area	High Wildfire Severity Zone			Very High Wildfire Severity Zone		
	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Planning Area	Percentage of Total Mono County Area
Swauger Creek	663	35.0%	<1%	-	-	-
Upper Owens	4,304	28%	<1%	-	-	-
Wheeler Crest	244	4.2%	<1%	-	-	-

Mammoth Lakes

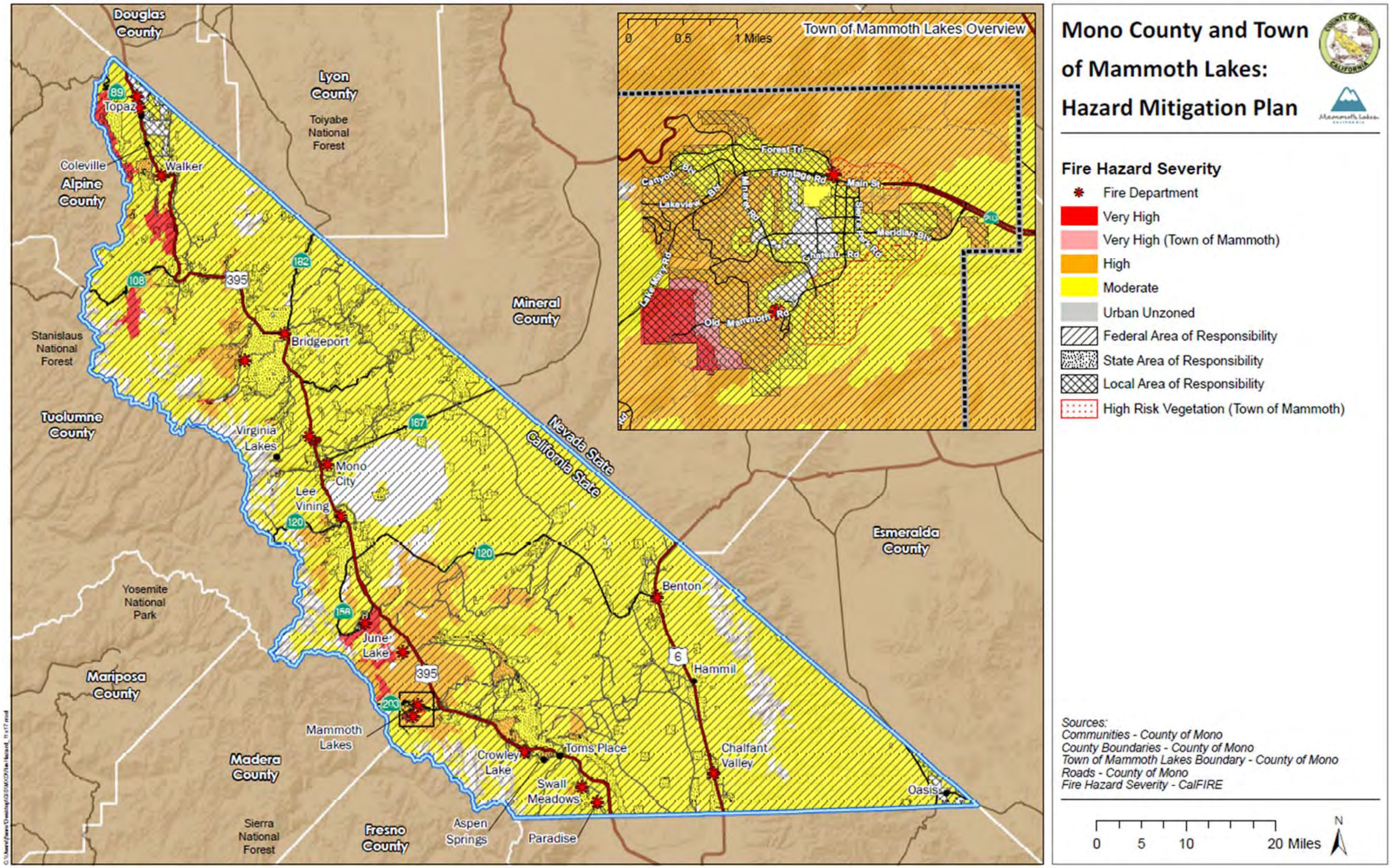
Wildfire is a concern for the entire town; historically, wildfires have occurred on all sides of town. However, certain portions of Mammoth Lakes have higher hazard exposure, including areas close to the Valentine Reserve Ecological Study Area and neighborhoods south of Old Mammoth Road (typically referred to as Old Mammoth and Lake Mary). **Figure 7.1** shows the fire hazard severity zones for Mono County and Mammoth Lakes, as well as local, state, and federal responsibility areas. Overall, roughly 3 percent of the incorporated town is in a very high fire severity zone and close to 34 percent is in a high fire severity zone, based on Cal Fire Hazard Severity Zone Mapping. The town has identified additional areas for which it enforces very high severity zone regulations and requirements, as shown on the inset on **Figure 7.1**.

Table 7.3 gives the acreage and percentage of total land area located within high and very high wildfire severity zones, as well as the additional land area identified by the town to be regulated as a very high wildfire zone.

Table 7.3: Wildfire Severity Zones in Mammoth Lakes

	High Wildfire Severity Zone		Very High Wildfire Severity Zone		Town Very High Wildfire Severity Zone		
Planning Area	Acres in Hazard Zone	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Mono County Area	Acres in Hazard Zone	Percentage of Total Mono County Area	Total Plan Area Acreage
Town Outside Urban Limit	4,186	31%	0%	425	3%	0%	16
Town Inside Urban Limit	1,109	44%	0%	51	2%	0%	90

Figure 7.1 Mono County Wildfire Hazard Severity Zones



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7.3.3 Hazard History

Wildland fires in Mono County have ranged from fires that burned less than 1 acre in size to the Cannon Fire in Walker in 2002, which burned 22,750 acres. Dozens of fires of various sizes typically burn in the county each year. Swall Meadows, June Lake, and Antelope Valley are populated areas that have experienced one or more significant fires since 2000 and have a pattern of fires from prior years. The following are the significant fires that have affected the county since 2000. Typically, these fires were wind-driven and consumed several thousand acres before suppression efforts were successful.

1. **Cannon Fire**. June 2002. Walker.

The Cannon Fire burned 22,750 acres. Three fatalities occurred due to an air-tanker crash, and one person was injured when a water truck was destroyed in a rollover accident. Economic damages from the fire totaled $7.9 million. The fire is thought to be human-caused but was strongly influenced by high winds (20–30 mph), dry fuel conditions, varied fuel types, and mountainous topography. Hundreds of evacuations occurred east and west of US 395 and portions of US 395 were closed.

2. **Gate Complex Fire** (Slinkard, Gate, Buckeye, and Coleville Fires). *July 2002. West side of Antelope Valley.*

The Complex Fire consisted of four fires that burned in the same region simultaneously. The Slinkard fire, the largest of the four, burned north from Slinkard Valley near SR 89 to the Topaz Lodge along US 395. In total, the fires burned roughly 9,866 acres and incurred more than $1.6 million in damages. Portions of US 395 (Bridgeport to Holbrook Junction) and SR 89 (Monitor Pass) closed. The fires are believed to have been started by lightning in a wildland area and spread quickly due to wind and dry ground conditions. Evacuations were required for all of Coleville and areas north to Nevada. All residents from the Monitor Pass turnoff north to the Nevada state line and from the Monitor Pass turnoff south to Topaz Lane were evacuated. Power and telephone outages occurred in Walker and Coleville. Just over 900 fire personnel were on scene, as well as helicopters and air tankers.

3. **Birch Place Fire**. September 2002. Birch Creek Canyon near Swall Meadows.

The Birch Place fire resulted in 2,500 acres burned and $386,000 in damages. The entire Rock Creek drainage area (including USFS campgrounds), local residents (including the entire Swall Meadows community), and merchants were evacuated. Lower and Upper Rock Creek Roads closed. No structures were destroyed.

4. **Larsen Fire**. June 2007. West of Coleville in Antelope Valley.

The Larsen fire burned for close to 20 days, ultimately burning 1,080 acres. The blaze caused mandatory evacuations in portions of Coleville and U.S. Marine housing, school closures, and the closure of US 395 from Bridgeport to Holbrook Junction. High winds caused quick spreading. Lightning is believed to have started the blaze.

5. **Indian Fire**. August 2012. North of SA 120 and southwest of Mono Lake.

The Indian Fire burned for roughly a week but burned more than 12,576 acres in that time and required 571 personnel on-site. The fire was believed to be caused by a lightning strike. The fire did not threaten life or property but burned several major transmission lines and destroyed critical habitat for sage grouse.

6. **June Lake Fire**. September 2014. June Lake Mountain.

The June Fire, which started at the base of June Mountain, was caused by an employee of June Mountain operating heavy equipment on June Mountain Ski Area. The fire threatened residential structures and necessitated mandatory evacuations east of June Mountain and south of Highway 158. Highway 158 was closed at the south junction with Highway 395 and to the north to Rainbow Lane.

7. **Walker Fire**. August 2015. Southwest of Lee Vining.

The fire burned for roughly two weeks and consumed 3,676 acres. It resulted in the temporary closure of SR 120 and Tioga Pass Road, and mandatory evacuations of several campgrounds and resorts near Lee Vining and Walker Lake. The fire was human-caused.

8. **Round Fire**. February 2015. South of Swall Meadows.

The most destructive fire in recent history, the Round Fire burned 40 homes, most of them in Swall Meadows, and 7,000 acres. The communities of Paradise and Swall Meadows were placed under mandatory evacuation orders. The blaze was started when strong winds caused a tree to fall over power lines, which sparked.

9. **Owens River Fire**. November 2016. East of June Lake, Clark Canyon.

Burning for roughly a week, the fire covered 5,443 acres. The Big Springs Campground, Clark Canyon (a popular climbing area), and nearby ranches and developments were evacuated. The Owens River

Road and Whitmore Springs Roads were closed and visitors were advised to avoid Bald Mountain Road, as well.

10. Slinkard Fire. September 2017. West slope of Antelope Valley, south of Topaz.

The Slinkard fire burned for roughly two weeks, burning more than 8,925 acres. The blaze was started by a lightning strike in Slinkard Valley. CA 395 was temporarily closed in both directions and voluntary evacuation notices were issued to residents in and around Topaz.

Mammoth Lakes

The Town of Mammoth Lakes regularly experiences wildfires in proximity to town boundaries. Most of these fires are extinguished before growing over 100 acres. The most destructive fire in town history was the 1992 Rainbow Fire, which began near the Devils Postpile National Monument. The fire burned more than 85 percent of the monument's acreage. The Rainbow Fire was ignited by lightning on August 20, 1992, in the Inyo National Forest, south of Devils Postpile National Monument, and spread to the monument by wind. Ideal weather conditions prevented the fire from further spreading into town.

Figure 7.2 shows all fire perimeters from 1990 to 2017 as well as the general location (displayed as single dot) of fires recorded in recent history, going to back to 1900 for the County and Town of Mammoth Lakes. A full list of document fires is contained in **Appendix H**.

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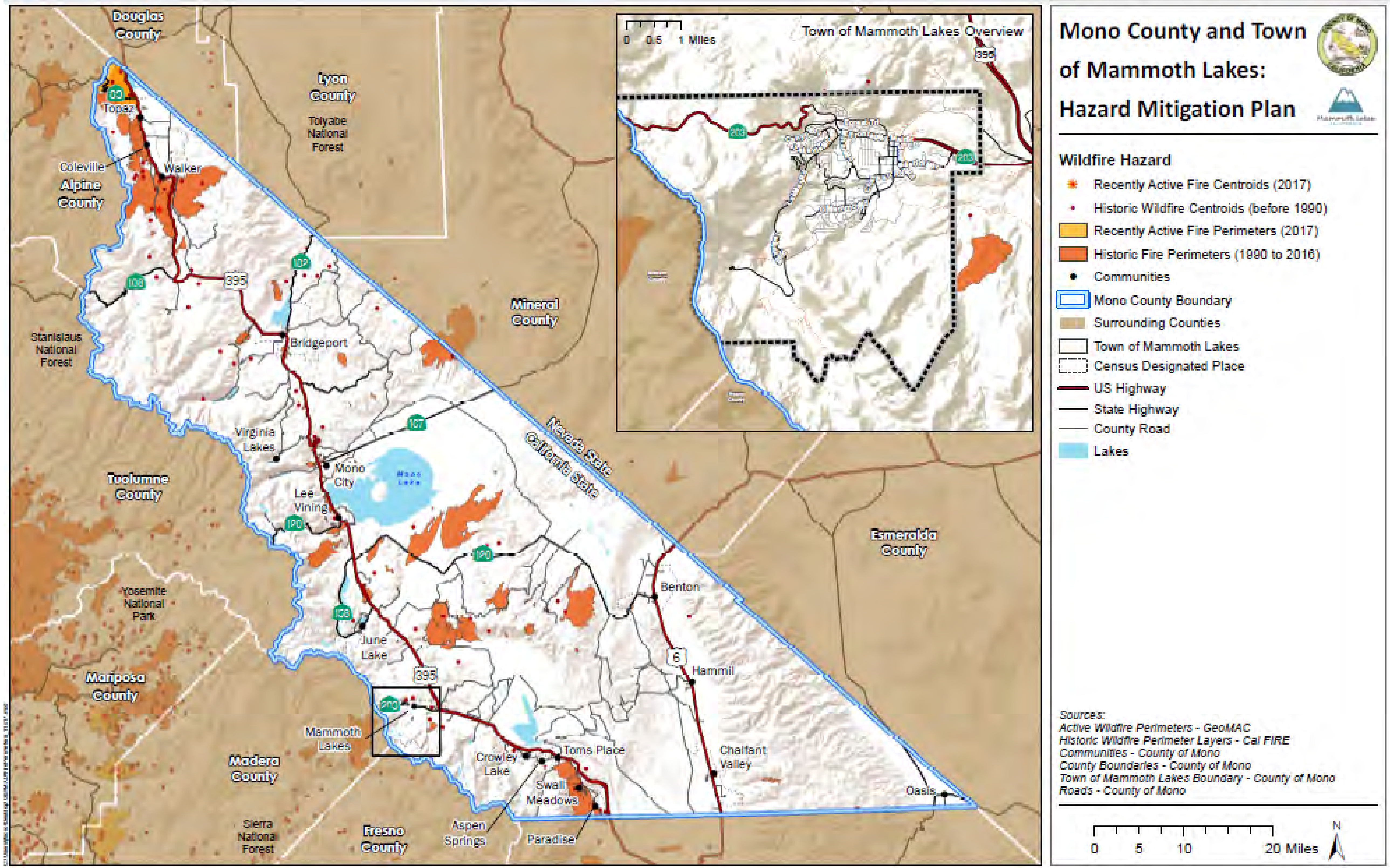
Figure 7.2 Historic Fires



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7.3.4 Risk and Vulnerability

The location, frequency, and severity of potential future wildfire hazard events is by itself insufficient to describe Mono County and Town of Mammoth Lakes' vulnerability to wildfire. A risk assessment is necessary to prepare a more accurate view of the threat that the county and the city face as a result of wildfire events likely to occur in their areas. Risk and vulnerability are assessed in terms of critical facilities and vulnerable populations that are located in high or very high wildfire severity zones. The approach and method for risk and vulnerability assessment are described in greater detail in **Chapter 4** of the MJHMP.

Social Vulnerability

A number of community members considered to have higher vulnerability in a hazard event reside within the high and very high hazard severity zones of both the county and town. Reflective of the overall area, a large number of individuals in Mammoth Lakes, nearly 2,130, and 798 households are in the high fire severity zone, and another 132 households are in the very high severity zone. However, there is no significant difference in social vulnerability between residents in the high wildfire hazard zones compared to residents in the entirety of the communities. A much lower percentage of total households in the unincorporated county are located in either zone. Vulnerable populations also do not seem to represent a much higher percentage than the overall population. **Tables 7.4 and 7.5** summarize the social vulnerability for unincorporated Mono County and Mammoth Lakes residents, respectively, in the high and very wildfire hazard zones.

Table 7.4: Social Vulnerability for Wildfire Hazard Zones – Unincorporated Mono County

Social Vulnerability Metric	Wildfire Hazard Zone		
	High	Very High	Mono County Total
Population	1,225	227	6,042
Number of households	485	52	2,469
Median household income	$61,643	$40,533	$56,944†
Number of households under poverty limit	7.0%	<1%	5.1%
Percent elderly households	42.7%	<1%	35.2%
Percentage of adults with English competency	98.6%	99.4%	95.5%
Percentage of households with a disabled member	17.3%	15.4%	15.3%

† Median income for the unincorporated county was not available so the total county median is shown

Table 7.5: Social Vulnerability for Wildfire Hazard Zones – Mammoth Lakes

Social Vulnerability Metric	Wildfire Hazard Zone		
	High	Very High	Mammoth Lakes Total
Population	2,130	267	8,104
Number of households	798	132	3,299
Median household income	$68,947	$69,438	$55,799
Number of households under poverty limit	4.0%	1.5%	4.3%
Percentage elderly households	19.3%	12.1%	6.9%
Percentage of adults with English competency	90.9%	91.0%	88.7%
Percentage of households with a disabled member	15.8%	7.6%	12.0%

Critical Facilities

In Mono County, 24 critical facilities are located in the high hazard severity zone and 5 in the very high hazard severity zones. Of these, 10 are located in the Town of Mammoth Lakes. Most of the recreation, transportation, and utility-related critical facilities face the risk of wildfire, although the public safety and social services facilities face the greatest cost risks. **Table 7.6** lists the number of facilities located in wildfire hazard zones for unincorporated Mono County and the Town of Mammoth Lakes. Additionally, the Digital 395 cables run through areas of moderate and high fire risk and major power lines run through all hazard severity zones.

Table 7.6: Critical Facilities in Wildfire Hazard Zones – Unincorporated Mono County and Mammoth Lakes

Facility Type	Unincorp. Mono County		Mammoth Lakes	
	High	Very High	High	Very High
Communications Facilities	3	0	0	0
Emergency Operations Center	3	0	2	0
Emergency Services	5	2	3	0
Hazardous Materials	0	1	0	0
Lifeline Utility Systems	8	2	3	0
Medical Services	1	0	2	0
Schools	0	0	0	0
Transportation Systems	2	0	1	0
Vulnerable Populations	1	0	0	0
Total	**23**	**5**	**11**	**0**

7.4 Potential Fire Behavior and Fuel Conditions in the Wildland Urban Interface

The wildland-urban interface (WUI) is defined as the area where structures and other human development meet or intermingle with undeveloped wildland. The WUI creates an environment in which fire can move readily between natural vegetation fuels to structures and from structures into the natural vegetation fuels.

All developed areas and communities in Mono County sit directly adjacent to huge swaths of forestland and open space lacking in human infrastructure. People come to this region to live in rural areas and direct proximity to natural ecosystem areas with attractive recreational and aesthetic amenities, especially forests. Consequently, all urbanized areas in the county are within the WUI, and face significant risk and likelihood that wildfires will threaten structures and people. There are significant implications for both the character and development of structures and behavior within those communities and for the health and management of wildlands directly adjacent to those communities and the thousands of acres beyond them.

For the purpose of this CWPP, the County applies WUI boundaries developed by Cal Fire. Additionally, the entire Town of Mammoth Lakes is considered to be in the WUI, as approved by Town Council in 2007 and shown in **Figure 7.3**. Cal Fire considers three main components in the assessment of threat from wildland fire to WUI areas:

1. Ranking fuel hazard.
2. Assessing the probability of wildland fire.
3. Defining areas of suitable housing density that lead to WUI fire protection strategy situations.

These three independent components were then combined using GIS capabilities to identify WUI areas threatened by wildfire. In addition to mapping these areas, a list of communities was developed that summarized a nonspatial assessment of key areas within the vicinity of significant threat from wildland fire.

Figure 7.3 displays the WUI (shown in orange) for the county. The entire Town of Mammoth Lakes is in the WUI; the Fire Commissioners approved and the Town Mayor ratified WUI boundaries in 2007, as shown in **Figure 7.4**. The WUI is defined as a 1.5-mile buffer around developed areas with densities greater than 1 unit per 40 acres. As is the case with most defined WUIs, some homesteads and ranches may lie outside of the defined boundary, as they are too dispersed to be included. These are not considered communities and are therefore not within the scope of this CWPP, although they may fall within the defined WUI.

7.4.1 Fire Regime Condition Class (FRCC)

Historical fires can provide a great deal of information for understanding future fire risk. However, as noted above, a complex interaction of natural and human conditions greatly impact both hazard and risk. Wildfire is a natural component of many ecosystems, including high-altitude forest and grassland that is predominant in Mono County. However, changes in those ecosystems—many driven by human development and action, such as long-term fire suppression to protect homes and other structures—have altered conditions in ways that change fire-related risk. Many of California's largest fires in recent decades resulted from changes to the ecosystem that drastically increased the fire risk and led to extremely large conflagrations.

The FRCC provides a landscape evaluation of expected fire behavior as it relates to the departure from historical norms. The FRCC is derived by comparing current conditions to an estimate of the historical range that existed prior to substantial settlement by Euro-Americans. The departure of the current condition from the historical baseline serves as a proxy to likely ecosystem effects. The condition class concept assumes that historical fire regimes accurately represent the conditions under which the components within a fire-adapted ecosystem naturally evolved.

The data used for this study is from California's FRAP vegetation data. Condition class measures are assigned, comparing natural fire regime and current fire conditions. FRCCs are defined as the "relative risk of losing key components that define an ecosystem." The conceptual basis is that for fire-adapted ecosystems, much of their ecological structure and processes are driven by fire. Departure from natural fire regimes creates instability and increases the risk to key components of that ecosystem. The method utilized follows that which is used at the national level, where lands are assigned one of three condition class levels—low, mixed, and high—which qualitatively rank the potential effects to the ecosystem based on the percentage of the dominant overstory vegetation that has been replaced. The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) and divided into the categories of 0–35 years, 35–100 years, and over 100 years. **Figure 7.5** shows the FRCC for Mono County and the Town of Mammoth Lakes.

Figure 7.3 Mono County Wildland Urban Interface

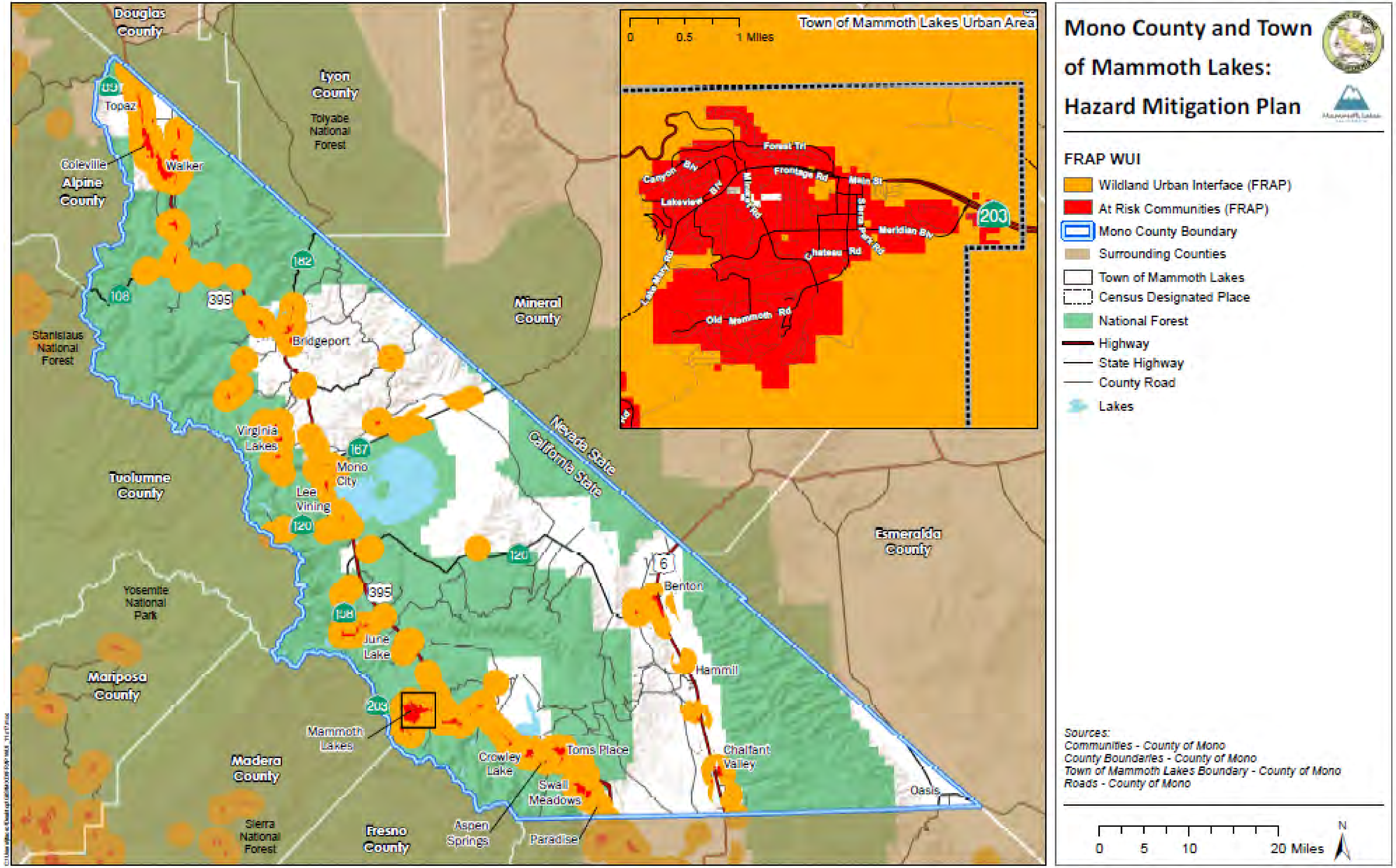

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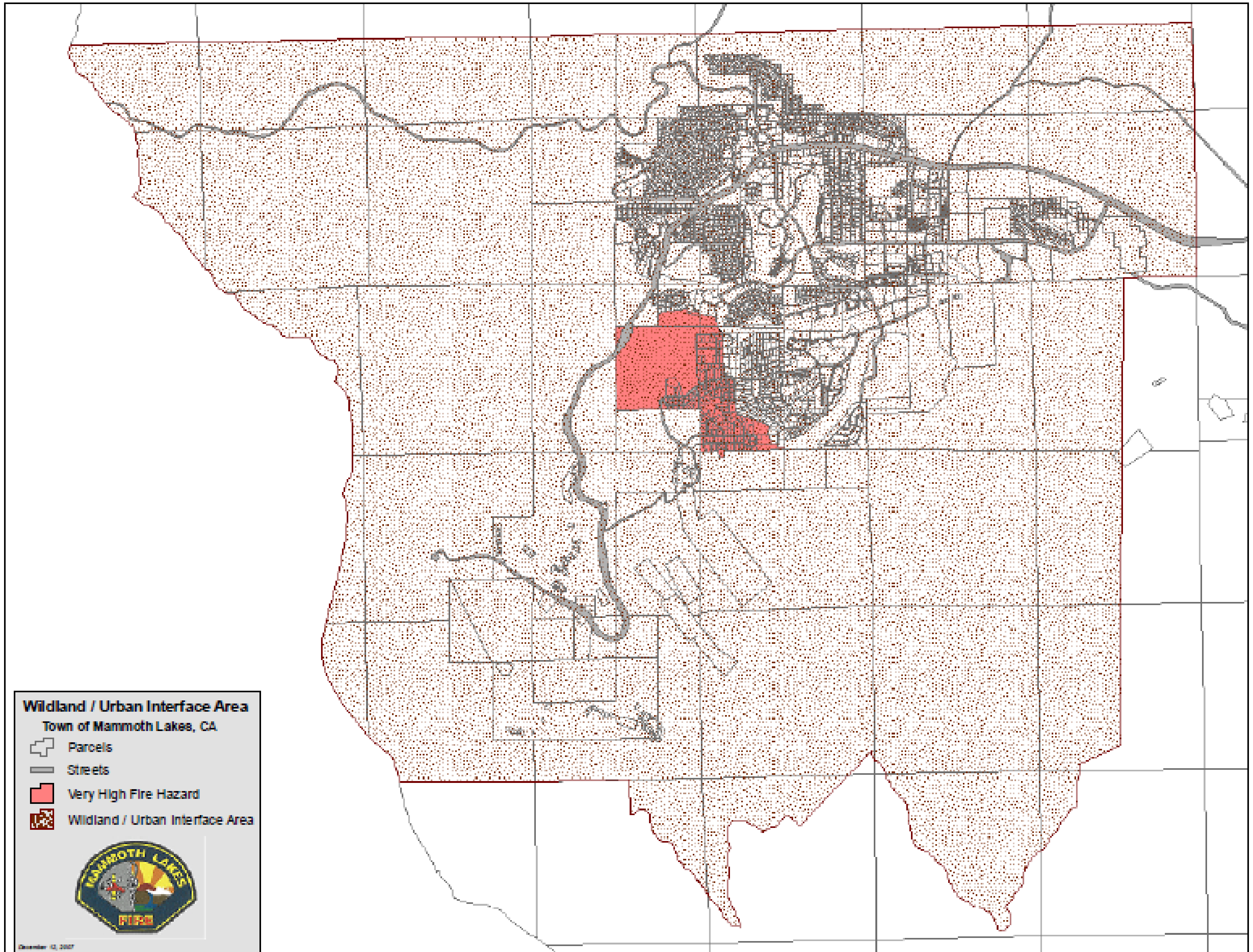
Figure 7.4 Town of Mammoth Lakes Approved Wildland Urban Interface



Source: Town of Mammoth Lakes 2007

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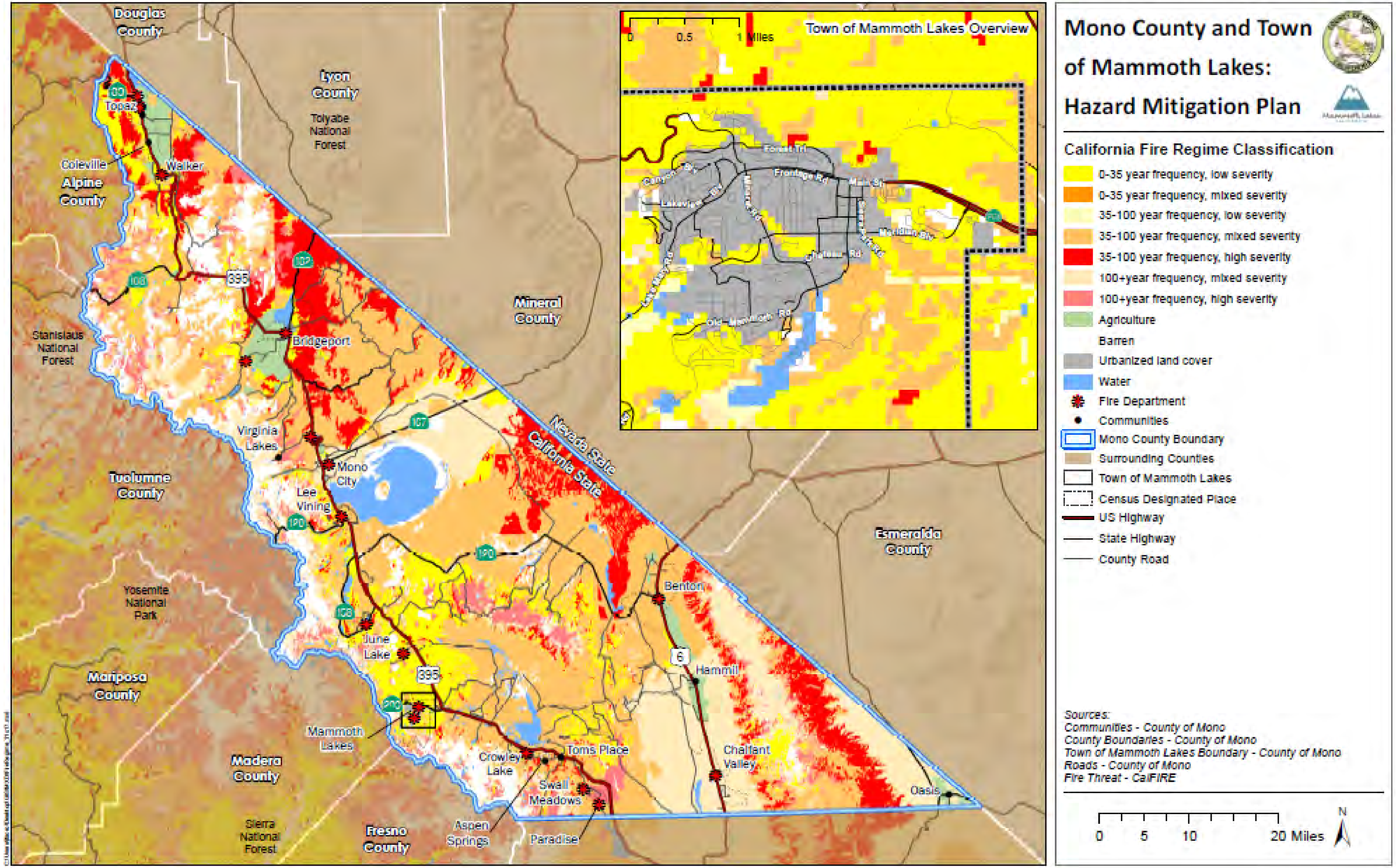
Figure 7.5 Fire Regimes Condition Class



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7.4.2 Fire Behavior Potential

This section predicts likely fire behavior in Mono County and the Town of Mammoth Lakes using the FlamMap 3.0 fire behavior modeling software. The modeling evaluation was completed in 2009. The model displays potential rate of spread, flame length, and crown fire activity for moderate and extreme fire weather conditions. Weather observations were collected for a 20-year period (1986–2006) and used to define two weather scenarios (moderate and extreme) for modeling fire behavior potential. Other model inputs included vegetative fuels (type and coverage based on Cal Fire's vegetation data) and topographical features such as slope, elevation, and aspect. The model does not calculate the probability a wildfire will occur; it assumes an ignition occurrence for every cell. However, it does predict how a wildfire would behave in each given area based on the inputs mentioned above. Additional information on the assumptions and methodology used are contained in **Appendix F**.

Rate of Spread

Figures 7.6 and **Figure 7.7** show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios, respectively. Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by foresters and firefighters. It is equal to 66 feet; therefore, 1 mile equals 80 chains. Rates of fire spread are influenced primarily by the wind, slope steepness, fuel type/continuity, and fuel sheltering from the wind. Fire is the only force of nature which moves faster uphill than downhill. In areas where high to extreme rates of spread are predicted (rates of spread of >40 CPH or one-half mile per hour), it is possible fires could spread faster than humans can escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident. Rates of spread in the eastern Sierras can follow a pattern of strong down-winds that can cause fast-moving extreme fire behavior down drainages in the afternoons during summer days, especially associated with frontal passages.

In the moderate fire weather scenario, moderate to extreme rates of spread are predicted throughout the populated areas in the northern parts of the study area. High rates of spread (>40 CPH or one-half mile per hour, shown in red) are predicted for portions of the southwestern part of the county where desert grasses and shrubs with little sheltering from the wind are the dominant fuels, including parts of Upper Owens, Mono Vicinity, Long Valley, Wheeler Crest, and Oasis. Rates of spread increase to extreme levels (>60 CPH, shown in maroon), where these conditions are combined with increasing slopes, most notably in the lower slopes of the eastern Sierras and the mountain ranges of the desert areas in the eastern and southern portions of the county. These include smaller portions of Upper Owens and Wheeler Crest in the southern part of the county, as well as swaths of the northern county along the US 395 corridor, including virtually all of Antelope Valley and Bridgeport Valley as well as portions of Sonora Junction and the northern side of Mono Basin. These model results are consistent with recent historic wildfires, which have been most frequent and burned the most acreage in these areas with rates of spread predicted at greater than 60 CPH.

In the extreme fire weather scenario, extreme rates of spread are predicted for all of the urbanized communities in the county with the exception of the higher elevations of the Sierras and White Mountains and areas where combustible fuels are sparse or not present.

Figure 7.6 Rate of Spread, Moderate Weather Conditions

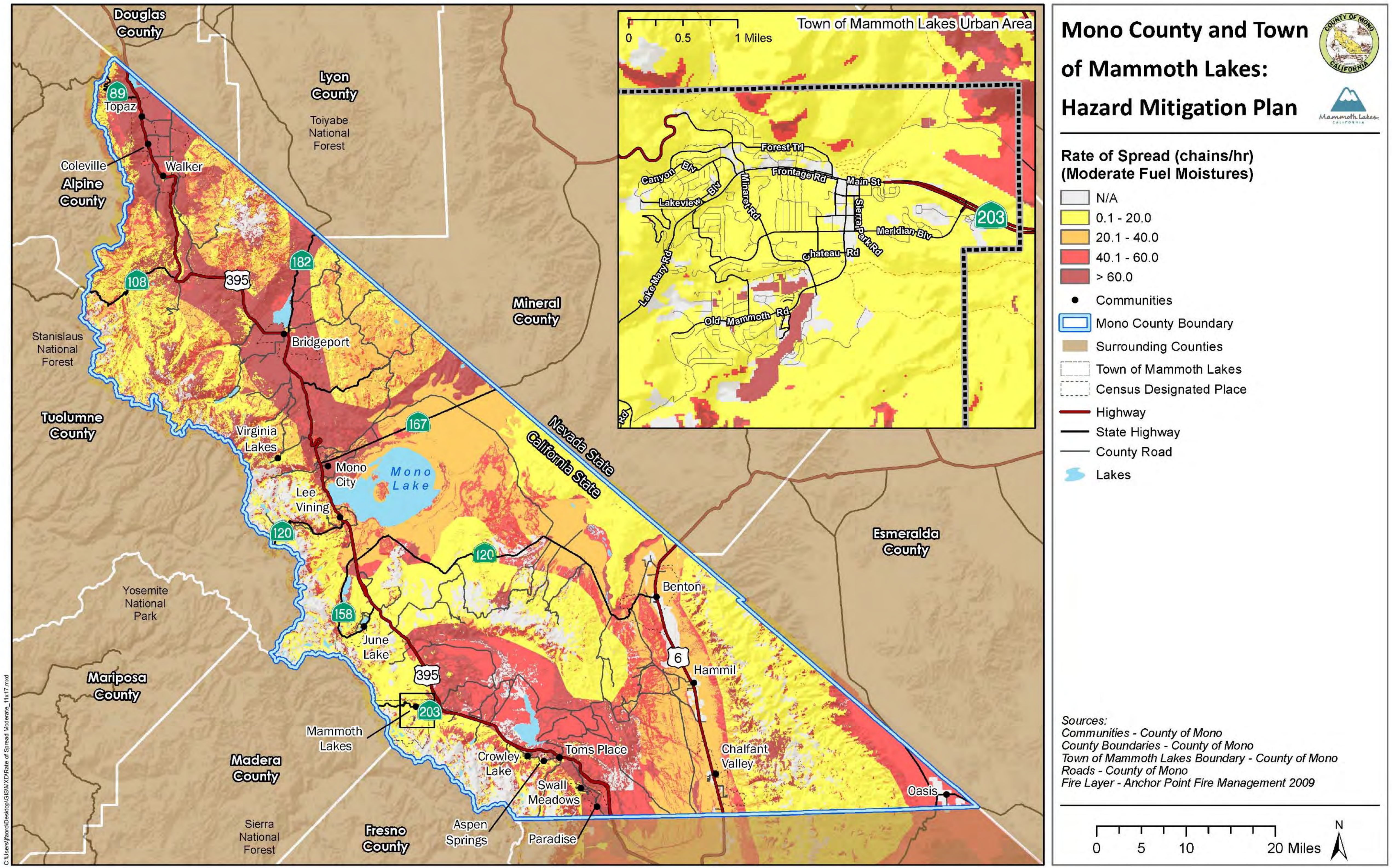

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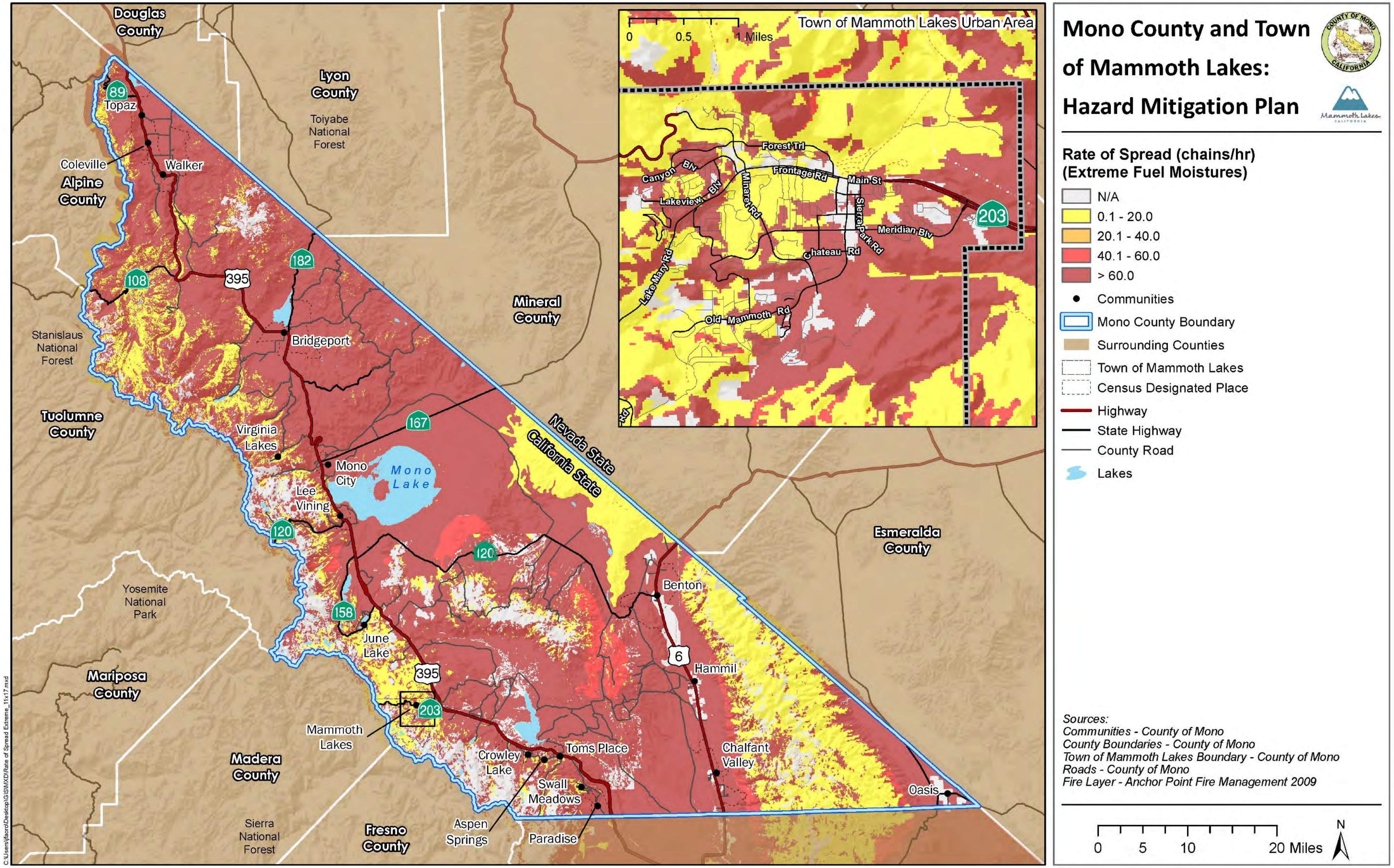
Figure 7.7 Rate of Spread, Extreme Weather Conditions



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Flame Length

Flame length is used as a proxy for fire intensity. It is important to note that flame length represents the entire distance from the base of the flame to the tip, irrespective of angle—not simply the flame height above the ground. In high wind conditions, it is possible to have very intense flames (high flame lengths) which are relatively close to the fuel bed.

Figure 7.8 and **Figure 7.9** display flame length in ranges that are meaningful and useful to firefighters. Flame lengths of 4 feet or less (shown in yellow) are considered low-enough intensity to be suitable for direct attack by hand crews, which represents the best chance of direct extinguishment and control. Flame lengths of less than 8 feet (shown in orange and yellow) are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of 8 to 12 feet (shown in red) are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12 feet (shown in maroon), the most effective tactic is fuel consumption ahead of the fire by burnouts or mechanical methods. Although indirect fire line and aerial attack are also used for such fires, flame lengths increase as the effectiveness of these tactics decrease. Their use in this case is generally intended to slow rates of spread and reduce fire intensity, especially in areas where values at risk are concentrated.

Even in the moderate fire weather scenario, most urbanized communities are located in areas with likely flame lengths of greater than 4 feet. Many areas—including the western side of Antelope Valley; portions of Sonora Junction, Bridgeport Valley, Bodie Hills, and Upper Owens; and nearly all of Mammoth Vicinity, Long Valley, and Swall Meadows—are predicted to have the potential for extreme flame lengths of 12 feet or greater.

Under the extreme fire weather scenario, high to extreme flame lengths are predicted throughout the areas covered by the WUI communities, with the exceptions of some small pockets, such as Tri-Valley and Oasis, where elevations and/or fuel conditions moderate the large-scale conditions. Under extreme weather and fuel moisture conditions, fire intensity is expected to be a genuine issue and control will be difficult and complex to establish and maintain.

Crown Fire Activity

The crown fire activity maps, shown in **Figure 7.10** and **Figure 7.11**, display the potential for fires to move from the surface into the canopy of trees and shrubs. The likelihood of progression from the surface into the aerial fuels is displayed in four categories. N/A ("not applicable") refers to areas where surface fires are unlikely to develop due to the lack of combustible fuels. These would include areas lacking a combustible fuel bed, such as rock, ice, snow fields, water, sand, or some urban landscapes. The surface fire category (shown in yellow) covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas where grass fuels without overstory plants are dominant fall into this category, regardless of the energy produced by the fire, due to the lack of an aerial fuel bed. Areas designated by the torching category (shown in orange) are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. The active crown fire category (shown in red) includes areas where sustained horizontal movements through tree crowns are expected. Crown fires represent extreme fire behavior conditions and are notoriously resistant to all methods of suppression and control.

Weather variables had trivial effects on the development of crown fire in the study area, as shown by the limited differences displayed on the two figures. In general, there is a possibility of torching and/or active crown fire development wherever timber fuels are present, which includes most of the WUI, except for eastern Antelope Valley, Mono Basin, Tri-Valley, and Oasis.

Figure 7.8 Flame Length, Moderate Fire Weather Conditions

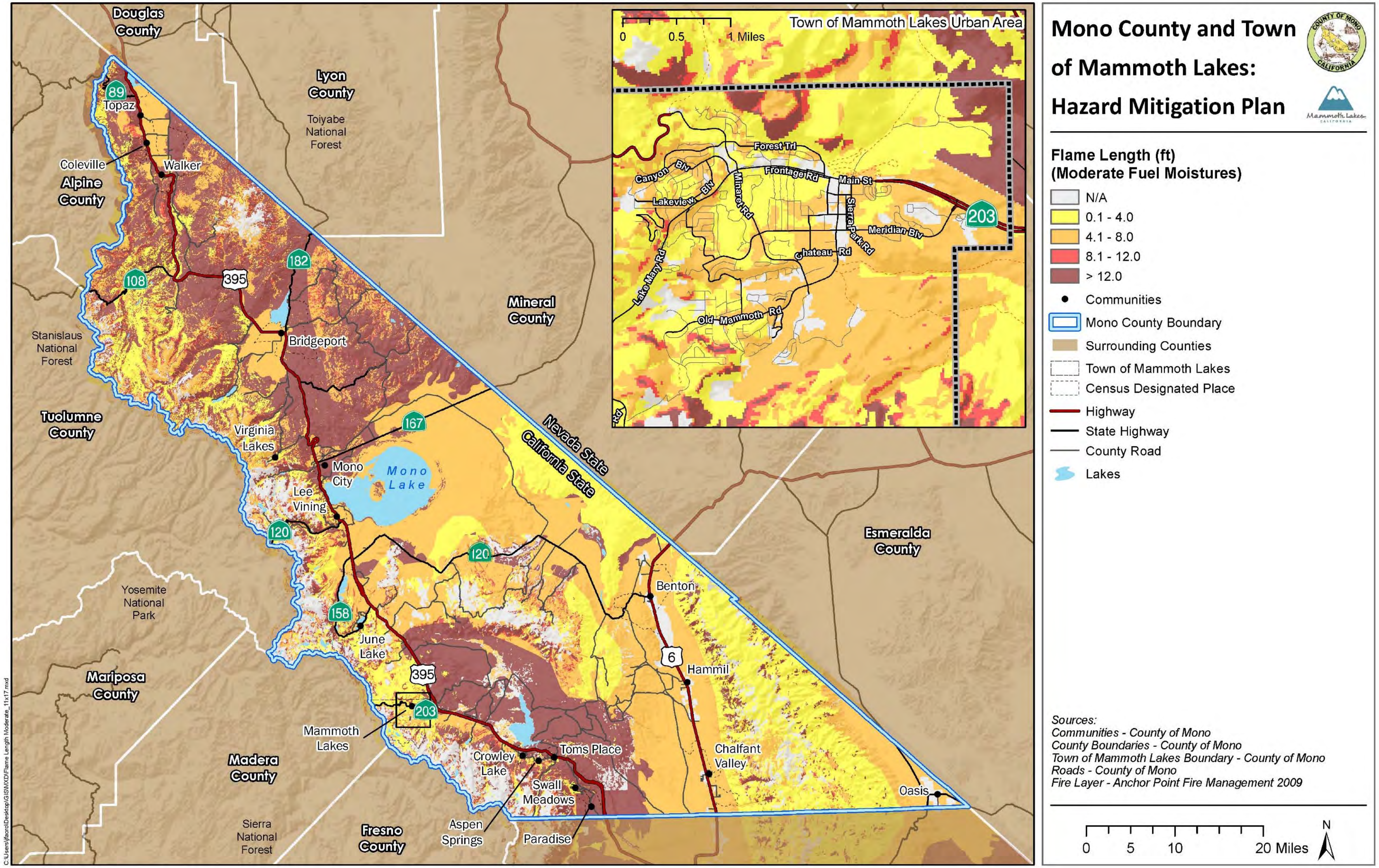

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Figure 7.9 Flame Length, Extreme Fire Weather Conditions

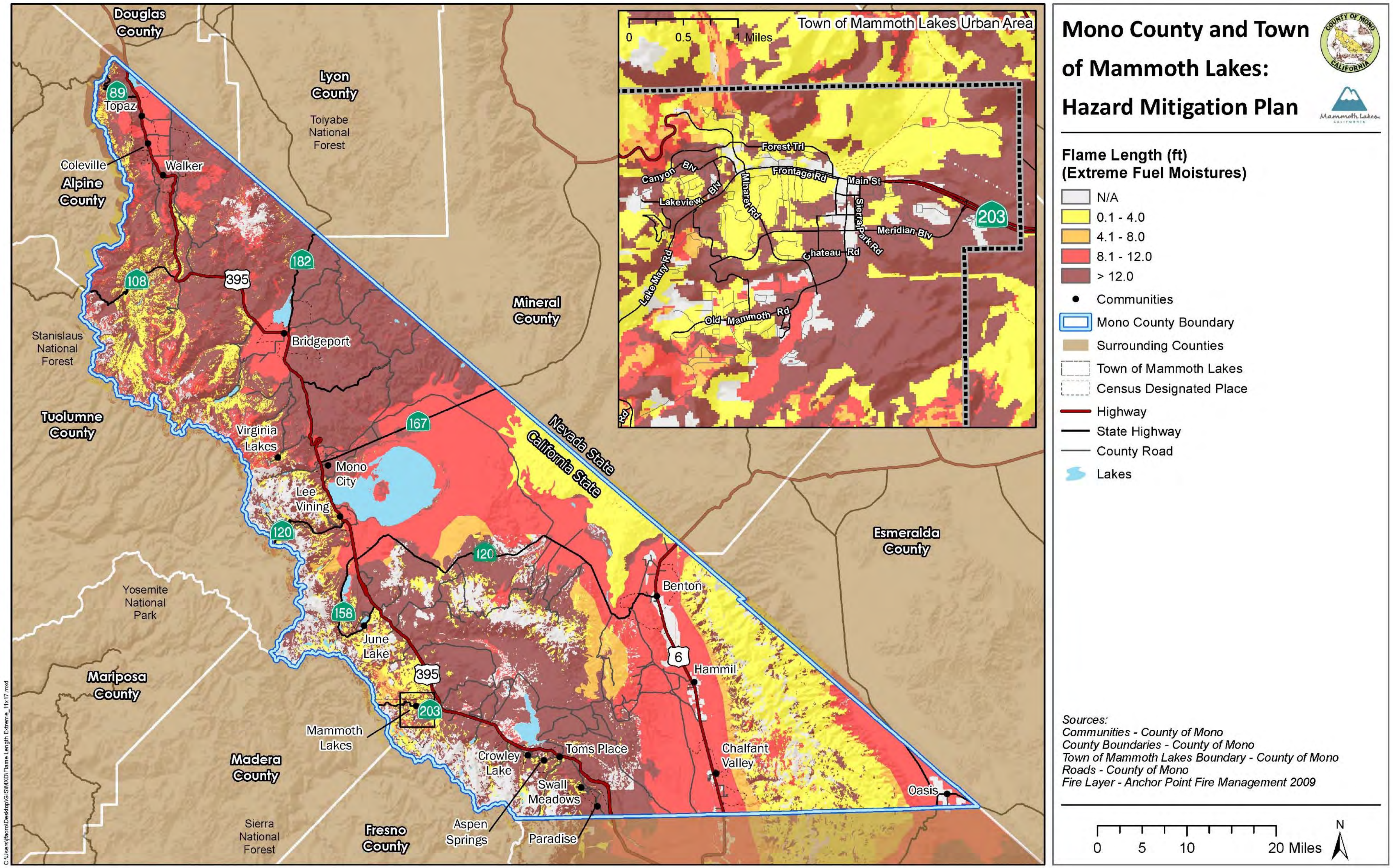

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Figure 7.10 Crown Fire Activity, Moderate Fire Weather Conditions

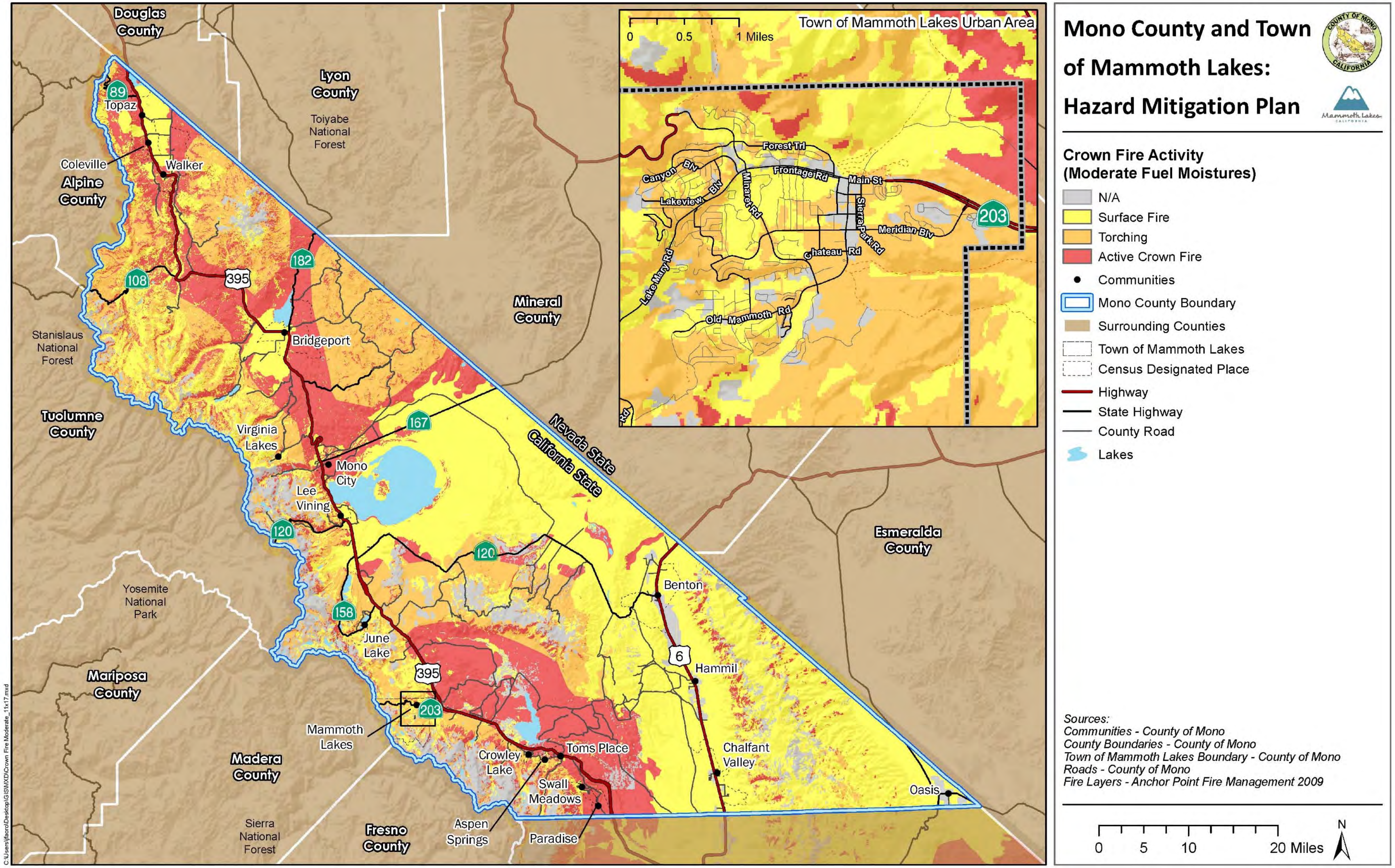

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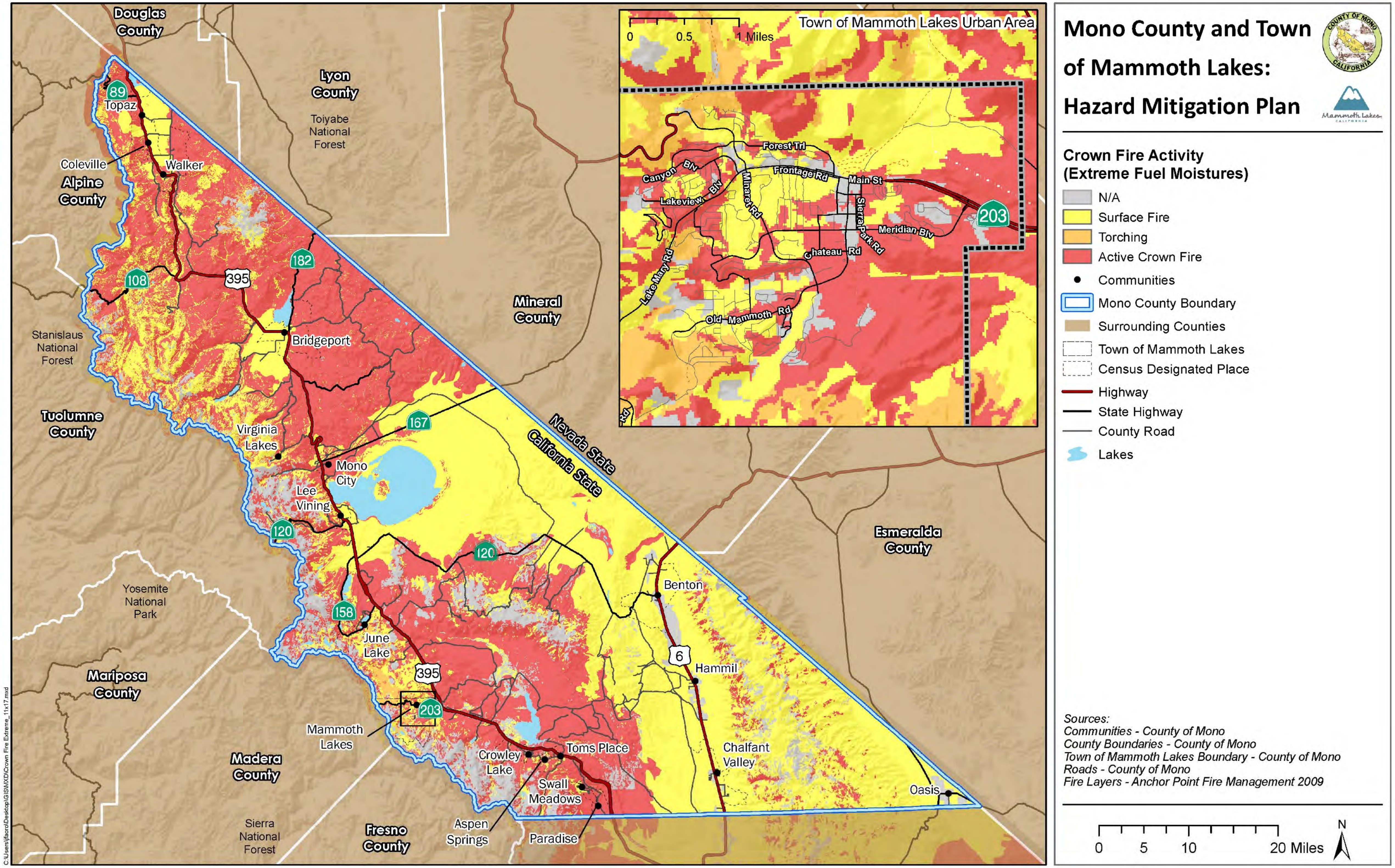
Figure 7.11 Crown Fire Activity, Extreme Fire Weather Conditions



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7.4.3 Community Risk Assessment

In 2009, the County and Town, in coordination with BLM Bishop field office, conducted a community-specific wildfire risk assessment for 36 urbanized areas. The area boundaries were selected through a stakeholder process and took into account factors including physical development characteristics such as housing density, lot size, dominant construction types, roadway access and navigational ease; availability of water for fire suppression; and natural characteristics such as slope and vegetation types.

Each area was then assigned a hazard ranking of low, moderate, high, very high, or extreme, based on these characteristics and the fire behavior potential components described in Section 7.4. The identified communities and their hazard rankings are shown in **Figure 7.12**. The full methodology for ranking the community areas and profile descriptions of each are available in **Appendix F**.

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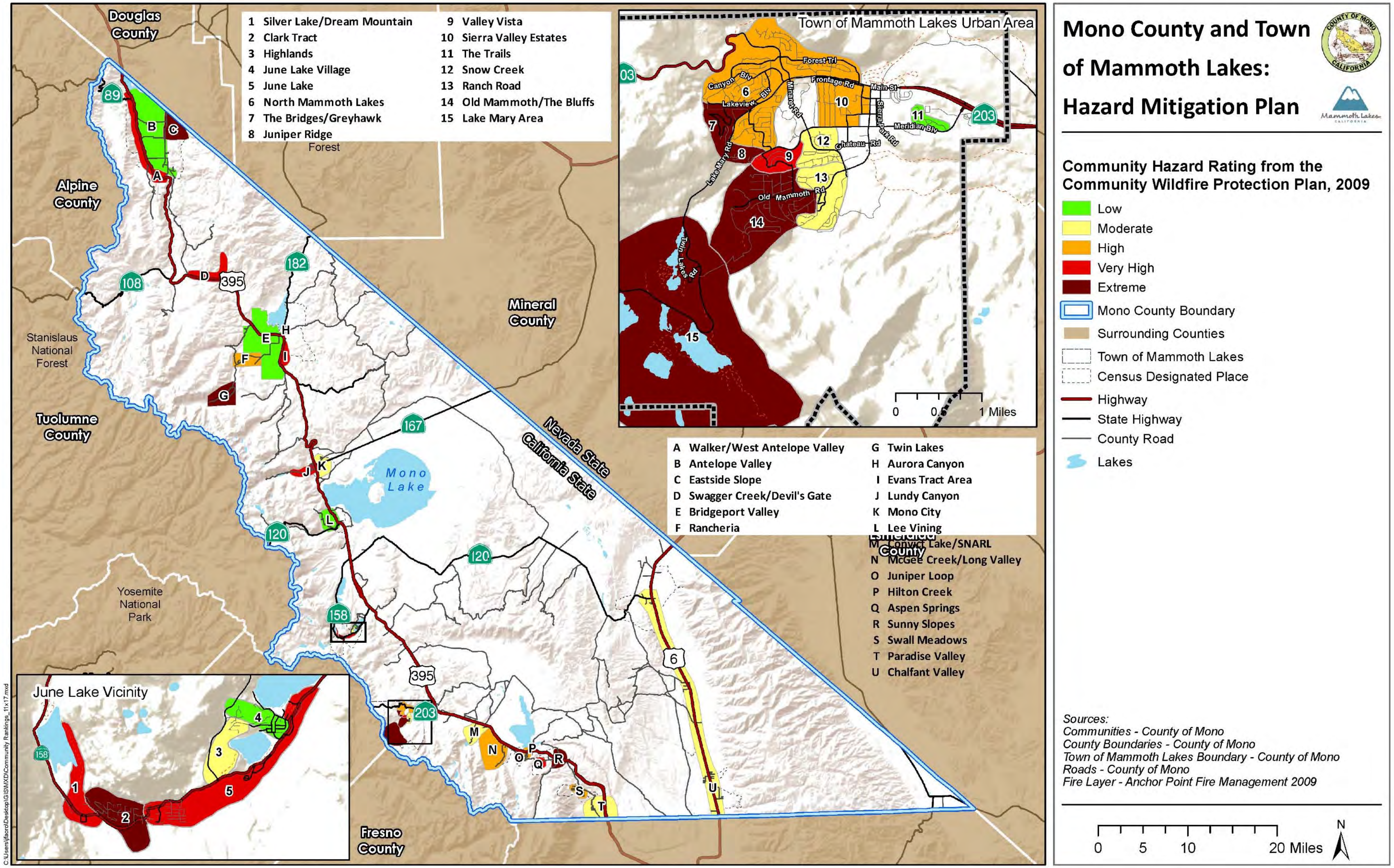
Figure 7.12 Community Area Specific Wildfire Hazard Ranking



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7.5 Fuel and Development Condition Changes in the Last Decade

As part of the 2018 CWPP update, physical development characteristics and development growth were reevaluated and confirmed. Each of the key infrastructure components are described below.

7.5.1 Single-Route Access

The communities of Paradise, Swall Meadows, Lundy Lake, Virginia Lakes, and Twin Lakes all only have one access route. Similarly, certain neighborhoods and subdivisions in Mammoth Lakes also have only one access route. Additionally, Mono City and portions of Tom's Place have secondary access routes that are narrow, poorly maintained, dirt roads. Addressing this issue can pose an especially great challenge in Mono County as the vast majority of land and roadways is owned by federal agencies, which are often short-handed on personnel. Identifying land for road siting and ensuring proper maintenance requires extensive coordination between the County, Town, and agencies.

During evacuation and emergency response procedures, the lack of alternative routes could inhibit transportation in and out of most areas. SR 203 is the primary access in and out of the Town of Mammoth Lakes, which connects to US 395. The Mammoth Scenic Loop provides a secondary access route to US 395 when not closed during winter months. Certain neighborhoods in the southern portion of the town do not have secondary access to either SR 203 or US 395.

7.5.2 Steep, Narrow, and Blocked-Access Roads

In most of the urbanized communities built in sloped environments, many of the roads are very narrow with poor surfaces, are poorly maintained, or are dead ends. Many roads and driveways are dirt, and rutting and washboarding are typical. These inadequacies can make access for emergency vehicles and apparatus difficult or impossible. Fire engines typically require wide turning radius and pullouts for turnarounds on dead-end roads.

Another common obstacle is the existence of locked gates blocking private, state, or federally owned roads and driveways. While concerted multiagency efforts and education campaigns over the last decades have resulted in fewer locked gates or gates with special codes or keys for emergency personnel, the problem persists on some roadways.

7.5.3 Water Supply and Pressure

As with many of the mountainous and rural areas of California, water is a critical fire suppression issue in Mono County. Only a few communities have a reliable source of water via hydrants. Most of the communities are reliant on seasonal ponds and creeks. In areas with limited nearby surface water, large cisterns are necessary but often not available and are difficult to site.

7.5.4 Addressing

In most of the WUI communities in Mono County, missing or inadequate street signage and addressing is an issue. Where applicable, this problem is also noted in the community descriptions in **Appendix F**. Markers of all types, some homemade, are used throughout the study area with no particular order or system. In some parts of Mono County, street signs are broken or worn out. Address numbers on mailboxes, or on the post, are frequently the only indication of the address. In most cases, address marker poles and mailbox poles are made of wood.

There are some community driveways where multiple homes are accessed from a single driveway off the public road. Often these driveways use flagged addressing, a term describing the placement of multiple addresses on a single sign. Flagged addressing can be confusing and difficult to interpret for emergency responders.

Numerous properties throughout the county also have no address markers of any type, or have small, nonreflective addressing that is hidden from view, difficult to see, or mounted onto a flammable material.

The value of the time saved to the welfare of homes and evacuees, especially at night and in difficult conditions, cannot be overestimated. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps.

7.5.5 Additional Developments Identified

As part of the 2018 reevaluation, the presence of new or excluded development was assessed. Certain smaller developments with clusters of structures were excluded from the original analysis; these additional areas have been added in **Table 7.7.** These include the Marine Warfare Mountain Training Center; several pockets of development along Sweetwater Road (CA 182) north of the identified Aurora Canyon area; and Crestview, a small clustering of homes and recreational structures both at Crestview directly alongside US 395 and farther west along Deadman Creek Road.

In general, conditions in the developed areas have not changed significantly since the hazard rating was first completed in 2009. However, certain areas have either seen additional growth which may increase the number of community assets at risk, or were not included within an analyzed area despite densities of structures existing. These include:

- **Old Mammoth/The Bluffs**: As documented in **Chapter 2**, a number of new single-family and multifamily homes were built between 2015 and 2018 on the southern edge of the Old Mammoth neighborhood, such as the Snowcreek neighborhood and in The Bluffs subdivision.

- **Mono City**: Additional low-density housing development on the southern side of Mono City was built after 2009.

- **Paradise**: Additional residential units and complementary uses were approved on the site of a former lodge. The development was approved in 2010.

Table 7.6 summarizes 2018 characteristics for 39 identified areas. Projects identified in the table that address a lack of infrastructure are the highest priority for the County and Town.

Table 7.7: Physical Development Characteristics

Planning Area	Community Area	Single-Route Access	Steep/ Narrow Roads	Water Supply	Lacks Water Supply/ Pressure	Lacks Adequate Addressing
Mammoth Lakes	Lake Mary Area	x	x	Draft	x	x
	Old Mammoth/ The Bluffs	x	x	Hydrants		x
	The Bridges/ Greyhawk		x	Hydrants	x	x
	The Trails			Hydrants		
	Valley Vista	x	x	Hydrants		x
	Snowcreek	x		Hydrants		
	North Mammoth Lakes		x	Hydrants		x
	Ranch Road	x		Hydrants		x
	Sierra Valley Estates			Hydrants		x
Antelope Valley	Eastside Slope	x	x	None	x	x
	Antelope Valley/ Topaz			Draft	x	x
	Walker	x	x	Draft	x	

Planning Area	Community Area	Single-Route Access	Steep/ Narrow Roads	Water Supply	Lacks Water Supply/ Pressure	Lacks Adequate Addressing
Sonora Junction	Swauger Creek/ Devil's Gate	x		Draft		x
	Mountain Warfare Training Center			Draft	x	
Bridgeport Valley	Bridgeport Valley			Hydrants		
	Twin Lakes	x	x	Draft	x	
	Virginia Lakes	x	x	Draft	x	x
	Rancheria-Bridgeport			Creek weir (portable pump)	x	
	Aurora Canyon	x		Hydrants		
	Sweetwater Road			Draft		x
	Evans Tract Area			Hydrants		x
Mono Basin	Lundy Canyon	x	x	Draft	x	
	Mono City		x	Hydrants	x	x
	Lee Vining			Hydrants		
June Lake	June Lake		x	Hydrants		x
	June Lake Village			Hydrants		
	Clark Tract		x	Hydrants		x
	Peterson Tract	x		Hydrants		
	Highlands			Hydrants		
	Silver Lake & Dream Mountain			Hydrants		x
Mammoth Vicinity	Crestview		x	Draft		x
	Convict Lake & SNARL	x		Hydrants	x	
Crowley Lake	McGee Creek/ Long Valley			Hydrants		x
	Juniper Loop		x	None	x	x
	Sunny Slopes	x	x	Hydrants	x	
	Aspen Springs	x		Cistern	x	
	Hilton Creek	x		Hydrants		

Planning Area	Community Area	Single-Route Access	Steep/ Narrow Roads	Water Supply	Lacks Water Supply/ Pressure	Lacks Adequate Addressing
Tri-Valley	Chalfant Valley		x	None	x	x
Swall Meadows	Swall Meadows	x	x	Hydrants		x
	Paradise	x		Hydrants		

Fuels Changes

Much of the available data for wildfire hazard location, intensity, and behavior potential in Mono County, including what is shown in this CWPP, is based on inputs from Cal Fire's vegetation and surface fuel mapping. Cal Fire FRAP data, in cooperation with California Department of Fish and Wildlife VegCamp program and extensive use of USDA Forest Service Region 5 Remote Sensing Laboratory data, compiled the "best available" land cover data for California into a single comprehensive statewide data set, with data spanning a period from approximately 1990 to 2014. The Cal Fire surface fuels data is shown in **Figure 7.13**.

While Cal Fire's vegetation data is the most comprehensive available, the age of the data means it does not fully reflect 2018 conditions. Varied factors have changed the vegetation landscape of Mono County, and consequently the fuel load that directly influences fire hazard and fire behavior. These include:

Wildfire events

Of the more than 64 fires discussed above, more than 40 have occurred, burning more than 80,000 acres, since vegetation mapping was last updated in 2003 and incorporated into the state's wildfire hazard mapping. While many of these high-intensity fires greatly reduce fuel loads in the short term, those that reach highest intensities can completely change the fire regime, and ultimately the fire likelihood and behavior potential.

Fuels modification projects

Since 2009, the USFS has completed more than 800 fuel modification actions, such as fuel breaks, prescribed burns, and thinning in Inyo National Forest. Although these projects cannot noticeably alter wildfire hazard severity areas, they can reduce risk to communities by promoting forest health, minimizing the size of fires, and helping prevent them from reaching people and structures. Several major fuel reduction projects to protect specific communities have been undertaken by the USFS from

2009 to 2018. These projects are described below. The areas addressed by these projects are shown in **Figure 7.14**. Maintenance of all projects in the coming years is vital.

- **Crowley Communities Hazardous Fuels Reduction Project:** Removal of hazardous fuels, by fuel breaks, chipping, piling, and thinning around the communities of Aspen Springs, Crowley, McGee Creek, Sunny Slopes, and Tom's Place.
- **Three Creeks Jeffrey Pine Forest Health and Restoration Project:** Provides for healthy forest conditions, promotes establishment of old growth, and reintroduces fire to the ecosystem through pre-commercial and commercial thinning of trees, piling of fuels, burning of piles, and forest disease control measures.
- **June Lake Loop Hazardous Fuels Reduction Project:** Fuels reduction work on 4,578 acres within WUI defense and threat zones in the June Lake Loop. Treatments include tree thinning, shrub cutting or mowing, prescribed fire, conifer removal from aspen, and slash pile burn or chip.
- **Mill City Fuels Reduction Project:** Reduces the risk of catastrophic wildfire and protects community, water quality, and recreation values through vegetation treatments, primarily thinning, piling, burning, and chipping, on 55 acres of public land within and adjacent to the community of Mammoth Lakes.
- **Sherwin Scenic Loop Hazardous Fuels Reduction Project**: Treatment to reduce hazardous fuels such as brush and trees in the Sherwin Creek, Mammoth Creek, and Mammoth Scenic Loop areas surrounding the Mammoth Lakes community, including thinning, piling, and disease control measures.
- **Rust II**: Thinning to reduce fuels and improve forest health on approximately 500 acres of Jeffrey pine forest located off of Bald Mountain Road.

The maintenance and expansion of area covered by the 2011 Mono City Hazardous Fuel Reduction Project and additional projects in Bridgeport Valley and Antelope Valley are also recommended. Both historic fire incidence and flame behavior modeling shows these planning areas to have the most extreme hazard from wildfire.

Figure 7.13 Mono County Surface Fuels from Cal Fire

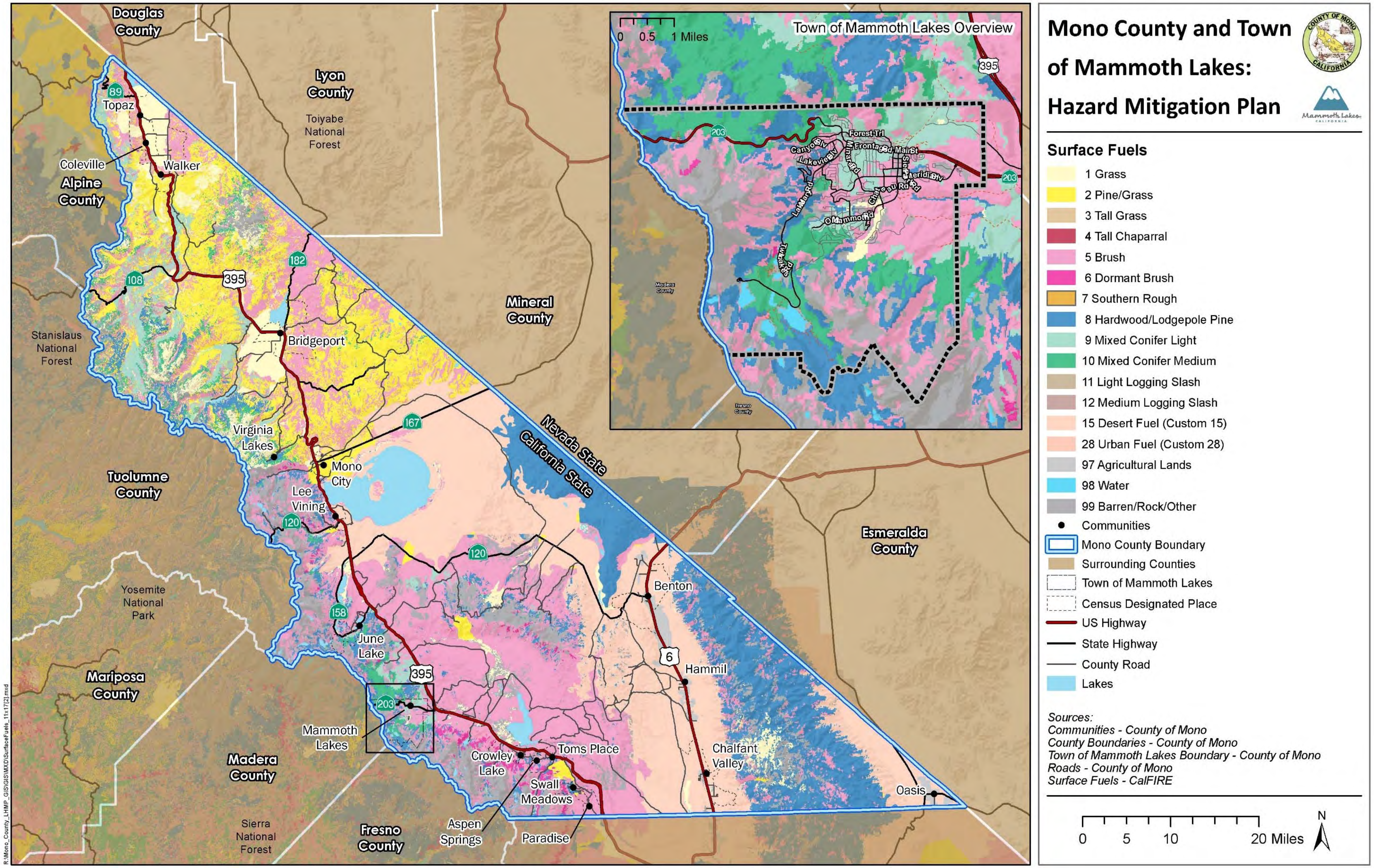

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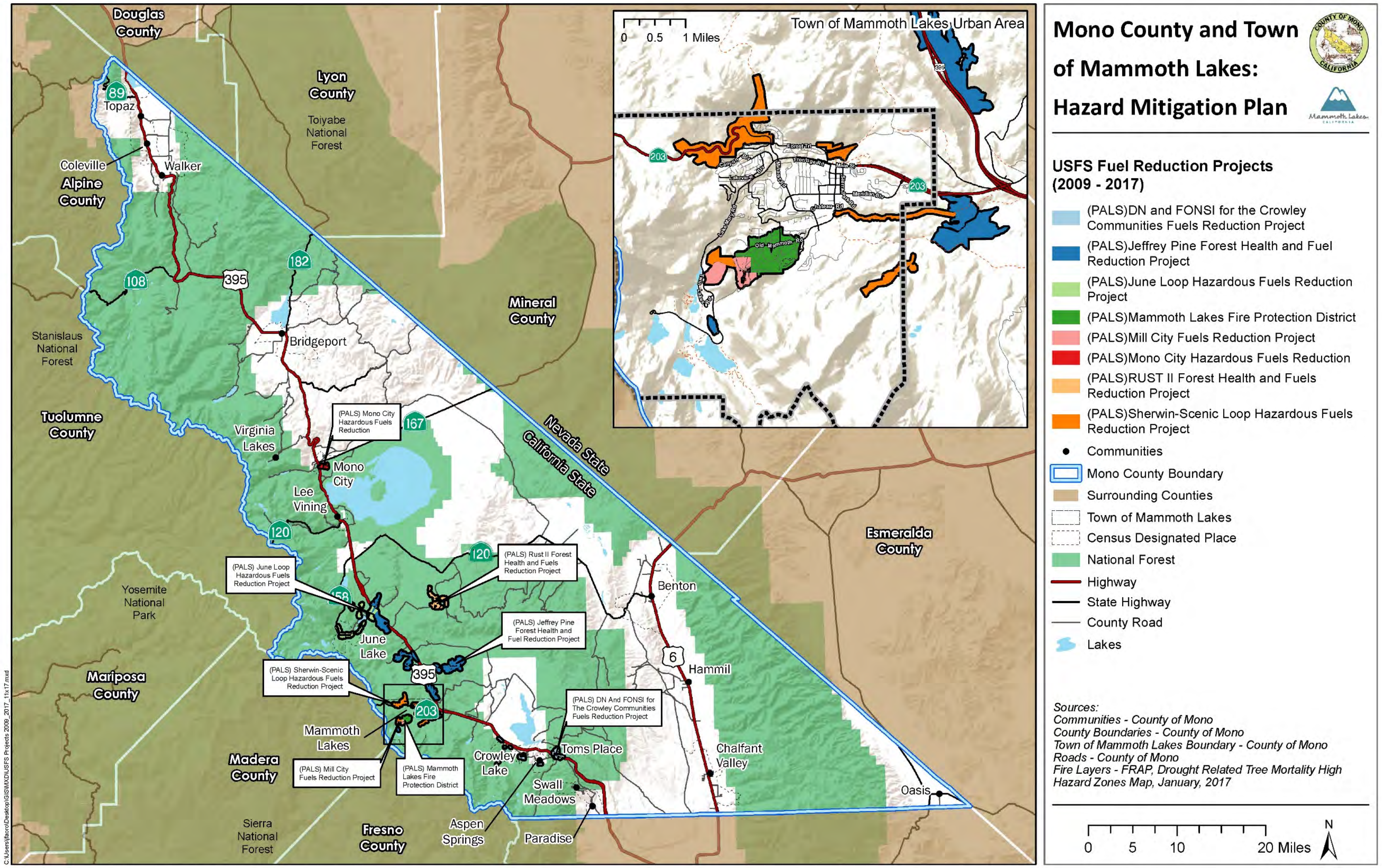
Figure 7.14 Major Fuel Reduction Projects in Mono County, 2009–2018



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Tree Mortality

Large numbers of trees have died in Mono County and across the state as the result of the record four-year drought from 2014 to 2017. The drought weakened trees and left millions of acres of forestland highly susceptible to bark beetle attacks. The drought stress was exacerbated in forests with too many trees competing for limited resources, especially water.

In 2015, Cal Fire identified areas of greatest tree mortality in the state and the potential impacts in relation to life and property, as shown in **Figure 7.15**. The figure shows the tree mortality that was recorded from 2012 through 2016 within two tiers. Tier 1 zones are areas identified by Cal Fire where tree mortality coincides with critical infrastructure such as roads, utilities, and public schools, which represents a direct threat to public safety. Tier 2 zones are areas defined by watersheds that have significant tree mortality as well as significant community and natural resource assets. Work at the Tier 2 level addresses the immediate threat of falling trees and fire risk, and also supports broader forest health and landscape-level fire prevention planning issues.

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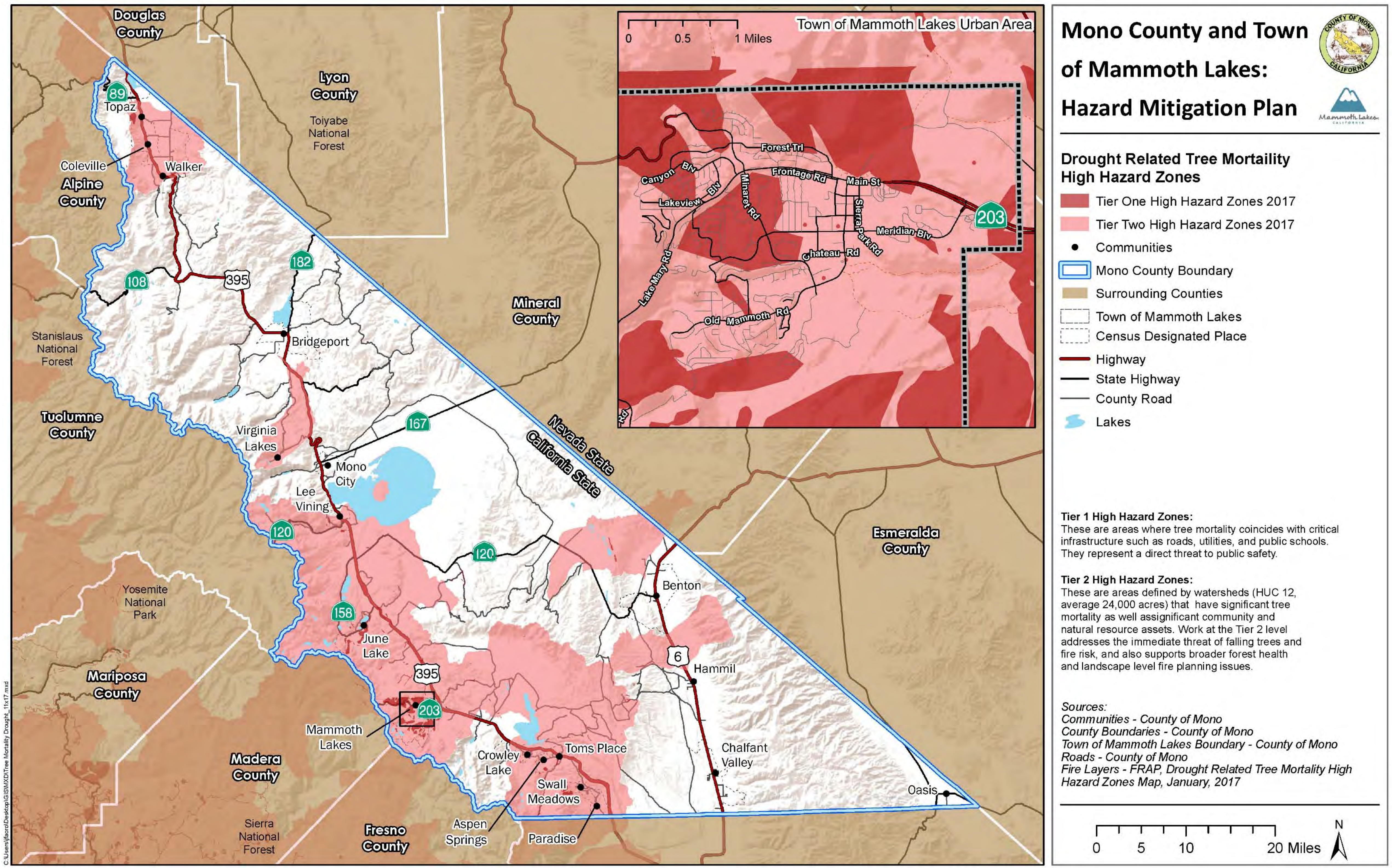
Figure 7.15 Drought-Related Tree Mortality and Hazard Zones



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7.5.6 Future Probability

The probability of a wildfire in Mono County causing damage to people or structures has increased within the past 20 years, as more people have built homes at the WUI and have chosen to become permanent residents of the region.

The impacts of climate change suggest a continuing and accelerated risk from wildfire. Climate change scenarios suggest more frequent droughts (Diffenbaugh et al. 2015) and higher fire severity in some portions of the state (Fried et al. 2007. Increasing temperatures have implications for vegetation distribution, which may further increase future fire extent and fire intensity (Lenihan et al. 2003). Some ecosystems may not be able to adapt fast enough to increasing drought stress, resulting in large-scale mortality from insects, fire, or disease). These future climate scenarios combined with continuing projections of residential growth into the wildland (Mann et al. 2014) suggest that existing wildfire-related problems are poised to become even larger in the near future.

Cal-Adapt estimates an increase of 1,500 to 2,600 hectares of burn area in the county by the year 2099. The estimated burn area in Mammoth Lakes is approximately double that of the annual mean burn area for the last several decades.

7.6 Wildfire Risk Reduction Actions

The information in the previous sections of this CWPP identifies the need for an action plan to mitigate the negative impacts from a wildland fire for the communities in Mono County. The entire intent of a CWPP is to provide a means to make WUI communities less vulnerable to the destructive forces of an uncontrolled wildland fire. To best reduce risk and vulnerability, the County and Town prioritize the following:

Fuel Treatment Projects: Fuel treatment projects within the WUI and adjacent to urbanized communities, while recognizing that broader health and management of the larger wildland environment is also important for long-term mitigation.

Infrastructure Lacks: Projects that address infrastructure and response needs of community areas at greatest wildfire risk, as detailed in **Figure 7.12** and **Table 7.6**.

Parcel-Specific CWPPs: Projects recommended by local Community Wildfire Protection Plans. The County encourages its communities and Firewise councils to prepare parcel-specific CWPPs, and, to the extent feasible, supports recommended projects that emerge from these plans, such as activities that educate community members about fire risk and how to prepare and protect their own properties against fire risk. While safety and fire management personnel in the County work to reduce risk as much as possible, community responsibility for self-protection from wildfire is essential. It is the priority of Mono County and the Town of Mammoth Lakes to work with communities and citizens to educate, inform, and involve them in all aspects of the wildfire issues facing its communities.

Home Improvements: Ensuring safety of homes and private property. Construction type, condition, age, the fuel loading of the structure/contents, and position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. There is also a likelihood of rapid fire growth and spread in these communities in general due to steep topography, fast-burning or flashy fuel components, and other topographic features that contribute to channeling winds and promote extreme fire behavior. Therefore, compliant, effective defensible space for every home in the study area is the most important element for protecting life and property. Defensible space is especially important for homes with wood roofs and homes located on steep slopes, in chimneys or saddles, or near any topographic feature that contributes to fire intensity. Due to the nature of the vegetation and topography, combined with the majority of homes situated on medium-sized parcels, an aggressive program of evaluating and implementing defensible space for all homes will do more to limit fire-related property damage than perhaps any other single recommendation in this report. Various high-quality reports and manuals are available to guide homeowners in construction and defensible space best practices, which supplement building codes from Cal Fire (California Code of Regulations (CCR), Title 24, Part 2), Mono County (Municipal Code Chapter 22), and the Town of Mammoth Lakes (Municipal Code Chapter 15.04).

Fire Management Best Management Practices for Sage-Grouse Conservation: Support of fire management best management practices for protection of sage-grouse habitat to minimize the risk of catastrophic wildfire, as directed by the Bi-State Action Plan. The County and Town will support and assist the USFS and BLM-Bishop in executing identified best management practices identified by those agencies. This includes active collaboration with the Bi-State Local Area Working Group and Bishop Field Office on cooperative habitat restoration projects. Recent projects have included conifer removal, improved grazing management, and fence marking. All projects are intended to further conservation of the Bi-State Distinct Population Segment of Greater Sage-Grouse, under the guidance of the Nevada Governor's Sage Grouse Conservation Team.

Table 7.8 summarizes recommended actions for Mono County and the Town of Mammoth Lakes to reduce wildfire risk. Measures directly linked to wildfire mitigation are located in Chapter 5 of the MJHMP.

Table 7.8: Recommended Preparedness and Response Actions

Action Number	Action
C.1	Develop a regional training program to facilitate local training for structural and wildland firefighting.
C.2	Work with state and federal agencies to conduct basic wildfire suppression and multiagency Incident Command System (ICS) training.
C.3	Work with state and federal agencies to conduct the pack test and annual refresher courses to work with local fire department schedules.
C.4	Consider adopting "appropriate response" or indirect fire suppression tactics in remote areas, given the threat from heavy fuel loading and the lack of County resources.
C.5	Train local fire departments on how to create defensible space around homes.
C.6	Provide minimum wildland personal protective equipment for all career and volunteer firefighters.
C.7	Maintain and distribute a list of frequencies for each fire department and list the associated channels.
C.8	Test hydrants annually to ensure they are operational, obstruction-free, and visible.
C.9	Operate a public information campaign for both residents and visitors to learn about and ensure their phone numbers are provided to the CodeRed Emergency Alert System database.
C.10	Provide training for "stay and defend" tactics as a last resort for communities at highest fire risk.
C.11	Conduct annual Radio Rodeos, in coordination with state, federal, volunteer, and County staff, to share and consolidate procedures and equipment use.
C.12	Purchase and install fire-hardened structures to store gasoline for emergency-vehicle fueling along major evacuation routes.
C.13	Identify communities most in need of backup generators for water supply and work with those communities to obtain the appropriate equipment and permits.
C.15	Where secondary pressurized water sources exist (golf courses, development landscaping, or other types of sprinkler systems), develop a procedure for quickly activating these systems.
C.16	Ensure that any and all Address Map books are updated to reflect information stemming from this CWPP. Consider the development of a Wildfire Pre-Attack Plan.
C.17	Where dead-end and private road markers occur, the addresses of homes beyond the marker should be clearly posted.
C.18	Develop a grant program to renovate older structures with code-compliant exterior materials.

7.7 Website Resources

American Red Cross, http://www.redcross.org/services/disaster

Bureau of Land Management, http://www.blm.gov
Cal Fire, http://www.fire.ca.gov

California Department of Fish and Wildlife, https://www.wildlife.ca.gov

California Fire Alliance, http://www.cafirealliance.org
Coarsegold Resource Conservation District, http://www.crcd.org
Fire Effects Information System, http://www.fs.fed.us/database/feis

Fire Safe Council, http://www.firesafecoucil.org

Firewise, http://firewise.org

Madera County, http://www.Madera-County.com

National Fire Prevention Association, http://www.nfpa.org/codes
North Fork Chamber of Commerce, http://www.north-fork-chamber.com
Oakhurst Area Chamber of Commerce, http://www.oakhurstchamber.com
Office of Emergency Services, http://www.oes.ca.gov
Office of State Fire Marshal, http://www.osfm.fire.ca.gov
Public Domain Software for the Wildland Fire Community, http://www.fire.org

Sierra Nevada Alliance, http://www.sierranevadaalliance.org

Threatened and endangered species,
http://imaps.dfg.ca.gov/CNDDB_QuickViewer/list_county_species.asp

United States Forest Service, http://www.fs.fed.us

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APPENDICES

Appendix A:
Adoption Resolution

APPENDIX 1: ADOPTION RESOLUTIONS

Public Draft | [Date]

The adoption resolutions will be added following adoption by the Mono County Board of Supervisors and the Town of Mammoth Lakes City Council.

Appendix B: Outreach

Mono County | Town of Mammoth Lakes

Multi-Jurisdictional Hazard Mitigation Plan

Technical Appendices

APPENDIX 2: PUBLIC OUTREACH MATERIALS

Public Draft | [Date]

Public Survey

Mono County and the Town of Mammoth Lakes prepared a survey for members of the public to assist with development of the MJHMP. The survey gauges respondents' awareness and past experiences with hazard events, preparedness for future hazards, and views on effective hazard mitigation strategies. The survey received approximately 26 responses, although not all respondents answered each question. This appendix presents the survey questions and the results of the public outreach survey.

Survey Questions

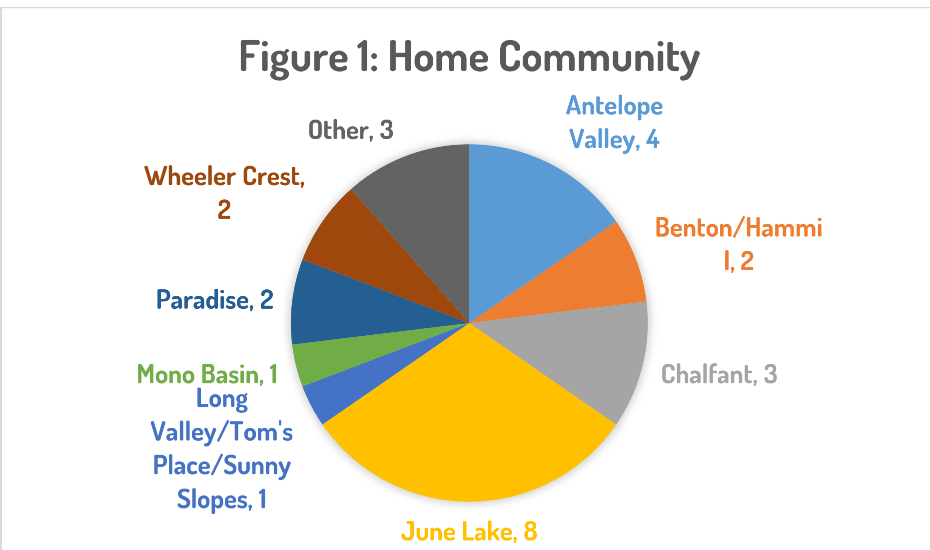
The survey included 24 questions to be completed and returned to staff by August 31, 2017. Questions focused on awareness of natural hazards in Mono County, and the perceived preparedness for such hazards.

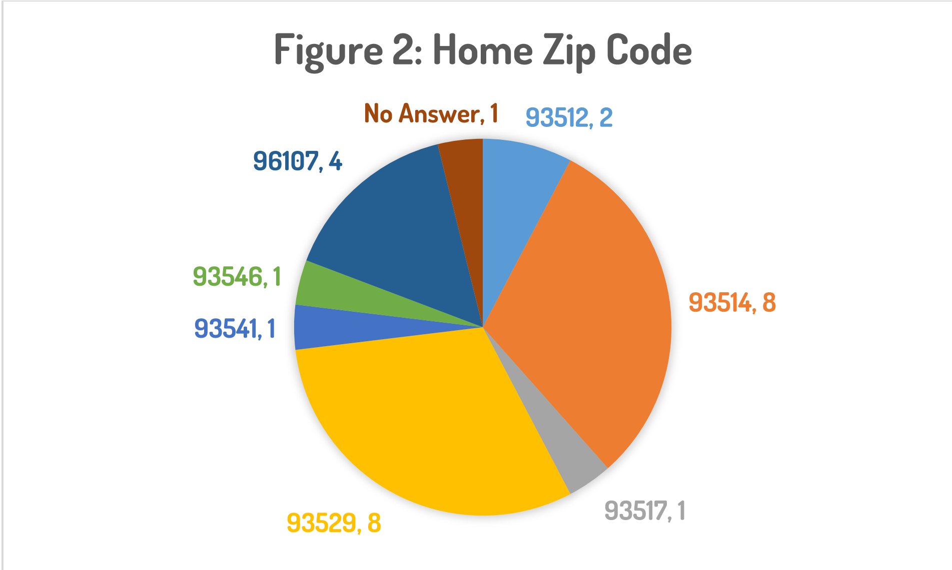
[Insert Survey Questions from pdf]

Summary of Results

Place of Residence (Questions 1-4)

This section established residence and employment of the survey respondents. All survey respondents lived in unincorporated Mono County and owned their homes. No survey participants were Town of Mammoth Lakes residents. **Figures 1** and **2** summarize the home community and zip code of respondents. Most respondents did not answer questions relating to employment, which may suggest that respondents are predominantly retired or work from home.





Hazard Awareness and Concern (Questions 5-7)

The next set of questions related to the respondents' awareness of and experience with natural hazards in Mono County. As shown in **Figure 3**, approximately 40 percent of respondents have been affected by a natural disaster at their current residence in Mono County. Of those that had, a handful had experienced several types of hazard events. **Figure 4** shows that fire, floods, and severe weather have been experienced the most.

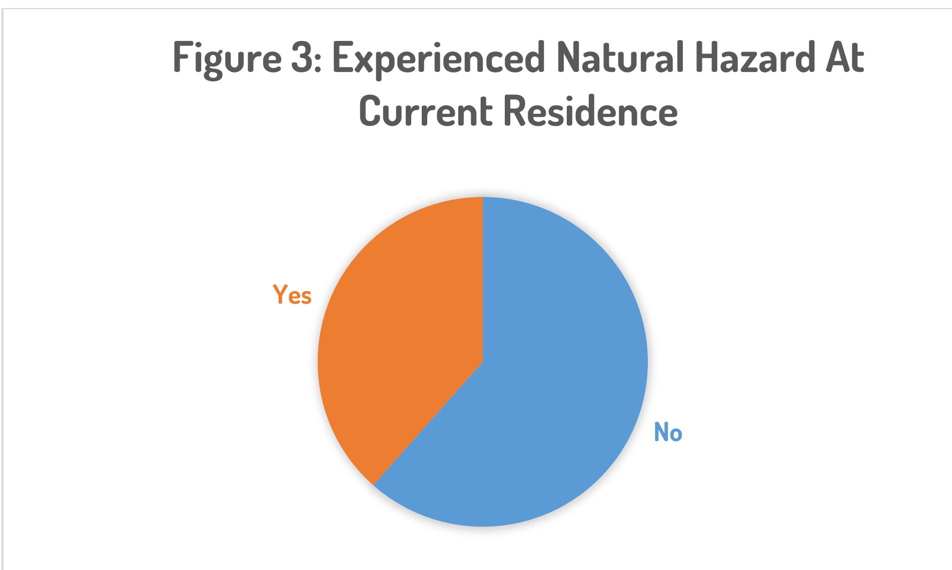
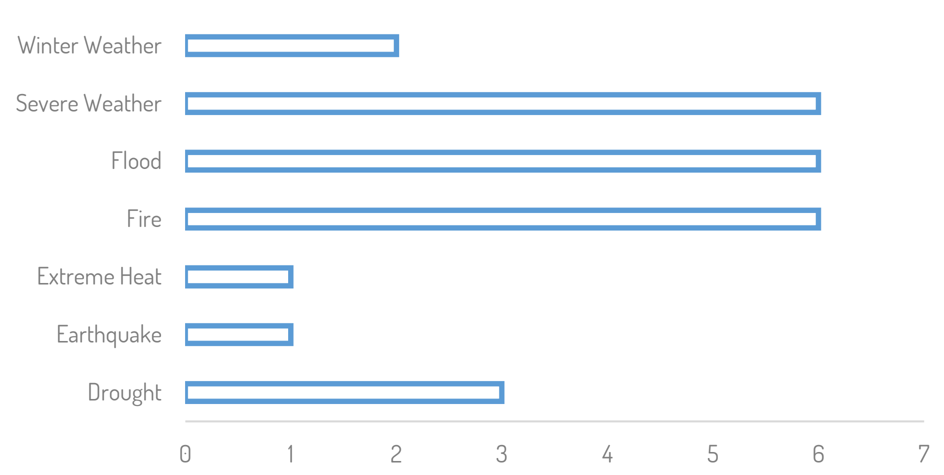


Figure 4: Type Of Hazard Experienced

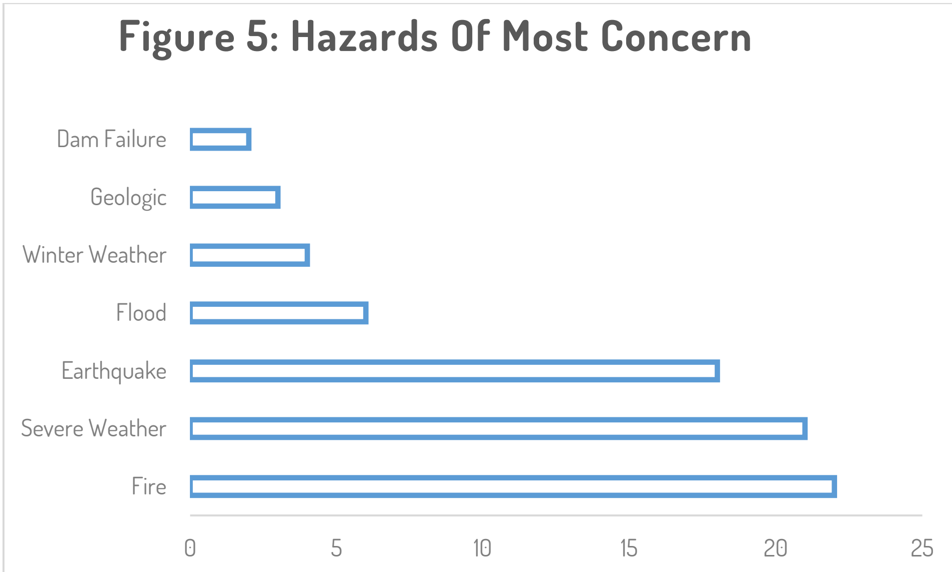


As shown in **Table 1**, Antelope Valley, June Lake, and Paradise each had the most respondents reporting they had been impacted by a hazard of some kind.

Table 1: Hazard Impact by Community Residence

	Drought	Earthquake	Extreme Heat	Fire	Flood	Severe Weather	Winter Storm	Total
Antelope Valley	1			1	1	1		4
June Lake	1				3			4
Paradise			1	2		1		4
Wheeler Crest	1			1		1		3
Chalfant					2			2
Benton/Hammil								0
Long Valley/Tom's Place/Sunny Slopes								0
Mono Basin								0
Other		1		2				3
Total	**3**	**1**	**1**	**6**	**6**	**3**	**0**	**20**

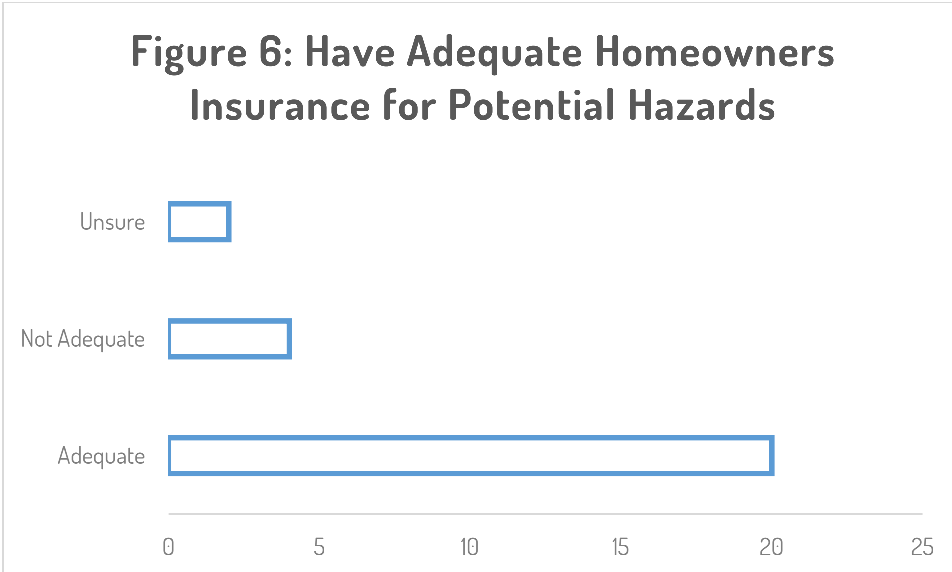
Respondents were also asked which of the seven listed hazards that could potentially impact Mono County cause them the most concern regarding their home and neighborhood. Respondents were able to select up to three hazards. **Figure 5** shows the hazards that most frequently selected as a concern to respondents. Fire, severe weather, and earthquakes were the top three concerns.

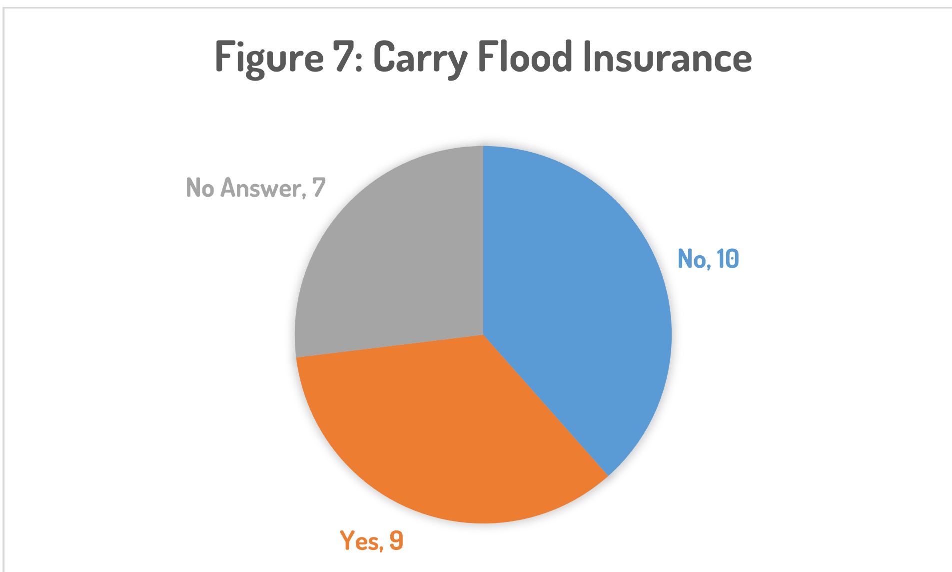


Hazard Knowledge and Preparation (Questions 8-16)

The survey included a series of questions relating to respondents' current level of preparedness for the impacts of potential hazards in the county, including having insurance, emergency kit items, and emergency response training and awareness. In general, most respondents indicated they carried comprehensive insurance for hazards and kept many or all of the items listed for home preparedness.

Figures 6 and **7** show homeowners' responses as to whether they felt their insurance was adequate and whether they owned flood insurance, respectively. The survey included an open-ended question asking if property owners carried any additional insurance for their property. In this space, nearly all indicated they also carry earthquake insurance and in some cases also commented on the need and costs of carrying flood insurance.

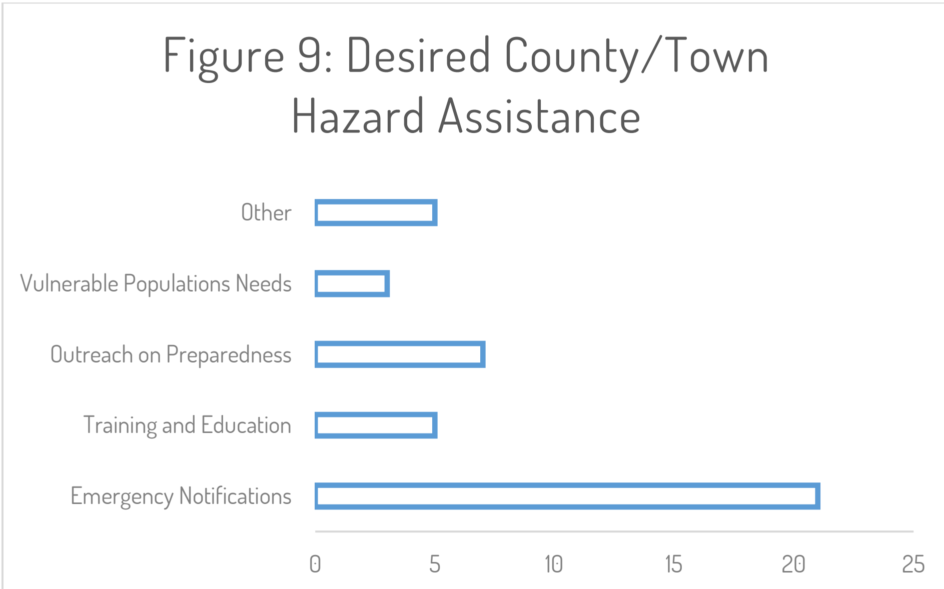




Most respondents felt they have taken steps to prepare their homes in case of a hazard event. The survey listed 18 items that might be included in home emergency kits (e.g., canned food, cash, walkie-talkies) in case of a hazard event causing services to be cut off for 72 hours. Most respondents indicated they owned half or more of the listed items. More than half also indicated they were familiar with any special needs their neighbors would have in a disaster situation. Only one survey respondent indicated being a currently trained member of the Community Emergency Response Team (CERT).

Mono County and Town of Mammoth Lakes Assistance (Question 17)

The survey included a question asking how respondents feel the County and Town of Mammoth Lakes might best help them be prepared for a disaster. The survey listed four potential actions and provided space for additional write-in answers. The potential actions were: providing emergency notifications and communication; training and education on how to reduce future damage; community outreach regarding emergency preparedness; and creation of awareness for special needs and vulnerable populations. Nearly all respondents felt that the County and Town should provide emergency notifications, while smaller numbers felt the jurisdictions should provide multiple other services. **Figure 8** shows the sum of selected items for each desired assistance action.



Employer Actions (Questions 18-20)

The survey included several questions about respondents' employers and the actions the employers may be taking to reduce risk from hazards. Nearly all respondents left this section blank. A possible explanation is that respondents are primarily retired—which several respondents wrote they were—or self-employed. Consequently, very little data was collected on this topic.

Future Participation and Contact Information (Questions 21-24)

The last section of the survey was devoted to collecting contact information for respondents to opt in regarding further involvement in the planning process. The majority provided contact information and indicated they would be willing to review and comment on the draft plan when it is ready.

Survey Code	1. Residence	2. Community	3. Place Employed	4. Home Zip	5. Impacted By Disaster?	6. Type of Disaster	6. Type of Disaster2	6. Type of Disaster3	6. Type of Disaster4	7. Hazards of most concern	7. Hazards of most concern5	7. Hazards of most concern6	8. Small Scale Issues	9. Adequate Insurance	10. Renters Insurance	11. Flood Insurance	12. Additional Insurance	13. Action Reduce Vulnerability	14. Items Readily Available	15. F
1	Unincorp	J.L.	Outside	93529	Yes	Drought	Flood	Sev Weather	Wint Weather	EQ	Flood	Fire	Am Aware	Adequate	N/A	Yes, own	Earthquake	Yes	Multiple, see survey	Yes
2	Unincorp	J.L.	Outside	93529	No	No Answer	No Answer	No Answer	No Answer	Sev Weather	Wint Weather	Fire	Am Aware	Adequate	N/A	Yes, own	None	Yes	Multiple, see survey	Yes
3	Unincorp	B./H.	retired	93512	No	No Answer	No Answer	No Answer	No Answer	Flood	EQ	Sev Weather	Not Aware	Adequate	N/A	Yes, own	Earthquake	No, p	Multiple, see survey	No
4	Unincorp	Other	No Answer	93514	Yes	Fire	Sev Weather	No Answer	No Answer	Sev Weather	Wint Weather	Fire	Not Aware	Adequate	N/A	No Answer	Write-in see survey	Yes	Multiple, see survey	Yes
5	Unincorp	A.V.	retired	96107	no	Flood	Fire	No Answer	No Answer	EQ	Sev Weather	Fire	Detail...	Adequate	N/A	No Answer	Earthquake	Yes	Multiple, see survey	Yes
6	Unincorp	J.L.	Unincorp	93529	Yes	Flood	No Answer	No Answer	No Answer	EQ	Flood	Fire	Am Aware	Adequate	N/A	No	Fire	Yes	Multiple, see survey	No
7	Unincorp	A.V.	Unincorp	96107	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Am Aware	Adequate		Yes, own	None	Yes	Multiple, see survey	No
8	Unincorp	Chalfant	Outside	93514	yes	Flood	No Answer	No Answer	No Answer	Flood	Geologic	Sev Weather	Am Aware	Not Adeq	N/A	Yes, own	Write-in see survey	Yes	Multiple, see survey	No
9	Unincorp	Chalfant	Outside	93514	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Not Aware	Adequate	N/A	Yes, own	Earthquake	Yes	Multiple, see survey	yes
10	Unincorp	A.V.	Unincorp	96107	Yes	Drought	Sev Weather	No Answer	No Answer	Sev Weather	Wint Weather	Fire	Not Aware	Adequate	N/A	No Answer	None	Yes	Multiple, see survey	Yes
11	Unincorp	J.L.	Outside	93529	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Not Aware	Unsure	N/A	No	No Answer	No, p	Multiple, see survey	No
12	Unincorp	W.C.	No Answer	93514	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Am Aware	Not Adeq	N/A	Yes, own	Write-in see survey	Yes	Multiple, see survey	No
13	Unincorp	A.V.	Unincorp	96107	No	No Answer	No Answer	No Answer	No Answer	Fire	No Answer	No Answer	Am Aware	Adequate	N/A	No Answer	Write-in see survey	Yes	Multiple, see survey	No
14	Unincorp	J.L.	No Answer	93529	No	No Answer	No Answer	No Answer	No Answer	Sev Weather	Wint Weather	Fire	Am Aware	Adequate	N/A	No	Write-in see survey	Yes	Multiple, see survey	Yes
15	Unincorp	Paradise	Outside	93514	Yes	Fire	Sev Weather	No Answer	No Answer	EQ	Sev Weather	Fire	Am Aware	Unsure	N/A	Yes, own	No Answer	Yes	Multiple, see survey	Yes
16	Unincorp	W.C.	No Answer	93514	Yes	Drought	Fire	Sev Weather	Write-in see survey	EQ	Sev Weather	Fire	Am Aware	Adequate	N/A	No	Earthquake	Yes	No Answer	Yes
17	Unincorp	J.L.	Unincorp	93529	No	No Answer	No Answer	No Answer	No Answer	EQ	Geologic	Fire	am Aware	Adequate	N/A	No	No Answer	Yes	Multiple, see survey	Yes
18	Unincorp	Other	Unincorp	93517	Yes	EQ	Fire	Wint Weather	Sev Weather	Flood	EQ	Fire	Am Aware	Adequate	N/A	No	Earthquake	Yes	Multiple, see survey	Yes
19	Unincorp	Paradise	No Answer	93514	Yes	Ex Heat	Fire	No Answer	No Answer	EQ	Sev Weather	Fire	Am Aware	Adequate	N/A	No	No Answer	Yes	Multiple, see survey	Yes
20	Unincorp	M.B.	No Answer	93541	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Am Aware	Adequate	N/A	No Answer	Earthquake	Yes	Multiple, see survey	No
21	Unincorp	B./H.	Tribal	93512	No	No Answer	No Answer	No Answer	No Answer	EQ	Geologic	Sev Weather	Not Aware	Adequate	No	No	No Answer	No, n	Multiple, see survey	No
22	Unincorp	Chalfant	Outside	93514	Yes	Flood	No Answer	No Answer	No Answer	EQ	Flood	Sev Weather	Not Aware	Adequate	N/A	Yes, own	No Answer	Yes	Multiple, see survey	Yes
23	Unincorp	J.L.	No Answer	93529	No	No Answer	No Answer	No Answer	No Answer	Dam Fail	Sev Weather	Fire	Am Aware	Adequate	N/A	No	Write-in see survey	No, p	Multiple, see survey	Yes
24	Unincorp	J.L.	Unincorp	93529	No	Flood	No Answer	No Answer	No Answer	Dam Fail	Sev Weather	Fire	Am Aware	Not Adeq	N/A	No	No Answer	Yes	Multiple, see survey	No
25	Unincorp	Other	Outside	No Answe	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Not Aware	Not Adeq	N/A	No Answer	No Answer	Yes	Multiple, see survey	Yes
26	Unincorp	L.V./T.P./S.S.	No Answer	93546	No	No Answer	No Answer	No Answer	No Answer	EQ	Sev Weather	Fire	Not Aware	Adequate	N/A	No Answer	Earthquake	Yes	Multiple, see survey	No

amiliar with Special Needs

16. CERT Trained	17. How Mono County can Help	17. How Mono County can Help?	18. Work Zip Code	19. Employer Disaster Plan	20. Employer Plan	22. Review MJHMP	23. Name	23. Email	23. Address	23. Town	23. State, Zip	24. Additional C
Not interested	Training/Ed	Awareness	No Answer	No Answer	No Answer	Yes	Thomas G. Duffy	tom114@dkllpcpa.com	10 Silver Meadow Lane	June Lake	CA 93529.	
Not interested	Other...	Complete elevatio	93514	No	No	Yes	Jora Fogg	jora.rehm.lorber@gmail.com	107 Bruce St	June Lake	CA 93529	
No, but like to	Notifications	Training/education	No Answer	No Answer	No Answer	Yes	Janet R. Barth	janetrbarth@gmail.com	26241 Hwy 6	Benton	CA 93512	
Not interested	Other...	Need to start by id	No Answer	No Answer	No Answer	Yes	Harvey VanDyke	hvandyke75@gmail.com	107 Pinon Drive	Swall Meadows	CA 93514	
Yes	Notifications	Training/education	No Answer	No Answer	No Answer	No	No Answer					
Not interested	Notifications	Training/education	93529	Yes	Yes	Yes	Abigail Ross	abigailross37@gmail.com	20 Foster Ave	June Lake	CA 93529	
No, but like to	Notifications	Outreach, awarene	96107	Yes	Yes	No	Scott Forbes	sforbes@mono.ca.gov	215 Muir Deer Rd	Coleville	CA 96107	
No, but like to	Notifications	Outreach	No Answer	No Answer	No Answer	Yes	Chris Wickham	hexen.bebad@gmail.com	194 locust st	Bishop	CA 93514	Write-in see survey
Not interested	Notifications	Other...	93514	Yes	Yes	Yes	Geri Bassett	gmb29515@gmail.com	295 Hunter Ave	Bishop	CA 93514	
Not interested	Notifications	Awareness	No Answer	No	No	No	No Answer					
No, but like to	Notifications	Training/ed, outre	91361	Don't Know	Don't Know	Yes	Chet Schreiber	Mt.Chet@raodrunner.com	31301 Glenbridge Rd	Westlake Village	CA 91361	
Not interested	Notifications	Well, in case of a n	No Answer	No Answer	No Answer	Yes	Russell R. Reese	monorrr@schat.net	261 Mountain View Dr	Swall Meadows	CA 93514	Write-in see survey
Not interested	Other...	Other...	No Answer	No Answer	No Answer	No	No Answer					
Not interested	Notifications	Outreach, awarene	retired	No Answer	No Answer	Yes	John Reilly	reillybiz@yahoo.com	PO Box 630	June Lake	CA 93529	
Not interested	Notifications	Outreach	93514	Yes	yes	No	No Answer					
No, but like to	Notifications	Training/education	No Answer	No Answer	No Answer	Yes	Karen Ferrell-Ingram	eastersierra.kfi@gmail.com				Write-in see survey
Not interested	Notifications	Awareness	93529	Yes	Yes	Yes	Sam Mahony	sammahony@gmail.com				
No, but like to	Notifications	Training/education	93517	Yes	Yes	Yes	Brett & Dawne Emery	P.O. Box 758		Bridgeport	CA 93517	
Not interested	Notifications	Awareness	No Answer	No Answer	No Answer	No	No Answer					Write-in see survey
Not interested	Notifications	Training/ed, outre	Retired	No Answer	No Answer	Yes	John E Boynton	jboynton66@gmail.com	P.O. Box 291	Lee Vining	CA 93541	Write-in see survey
No, but like to	Notifications	Training/ed, outre	93512	No	No	Yes	Honovaa Lewis	honovaalewis@yahoo.com	192 Utu Utu Lane	Benton	CA 93512	
Not interested	Notifications	Other...	93514	No	No	No	No Answer					
Not interested	Notifications	Outreach	No Answer	No Answer	No Answer	No	No Answer					
No, but like to	Notifications	Training/Ed	93529	No	Yes	Yes	Don Morton	don@JuneLakeAccommodations.com				Write-in see survey
Not interested	Other...	Other...	No Answer	No Answer	Yes	No Ans	No Answer					Write-in see survey
Not interested	Notifications	Training/ed, Outreach, awareness			No Answer	yes	Rick Kattelmann	rickk@qnet.com	143 Jeffrey Pine Rd	Crowley Lake	CA 93546	

Completed Surveys

[Insert completed surveys]

Community Stakeholder Meetings

The Planning Team held four meetings during the plan development process with stakeholders and the Regional Planning Advisory Committees (RPACs).

Kickoff Meeting - June 15, 2017

Agenda

1. Introductions
2. Project Goals and Expectations
3. Work Program
    a. Community Profiles
    b. Community Outreach and Involvement
        - Community meetings (1 with each RPAC + 2 with stakeholders)
        - HMP Team meetings (5 – see below)
    c. Risk Assessment
        - Capabilities assessment
        - Hazard profiles
        - Vulnerability assessment
        - Critical facilities loss estimation
        - Land use and development trends
    d. Mitigation Strategy
        - Goals and objectives
        - Strategies and actions
        - Plan maintenance
    e. LHMP Draft and Adoption
        - Draft plan and update REP
        - AB 2140/Safety Element
        - Submit draft plan to FEMA
        - Adoption
    f. Additional optional tasks
4. Timing for Project Check-Ins
5. Initial Work Program Steps
    a. Schedule with deliverables
    b. Data needs/data collection

c. Community engagement strategy
d. HMP Team composition/meeting schedule
    - Meeting 1: Introduction, discussion of plan goals/objectives, identification of hazards of concern and identification of data/information
    - Meeting 2: Review of hazards profiles and hazards mapping
    - Meeting 3: Review of risk assessment and loss estimations
    - Meeting 4: Discussion of mitigation actions and action prioritization
    - Meeting 5: Review/discussion of administrative draft HMP document

6. Communications and Role of County and Town Staff
7. Wrap Up

Meeting Notes

Attendees: Jeff Henderson, Mike Skowronek, Starla Barker, Emma Reed, Holly Pearson, Wendy Sugimura, Michael Schaeffer (County Administrative), Paul McFarland (Public Works), Brian, and Ingrid Braun (Sheriff)

Not in attendance: Pam Kobylarz (will be out for maternity leave later this year)

*2011 Mono County HMP was written but never adopted; may not have been approvable by CalOES/FEMA

1. Introductions
2. Project Goals and Expectations
    a. Ensure successful adoption and implementation of this plan
    b. Ensure other plans are updated with information that comes out of HMP update
    c. Successfully engage stakeholders and regional advisory committee
    d. Ensure life/safety and prevent cookie cutter approaches that do not necessarily match up
    e. Ensure plan includes what the jurisdiction actually does rather than lofty direction
    f. Ensure that hazard profiles are appropriate and relevant to communities in the jurisdiction (i.e., avalanches have affected several homes this year)
        - Make certain that hazard zones are identified so further buildings/development projects account for these
        - Make sure that zones (i.e., fire protection zone) are well-defined and precisely mapped
    g. Most politically charged issue relating to this project is *property values* and how they may be affected by designated/mapped hazard zones
        - Issues relating to secondary access when roads/routes are shut down due to rockslides, avalanches, etc.
        - Backup/Evidence of need for secondary access will be useful when attempting to get funding for additional roads, etc.

- These issues and more will come up through the community engagement process for this plan

h. Another overarching goal is to ensure implementation will follow the completion of the HMP (i.e., importance of the long-term)
   - Identifying mitigation projects and issues in the plan will help with prioritization and implementation of these projects and will make a good case to obtain funding for these
   - What percentage of funding comes from local revenue for mitigation projects?
   - Need to consider who are the partners, not just in the County, but possibly neighboring counties in the region, etc.
   - Need to associate grant resources with the actions/projects in the HMP to ensure funding for these to get implemented

3. Work Program
   a. Community Profiles
      - First step in the process
   b. Community Outreach and Involvement
      - Community meetings (1 with each RPAC + 2 with stakeholders)
         - See more detailed meeting schedule below in step 5
      - HMP Team meetings
         - The group on the phone today is the "core" group but there may be a few more for Team meetings (possible addition of three more staff)
         - Local fire department reps and County Public Health staff should be involved also
         - Stakeholders would include public agencies also
         - Planning Commission could be included in community meetings
         - Core Team will do outreach to let other potential attendees know when meetings are being held
   c. Risk Assessment
      - Capabilities assessment
         - Town's draft EOP just got completed; Pam will put Jeff in touch with the contractor who is working on that document -> Willdan
      - Hazard profiles
      - Vulnerability assessment
      - Critical facilities loss estimation
      - Land use and development trends
   d. Mitigation Strategy
      - Goals and objectives
      - Strategies and actions
         - Michael Baker will get input on these from Planning Team before finalizing them in the plan document
      - Plan maintenance
   e. LHMP Draft and Adoption
      - Draft plan and update REP
      - AB 2140/Safety Element
      - Submit draft plan to FEMA

- Adoption

f. Additional optional tasks
   - *Wendy* will check if grant money can be used for actual mitigation actions/projects resulting from this plan (need to check with FEMA on eligible expenses)

4. Timing for Project Check-Ins
   a. Grant funding expires in May 2019
   b. Bi-weekly half-hour check-in calls with County reps for duration of project
5. Initial Work Program Steps
   a. We are meeting internally next week
   b. Will be taking first steps laid out in proposal
   c. One of the first things we have will be a data collection list (County will need to confirm, provide additional, etc.)
   d. A proposed schedule for meetings, deliverables, etc. will be created and run by everyone involved (ideally will have several meetings in same day or over a couple of days)
   e. *Wendy* will complete a contact list for jurisdiction staff and *Jeff* will complete with Baker contact list for full project staff list
   f. Schedule with deliverables
      - Grant funding expires in May 2019
      - There is time between when the HMP schedule ends and the end of the grant funding timeline
      - Extra funding for additional/optional projects (i.e., CWPP) can be approved fairly easily
   g. Data needs/data collection
      - Initial item – County will need to provide input on data collection (confirmation and additional data/information needed)
   h. Community engagement strategy
      - This will be an initial item also
   i. HMP Team composition/meeting schedule
      - Meeting 1: Introduction, discussion of plan goals/objectives, identification of hazards of concern and identification of data/information
      - Meeting 2: Review of hazards profiles and hazards mapping
      - Meeting 3: Review of risk assessment and loss estimations
      - Meeting 4: Discussion of mitigation actions and action prioritization
      - Meeting 5: Review/discussion of administrative draft HMP
6. Communications and Role of County and Town Staff
   a. Core Team of County staff plus some extended staff from various departments to be involved in the planning process
   b. Primary people Wendy will be hearing from will be Jeff Henderson (Rancho Cordova) and Emma Reed (Oakland)
   c. All County staff should feel free to reach out to Baker Team
7. Wrap Up

Meeting #2

September 28-29, 2017

Agenda

1. Introductions
2. Review Agenda and Meeting Objectives
3. Overview of Project
    a. Project Objectives
    b. Project Benefits
    c. HMP Requirements and CWP Requirements
4. Stakeholder Discussion Questions
    a. Stakeholder Expectations for the HMP/CWPP
        - What do you want to achieve through these planning processes?
        - What is your end goal?
        - Can these planning processes align with existing efforts?
        - You will be content if this plan _________________?
        - Does your district intent to formally adopt the HMP?
    b. Previous Planning and Mitigation Efforts
        - Past mitigation actions (10-Year Strategy Implementation Plan [2006])?
    c. Mitigation Capabilities?
        - In a perfect world, what types of capabilities would allow you to implement mitigation actions?
        - What is currently limiting mitigation efforts? i.e.: $$$, regulatory tools (policies, programs, ordinance, codes, plans), personnel, programs, infrastructure, equipment?
    d. Best Available Data?
        - Historical events
        - Risk/vulnerability
        - Critical facilities
        - Past mitigation actions
        - Other applicable studies, reports
    e. Specific Areas/Locations of Concern
5. Project Schedule
6. Questions and Comments

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[Insert PowerPoint Slides]

Meeting Notes

9/28 – Bridgeport 11 am

- Bruce Woodworth – Mono County RCD – also Antelope Valley CERT. Prepares 20-page plans for emergency situations on occasion.
- Karla Benedicto – CalOES representative.
- Bill - CHP

Expectation – Improve access to mitigation funding for rural areas – the cost-benefit isn't usually favorable, but the damage potential is still high. Short answer is "money".

Traffic and amount of people are always a failure in plans for evacuation – easy to use the FEMA guidelines for evacuation, but its not practical. Let's get a realistic plan for evacuation and how we'll move people, and be sure that they are adapted to weather and seasonal conditions. CHP has a good operations plan with Nevada DOT – but all traffic outside of Mammoth is CHP

Emergency Operations Plan – would use EOP. SCE has a plan for all seasons. This process needs to daylight the evacuation plans and ensure that stakeholders feel it is adequate. Focus potential mitigation resources on improving evacuation capacity.

CHP and Caltrans have an outstanding relationship here – not much red tape.

County Public Works are also very helpful – outstanding job with the resources available. So few people here, we have to work together as a team.

Volunteer firefighters here are very effective, and strong volunteer network.

Plan shouldn't be limited to "natural" hazards – consider plane crashes, man-made hazards, terrorist attacks, etc. as well.

Dams – should be considered critical infrastructure – but what's critical may depend on the hazard in question. Inspection stations could be critical. **Hwy 395 is likely the biggest critical facility**. A dam failure would wash-out 395 which is the only way in and out. Edison also has plans and federal guidelines. (should engage SCE into conversations, perhaps also LADWP).

2015 fires – resulted from high wind events when telephone poles came down starting a series of fires.

CHP's biggest issue is Highway 395 and whether the main artery would be inaccessible. There are certain areas here that would be completely cut off. Weather could prevent flight access or allow for goods to be brought in only by air. **Mammoth Airport is also a critical facility.**

(Look at Edison's EOP and hazards plans.)

Communications Interoperability – Testing. Need exercises to test strength of the plans. Have done exercises (Dr. Johnson in Health Department has brought folks together.) Its table-top exercises at this point – but that doesn't test communications in the field. Need to test and make sure communications work. There's been a "radio rodeo" event – issues with towers, etc. But our communications equipment is challenging. This is a technology issue – hard to get facilities to where they need to be. Bridgeport did try mobile communications: radios, batteries, and back-up. This is also a process matter.

Mitigation Capabilities – keeping culverts clear is an ongoing and conscientious effort. Maintaining riparian zones is also helpful to keep water flowing.

Invest in exercises as part of mitigation – wholescale response exercise in the County would be educational and helpful. Look for grants and resources to support this. Someone who is actively testing exercises.

Need to look at radio system – make it better. There are means for reverse 911.

Bruce - Standard Operating Guidelines –

Mass casualty/haz mat

Health/Pandemic

Flood Emergency

Fire Emergency

Earthquake

Power outage – power → water → habitability in rural environments

Recent power outage – County didn't see as a need for reverse 911 deployment. (Need both reverse 911 for hardlines, and reverse 911 for cell phones)

Mono County has some partial coverage for cell phone reverse 911.

CHP has all kinds of action plans – SOPs, which are statewide.

Need – volcanic eruption action plan. Gathering dust on a state level.

1:00p Meeting

- Dana, Jeff, Karla, Wendy, Mike Garner (M. Baker)
- Doug Toskin – Marine Corps MTC
- Brett Hawn – MWTC
- Ron Allen – MCWTC – police, fire, safety, staff protection
- Shannon Anderson – MCWTC – 25 years DOD and lots of hazard planning in the past. Involved with unified command in Mono County. Participant in recent fire effort.
- Don Heller – Mammoth Lakes FD – been involved in Town and Forest Svc EM plans.

1997 100-year flood – hit North County pretty hard. Pickle Meadow was flooded out, lost Sonora Bridge on SR 108, had to evacuate the base. Had to evacuate 60 horses and mules – Walker River Canyon was flooded out. Most folks here live in Douglas County NV – Silver Creek fire.

Also Propane explosion at military housing – County responded very well. There were concerns about whether the homes then were safe. These affected the base and bled over into County services, etc. How can we help others, as well as they help us? Installation Commander can provide military resources for 3 days. Don't have D9 Caterpillars, but do have some earthmoving equipment, a big water bowl (movable tank for potable water), limited amount of MREs. However, if we're surging – mission priority remains taking care of the on-site Marines.

Swift-water rescue – for Lyon County – had to stay mission-focused.

Fire Chief Anderson: This year, lots of localized flooding from snowmelt – Base Fire Department is swift-water rescue certified and completes training each year. Add to plan – ready to provide that service. Able to assist.

"Tyranny of distance" – is a big challenge to being responsive with assistance. We also have limited use of helicopters to assist with disasters. Some lift capability that can be authorized by the base commander. All depends on timing.

DSCA – base would not be the place where people would be evacuated to, or would provide services. County already has those resources in place. However, supporting responders before USFS can get resources in place – can bed, feed, fuel resources until USFS gets setup. Best service we can provide is to support responders.

Don't have a portable fuel capability for stranded vehicles. FEMA Region IX report every six months regarding capabilities that the base has.

Is a staging area a possibility – to pass through resources to the south? Yes, it's a possibility. Base commander is all about mutual aid. Community plans liaison officers always attend. In the summertime, we used to have 500+ surge of Marines to attend training and would let County know. Definitely would support staging. Airfield has limitations and FEMA knows what they are – limited space and refilling capabilities.

Have worked together with County and military base – dynamic relationship for 25+ years. Dynamic and wonderful support resource.

Re: Mitigation – Slinkert fire – when poles and wires were burned, Antelope Valley had no power. Some sort of backup power would be ideal. Perfect mitigation example. Pre-stage generator or generator on very short leash plugged into north part of the County. Backup generator was in Las Vegas – took 2-3 days to arrive. Liberty Energy is provider for Antelope Valley.

Central California Threat Center – Can we engage Liberty Energy to deal with more than what they are doing now? **Get redundant power supply options** – or staged generators, etc.

As a mitigation contribution, base commander could authorize siting/staging for major generator.

1997 flood – SR 108 is vulnerable because of the bridges. Scoured around the bridges, took days to blast earth from surrounding areas and resupport the bridge. Can't get materials over the hill to us in the winter. **SR 108 and US 395 are the most critical facilities**. Can we ensure better routes? Or open facilities when we need to – it's a Caltrans issue.

Riparian zones – need to consider the inter-agency relationships and needs of riparian areas – how they are managed, how that contributes to flooding, how washed out bridges. Walker River Canyon is still vulnerable to high water and scouring. 4,000 cfs – but it never flooded. Some campgrounds affected. Road closure was a greater issue from the Slinkert Fire. Doing mitigation with controlled burns? Power in northern part of County gets knocked out all the time – South County ends up with similar problems with the biggest issue being loss of phone coverage and data disruption due to trunk lines getting cut.

Geothermal plant is potentially a backfill. EMS in the County is very limited. Mammoth has good hospital – closest, other than Carson City and Reno. Almost an hour of flight from Bridgeport to get a victim to care – vulnerable with regard to emergency medical services. Particularly if air service gets limited. 5 ambulances in the County, 3 at base, 2 in Mammoth. Pilots won't fly/not safe to fly in conditions. Another record year of snowfall coming. Vehicle accidents in Walker Canyon but fortunate not to have a high number of incidents. If have natural variation in cycles, you build up sediment, then flush it out.

Money is a big constraint – not much investment here in these items. Paramedics approached base to see if they could coordinate all of the EMS calls in North County. Unfortunately, no. Redundant utilities, cell towers on wheels, these are all good improvements. Needed a "cow" – for fire fighting. Only 3-4 for the whole state and privately owned equipment. Cell towers are a big issue throughout the County – Verizon put one in at the base.

Need to recognize we're a remote part of the state – need to come up with alternate means that we can afford, support and have control over. We're going to be in a difficult time under an event, and need to work together. FEMA's current push is for 72 hours of preparation which is not enough – threats are real, particularly when we're this remote. Public education is a mitigation capacity and should be reinforced. Antelope Valley CERT has some efforts going, but kind of hit and miss in terms of having enough training. Down in Mammoth, CERT is doing better. Having trouble up here just getting volunteer firefighters. **Supporting and investing in CERT in Antelope Valley would be a great mitigation action**. Consider social vulnerability – identify folks who cannot self-evacuate, or are energy dependent, etc. Dr. Johnson and his staff are working on this issue – and doing a great job.

Red Cross – consider reaching out to Red Cross as well.

Shelters are in place – more than likely, people will go north to Douglas County, depending on connections and need.

For evacuation, either North or South –

Mutual Aid Agreements with multiple agencies (4+).

Power should be #1 issue – redundant power. Potable water – most people are on wells, which are power dependent. Road networks are issues.

Life support – how to provide the basic needs to maintain life. Need own resources available here – life support. Consider undergrounding the utilities – Edison/LADWP/Liberty Energy – how much would it cost to bury lines for Liberty Energy? Edison doesn't want to bury anything greater than 33KV. Strong resistance to bury anything greater than 33KV. **Digital 395 was a successful bury project and accomplished very quickly – look to this as a model.** Marine Corps base is the absolute end of the line for SCE – backup generator on base capable of running a small city, but can't put power on the grid. Trying to go solar – energy independent. Edison said no to pushing power back to the grid.

3:30p Meeting – Mammoth Lakes

- Thom Heller – Mammoth FD – Fire Marshall **CWPP in 2008 with the County**, lots of fuels reduction work. $400k grant for fuel reduction, fuel management plan submitted to state, applying for SNC grant for fuels reduction. Working with CWPP out of Colorado in hopes of putting together a **CPAW endorsement. Active Firesafe Council in Town.**
- Sagar Fowler – CalFIRE, new to the area, but never dealt with planning process
- Mark Ingraham – Inyo NF and Bishop BLM – let's update the Forest Service contracts
- Ingrid Braun – Sheriff and Director of Emergency Services
- Jeff, Dana, Wendy, Karla

Road system is a confining situation – we have limited number of roads, challenging weather events, not as much power issues as in the north part of county. But, major communication issues on south part of County. We work together as a community of responders – give and take, considering our isolated situation, we do a good job of piecing together solutions.

Lack of redundancy of communication system is a huge issue. Verizon hasn't fixed it. Perhaps 50% of people here no longer have land lines. US 395 and US 6 are really our only highway options. Major event strands people here.

Living in a forest, the natural disasters are what get us. Avalanche, forest fires, homes in Twin Lakes area in avalanche zone, also Virginia Lakes, Mammoth, and June Lake Loop.

Will be content if this plan gets finished, approved, so funds are available.

Incident that will affect everyone here is wildfire – likely most devastating in the short term. Earthquake and volcanic activity could also be major events. 6.0 earthquake could stretch recovery resources to max, particularly with community growth.

Weak systems – radio communication. We're working on it, but requires more money. Operating at 1995 standards now. Under Digital 395, there's so much more that we can do. Hired Delta Wireless to evaluate – we can provide their study. Checked out repeaters, looking at car-to-car communications. Its already better now, medics have noticed improvement, as has Town FD. Modernizing and digitizing this toward the future would make big improvements. Traditional systems don't work in the mountain environment.

The more we can work interagency in finding solutions, the better. USFS has developed a good system, which is available in spots, not uniform coverage. If we could work together on co-locating resources, that would be best.

Topography makes communication systems challenging. **Delta has a written assessment and upgrade recommendations.**

Wendy – Emphasis on implementable, fundable projects identified in the plan.

2008 CWPP is Countywide… need to reference. Includes update to project list and defensible space inspections.

County EOP and other emergency plans also available.

Secondary emergency access – Issue in Old Mammoth area? What's on the books? Installed Waterford Bridge just for that purpose. From that point west, we're working on one other location Snowcreek 1,2,3 to connect. Topography to the west is challenging. Becoming cost-prohibitive. Lakes Basin has one road in and out – in summertime, 3,000 people up there, plus campsites and resorts. Only one way in, one way out. Its in the fire avenue due to winds, etc.

Heller: May have computerized list of troublesome secondary access spots.

US 395 is becoming an increasingly busy route for hazardous materials such as fuel spill, gas and asphalt.

Propane – probably from an incident standpoint, the greatest potential hazard.

Walker River Canyon – big impacts in 1997. Its pretty well armored – strong storm winters will push debris through. Walker River never flooded this year. Topaz Lake loses half its capacity but not sure what is left to be done for that.

Infrastructure is relatively old – high potential for infrastructure to be impacted.

Flooding events in Tri-Valley – last year, rain-runoff. DWP came out with graders and cleared it out. Storm system just sort of sat over Tri-Valley – BLM land, DWP lands, Caltrans roads ROW, floodplains. Big events, limitations to what could be done because of jurisdictional boundaries and where water could be diverted – cross-jurisdictional issues, who's responsible to mitigate this? DWP? Landowners? Caltrans? Only one house significantly impacted – had a basement.

Education as a mitigation strategy/along with volunteers-CERT. Town enabled people this winter with too much snow on roofs – but its private responsibility. Don't set expectations that government is going to solve those problems.

Radon – County Env. Health have Radon test kits. Radon mitigation system permits were on rise. Hard to find someone who does Radon mitigation – have to get someone down from Reno. Also expensive.

Has County infrastructure been hardened enough to withstand risks? Potential shelters, etc. Community Centers are relatively new, mostly one-story. EAPs for Edison – Sheriff has their plans – we're talking weekly. Agnew Dam – was a scary proposition, but resulted now in good coordination. Three Dams for Edison, also need to add DWP. Sheriff can provide contacts.

County facilities are built to building codes – but not specifically hardened to hazards. Current jail was built in mid-1980s. New jail will be where old hospital site was. Will have dispatch and be built to critical facility standards. Should identify critical facilities for purpose, then develop programs to retrofit to critical facility standards. Look at in EOP.

Schools/higher education – participate in unified command meetings. Use their buildings as shelters, and generation. Sheriff meets regularly with school reps. Mammoth USD has recently held workshops on upgrading their facilities.

Look at Red Spano Meadow area in Madera County. Only road in and out of there in summer months is a hazard. Got a FLAP grant for part of that. Look at moving County line to provide better emergency access. Madera does not pay… We have an MOU with Madera County to provide service – Madera gets the property tax revenue, but doesn't pay.

Cell phone coverage generally an issue in Walker River Canyon– needs to be improved. Disabled semi from bear strike, couldn't call it in to dispatch. Benton has spotty coverage.

Wildlife hazards – animal crossings – Wendy to send a few studies on optimal locations.

Rockfall – Lower Rock Creek location. SR 158 between south junction and Oak Ridge. Public works may know more about rock fall locations. Also an avalanche zone. Lundy and Tioga Road. Caltrans can also provide input on this. Ask Caltrans about rockwall . GasX project near Lee Vining to trigger avalanche and open road.

CalFIRE – information and help would come from foresters. Defensible space reviews as well.

BLM – Commsite issue should be an easy fix – providing a spot for communications facilities. Communications is lacking and a big challenge. Two new repeaters installed this week at Piper. Should extend to Sagehen, Benton.

What's condition of OES system up here? Potato keeps coming up. Radio rodeo happens on occasion. OES has a radio shop in Bishop. Microwave and radio. OES communications backbone is aging. FirstNET – safety communications system integrated nationwide. CHP can now come up on County's frequency and provide backup. Good levels of cooperation.

Red Meadows - Do what we can toward fuel reduction. Still downed trees from wind events from 5 years ago. BLM is having a vegetation reduction meeting on Monday, including project list. Also seeking a list of firesafe councils. See if we have a solid list of fuel reduction projects. Sheriff sent a sharepoint link of local Firesafe Councils.

BLM list of contacts needs to be updated/replaced.

4:30pm meeting

- Andy Seltzer
- Dana, Jeff

From Tom's Place … Sunnyslopes HOA – hoping to form a FireSafe Council

Obvious fire hazard – CalFIRE has community in highest fire hazard severity zone. February 2015 fire created significant hazards. 49 homes taken out.

Pine Glen: 48-home tract on Forest Service Recreational Residence tract. Adjacent to 70 private homes in Sunnyslopes. Forest service has done some work 3-4 years ago. Community organizing themselves to remove branches. Working to coordinate a fuels-reduction plan for our area. Substantial hazards, particularly with drought. 2 HOAs working together.

Other concerns – water supply to support suppression. USFS has denied permitting to create any fire suppression. Sunnyslope does take care of this issue on their own. USFS didn't want to create a precedent for other areas.

Long Valley FD is supportive of creating fire suppression water supply.

Fuels reduction efforts would be helpful.

Crawley Lake – water for helicopters – end up borrowing water from water district.

Combined hazards of wind, fire, and power line outages. Power lines are really vulnerable. What is Edison's liability for homes lost due to power line-caused fires?

Neighborhood has power lines attached to trees still. What's the voltage of the lines in different locations? Is risk based on the voltage? Is it possible to underground the lines?

No real flooding issues. The key hazard here is really fire. Perhaps also earthquakes.

Fuel reduction, water suppression opportunities. Tom's Place resort would also be interested in hearing what's happening with this project.

Probably a big range in terms of awareness of preparedness and evacuation strategies. Most residents have been around 15+ years.

Folks are generally aware of evacuation routes, have annual meetings, and cover this information.

Assuming we make a FireSafe Council – would likely include LowerRock Creek tract. 70-130 homes. Major fuels reduction concern.

Provided email: Andy Selters – info@andyselters.com. Send existing CWPP.

9am Friday Meeting

Karen, Wheeler Crest Firesafe Council (20 miles south near Swall Meadows. Swall community and Paradise community, 200 homes or so. Active, got going after the Round fire. Just got a grant from CalFire to do their own CWPP. Want to work together to make. *will share info on the consultants they are working with)

- Austin, Transportation planner with Caltrans district 9
- Greg, Caltrans, Maintenance manager (which includes Inyo, Mono, and E. Kern, 30 years here)
- Chris, water district HR Risk Analyst. Keeps track of the districts plans
- Wendy, county staff
- Scott, county staff

Karla: education comment, train for the types of things you'd do without

Karen: 2nd home owners, full-time, tourists, Airbnb,. A lot of those people aren't in the loop about how to be fire safe. Raising awareness to all those groups. And how to be realistic about what kind of help can get to them, and how personally prepared they need to be if a big one comes along.

Caltrans: Does the district have documentation or mapping of hazards that effect the roads? Yes, but would have to look up where. Winter impacts.

Biggest issue is no alternative routes, which CHP gives a lot of pressure on but we close even with high winds.

Also District 9 is a really big district. Just hired a 2nd PIO to help do public information notices for this very big district.

They use wind monitors and videos in certain locations. The cell/radio signal problem impacts the updates of that information

167, community summit.

RW information system, working to get more of that in place

Caltrans and CHP work together to make the call of when to shut down roads

Wind socks are just used as indicators to drivers of which direction the wind is blowing. Flashers are useful. Need more in high issue areas

Karen: would like to see a comprehensive look at all the hazards and identification of who is responsible for dealing with each of those hazards and who in government are the contact points to communities. Also clarity on what is the responsibilities of the community vs the government

Greg: agreements with local governments so we can take action without liability . Caltrans is not supposed to even go off their own roads to plow. They have also stepped in for a couple areas that they are not technically responsible to help. They have the resources, but end up waiting on a call to cross the line.

Highway 6 flooded the Tri-Valley area. DWP and the District were involved and got through it. Hammel—had a lot of flooding.

Swall, needs to coordinate closely between the council.

In that fire, there was an issue because it started in Inyo and then jumped into Mono.

Highway 6 also has wind issues too

Blowing dust in the Tri-Valley because of the farming. Air pollution control district is the enforcing agency, conservation management plans are supposed to address those. It is unclear how much those have helped. Power lines, wind events and fire events.

Caltrans has a generator but ultimately has issues having enough fuel. On February 6, 2015, countywide wind event took out power. Fuel from generators.

Caltrans has its own radios. Also have dead spots. Actively working on that.

Dale Schmidt fire chief for Wheeler Crest area has a lot to say about communications issues. Should follow up with him.

Code Red system has been around for a couple years and is getting better. But that doesn't help if the service is down.

Digital 395 was a savior in a previous case. They are in last phase to complete that project. Additional improvements to it are needed in order to make it better. Local agencies haven't actually connected into the Digital 395. For instance, Caltrans uses a really old system to connect to the new wires of Digital 395.

Caltrans maintenance stations are all critical facilities. Facilities are supposed to have a go bag for 72 hours but none really have fuel for that amount of time. They run out of fuel more than anything else and don't have the current capacity on site to store enough of it.

Paradise and Swall Meadows are very dependent on Rock Creek Road which is vulnerable to a number of hazards. Frequently half of it gets closed due to flooding/run-off, storms, avalanche, etc. They have been building alternate routes (several of the "scenic loops") since the 1980s and need more of those.

And DON'T forget the passes like SR 108. Opening and closing becomes a big effort and there are still issues of people getting stuck. Swall Meadows itself doesn't have secondary access and Swall Meadows road is the only way into a 200-home area. There are only a few 4-wheel dirt roads through forest service land.

We haven't talked much about tourist population, which is usually invisible to demographics data. The percentage of the Town at any given time is huge and many of them are not English speakers. There is usually a lot of freight and goods movement coming through. Caltrans is doing a study on dealing with additional goods movement.

Karen: they have a really popular bike trail. Biker sparked a fire by cheat grass getting hit by a spark. It is super flammable. Should we be closing recreational trails use in very extreme fire danger times?

Greg: Caltrans meets regularly with SCE, DWP to discuss. A lot of issues with dams. They kicked out the recreational users at the time the dam was an issue.

Could the "red flag" fire day warnings be informational but also trigger a set of actions such as shutting down areas or certain activities?

What about native plant restoration? Seed mix. Need to be careful about what seeds to use and is a long-term process. Serious invasive weeds are increasing fire danger. Information to local property owners on preferred plants is needed. Revegetation efforts any time the ground is being disturbed.

BEAR reports. Forest service reports after a major fire to evaluate.

Ideal capabilities: In a perfect world the Forest Service would exchange land for private properties in avalanche areas, and make that open space. In a perfect world, we have a way to control how much foreign vegetation comes in. Just to clean a culvert, Caltrans need to wait several weeks and get a conservation evaluation

CalFire never comes back to check on its regulations/rules. Further enforcement is needed. Property owners that are away aren't doing the frequent maintenance around their homes that needs to be done. What enforcement processes are in place?? Anything?

Swall's parcel based CWPP. Deer Creek consultant will be doing a parcel-by-parcel evaluation and rating system and will be using the same criteria that CalFire uses.

SNC grant to June Lake to take out dead trees.

There is an issue of getting insurance for property owners after the maps come out. Has been especially true for June Lake. There needs to be better awareness of what insurance options are. Raise awareness of what you should be looking for in home insurance.

Hazard Mitigation Planning Team Meeting #2

- Bob Rooks – Mono County EMS – created last CWPP for the county (2008)
- Grady – PW Director for Town. Town's EOP is nearly completed, just finished training related to plan.
- Al Davis – Mammoth Lakes Police Chief
- Louis Molina – County EH Director
- Jerry Le Francois – Mono County Planning, LTC. LTC wants staff to put together a winter debrief from last winter.
- Wendy Sugimura
- Scott Burns
- Tony Dublino – Assistant CAO. Some familiarity with these plans. Former solid waste services director, was directly involved in cleanup efforts after recent fires.
- Mike Garner – Michael Baker Int'l.

Priority Hazards discussion – is it based on potential to occur, or potential to have a big impact?

Man-made hazards – consider hazardous freight movement. Include as a hazard.

"Severe Winter Storm" – needs to include "snow" in title

For Wildfire hazards – consider ignition sources as part of the "wildfire" hazard.

Dam Failure – is it a weather issue, or something else? This is relevant, keep for now.

Potentially remove Liquefaction as a hazard.

Town discussions of climate change are centered on Adaptation.

Tony – there was interest in having risk factors established really high – due to funding possibilities. Caused some blow-back on insurance ratings? But this is public data in the end – insurance companies can get the information and use it. Our risk layers are already publicly available.

Real issues with snow were snow removal and propane tank issues. These are mitigable.

Top results for each participant in hazards priority survey:

Wildfire, Seismic Hazards, Landslide/Fault Rupture

Seismic, Severe Weather, Volcano

Wildfire,

Smoke/PM issues – important health hazards. Consider secondary impacts of smoke/PM – originating from the Central Valley and controlled burns.

Wildfire, Seismic/Earthquake/Landslide

Seismic is a long-term impact – longer recovery period.

Wildfire, Severe Winter Weather (snow), Flood

With Severe Weather – be sure to consider secondary issues.

Ideal world Mitigation

Undergrounding utilities

Enhanced Digital 395 project

Communications capabilities – Notifications (Reverse 911 system)

Slinkert Fire – residents were unsure what was going on, or what to do.

Eliminate cell dead zones on Highway 395.

Unlimited resources for fuel reduction? How can we provide additional resources for fuel reduction. Policies and ordinances that are out there don't allow us to manage resources.

Investigate full access for brush clearance to all of the WUI.

Personnel is always going to be an issue here – don't have a large corps of first responders.

Fire stations and medic stations throughout the County are in need of hardening. (Mammoth is in good shape.)

Evacuation Routes – Need better secondary access to Mono City, Twin Lakes, other locations.

Engage SCE, DWP, Liberty – also propane providers.

Other Staff discussion:

Assessor Data. Parcel Viewer – attribute table for assessor data. Gather a list of specific attributes they need from the assessor.

Avalanche – "conditional development area." Build here at your own risk. They sign a waiver. Avalanche expert mapped out areas 30 years ago.

Identify Avalanche Influence areas.

Highest risk outside Alaska. All communities are at the bottom of "runout zones." Crosses state highways.

Can Caltrans grant money apply Sustainable Transportation Grant – go after resiliency grant because of wet snow flow. Or could just look at where it impacts public assets.

Walt has secondary access map

Gases route outside June Lake.

Planning areas from SP3. Demographics.

Wendy – Will provide Housing Needs Assessment.

395, 203 & Creek Maintenance.

Digital 395 – Nate Greenberg. Repeaters. 911 redundancy – all Nate

High tension areas are the big ones & can't do anything about melt but power down, no water, no heat.

Communications – no cell service during a big event.

Notification – Code red system works best but depends on cell. What to do about notifications? What the public should do?

Eliminate dead zones for cell service.

Unlimited fuel reduction. Policies sometimes prevent.

Clearance – since we don't have access to forest land on back side of homes.

We are on our own for snow. Yes for fire, equipment.

Personnel is always an issue.

Sections of County have old buildings that won't. Rural area stations are old & not to standards. Same is true for medic facilities.

Secondary evacuation routes. Twin Lakes, Swall, June Lake, Mono.

Tribal Contact List

Contact Propane companies in county.

Meeting #3

Bridgeport RPAC – 12/12/17

[Insert PowerPoint]

- Dana's presentation
- Question: Live near Bridgeport Reservoir – what would happen if the Dam for Twin Lakes were to breach? Is there enough capacity in Bridgeport Reservoir to accommodate?
    - Modeling doesn't account for multiple, secondary failures.
- How do we see the Hazard Mitigation Plan integrating with the EOP, and Continuation of Services plan?
    - Types of plans have to do with where in the emergency management cycle they occur.

Hazard Mitigation Planning Team Meeting - 12/13 @ 1p

Agenda

1. Review Agenda and Meeting Objectives
2. Presentation: Hazard risk and vulnerability assessment
    a. Hazard prioritization results summary
    b. Hazard profile and vulnerabilities assessment process
    c. Priority hazard risk and vulnerability assessment results
3. Next Steps and Upcoming Planning Team Meetings
4. Open Floor

[Insert PowerPoint]

Meeting Notes

- Planning Areas Table: Paradise and Wheeler Crest – have a joint grant to complete the CWPP. Its under the asupices of Wheeler Crest Fire Safe Council. Add the FSC for both Wheeler Crest and Paradise.

- In the plan document, let's use some additional break-out/inset maps to identify community areas in addition to TOML.
- Lifeline utility systems – Given Frontier's lack of response in TriValley – may not want to consider all as lifeline. Also need to include tribal facilities. And, Camp Antelope. There is a clinic in Camp Antelope, and Benton tribe is pursuing resources for similar. Supervisor will provide our contact info to tribal chair.
- Cindy.nelson@cpuc.ca.gov would be good contact regarding lifeline utilities. Document these concerns in the plan.
- Should expand the socially vulnerable population areas to include designated DUCs by the state.
- Agnew Dam – confirm contact with SCE. **(follow up with Wendy)**
- Where did we determine that mosquitoes are most prevalent in Tri-Valley? There is a dedicated mosquito control function in the Town. It seems like this would be a bigger issue in west county, where its wetter and there are wetlands present. Talk to Ag Commissioner (Inyo Co) in Bishop – they did a count, got as many as 5k trapped, where only 10% of that is normal. **Wendy will pass along contact info.**
- Antelope Valley District – drilled about 20 new wells last year to replace domestic wells gone dry. Wendy to provide additional information from Louis. DWR can provide groundwater basin data related to overdraft. It's the south part of the county, includes Tri-Valley and wraps around to Swall Meadows. Will be a GSP prepared.
- Change "Coleville" to Antelope Valley – on severe wind. This is a hazard throughout the entire valley.
- Problems with severity zones – they fail to incorporate fire history. Fire history means fuel type conversion, means more frequent fires. Swall Meadows to Crowley Lake – has gone from 11 year interval to 8 year interval. Climate Change discussion has to do with invasive species, which has changed fuels. Major incidents around TOML have not been in the community, but rather in adjacent areas where fuel types have changed. Severity zone mapping doesn't capture historic trends – if its burned before, it will burn again.
- FRAP – developed and geared for 4,000 ft elevations on the west slope, not geared for Great Basin, elevation, and fuel types. Fire history also needs to be considered. Confirm if the FRAP updates are including changes in vegetation.
- Historic Fires map – go farther back than 2007. There was a lot of fire activity in the 1990s. Bridgeport Fire isn't on the map, but was only 3 years ago.
- Swall Meadows fire caused significant structural loss – that's an indicator of risk. Consider prioritizing the areas with potential for structural loss.
- Reason there's a second access road out of TOML is due to the 1980 earthquake. Need to capture accurate data to understand and prioritize the risks. In practice, its Antelope Valley and Swall Meadows into Tri-Valley.
- Try to synch all of the historic information to 1996+. (Swall Meadows Fires 1981, 1992, 2002, 2015, evac'd again in 2016)
- Fire intervals are potentially more important than structural damage information. Perhaps some tables of fire centers near communities going back a number of years. Our purpose is to protect the population – and we should be focusing on vulnerabilities.
- Can define the WUI as we want for CWPP. Should also consider approved subdivision applications. **Will work with staff to refine the WUI mapping.**

- 2009 WUI map may be a better representation. Should extend Very High all the way up to State line. Also, the Extreme area should be extended down to Walker.
- Caltrans did a big rockfall project near Lee Vining – temporary fencing, etc. Much of the work done in this location was due to the burn scar. Can be discussed in the plan narrative – build the relationship between the burn scars, flooding, and landslides.
- Did we also consider distance to outside resources to respond to incidents?
- Plan needs to clearly describe the isolation of Mono County. American Red Cross refused to call the Nevada Chapter for support in Mono County because Mono is in California.
- Because of isolation, there's a need to harden response capacity.
- Regarding water in Mammoth Lakes, should try and get in touch with Chris Weibert
- Regarding fire outcomes—Crowley shows no historic fire circles and fairly low risk but fires throughout the 1990's, the Canyon Fire was extremely threatening.
- Frequently, in various parts of the County. Some fires have results in days without power OR phones for Crowley
    - Both Verizon and Frontier refuse to utilize digital 395 have facilities that remain highly susceptible to fire
- Fred Stump notes that the county used to have access to an excursion vehicle which acted as a mobile, multiple frequency repeater and allowed great operability, but that vehicle was taken away for alternative uses.
- Access roads remain a major issue.
    - Access not adequate for parts of Mono City.
    - Many 2ndary access routes are through BLM land and are not adequately maintained. It's a major difficulty coordinating across the all the agencies that a 2ndary access route may pass through to identify responsibly for/ensure full maintenance.
    - NEPA exemptions may be critical to get better maintenance and additional access routes that must pass through federal lands

Fire Chiefs Meeting - 12/13/17 @ 10:30AM

Agenda

1. Introductions
2. Review Agenda and Meeting Objectives
3. Presentation: Overview of Project
    a. Project objectives
    b. Hazard profile and vulnerabilities assessment process
    c. Fire hazard assessment results
4. Community infrastructure needs review
5. Draft CWPP measure review and input
6. Project Schedule
7. Questions and Comments

[Insert PowerPoint]

Meeting Notes

- Deer Creek Resources – doing Swall Valley CWPP modeling.
- Explain differences between interface and intermix
  - Interface – communicates a harder boundary
  - Intermix – more of a mix of housing and fuels
- Any correlation between the WUI and California Building Code? Seems like there should be some correlation.
- PRC 42-90, 42-91 provides information regarding access information and egress, as well as construction methods.
- Could we base our work off of the State's WUI information (CalFIRE) – the CalFIRE maps are much older (like 2000)?
  - Overlay older CalFIRE WUI information with newer federal data and identify any major gaps – then fill gaps based on research info.
- What types of vegetation are included in areas characterized as highly flammable/fuels.
- All the vegetation types changed in 2015 due to the fires.
- Does Swall Meadows CWPP cover Paradise too? Yes; can incorporate their more precise WUI in Countywide plan if schedules allow.
- County should have all of the local fire district boundaries available. If we don't have them, ask for copy.
- Regarding table showing planning areas, communities, and related fire response providers (Slide 13):
  - If one of the local volunteer fire districts aren't covering an area, who does? Look to CalFire maps of responsibility areas. Either Local, and then the rest is mostly Federal or Forest Service
  - Mono City can provide Fire District boundary maps – does overlap with Forest Service, runs up to the end of Lundy Canyon. Dispersed, not contiguous.
  - For Wheeler Crest – there's no separate community called Wheeler Crest, just Swall Meadows.
  - No "Special" Fire Protection districts, just Districts
  - Add Pine Glade community to Crowley Planning Area
  - Not sure who covers Oasis. May be a volunteer department that serves from Nevada. Maybe Dyer?
    - Big Pines (Inyo County) may provide fire protection for Oasis. Its mostly ag uses.
    - Also consider interagency collaborations from Nevada – along 167?
- Critical facilities map and Hazard Severity Map and Fire Threat Map (Slides 15, 18, 22)
  - Clarify that roads and powerlines are critical facilities on the critical facilities map.
  - **Send the critical facilities list to County staff (Michael and Wendy) to verify.**
  - Areas N and E of Mono City are rated "moderate" but we question that – there's very high potential in this area. Mono City has all of the criteria for high fire potential except for topography.

    - Swall Meadows is doing parcel-based assessments for fire modeling.
    - Reimbursement is easier for repairs/mitigation for High and Very High FHSZs.
    - **Adjust colors between high, very high, extreme colors on Fire Threat map. And differ from color for fire stations.**
- Regarding table showing which communities have which infrastructure related problems for fire risk (Slide 25):
    - Adequate water supply: “x” both Swall Meadows and Paradise
    - Addressing: “x” for Paradise
    - Walker: “x” for all four
    - “x” for all communities on overhead powerlines
- Regarding Draft CWPP measures (handout/attachment)
    - In Measures – only LRA is Antelope Valley. Can remove WUI codes re: ignitability. A lot of these measures are already completed.
    - Measures list – add items related to water tank installation. Add 50,000g water tanks to reduce ISO ratings. Some insurance companies are cancelling insurance in the WUI.
    - 5-year plan for Topaz, Colville, Walker – get a 50,000g tank. Tank wouldn’t meet scenic byway standards, went instead for smaller in-ground tanks, but also denied due to groundwater quality concerns. Mapping of hydrants? There aren’t hydrants in many places.
    - Where a 5-year plan exists – or where fire districts can provide working lists of projects, that’s really helpful.
    - Antelope Valley wants to remain rural – don’t want urban infrastructure, but do need a water tank. Should facilitate need through the County. ~1,200 residents in Antelope Valley.
    - Under “Organizational” – We already do ops plans…
    - Eastern Sierra Fire Safe Council – not around anymore. BLM should provide a list of the firesafe councils in the County.
- Swall Meadows/Paradise – could attend Crowley RPAC for input/review of the LHMP/CWPP. There’s a Firesafe Council meeting on February 5 which would be good for presentation.
- Swall Meadows emergency access road – narrowed down to Quail Circle road alternative. May need to work with residents regarding need for easement across private property to provide for road.
- Input from USFS Forester: There are opportunities for grants on anything we put into the Mono County CWPP – and grant openings are coming. Would like to see large fuel reduction projects in there, they have a better chance of being funded. House numbers, street signs, multiple ingress/egress (especially in Swall) – this needs to be setup and ready for when the Cap and Trade funding is coming.

Mono Basin RPAC Meeting Notes--12-13-17@6:30PM

[Insert PowerPoint]

- Race Communication fiber optic cable. Work would be owner’s cost.
- Mono Basin fire safe council getting started again. Starting up monthly.

- Caltrans presentation: Lee Vining Rehab. 3R. will shut down road for a period of time. 40 year roadway improvement project visioning led by MIG
    - Rock fall issue fixed along Lee Vining roadway.
- Question to SCE: undergrounding powerlines and prioritization. Continued interest in undergrounding. Avenue from town to visitor center. Been on wish list for a long time.
    - SCE removing a distribution line.
    - Share the cost with TeleCom
    - Rural 20a funds
        - Prioritization has not been established

Jeff's presentation

- June lake dams
- Rush creek drainage has had
- Comment on wildfire. **Just for mono basin they just put together historic fire boundaries. They committee can share that data with us.**

Town of Mammoth Lakes Planning Commission Hearing

[Insert PowerPoint]

Meeting #4

Collaborative Planning Team – Jan. 25, 2018

[Insert PowerPoint]

Share PowerPoint

Q: Consideration of Federal WUI?

Yes, we looked at it. It seems for the plan that the CalFire WUI is the most preferred. Forest Service is broader, but the WUI is out for comment to the Fire people if they'd like to modify it.

Q: Have you looked at scale and intensity of fire, and recent history versus long-term? Because there's been a substantial change.

I've heard that, unfortunately for this round we're depending on CalFire mapping and modeling done in 2009. We've been told updated ones will come out in the next year, but that we should proceed without them.

Q: Last year they didn't consider heavy snow to be a condition to get money back; that it didn't qualify.

Goals have to specify the hazards you want the mitigations to address to get funding back, and previously the goal didn't specify heavy snow – that will be corrected in this Plan.

Fire and Fuels Management Plan update

Hoping to be done this year

Long Valley RPAC – Jan. 24, 2018

[Insert PowerPoint]

- **Members of Fire Safe Council of Swall Meadows/Paradise in attendance – interested in doing their own fire safety plan and getting an additional evacuation route.**
- **Communications – getting broadband and fiber optic in County slowly to residents and businesses through (Company named Race? Raze?). Grant funded. Will not cover Hammill Valley and some other areas in the County.**
- **Hazards comment from attendee – Swall Meadows has high winds specifically**
  - **Dana: It's countywide assessment and there won't be specific measures for any one area, so Swall Meadows will be covered.**
- **Question – when you add something to the plan, do you reiterate what we request you to say, or do you make a judgment call on whether something is needed in the Plan?**
  - **Dana: We do rate levels of risk and create measures based on that risk. So the intent is to look at the communities at greatest risk, and implementation depends on funding as well.**
- **Do you do site visits, drones?**
  - **Not for this one; mostly using State data and updating with current local information.**
  - **Staff: do have an avalanche consultant on staff and she analyzed risks last year and is involved in warnings and evacuations, and that will fit into the measures that we're already doing.**
  - **Sheriff: there is an avalanche meeting coming up and anyone living in an avalanche zone should get a notice. Covering evacuations notices including code reds and IPAS(?) which notifies cell phone owners based on their current location when there's an avalanche danger. First Net – first responder network for entire nation to give priority to first responder networks – AT&T will provide service for these networks**

Hazard Mitigation Plan Team

[Insert PowerPoint]

- Fire history Q - Dave: any consideration in changes to vegetation in the last decade?
  - Dana: last vegetation data I have is from 2009 in the last CWPP, so we don't have truly up-to-date info.
  - Dave: some areas are completely different, esp. in post-fire areas
  - Dana: CalFire said they'll be coming out with data this year but that we shouldn't wait for that to come out. May be worth considering an on the ground inventory based on funding
  - Fred: Just talk in narrative about the change due to fires and invasive species, etc. to leave space for future changes and updates.

Appendix C: Critical Facilities

Name	Community	CriticalFa	FullAddres	Flood	Fire_Haz	Dam_ Fail	Fault
Benton Fire Camp - BLM	Benton	Emergency Services	27485 HWY 6	500 year	Moderate	No	
White Mountain Fire Protection District - Benton Fire Department	Benton	Emergency Services	25474 HWY 6	500 year	Moderate	No	
Benton Transfer Station / Landfill	Benton	Hazardous Materials		500 year	Moderate	No	
County District #2 Yard - Snow Removal Equipment	Benton	Lifeline Utility Systems	25574 HWY 6	500 year	Moderate	No	
Edna Beaman Elementary School	Benton	Schools	25541 HWY 6	500 year	Moderate	No	
Benton Senior Center	Benton	Vulnerable Populations	58869 HWY 120	500 year	Moderate	No	
Benton Park	Benton	Vulnerable Populations	58869 HWY 120	500 year	Moderate	No	
Benton Community Center	Benton	Vulnerable Populations		500 year	Moderate	No	
California Interstate Telephone Co.	Bridgeport	Communications Facilities			Moderate	No	
Escape Broadband LLC	Bridgeport	Communications Facilities	45 S Buckeye Drive	100 year	Moderate	No	
Mono County Offices	Bridgeport	Emergency Operations Center	49 Bryant Street		Moderate	No	
Mono County Memorial Hall	Bridgeport	Emergency Operations Center	73 N School Street		Moderate	No	
Sheriff's Office	Bridgeport	Emergency Services	49 Bryant Street		Moderate	No	
California Highway Patrol	Bridgeport	Emergency Services	125 Main Street		Moderate	No	
Bridgeport Fire Station	Bridgeport	Emergency Services	309 Main Street		Moderate	No	

Bridgeport Transfer Station / Landfill	Bridgeport	Hazardous Materials			Moderate	No	
Amerigas	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	233 Twin Lakes Road		Moderate	No	
Bridgeport Public Utilities District - Sewer Ponds	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
County District #4 Yard - Snow Removal Equipment	Bridgeport	Lifeline Utility Systems	197 Jack Sawyer Road		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
So. California Edison Company	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	149 Stock Drive	100 year	Moderate	No	
CalTrans - Snow Removal Equipment	Bridgeport	Lifeline Utility Systems	415 Jack Sawyer Road		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	118 Twin Lakes Road		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	1111 Aurora Canyon Road		Moderate	No	
Bridgeport Public Utilities District	Bridgeport	Lifeline Utility Systems	153 S Buckeye Drive		Moderate	No	
So. California Edison Company	Bridgeport	Lifeline Utility Systems	Bridgeport		Moderate	No	
Bridgeport Elementary School	Bridgeport	Schools	205 Kingsley Street		Moderate	No	

Helipad - Bridgeport Clinic	Bridgeport	Transportation Systems	193 Twin Lakes Road		Moderate	No	
Bryant Field Airport	Bridgeport	Transportation Systems	76 Stock Drive		Moderate	No	
Helipad - Bryant Field	Bridgeport	Transportation Systems	76 Stock Drive		Moderate	No	
Bridgeport Senior Center	Bridgeport	Vulnerable Populations	Bridgeport		Moderate	No	
Continental Telephone Co.	Chalfant Valley	Communications Facilities	Chalfant Valley	100 year	Moderate	No	
Chalfant Community Center	Chalfant Valley	Emergency Operations Center	215 Valley Road	100 year	Moderate	No	
Chalfant Fire Station	Chalfant Valley	Emergency Services	215 Valley Road	100 year	Moderate	No	
Chalfant Transfer Station / Landfill	Chalfant Valley	Hazardous Materials			Moderate	No	
Chalfant Valley Mutual Water Co.	Chalfant Valley	Lifeline Utility Systems	Chalfant Valley		Moderate	No	
Chalfant Valley Mutual Water Co.	Chalfant Valley	Lifeline Utility Systems	Chalfant Valley		Moderate	No	
New Communications of the Southwest, Inc.	Coleville	Communications Facilities	111671 HWY 395		Moderate	No	
Coleville Elementary School	Coleville	Schools	111527 HWY 395		Moderate	No	
Coleville High School	Coleville	Schools	111591 HWY 395		Moderate	No	
Continental Telephone Co.	Crestview	Communications Facilities			High	No	
CalTrans - Snow Removal Equipment	Crestview	Lifeline Utility Systems	34084 HWY 395		High	No	
Continental Telephone Co.	Crowley Lake	Communications Facilities	4035 Crowley Lake Drive		High	No	

Crowley Lake Community Center	Crowley Lake	Emergency Operations Center	58 Pearson Road		High	No	
Crowley Sub Station	Crowley Lake	Emergency Services	3605 Crowley Lake Drive		High	No	
Long Valley Fire Department	Crowley Lake	Emergency Services	3605 Crowley Lake Drive		High	No	
Water Tank	Crowley Lake	Lifeline Utility Systems	Crowley Lake		High	No	
Crowley Mutual Water Company	Crowley Lake	Lifeline Utility Systems	80 South Landing Road		High	No	
DWP Hydroelectric Generating Station	Crowley Lake	Lifeline Utility Systems	Crowley Lake		Moderate	No	
McGee CalTrans	Crowley Lake	Lifeline Utility Systems	518 Crowley Lake Place		Moderate	No	
Hilton Creek Community Service District	Crowley Lake	Lifeline Utility Systems	Crowley Lake		High	No	
Mountain Meadows Mutual Water Co.	Crowley Lake	Lifeline Utility Systems	93 Meadow View Drive		High	No	
South Landing Road/Crowley Overpass	Crowley Lake	Transportation Systems			High	No	
So. California Edison Company	Hammil Valley	Lifeline Utility Systems	Hammil Valley		Moderate	No	
California Interstate Telephone Co.	June Lake	Communications Facilities	June Lake		High	No	
June Lake Community Center	June Lake	Emergency Operations Center	90 W Granite Avenue		High	No	
June Lake Fire Station #2	June Lake	Emergency Services	5205 HWY 158		Very High	No	
June Lake Fire Department	June Lake	Emergency Services			Very High	No	
June Mountain Ski Area (JMSA)	June Lake	Hazardous Materials	3819 HWY 158		Very High	No	
June Lake Public Utilitiy District	June Lake	Lifeline Utility Systems	45125 HWY 395		Moderate	No	

So. California Edison Company	June Lake	Lifeline Utility Systems	June Lake		Very High	Yes	
So. California Edison Company	June Lake	Lifeline Utility Systems	June Lake		Very High	Yes	Inside Fault Rupture Zone
California Interstate Telephone Co.	Lee Vining	Communications Facilities	41 Third Street		Moderate	No	Inside Fault Rupture Zone
Lee Vining Indian and Community Center	Lee Vining	Emergency Operations Center	296 Mattly Avenue		Moderate	No	
Lee Vining Fire Department	Lee Vining	Emergency Services	51468 HWY 395		Moderate	No	
Cal Tans - Lee Vining Station	Lee Vining	Hazardous Materials	51548 HWY 395		Moderate	No	
County District #3 Yard - Snow Removal Equipment	Lee Vining	Lifeline Utility Systems	51596 HWY 395		Moderate	No	
Lee Vining Public Utility District	Lee Vining	Lifeline Utility Systems	Lee Vining		Moderate	No	
Lee Vining High School	Lee Vining	Schools	51710 HWY 395		Moderate	No	
Lee Vining Elementary School	Lee Vining	Schools	132 Lee Vining Avenue		Moderate	No	Inside Fault Rupture Zone
Lee Vining Airport	Lee Vining	Transportation Systems	Lee Vining		Moderate	No	
MMSA Canyon Lodge	Mammoth Lakes Area	Emergency Operations Center			High	No	Inside Fault Rupture Zone
Mammoth Mountain Ski Area	Mammoth Lakes Area	Hazardous Materials	10400 Minaret Road		Moderate	No	
Turner Gas - Propane	Mammoth Lakes Area	Lifeline Utility Systems	3439 Main Street		Moderate	No	
Mammoth Overpass	Mammoth Lakes Area	Transportation Systems			Moderate	No	Inside Fault Rupture Zone
Mono County Volunteer Fire Dept.	Mono City	Emergency Services	Mono City		Moderate	No	

California Electric Power Co.	Mono City	Lifeline Utility Systems	Mono City		High	No	
Lundy Mutual Water Company #2	Mono City	Lifeline Utility Systems	Mono City		Moderate	No	
Lundy Mutual Water Company #1	Mono City	Lifeline Utility Systems	Mono City		Moderate	No	
So. California Edison Company	Mono City	Lifeline Utility Systems	Mono City		Moderate	No	
So. California Edison Company	Oasis	Lifeline Utility Systems	Oasis		Moderate	No	
Paradise Fire Department	Paradise Estates	Emergency Services	5300 Lower Rock Creek Road		Moderate	No	
Paradise Transfer Station	Paradise Estates	Hazardous Materials		100 year	Moderate	No	
Paradise Water Storage Tanks	Paradise Estates	Lifeline Utility Systems	Paradise Estates		Moderate	No	
Paradise Water Supply Wells	Paradise Estates	Lifeline Utility Systems	Paradise Estates		Moderate	No	
USMC Mtn. Warfare Training Center - Fire Station	Pickle Meadows	Emergency Services	Pickle Meadows		High	No	
MWTC Medical Clinic	Pickle Meadows	Medical Services	Pickle Meadows		High	No	
Helipad - USMC Mountain Warfare Training Center	Pickle Meadows	Transportation Systems	Pickle Meadows		High	No	
Pumice Valley Landfill	Pumice Valley	Hazardous Materials	200 Dross Road		Moderate	No	
CalTrans - Snow Removal Equipment	Sonora Junction	Lifeline Utility Systems	93922 HWY 395		Moderate	No	
Wheeler Crest Volunteer Fire Dept.	Swall Meadows	Emergency Services	Swall Meadows		Moderate	No	
Wheeler Crest Community Service District	Swall Meadows	Lifeline Utility Systems	334 Rimrock Drive		Moderate	No	

Sherwin Sand Shed	Swall Meadows	Lifeline Utility Systems	Swall Meadows		Moderate	No	
DWP Hydroelectric Generating Station	Swall Meadows	Lifeline Utility Systems	Swall Meadows		Moderate	No	
Long Valley Fire Protection District	Tom's Place	Emergency Services	Tom's Place		Moderate	No	
Birchim Community Service District	Tom's Place	Lifeline Utility Systems	636 Owens Gorge Road		Moderate	No	
Antelope Valley Fire District; Topaz Station #2	Topaz	Emergency Services	Topaz		Moderate	No	
Topaz Interagency Fire Control Station	Topaz	Emergency Services	116999 HWY 395		Moderate	No	Inside Fault Rupture Zone
Continental Telephone Co.	Virginia Lakes	Communications Facilities	Virginia Lakes		Moderate	No	
Conway Summit Fire Station	Virginia Lakes	Emergency Services	63560 HWY 395		Moderate	No	
Caltrans - Snow Removal Equipment	Virginia Lakes	Lifeline Utility Systems	63560 HWY 395		Moderate	No	
So. California Edison Company	Virginia Lakes	Lifeline Utility Systems	Whitmore Hot Springs		High	No	Inside Fault Rupture Zone
Helipad - Conway Summit	Virginia Lakes	Transportation Systems			Moderate	No	
Walker Community Center	Walker	Emergency Operations Center	442 Mule Deer Road		High	No	
Mono Rescue / Antelope Valley FD; Station #1	Walker	Emergency Services	51 Shop Road		High	No	
Walker Paramedics - 1	Walker	Emergency Services			High	No	
Walker Transfer Station / Landfill	Walker	Hazardous Materials			Moderate	No	
County District #5 Yard - Snow Removal Equipment	Walker	Lifeline Utility Systems	62 Shop Road		High	No	

Toibye Indian Health Project	Walker	Medical Services	259 Camp Antelope Road		Moderate	No	
Antelope Senior Center	Walker	Vulnerable Populations	399 Mule Deer Road		High	No	
White Mountain Mutual Water Co.	White Mountain Estates	Lifeline Utility Systems	197 Sequoia Street		Moderate	No	
Benton Crossing Landfill	Whitmore hot Springs	Hazardous Materials	899 Pit Road		Moderate	No	
Mammoth Yosemite Airport	Whitmore hot Springs	Transportation Systems	Mammoth Lakes City		Moderate	No	

Appendix D: Mono County Hazus Faults Reports

Hazus-MH: Earthquake Global Risk Report

Region Name: Mono_County_EQ_RC

Earthquake Scenario: M6.9-Fish Slough v14

Print Date: January 09, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,131.05 square miles and contains 3 census tracts. There are over 5 thousand households in the region which has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,755 (millions of dollars). Approximately 95.00 % of the buildings (and 89.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,656 and 360 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 2,755 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 81% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 3,016.00 (millions of dollars). This inventory includes over 588 kilometers of highways, 29 bridges, 1,085 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	29	13.20
	Segments	44	2,593.10
	Tunnels	0	0.00
		Subtotal	**2,606.30**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.30
		Subtotal	**1.30**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	1	10.70
	Runways	1	38.00
		Subtotal	**48.60**
		Total	**2,656.20**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	10.90
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**10.90**
Waste Water	Distribution Lines	NA	6.50
	Facilities	1	78.60
	Pipelines	0	0.00
		Subtotal	**85.10**
Natural Gas	Distribution Lines	NA	4.30
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**4.30**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	2	259.60
		Subtotal	**259.60**
Communication	Facilities	1	0.10
		Subtotal	**0.10**
		Total	**360.00**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	M6.9-Fish Slough v14
Type of Earthquake	
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	0.00
Latitude of Epicenter	0.00
Earthquake Magnitude	6.89
Depth (km)	0.00
Rupture Length (Km)	0.00
Rupture Orientation (degrees)	0.00
Attenuation Function	

Building Damage

Building Damage

Hazus estimates that about 448 buildings will be at least moderately damaged. This is over 5.00 % of the buildings in the region. There are an estimated 7 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage categories by General Occupancy Type

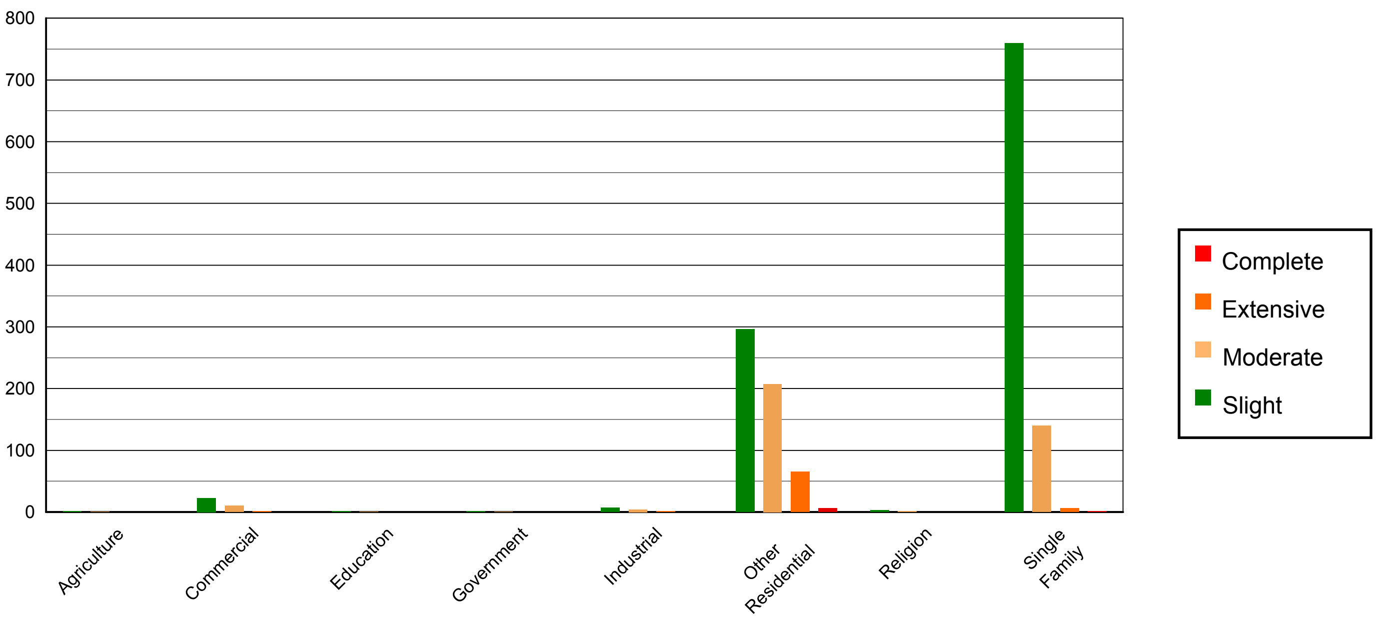


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	12	0.18	2	0.14	1	0.21	0	0.23	0	0.29
Commercial	241	3.39	23	2.11	11	2.88	2	2.49	0	2.26
Education	19	0.27	1	0.13	0	0.13	0	0.10	0	0.06
Government	24	0.33	2	0.14	1	0.17	0	0.14	0	0.13
Industrial	57	0.80	8	0.69	4	1.17	1	1.22	0	1.22
Other Residential	1,767	24.79	296	27.09	208	56.84	65	87.42	6	76.26
Religion	36	0.50	3	0.31	1	0.38	0	0.34	0	0.33
Single Family	4,969	69.74	759	69.39	140	38.21	6	8.08	2	19.45
Total	**7,125**		**1,094**		**365**		**75**		**8**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	5,962	83.67	860	78.58	151	41.25	6	7.91	2	21.31
Steel	139	1.96	15	1.33	9	2.49	2	2.32	0	1.84
Concrete	159	2.23	17	1.53	6	1.74	1	1.67	0	1.24
Precast	64	0.90	7	0.63	4	1.20	1	1.14	0	0.83
RM	222	3.12	16	1.51	10	2.71	2	2.69	0	0.90
URM	47	0.66	7	0.66	4	0.97	1	1.01	0	2.16
MH	531	7.45	172	15.76	181	49.65	62	83.25	6	71.71
Total	**7,125**		**1,094**		**365**		**75**		**8**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 15 hospital beds available for use. On the day of the earthquake, the model estimates that only 14 hospital beds (96.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	0	0	1
Schools	22	0	0	20
EOCs	0	0	0	0
PoliceStations	3	0	0	3
FireStations	10	0	0	8

Transportation Lifeline Damage

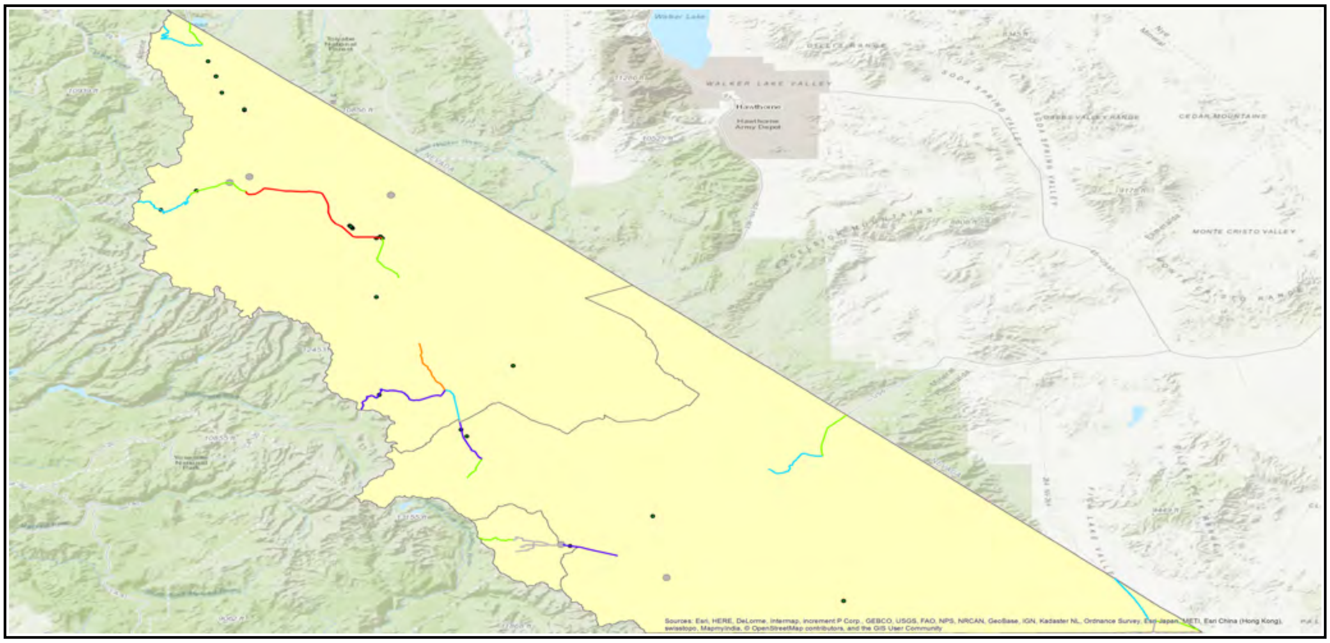


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	44	0	0	44	44
	Bridges	29	0	0	29	29
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

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

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	543	18	4
Waste Water	326	13	3
Natural Gas	217	4	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	5,768	0	0	0	0	0
Electric Power		0	0	0	0	0

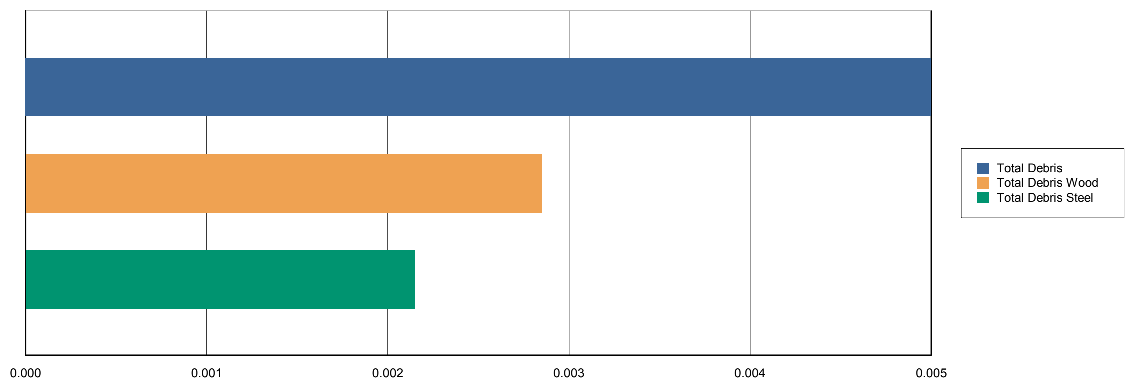
Induced Earthquake Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 57.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 200 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



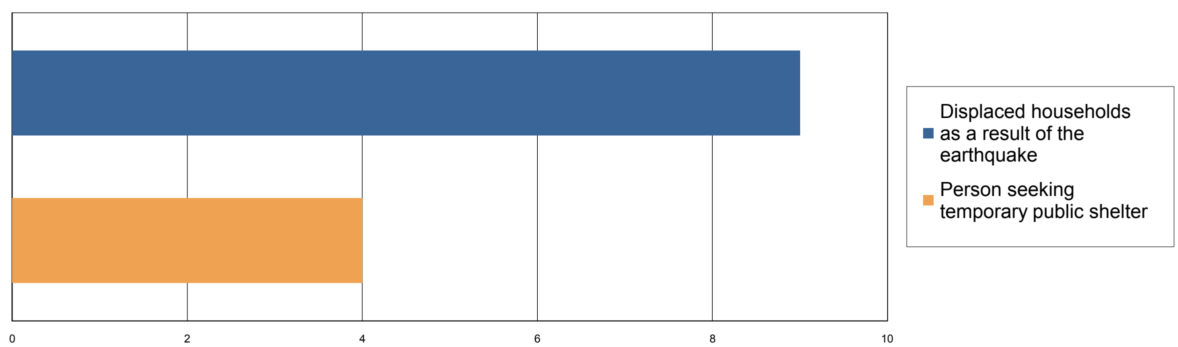
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.01	200 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 9 households to be displaced due to the earthquake. Of these, 4 people (out of a total population of 14,202) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
9	4

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

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

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	2	0	0	0
	Single Family	1	0	0	0
	Total	**3**	**0**	**0**	**0**
2 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**4**	**1**	**0**	**0**
5 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	0	0	0	0
	Total	**3**	**0**	**0**	**0**

Economic Loss

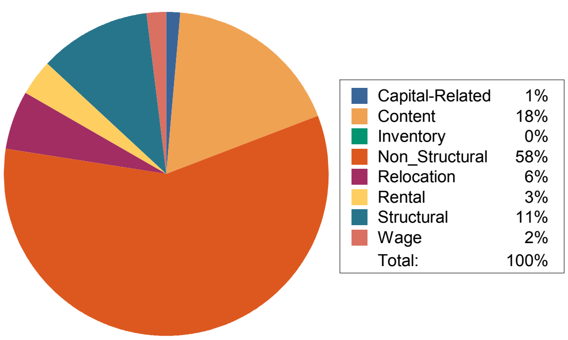
The total economic loss estimated for the earthquake is 43.38 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 33.15 (millions of dollars); 13 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

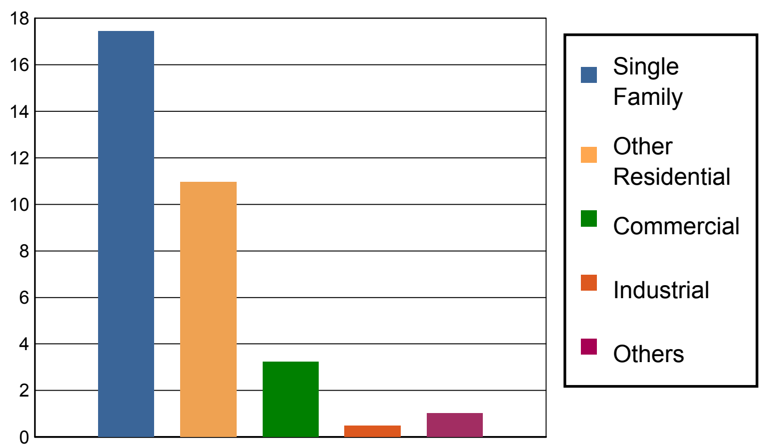


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.29	0.31	0.01	0.06	0.66
	Capital-Related	0.00	0.12	0.34	0.01	0.01	0.47
	Rental	0.31	0.66	0.16	0.00	0.01	1.14
	Relocation	1.01	0.67	0.21	0.02	0.10	2.01
	Subtotal	**1.31**	**1.74**	**1.03**	**0.04**	**0.17**	**4.29**
Capital Stock Losses							
	Structural	1.95	1.22	0.32	0.06	0.13	3.68
	Non_Structural	10.74	6.59	1.24	0.23	0.47	19.28
	Content	3.44	1.41	0.61	0.13	0.26	5.86
	Inventory	0.00	0.00	0.02	0.02	0.00	0.04
	Subtotal	**16.13**	**9.23**	**2.19**	**0.45**	**0.87**	**28.86**
	Total	**17.45**	**10.96**	**3.22**	**0.49**	**1.04**	**33.15**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,593.13	$0.00	0.00
	Bridges	13.15	$0.01	0.05
	Tunnels	0.00	$0.00	0.00
	Subtotal	**2,606**	**0.00**	
Railways	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	1.29	$0.01	0.82
	Subtotal	**1**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	10.65	$1.04	9.73
	Runways	37.96	$0.00	0.00
	Subtotal	**49**	**1.00**	
	Total	**2,656.20**	**1.10**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	10.90	$0.08	0.74
	Subtotal	**10.85**	**$0.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	78.60	$2.00	2.54
	Distribution Lines	6.50	$0.06	0.88
	Subtotal	**85.10**	**$2.05**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	4.30	$0.02	0.38
	Subtotal	**4.34**	**$0.02**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	259.60	$7.02	2.70
	Subtotal	**259.60**	**$7.02**	
Communication	Facilities	0.10	$0.00	1.27
	Subtotal	**0.12**	**$0.00**	
	Total	**360.01**	**$9.17**	

Appendix A: County Listing for the Region

Mono,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California					
	Mono	14,202	2,459	296	2,755
Total State		**14,202**	**2,459**	**296**	**2,755**
Total Region		**14,202**	**2,459**	**296**	**2,755**

Hazus-MH: Earthquake Global Risk Report

Region Name: Mono_County_EQ_RC

Earthquake Scenario: M6.9-Hilton Creek v14

Print Date: January 09, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,131.05 square miles and contains 3 census tracts. There are over 5 thousand households in the region which has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,755 (millions of dollars). Approximately 95.00 % of the buildings (and 89.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,656 and 360 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 2,755 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 81% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 3,016.00 (millions of dollars). This inventory includes over 588 kilometers of highways, 29 bridges, 1,085 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	29	13.20
	Segments	44	2,593.10
	Tunnels	0	0.00
		Subtotal	**2,606.30**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.30
		Subtotal	**1.30**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	1	10.70
	Runways	1	38.00
		Subtotal	**48.60**
		Total	**2,656.20**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	10.90
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**10.90**
Waste Water	Distribution Lines	NA	6.50
	Facilities	1	78.60
	Pipelines	0	0.00
		Subtotal	**85.10**
Natural Gas	Distribution Lines	NA	4.30
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**4.30**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	2	259.60
		Subtotal	**259.60**
Communication	Facilities	1	0.10
		Subtotal	**0.10**
		Total	**360.00**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	M6.9-Hilton Creek v14
Type of Earthquake	
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	0.00
Latitude of Epicenter	0.00
Earthquake Magnitude	6.92
Depth (km)	0.00
Rupture Length (Km)	0.00
Rupture Orientation (degrees)	0.00
Attenuation Function	

Building Damage

Building Damage

Hazus estimates that about 922 buildings will be at least moderately damaged. This is over 11.00 % of the buildings in the region. There are an estimated 15 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage categories by General Occupancy Type

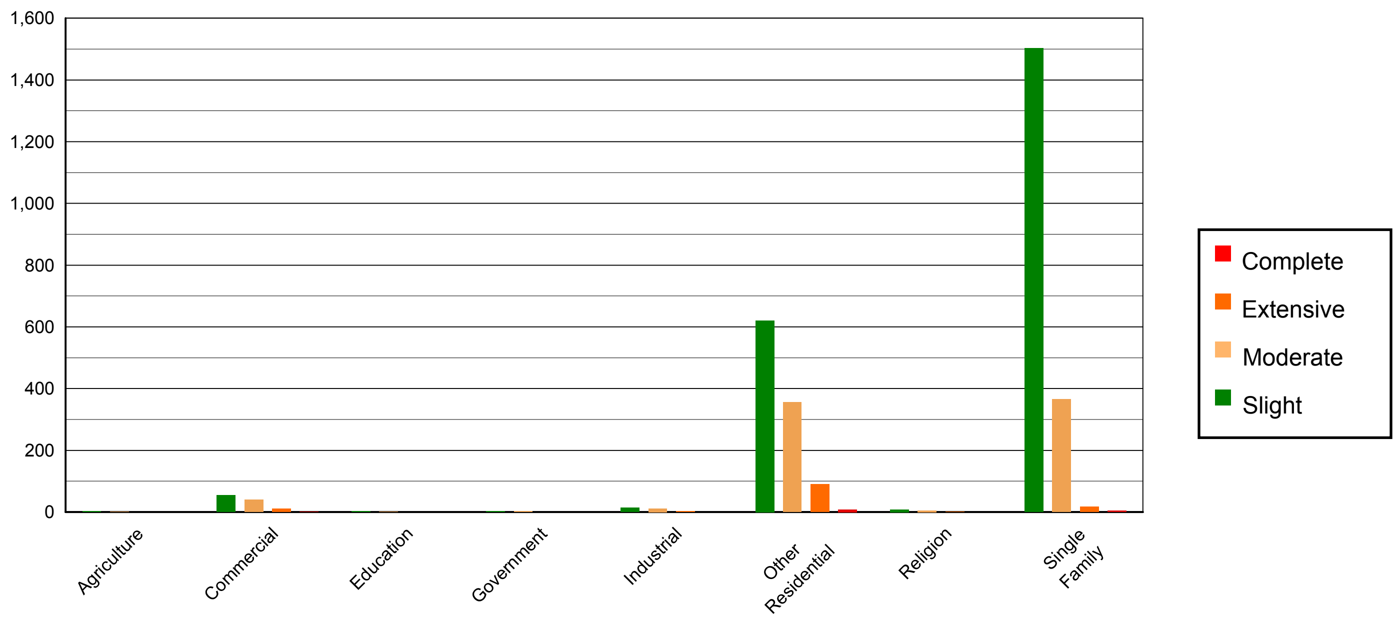


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	12	0.22	2	0.08	1	0.11	0	0.14	0	0.15
Commercial	170	3.08	55	2.49	40	5.10	10	8.38	1	8.66
Education	16	0.28	3	0.15	2	0.22	0	0.29	0	0.21
Government	20	0.37	3	0.15	2	0.24	0	0.39	0	0.40
Industrial	40	0.73	15	0.66	12	1.47	3	2.59	0	2.69
Other Residential	1,266	22.87	621	28.09	356	45.52	90	72.56	9	56.61
Religion	25	0.46	9	0.39	5	0.70	1	1.15	0	1.21
Single Family	3,984	72.00	1,503	67.99	365	46.64	18	14.50	5	30.08
Total	**5,534**		**2,210**		**783**		**124**		**15**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Wood	4,624	83.56	1871	84.63	458	58.47	21	17.22	6	38.17
Steel	90	1.62	32	1.44	33	4.16	10	8.05	1	6.28
Concrete	103	1.86	44	1.99	27	3.50	8	6.56	1	5.32
Precast	43	0.77	15	0.66	14	1.85	4	3.55	0	2.77
RM	165	2.99	41	1.87	34	4.33	10	7.72	1	3.46
URM	27	0.48	14	0.65	12	1.58	4	3.42	1	9.11
MH	483	8.72	194	8.76	205	26.12	66	53.49	5	34.89
Total	**5,534**		**2,210**		**783**		**124**		**15**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 15 hospital beds available for use. On the day of the earthquake, the model estimates that only 8 hospital beds (59.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 94.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	22	0	0	11
EOCs	0	0	0	0
PoliceStations	3	0	0	1
FireStations	10	0	0	6

Transportation Lifeline Damage

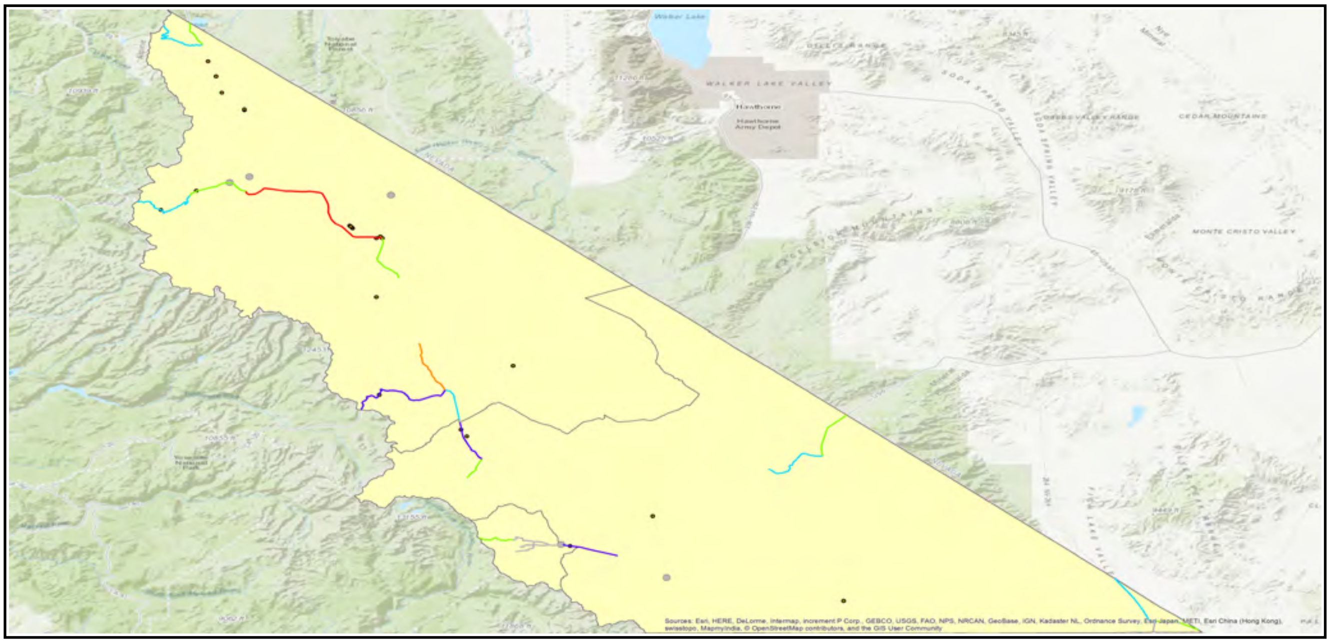


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	44	0	0	44	44
	Bridges	29	0	0	29	29
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	1	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

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

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	543	35	9
Waste Water	326	25	6
Natural Gas	217	7	2
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	5,768	0	0	0	0	0
Electric Power		0	0	0	0	0

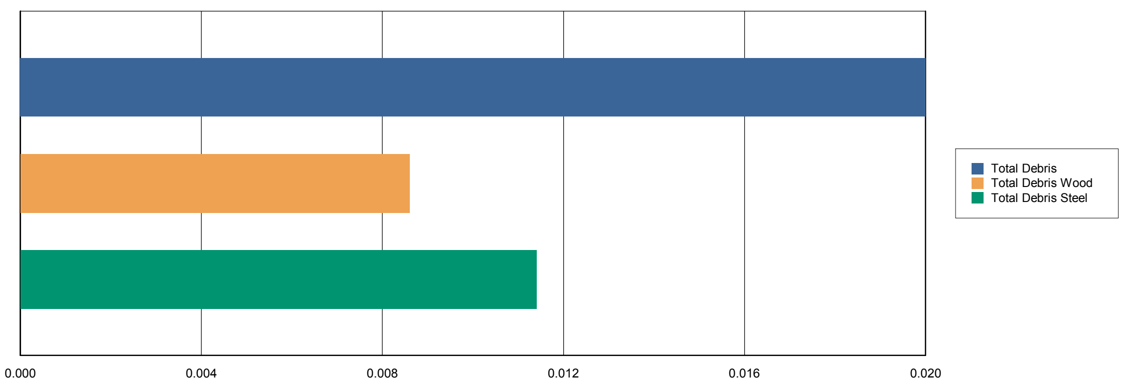
Induced Earthquake Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.02 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 43.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 800 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



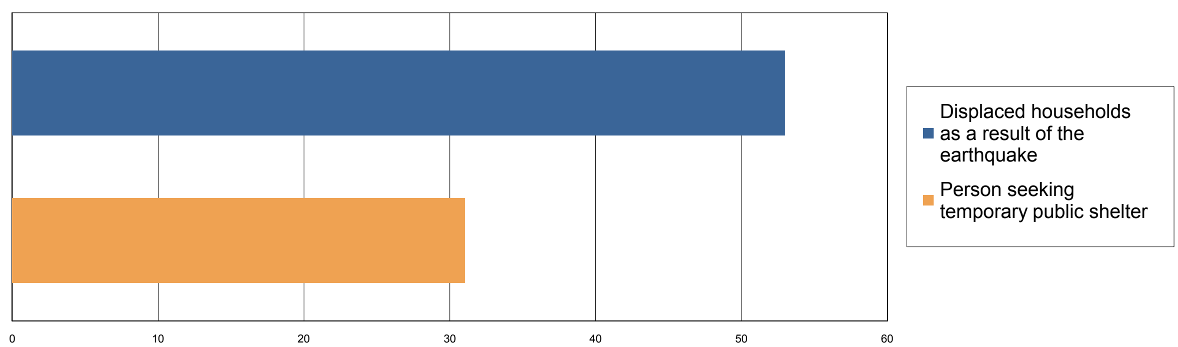
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.01	0.01	0.02	800 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 53 households to be displaced due to the earthquake. Of these, 31 people (out of a total population of 14,202) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
53	31

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

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

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	6	1	0	0
	Single Family	3	0	0	0
	Total	**9**	**1**	**0**	**0**
2 PM	Commercial	9	2	0	0
	Commuting	0	0	0	0
	Educational	2	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	1	0	0	0
	Single Family	0	0	0	0
	Total	**14**	**2**	**0**	**1**
5 PM	Commercial	6	1	0	0
	Commuting	0	0	1	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	2	0	0	0
	Single Family	1	0	0	0
	Total	**11**	**2**	**1**	**0**

Economic Loss

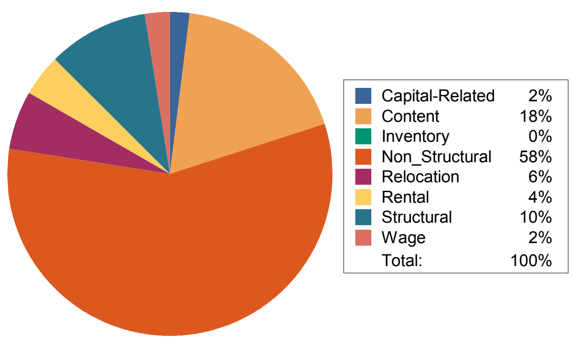
The total economic loss estimated for the earthquake is 159.29 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 118.72 (millions of dollars); 14 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 82 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

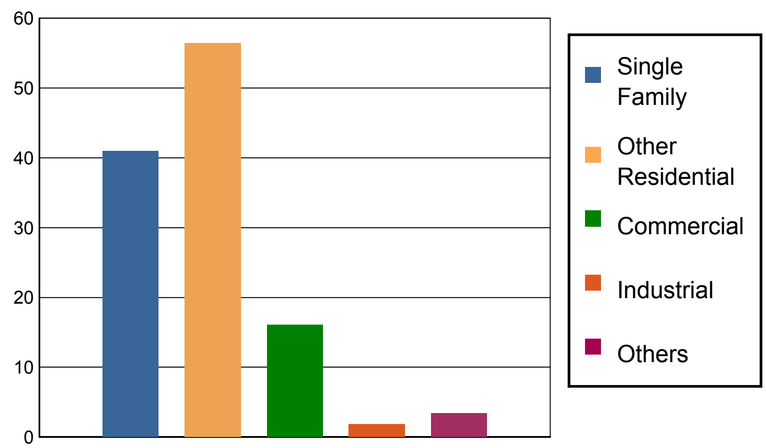


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	1.02	1.69	0.03	0.14	2.88
	Capital-Related	0.00	0.44	1.72	0.02	0.02	2.20
	Rental	0.78	3.39	0.78	0.01	0.05	5.02
	Relocation	2.67	2.36	1.16	0.10	0.41	6.71
	Subtotal	**3.45**	**7.20**	**5.35**	**0.16**	**0.63**	**16.80**
Capital Stock Losses							
	Structural	4.57	5.06	1.70	0.23	0.43	12.00
	Non_Structural	24.89	35.14	5.93	0.86	1.58	68.38
	Content	8.05	9.04	2.98	0.50	0.81	21.38
	Inventory	0.00	0.00	0.07	0.08	0.00	0.15
	Subtotal	**37.51**	**49.23**	**10.68**	**1.67**	**2.82**	**101.92**
	Total	**40.97**	**56.44**	**16.03**	**1.83**	**3.45**	**118.72**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,593.13	$0.00	0.00
	Bridges	13.15	$0.43	3.26
	Tunnels	0.00	$0.00	0.00
	Subtotal	**2,606**	**0.40**	
Railways	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	1.29	$0.00	0.33
	Subtotal	**1**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	10.65	$4.46	41.92
	Runways	37.96	$0.00	0.00
	Subtotal	**49**	**4.50**	
	Total	**2,656.20**	**4.90**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	10.90	$0.16	1.45
	Subtotal	**10.85**	**$0.16**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	78.60	$13.22	16.82
	Distribution Lines	6.50	$0.11	1.74
	Subtotal	**85.10**	**$13.33**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	4.30	$0.03	0.75
	Subtotal	**4.34**	**$0.03**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	259.60	$22.14	8.53
	Subtotal	**259.60**	**$22.14**	
Communication	Facilities	0.10	$0.01	7.71
	Subtotal	**0.12**	**$0.01**	
	Total	**360.01**	**$35.67**	

Appendix A: County Listing for the Region

Mono,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California					
	Mono	14,202	2,459	296	2,755
Total State		**14,202**	**2,459**	**296**	**2,755**
Total Region		**14,202**	**2,459**	**296**	**2,755**

Hazus-MH: Earthquake Global Risk Report

Region Name: Mono_County_EQ_RC

Earthquake Scenario: M7.4-White Mountains v15

Print Date: January 09, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,131.05 square miles and contains 3 census tracts. There are over 5 thousand households in the region which has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 2,755 (millions of dollars). Approximately 95.00 % of the buildings (and 89.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,656 and 360 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 8 thousand buildings in the region which have an aggregate total replacement value of 2,755 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 81% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 3,016.00 (millions of dollars). This inventory includes over 588 kilometers of highways, 29 bridges, 1,085 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	29	13.20
	Segments	44	2,593.10
	Tunnels	0	0.00
		Subtotal	**2,606.30**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	1	1.30
		Subtotal	**1.30**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	1	10.70
	Runways	1	38.00
		Subtotal	**48.60**
		Total	**2,656.20**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	10.90
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**10.90**
Waste Water	Distribution Lines	NA	6.50
	Facilities	1	78.60
	Pipelines	0	0.00
		Subtotal	**85.10**
Natural Gas	Distribution Lines	NA	4.30
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**4.30**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	2	259.60
		Subtotal	**259.60**
Communication	Facilities	1	0.10
		Subtotal	**0.10**
		Total	**360.00**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	M7.4-White Mountains v15
Type of Earthquake	
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	0.00
Latitude of Epicenter	0.00
Earthquake Magnitude	7.38
Depth (km)	0.00
Rupture Length (Km)	0.00
Rupture Orientation (degrees)	0.00
Attenuation Function	

Building Damage

Building Damage

Hazus estimates that about 448 buildings will be at least moderately damaged. This is over 5.00 % of the buildings in the region. There are an estimated 7 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage categories by General Occupancy Type

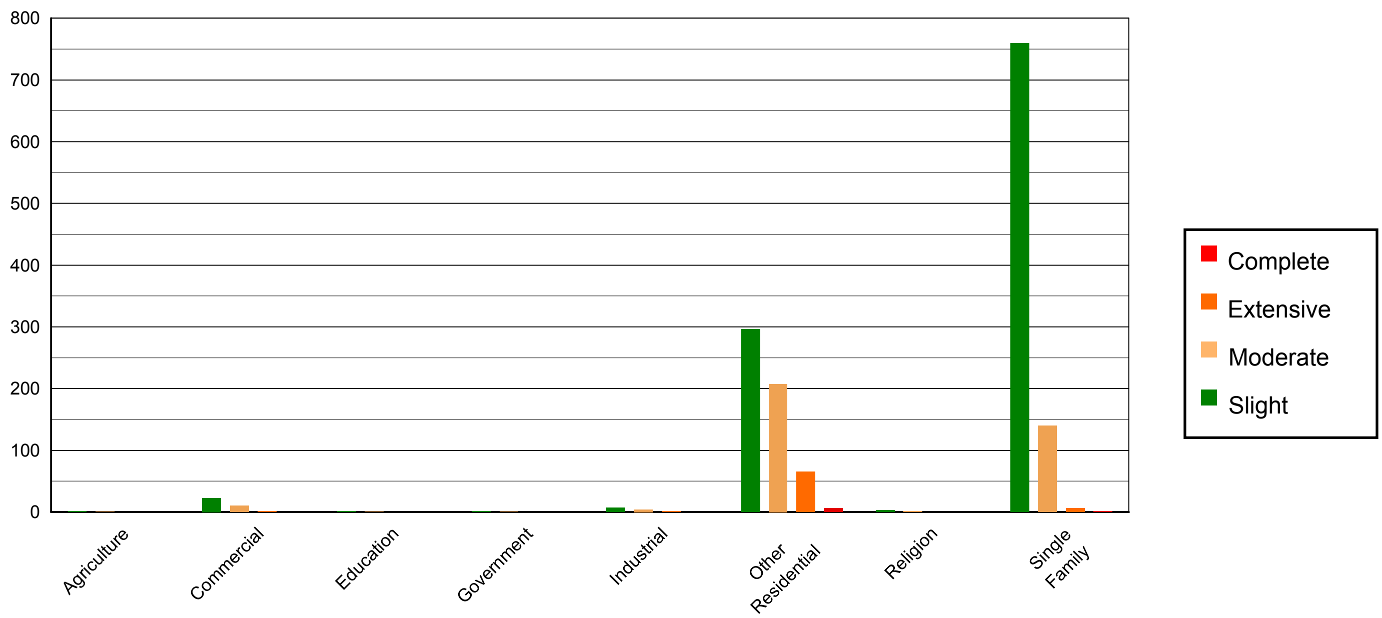


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	12	0.18	2	0.14	1	0.21	0	0.23	0	0.29
Commercial	241	3.39	23	2.11	11	2.88	2	2.49	0	2.26
Education	19	0.27	1	0.13	0	0.13	0	0.10	0	0.06
Government	24	0.33	2	0.14	1	0.17	0	0.14	0	0.13
Industrial	57	0.80	8	0.69	4	1.17	1	1.22	0	1.22
Other Residential	1,767	24.79	296	27.09	208	56.84	65	87.42	6	76.26
Religion	36	0.50	3	0.31	1	0.38	0	0.34	0	0.33
Single Family	4,969	69.74	759	69.39	140	38.21	6	8.08	2	19.45
Total	**7,125**		**1,094**		**365**		**75**		**8**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Wood	5,962	83.67	860	78.58	151	41.25	6	7.91	2	21.31
Steel	139	1.96	15	1.33	9	2.49	2	2.32	0	1.84
Concrete	159	2.23	17	1.53	6	1.74	1	1.67	0	1.24
Precast	64	0.90	7	0.63	4	1.20	1	1.14	0	0.83
RM	222	3.12	16	1.51	10	2.71	2	2.69	0	0.90
URM	47	0.66	7	0.66	4	0.97	1	1.01	0	2.16
MH	531	7.45	172	15.76	181	49.65	62	83.25	6	71.71
Total	**7,125**		**1,094**		**365**		**75**		**8**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 15 hospital beds available for use. On the day of the earthquake, the model estimates that only 14 hospital beds (96.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	0	0	1
Schools	22	0	0	20
EOCs	0	0	0	0
PoliceStations	3	0	0	3
FireStations	10	0	0	8

Transportation Lifeline Damage

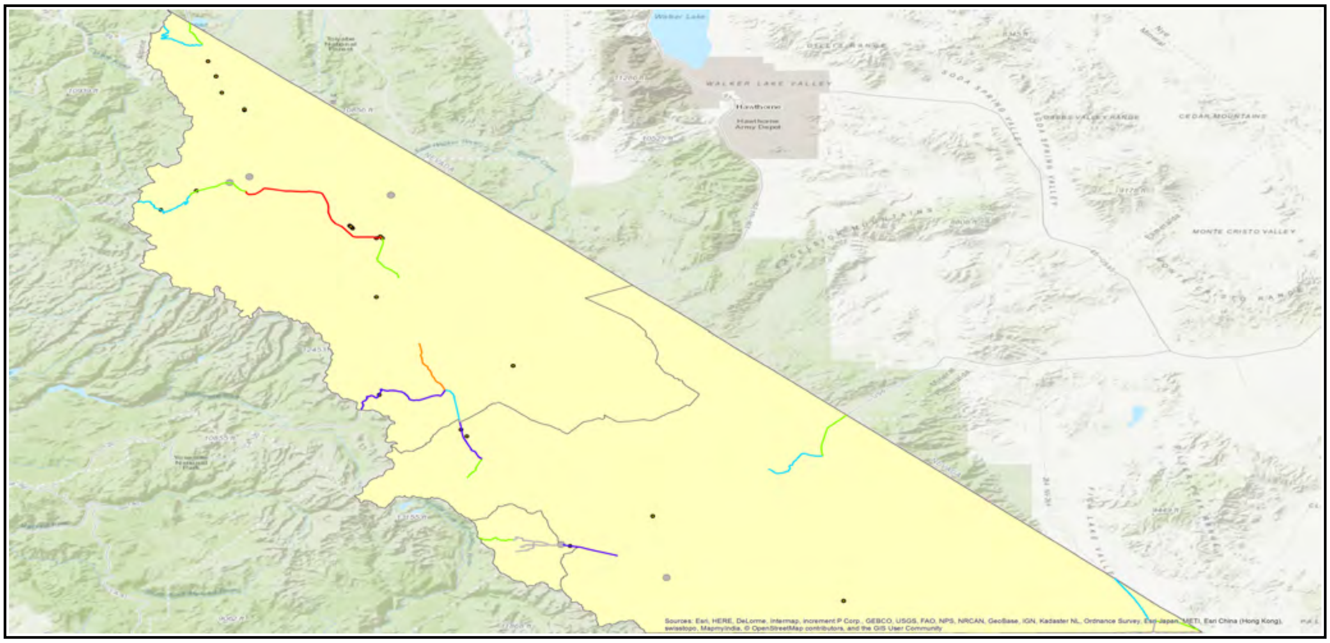


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	44	0	0	44	44
	Bridges	29	0	0	29	29
	Tunnels	0	0	0	0	0
Railways	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

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

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	543	18	4
Waste Water	326	13	3
Natural Gas	217	4	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	5,768	0	0	0	0	0
Electric Power		0	0	0	0	0

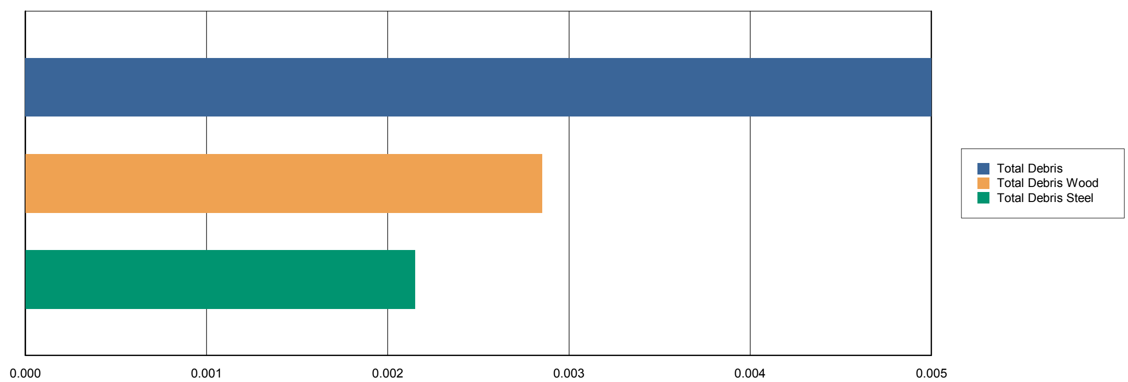
Induced Earthquake Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 57.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 200 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



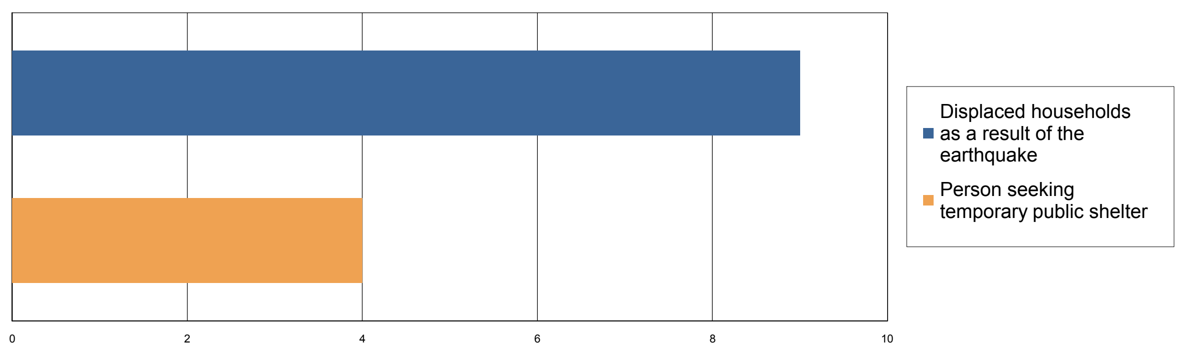
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.01	200 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 9 households to be displaced due to the earthquake. Of these, 4 people (out of a total population of 14,202) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
9	4

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

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

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	2	0	0	0
	Single Family	1	0	0	0
	Total	**3**	**0**	**0**	**0**
2 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**4**	**1**	**0**	**0**
5 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	0	0	0	0
	Total	**3**	**0**	**0**	**0**

Economic Loss

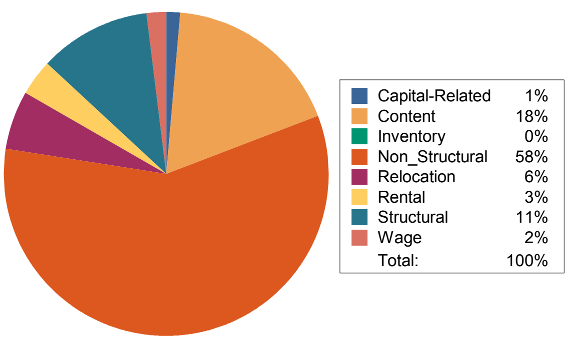
The total economic loss estimated for the earthquake is 43.38 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 33.15 (millions of dollars); 13 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 86 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

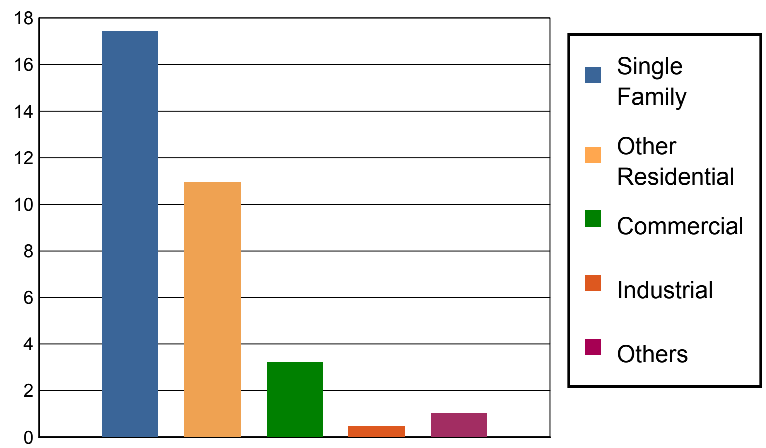


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.29	0.31	0.01	0.06	0.66
	Capital-Related	0.00	0.12	0.34	0.01	0.01	0.47
	Rental	0.31	0.66	0.16	0.00	0.01	1.14
	Relocation	1.01	0.67	0.21	0.02	0.10	2.01
	Subtotal	**1.31**	**1.74**	**1.03**	**0.04**	**0.17**	**4.29**
Capital Stock Losses							
	Structural	1.95	1.22	0.32	0.06	0.13	3.68
	Non_Structural	10.74	6.59	1.24	0.23	0.47	19.28
	Content	3.44	1.41	0.61	0.13	0.26	5.86
	Inventory	0.00	0.00	0.02	0.02	0.00	0.04
	Subtotal	**16.13**	**9.23**	**2.19**	**0.45**	**0.87**	**28.86**
	Total	**17.45**	**10.96**	**3.22**	**0.49**	**1.04**	**33.15**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,593.13	$0.00	0.00
	Bridges	13.15	$0.01	0.05
	Tunnels	0.00	$0.00	0.00
	Subtotal	**2,606**	**0.00**	
Railways	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	1.29	$0.01	0.82
	Subtotal	**1**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	10.65	$1.04	9.73
	Runways	37.96	$0.00	0.00
	Subtotal	**49**	**1.00**	
	Total	**2,656.20**	**1.10**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	10.90	$0.08	0.74
	Subtotal	**10.85**	**$0.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	78.60	$2.00	2.54
	Distribution Lines	6.50	$0.06	0.88
	Subtotal	**85.10**	**$2.05**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	4.30	$0.02	0.38
	Subtotal	**4.34**	**$0.02**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	259.60	$7.02	2.70
	Subtotal	**259.60**	**$7.02**	
Communication	Facilities	0.10	$0.00	1.27
	Subtotal	**0.12**	**$0.00**	
	Total	**360.01**	**$9.17**	

Appendix A: County Listing for the Region

Mono,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California					
	Mono	14,202	2,459	296	2,755
Total State		**14,202**	**2,459**	**296**	**2,755**
Total Region		**14,202**	**2,459**	**296**	**2,755**

Appendix E: Mono County Hazus Flood Reports

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 1

Print Date: Wednesday, January 24, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

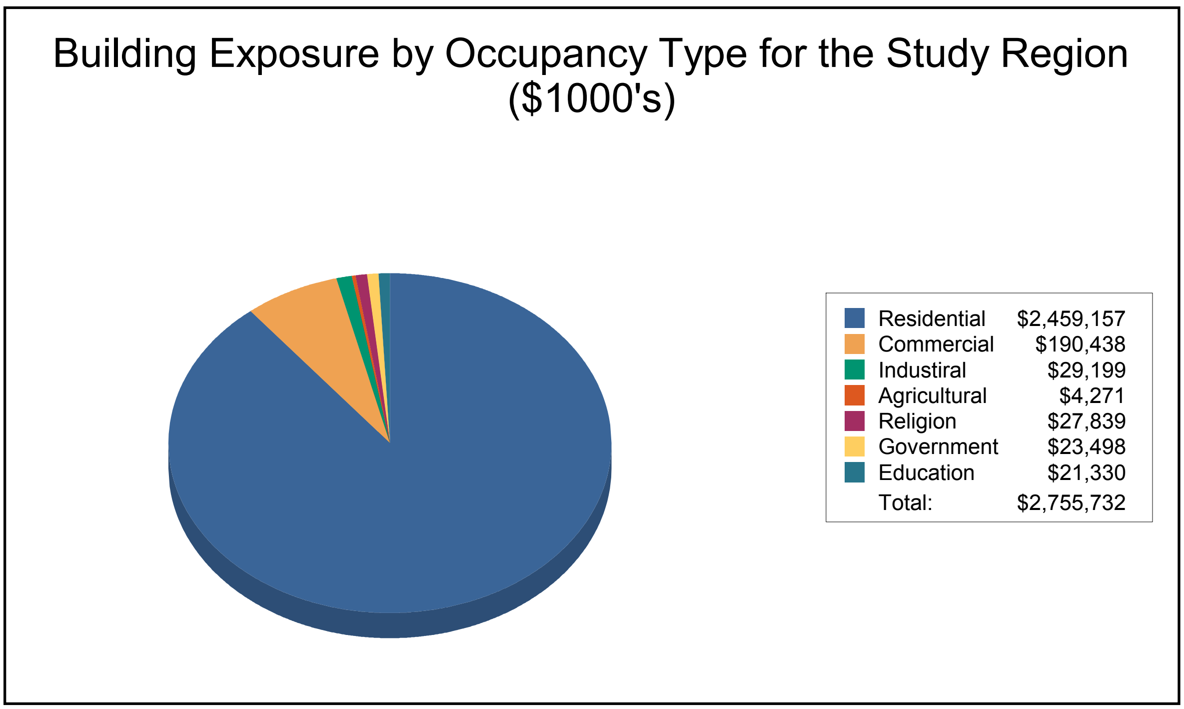
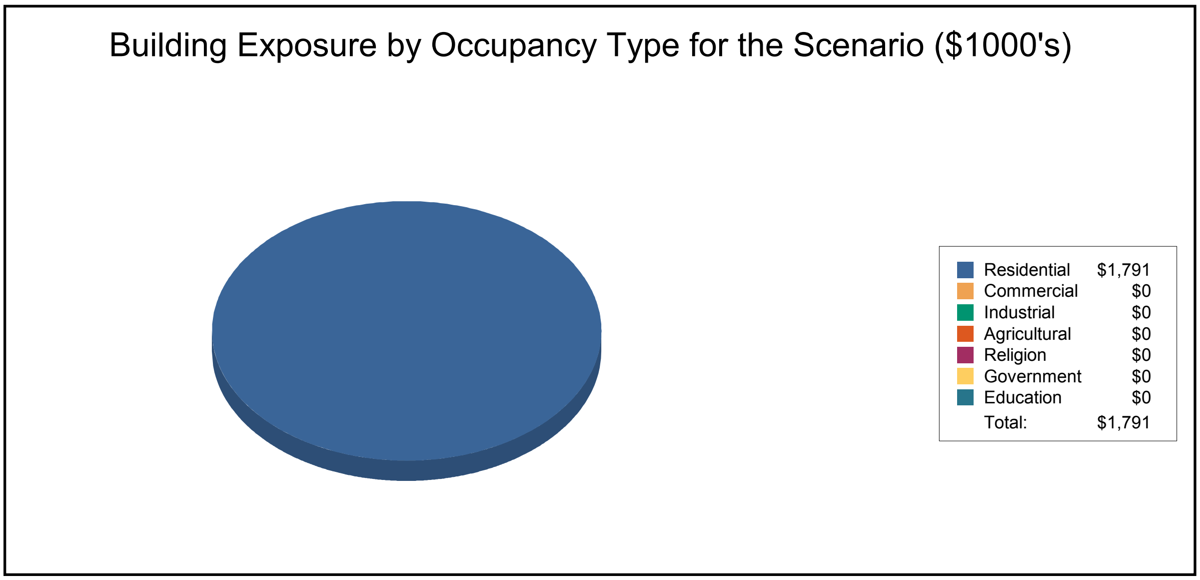


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,791	100.0%
Commercial	0	0.0%
Industrial	0	0.0%
Agricultural	0	0.0%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**1,791**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

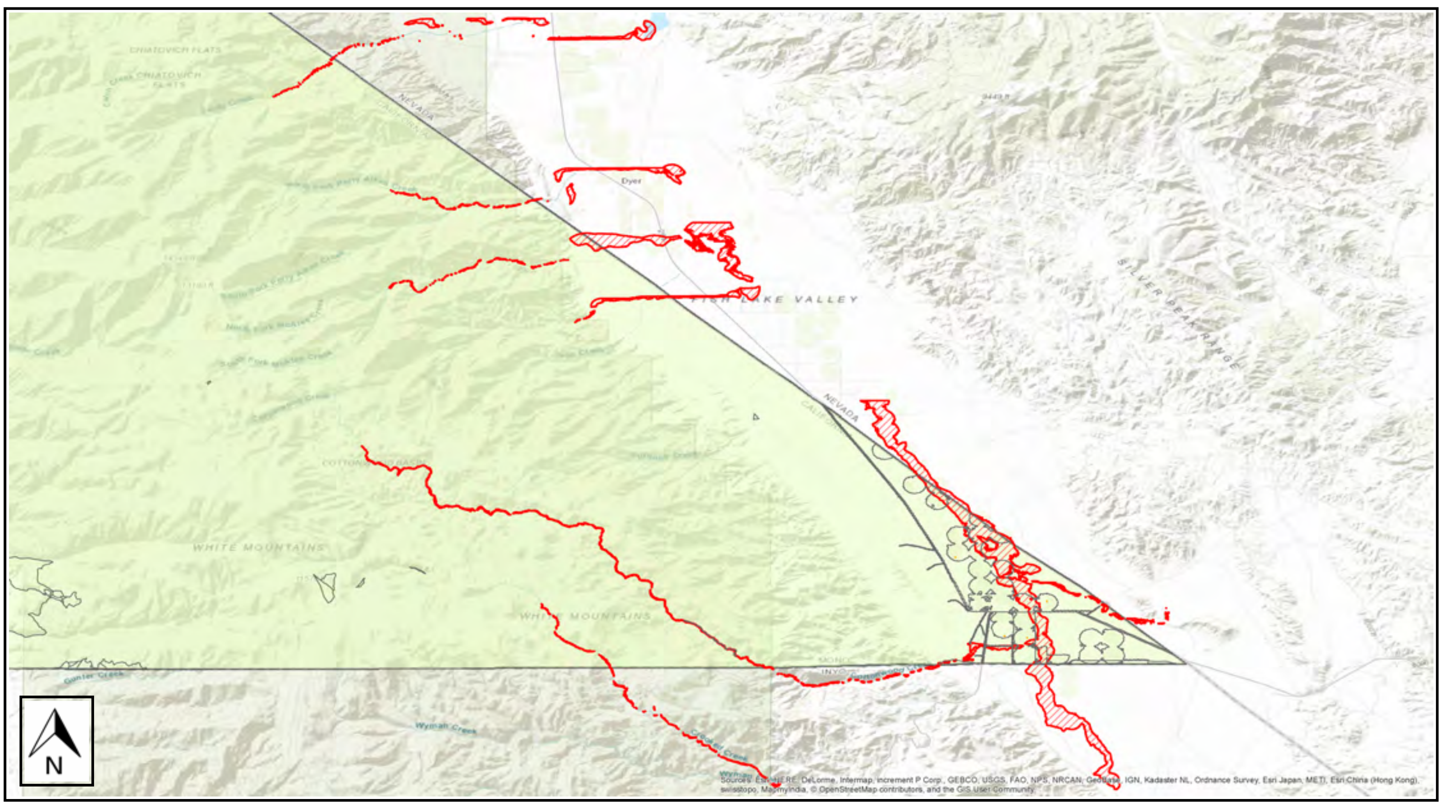
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 1
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

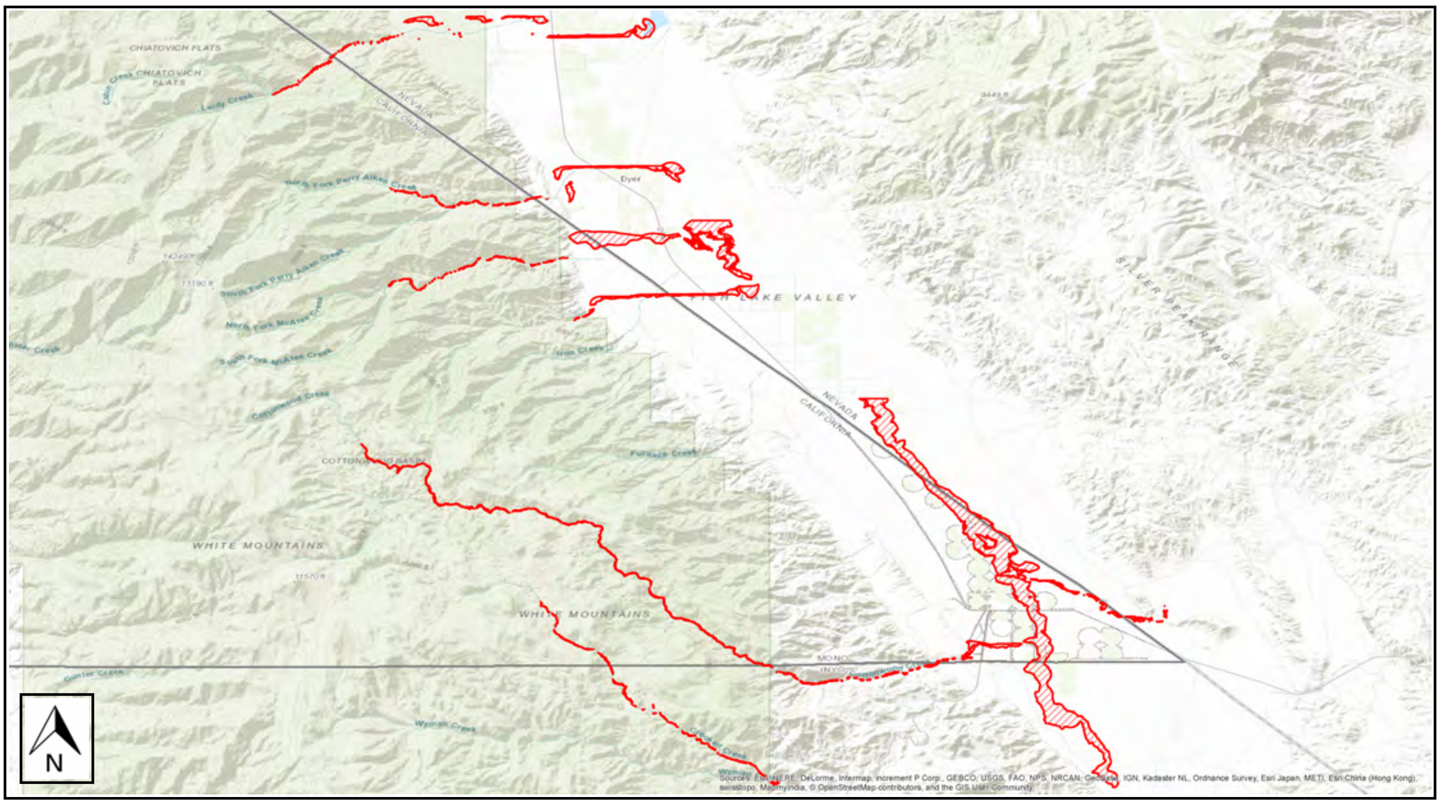


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

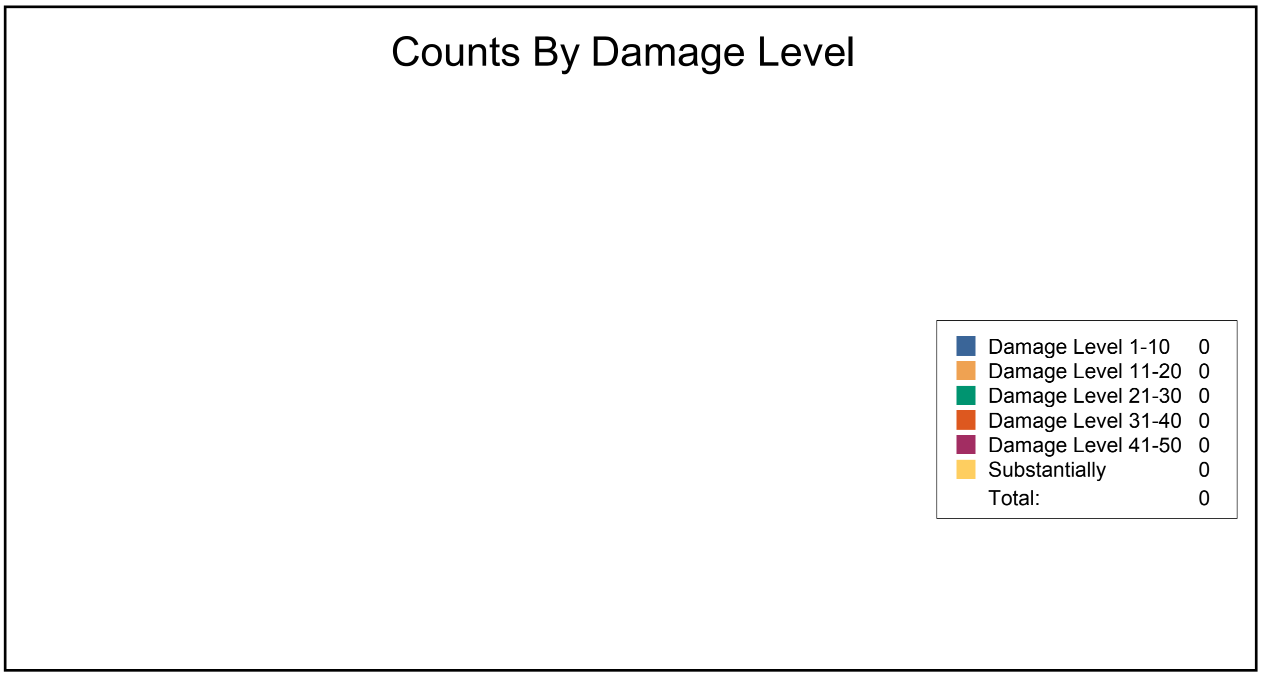


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

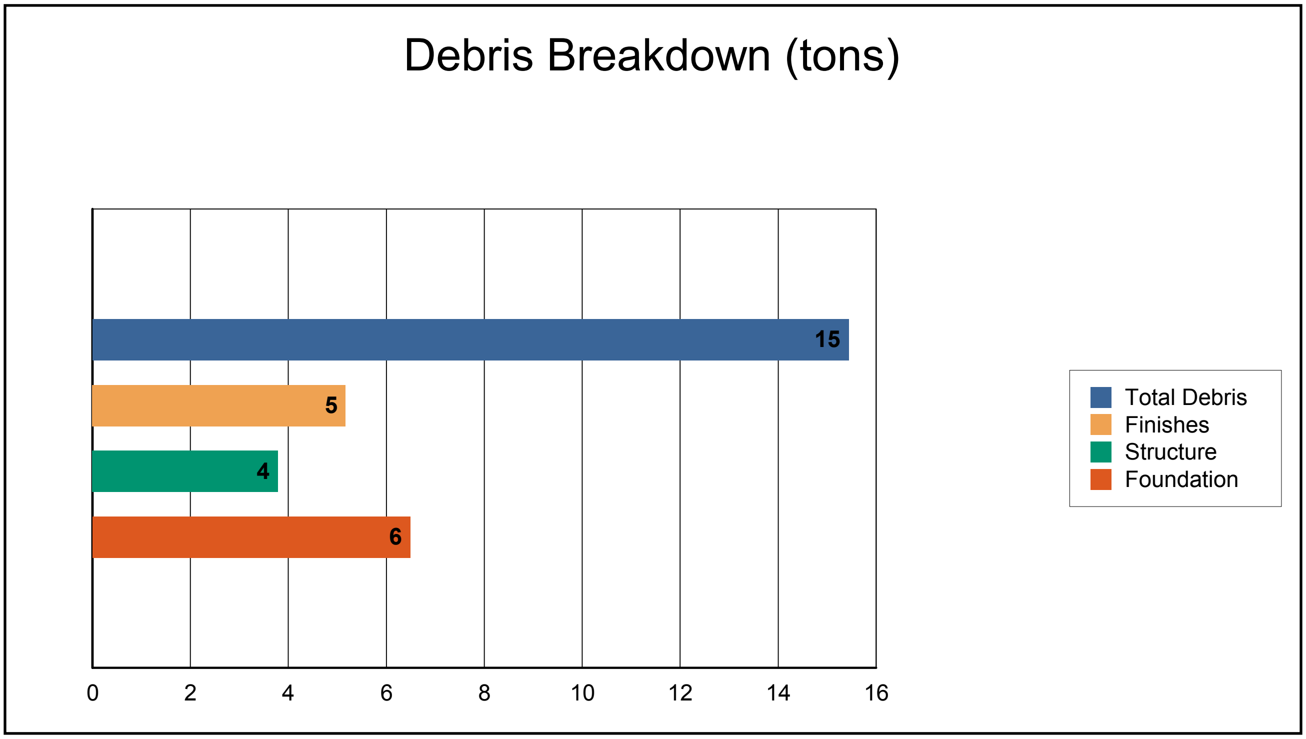
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

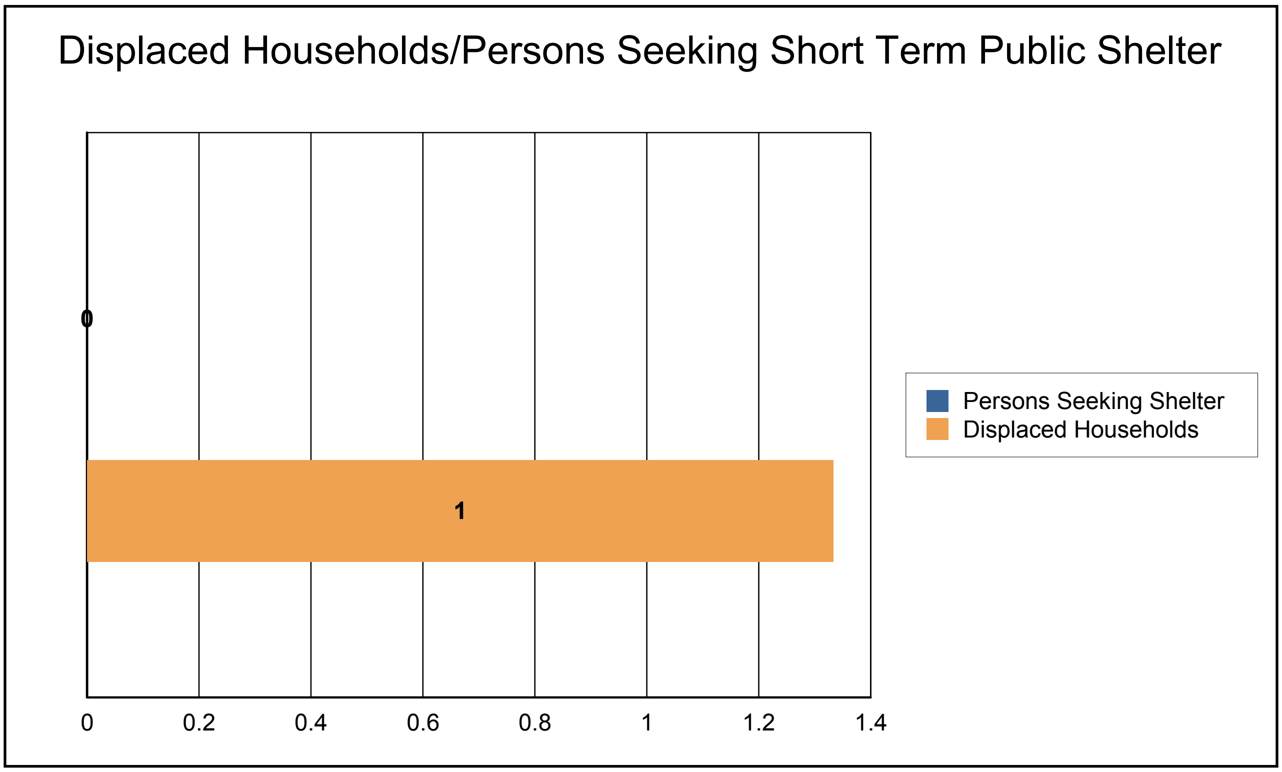


The model estimates that a total of 15 tons of debris will be generated. Of the total amount, Finishes comprises 33% of the total, Structure comprises 25% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 0.09 million dollars, which represents 4.97 % of the total replacement value of the scenario buildings.

Building-Related Losses

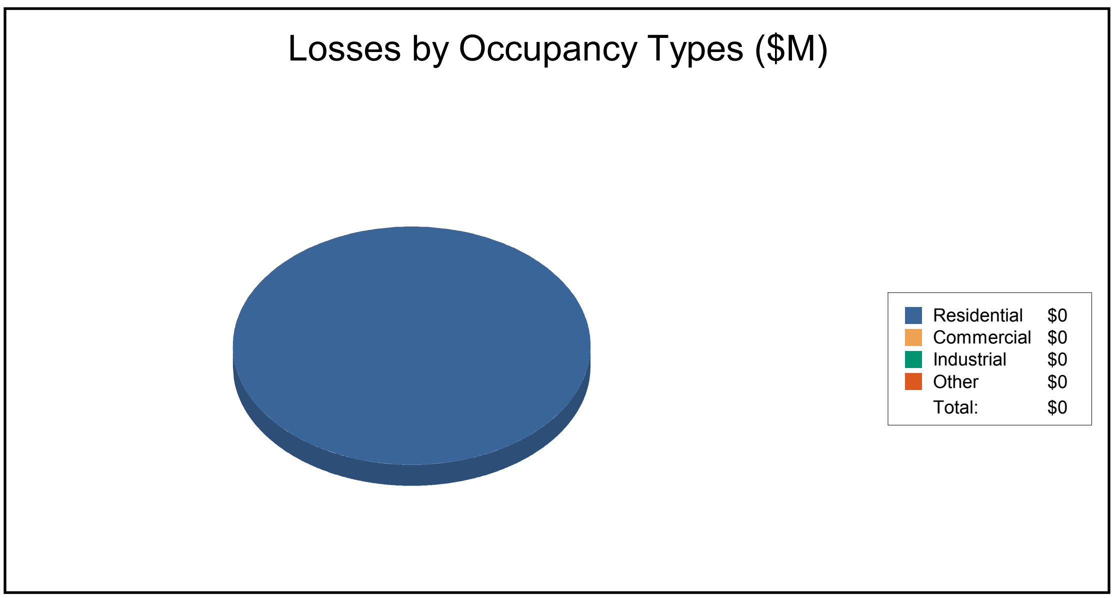
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.09 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 100.00% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.06	0.00	0.00	0.00	0.06
	Content	0.03	0.00	0.00	0.00	0.03
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.09**	**0.00**	**0.00**	**0.00**	**0.09**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.09**	**0.00**	**0.00**	**0.00**	**0.09**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

EARTHQUAKE • WIND • FLOOD

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 2

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

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FEMA

RiskMAP
Increasing Resilience Together

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Note:
Appendix A contains a complete listing of the counties contained in the region.

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Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

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Residential	2,459,157	89.2%
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Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

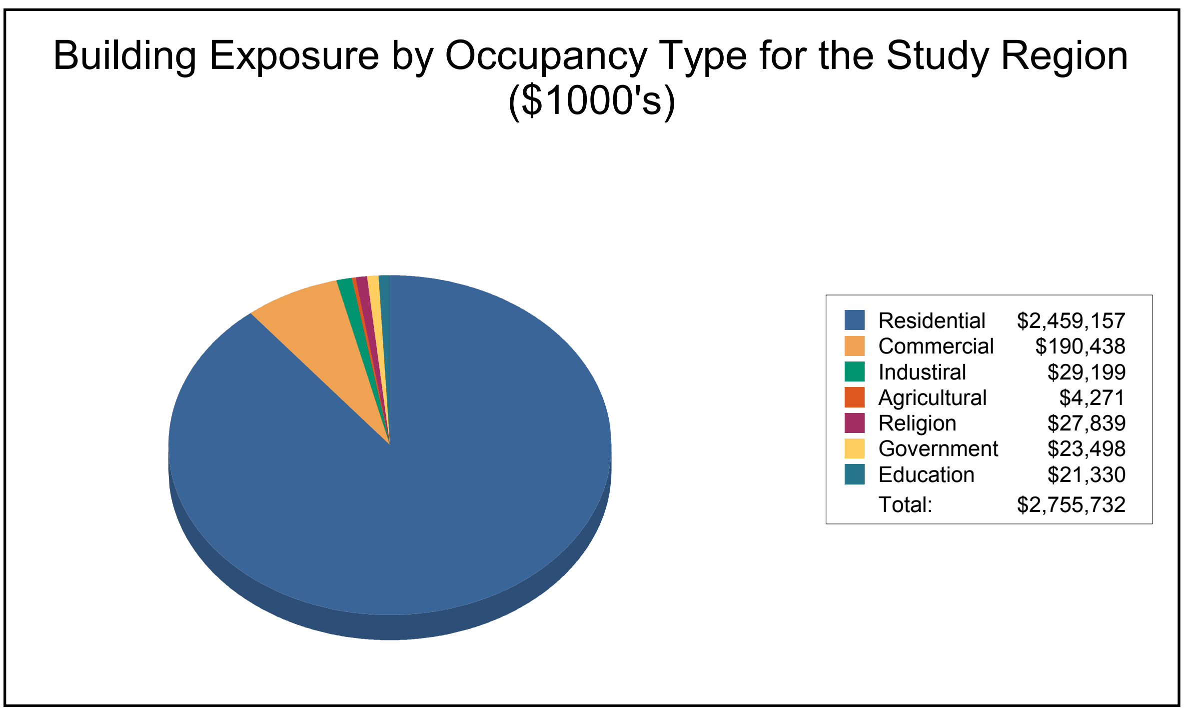
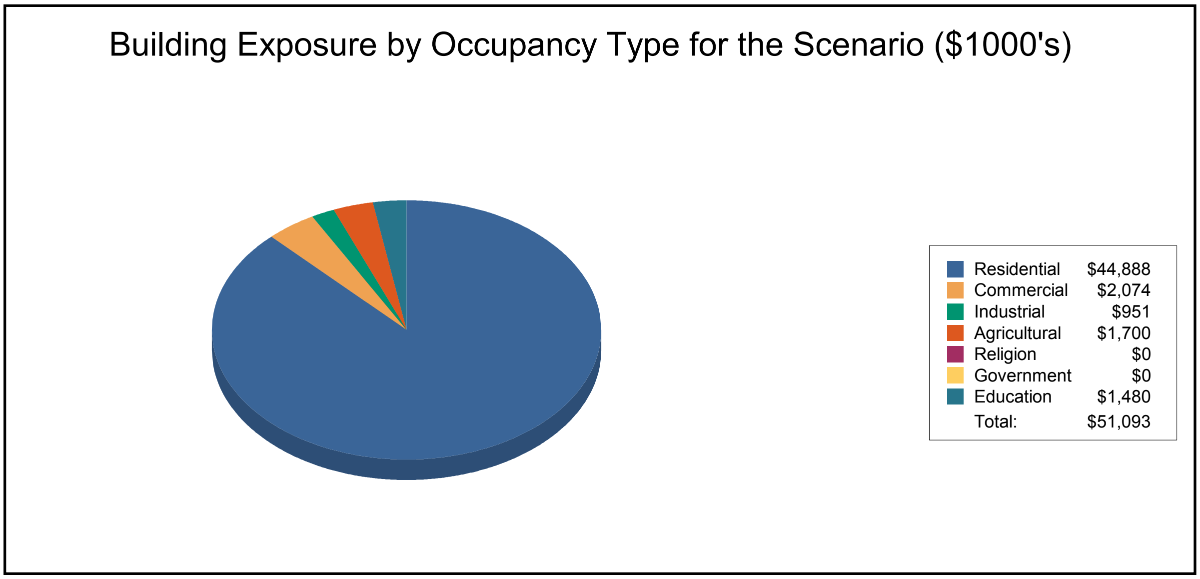


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	44,888	87.9%
Commercial	2,074	4.1%
Industrial	951	1.9%
Agricultural	1,700	3.3%
Religion	0	0.0%
Government	0	0.0%
Education	1,480	2.9%
Total	**51,093**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

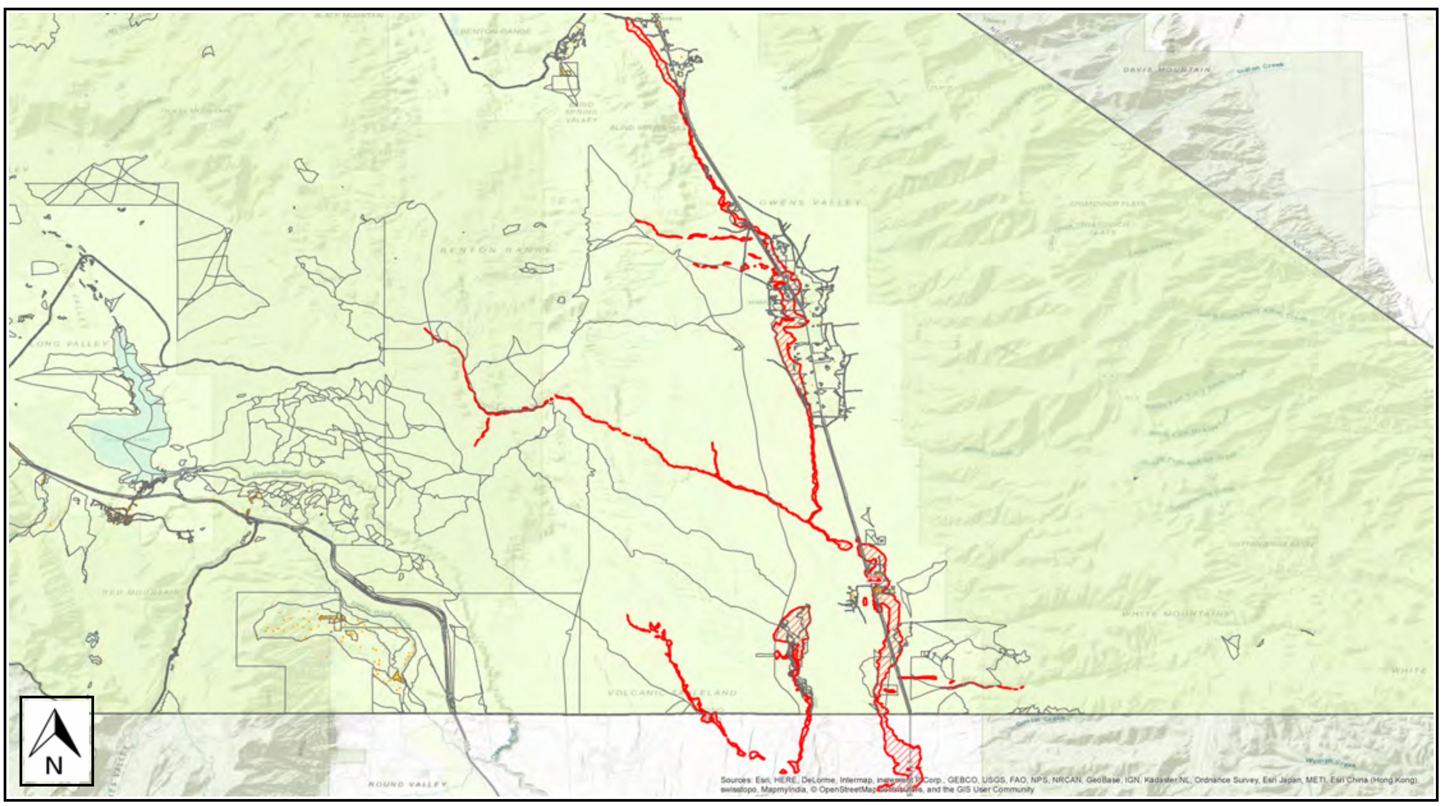
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 2
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 62 buildings will be at least moderately damaged. This is over 13% of the total number of buildings in the scenario. There are an estimated 48 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

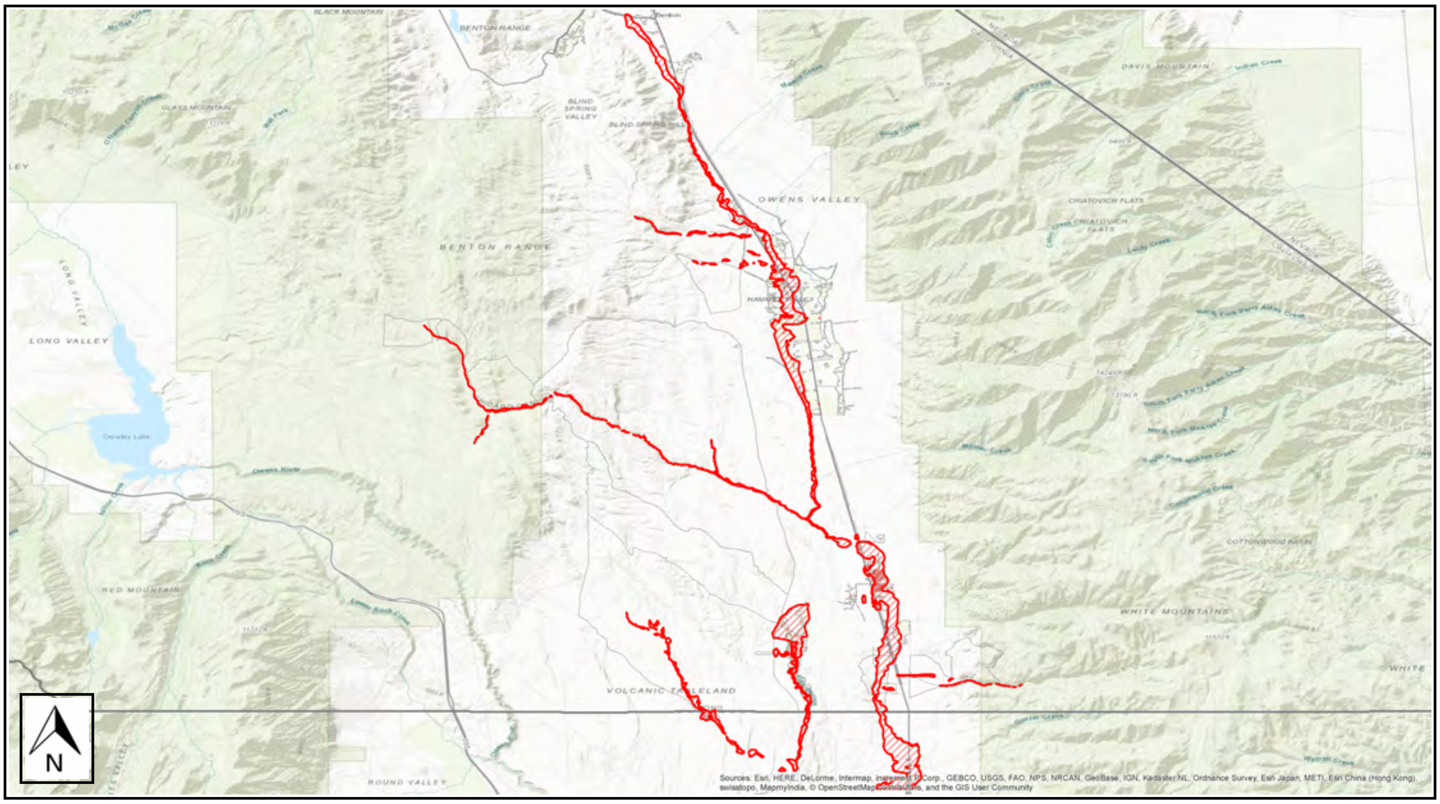


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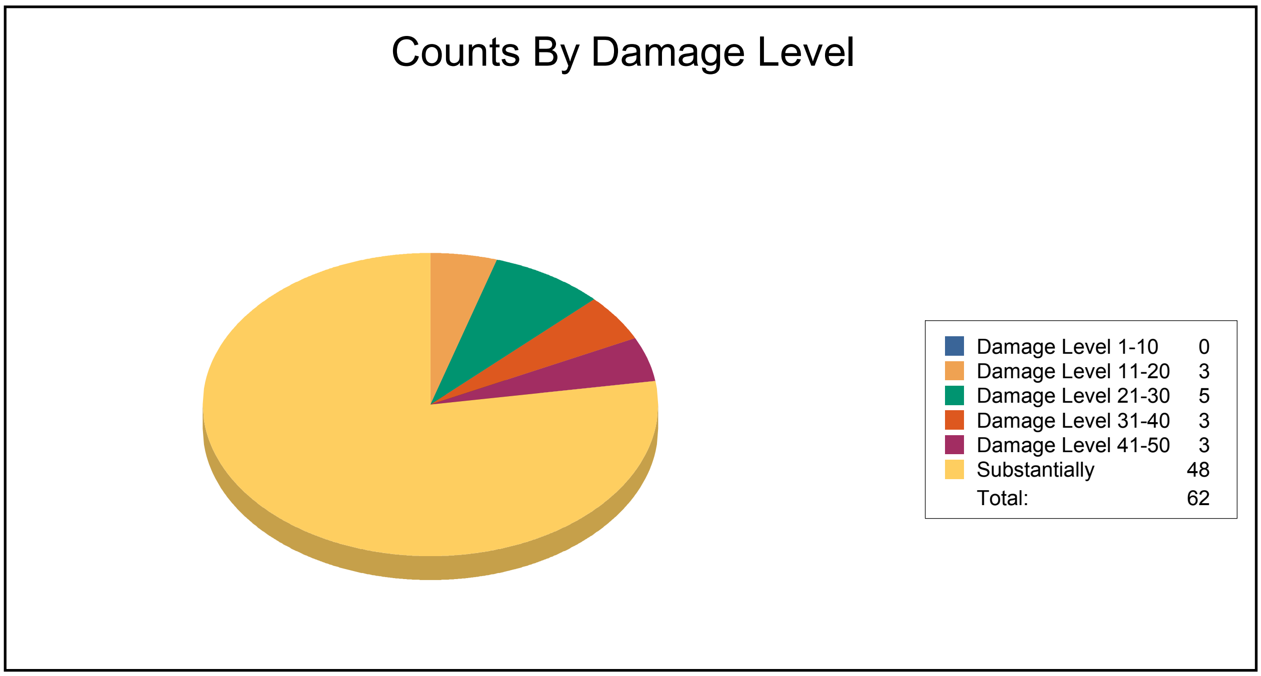
Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	3	4.84	5	8.06	3	4.84	3	4.84	48	77.42
Total	**0**		**3**		**5**		**3**		**3**		**48**	



FEMA

RiskMAP
Increasing Resilience Together

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	34	100
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	3	11	5	18	3	11	3	11	14	50

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	1	0	1
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

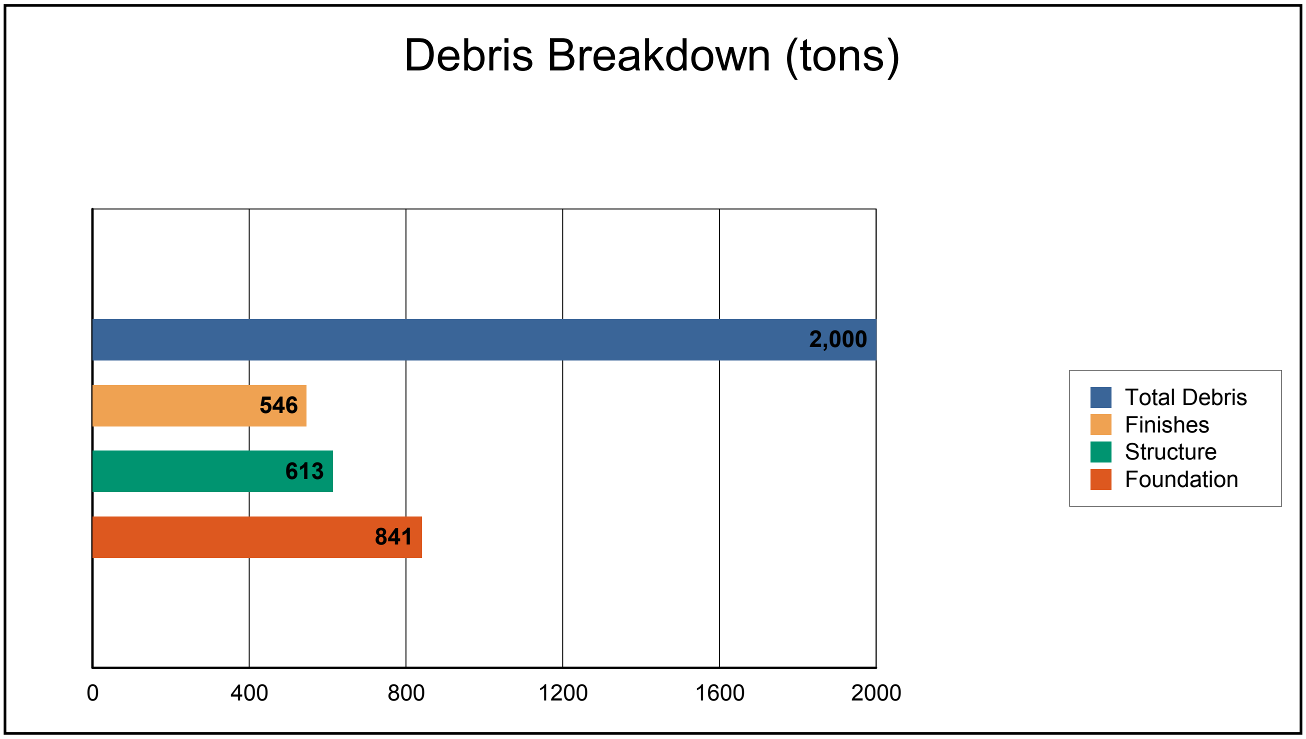
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

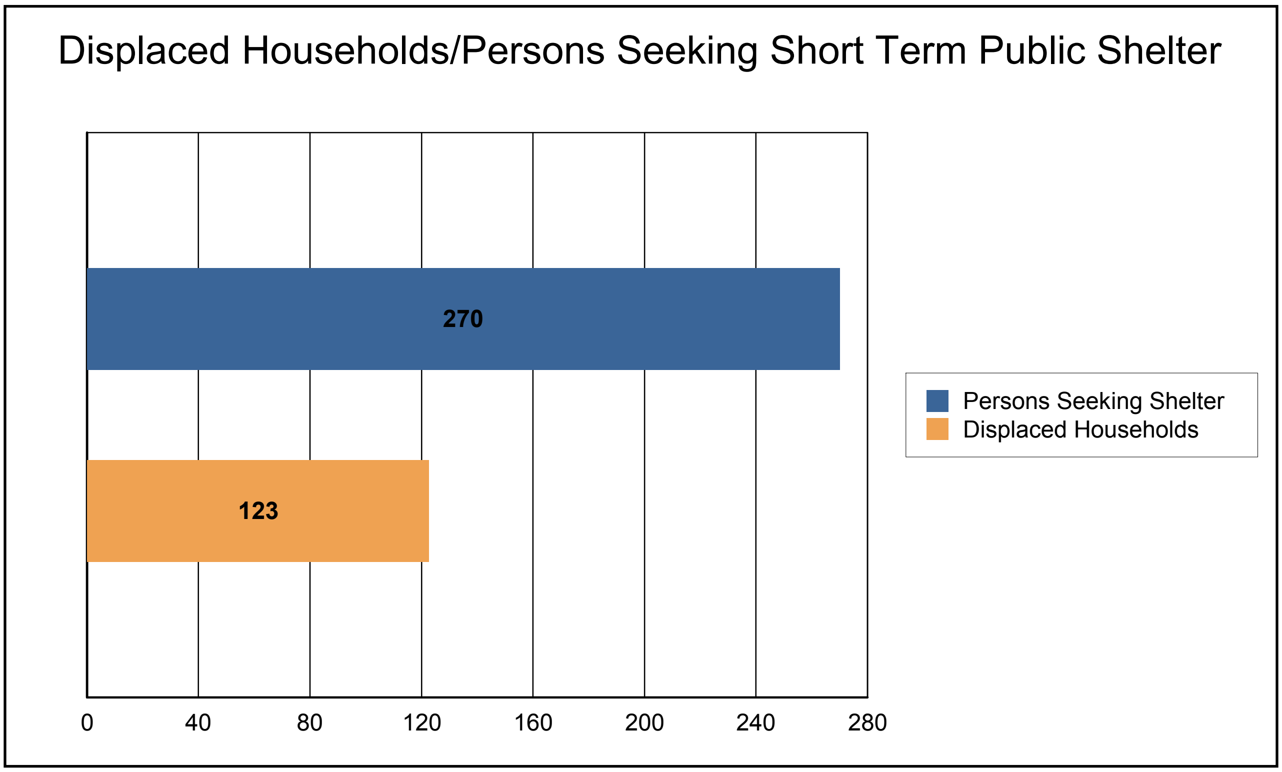


The model estimates that a total of 2,000 tons of debris will be generated. Of the total amount, Finishes comprises 27% of the total, Structure comprises 31% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 80 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 123 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 270 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 15.61 million dollars, which represents 30.54 % of the total replacement value of the scenario buildings.

Building-Related Losses

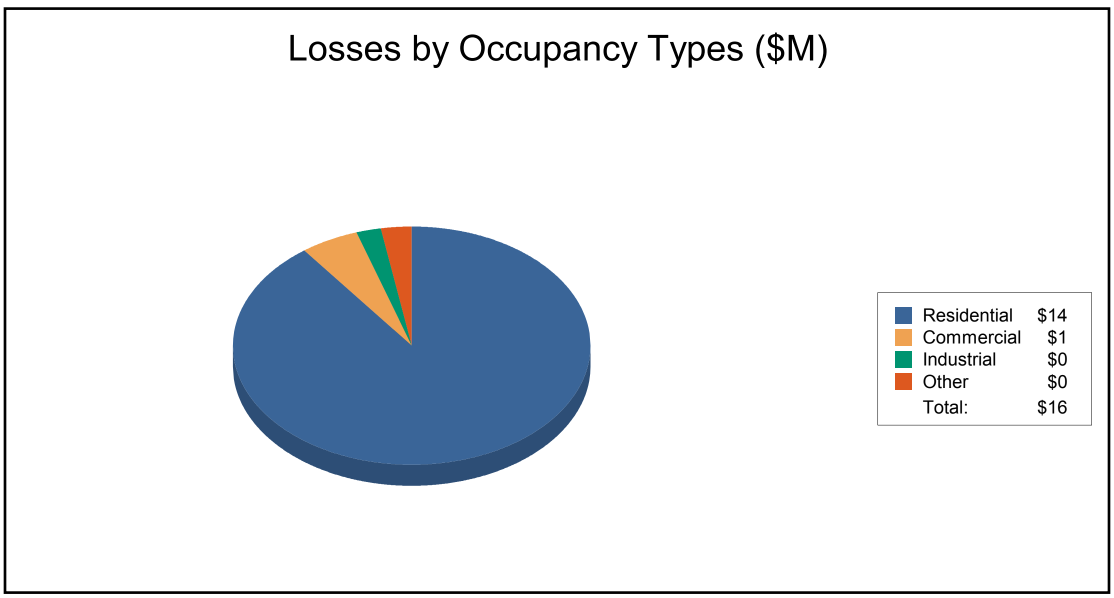
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 15.60 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 89.75% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	9.26	0.25	0.13	0.13	9.77
	Content	4.73	0.58	0.17	0.28	5.75
	Inventory	0.00	0.01	0.02	0.04	0.07
	Subtotal	**14.00**	**0.83**	**0.32**	**0.44**	**15.60**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.01	0.00	0.00	0.00	0.01
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**
ALL	**Total**	**14.01**	**0.83**	**0.32**	**0.44**	**15.61**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 3

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

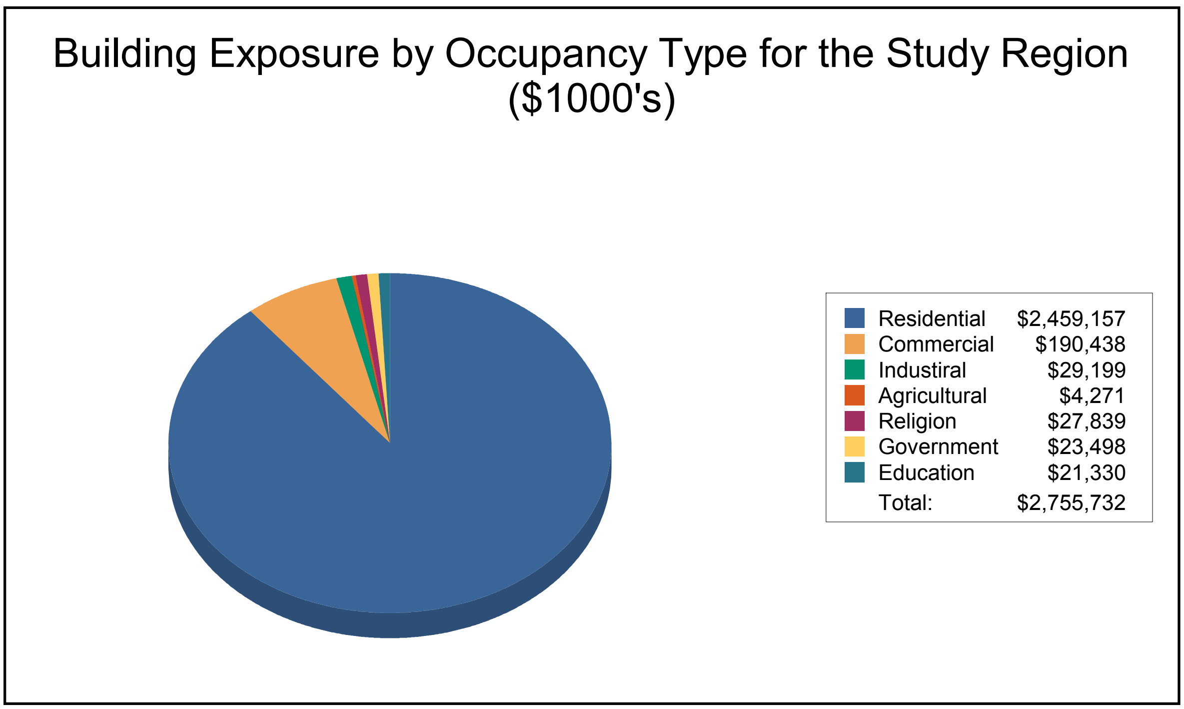
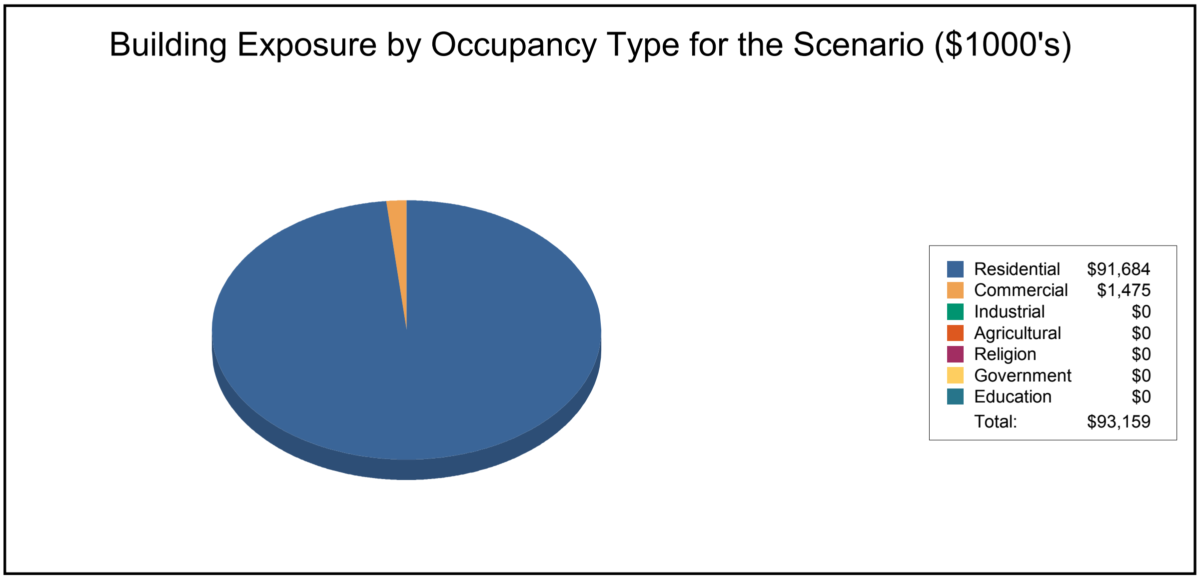


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	91,684	98.4%
Commercial	1,475	1.6%
Industrial	0	0.0%
Agricultural	0	0.0%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**93,159**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

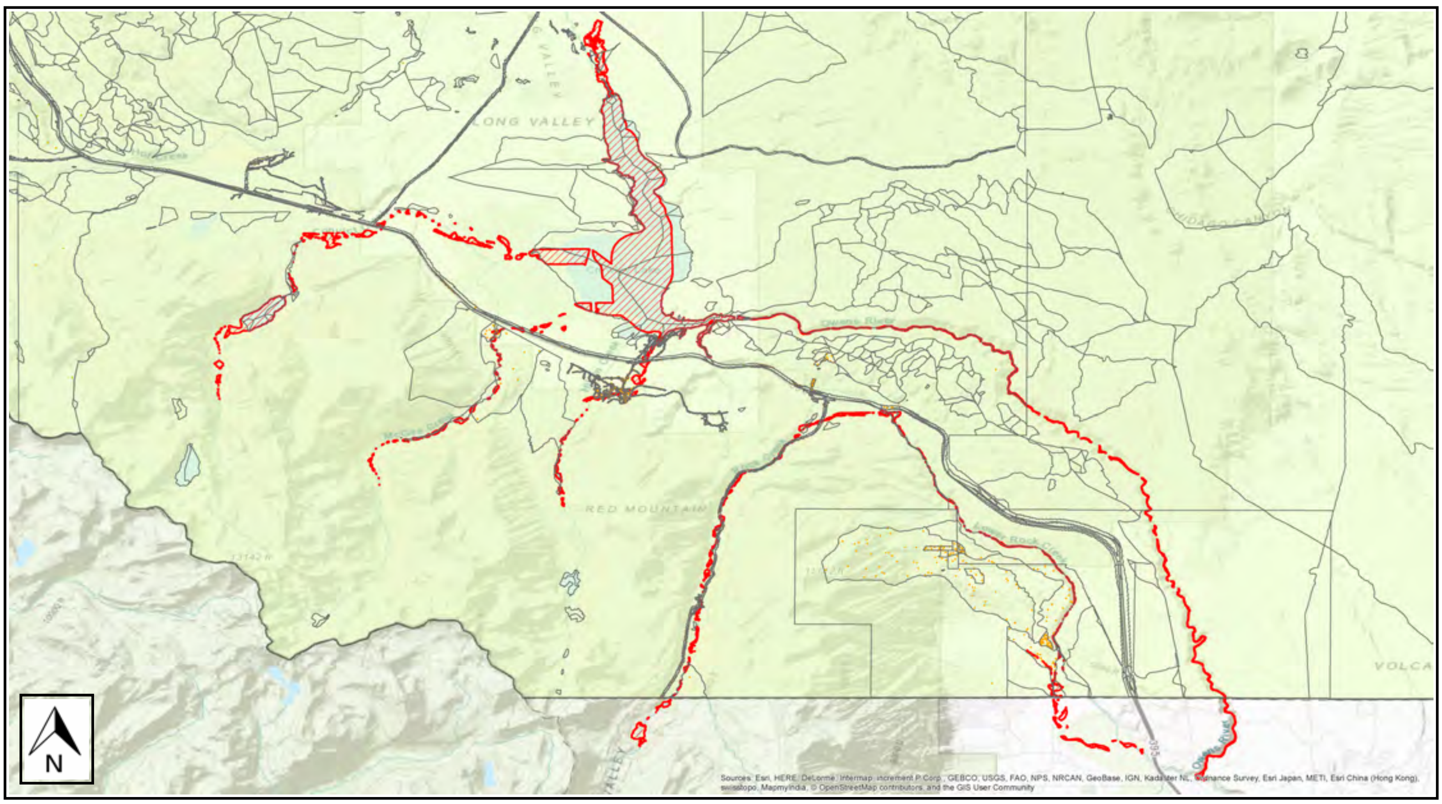
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 3
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 7 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

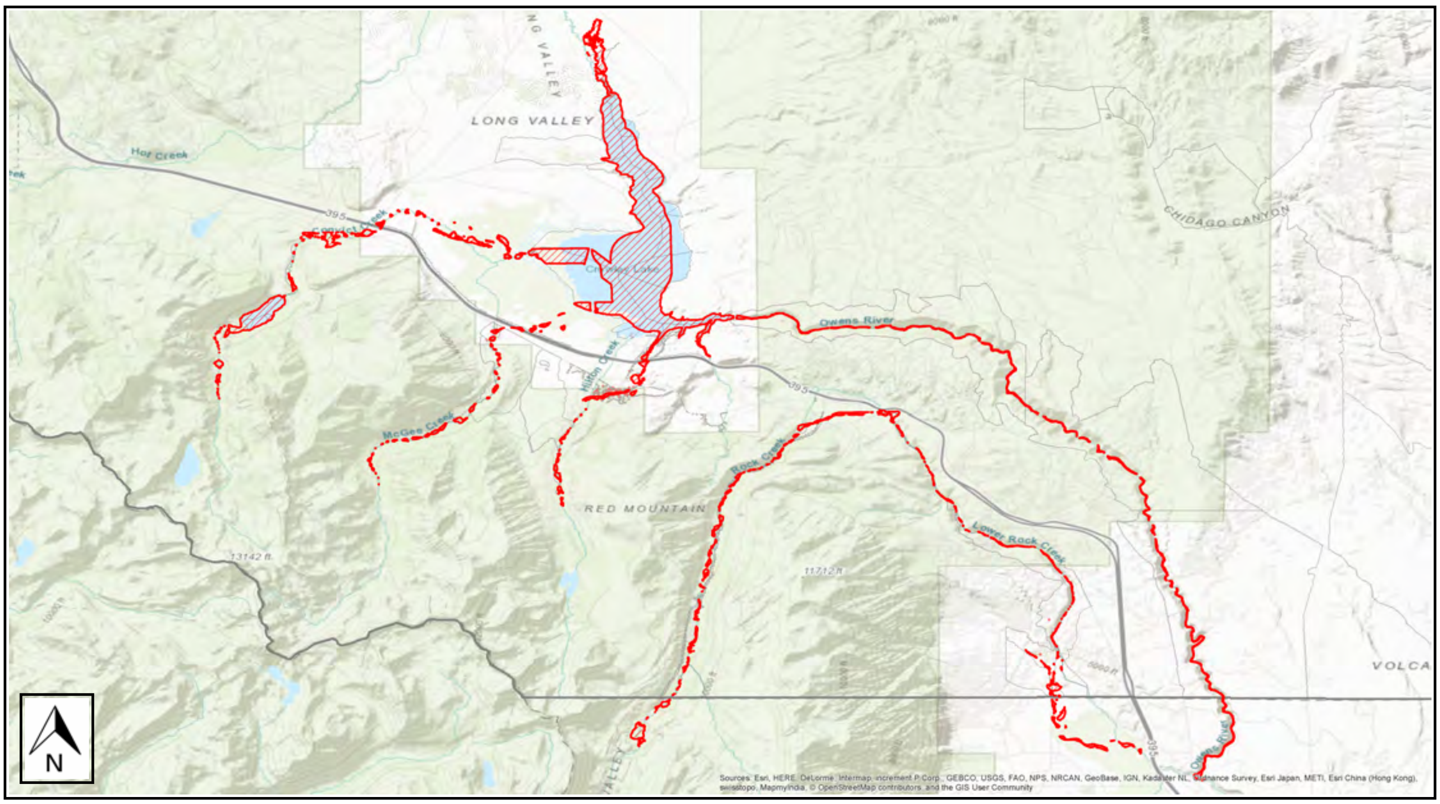


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	7	100.00
Total	**0**		**0**		**0**		**0**		**0**		**7**	

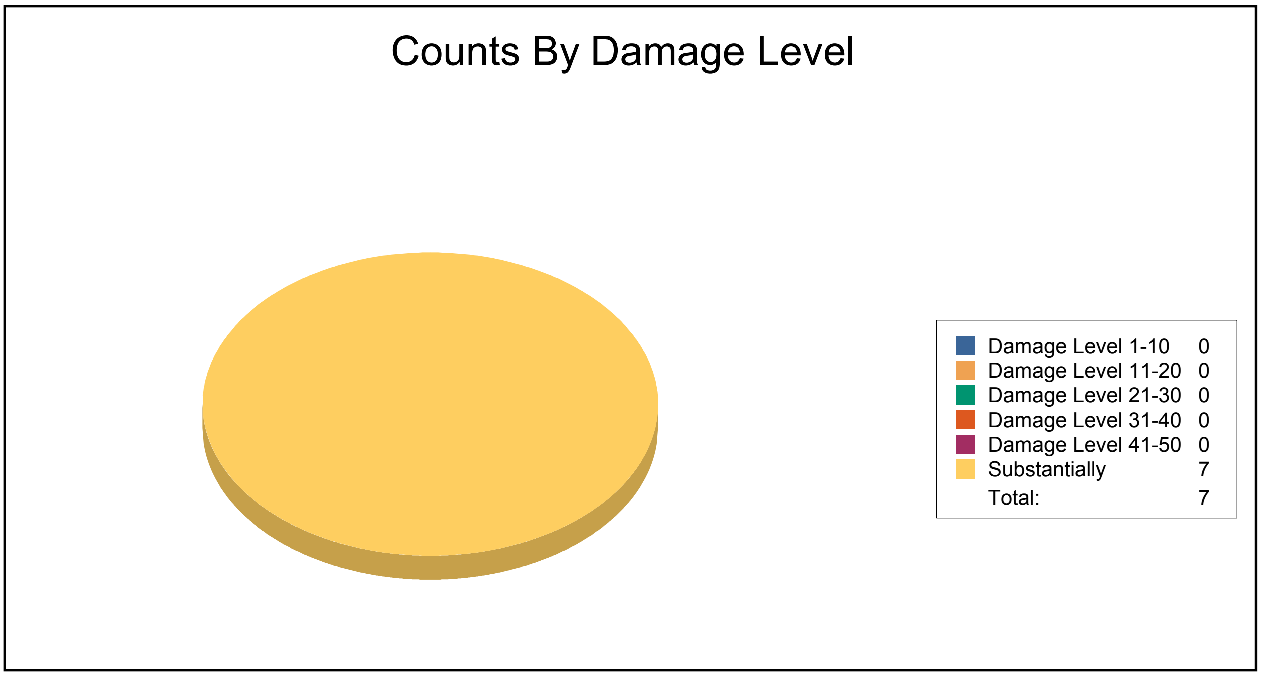


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	1	100
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	6	100

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

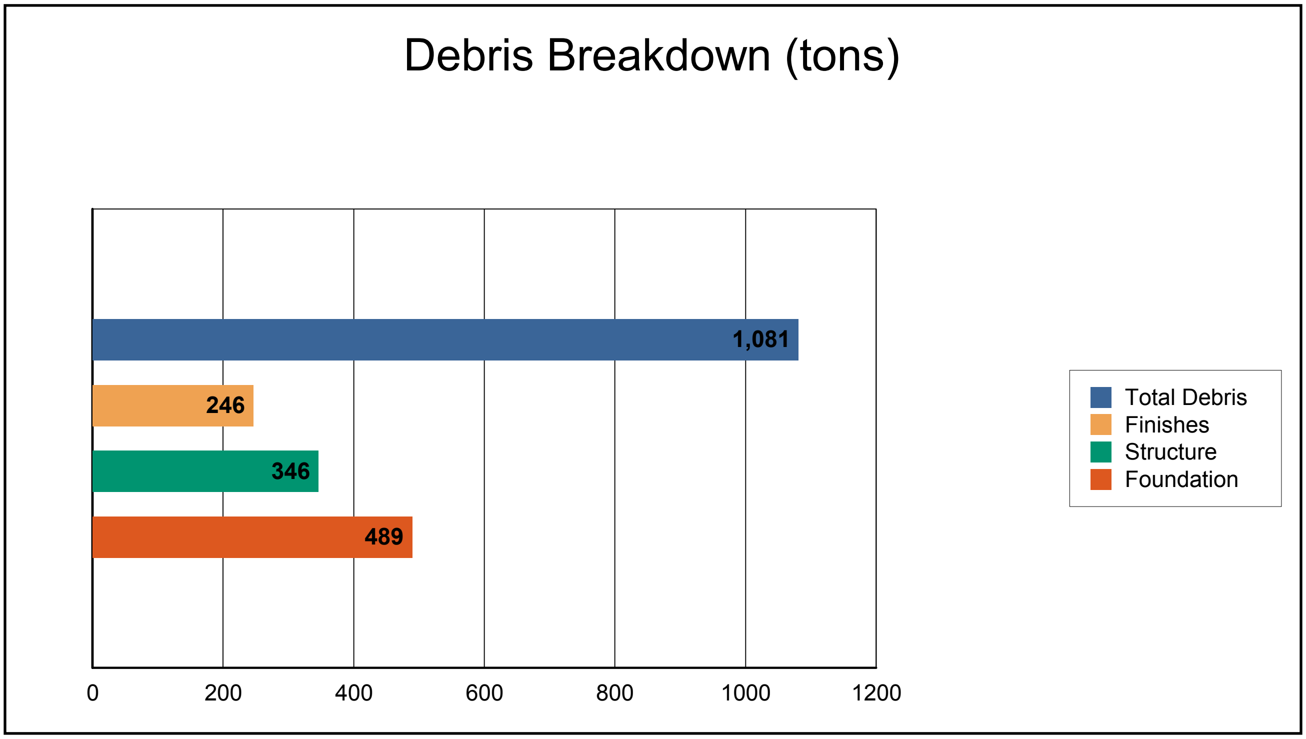
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

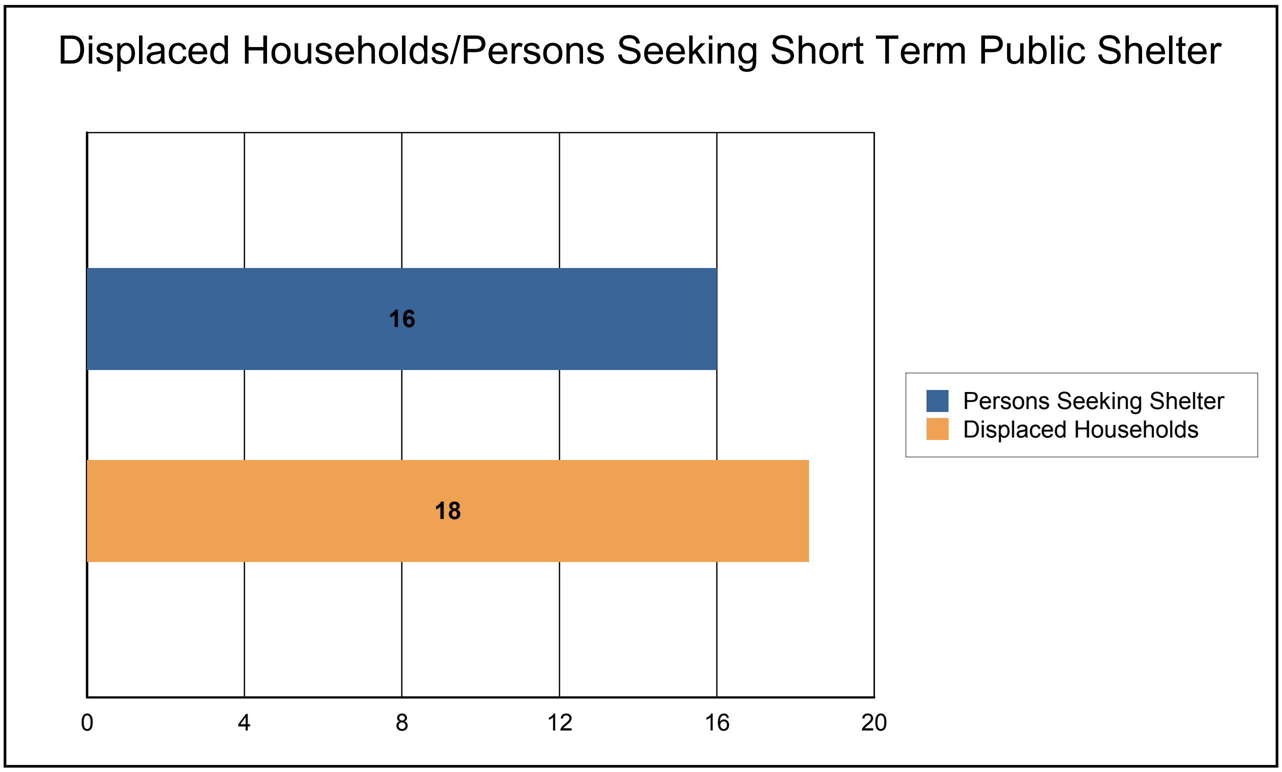


The model estimates that a total of 1,081 tons of debris will be generated. Of the total amount, Finishes comprises 23% of the total, Structure comprises 32% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 43 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 18 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 16 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 7.35 million dollars, which represents 7.89 % of the total replacement value of the scenario buildings.

Building-Related Losses

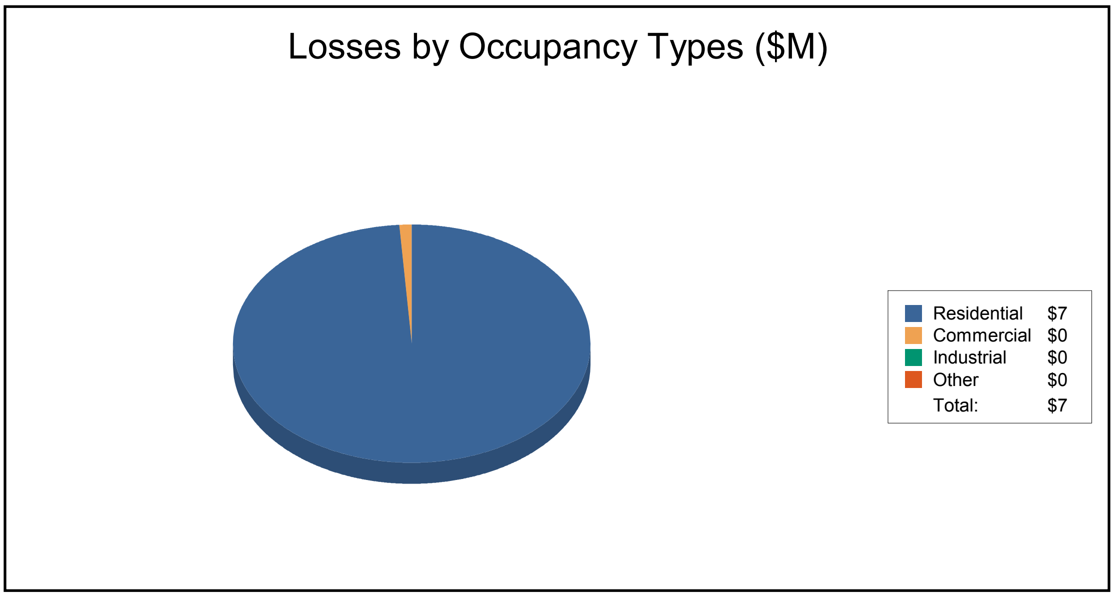
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 7.35 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 99.01% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	4.90	0.03	0.00	0.00	4.94
	Content	2.38	0.04	0.00	0.00	2.42
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**7.28**	**0.07**	**0.00**	**0.00**	**7.35**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**7.28**	**0.07**	**0.00**	**0.00**	**7.35**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 4

Print Date: Wednesday, January 24, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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Note:
Appendix A contains a complete listing of the counties contained in the region .

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

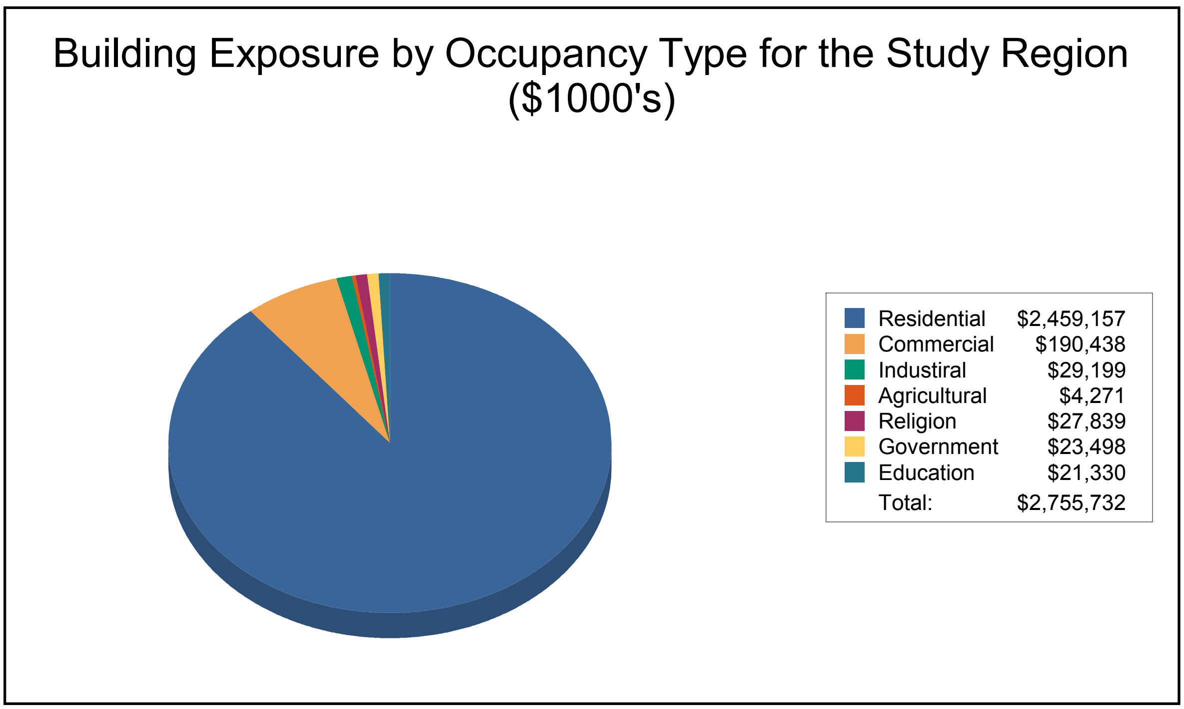
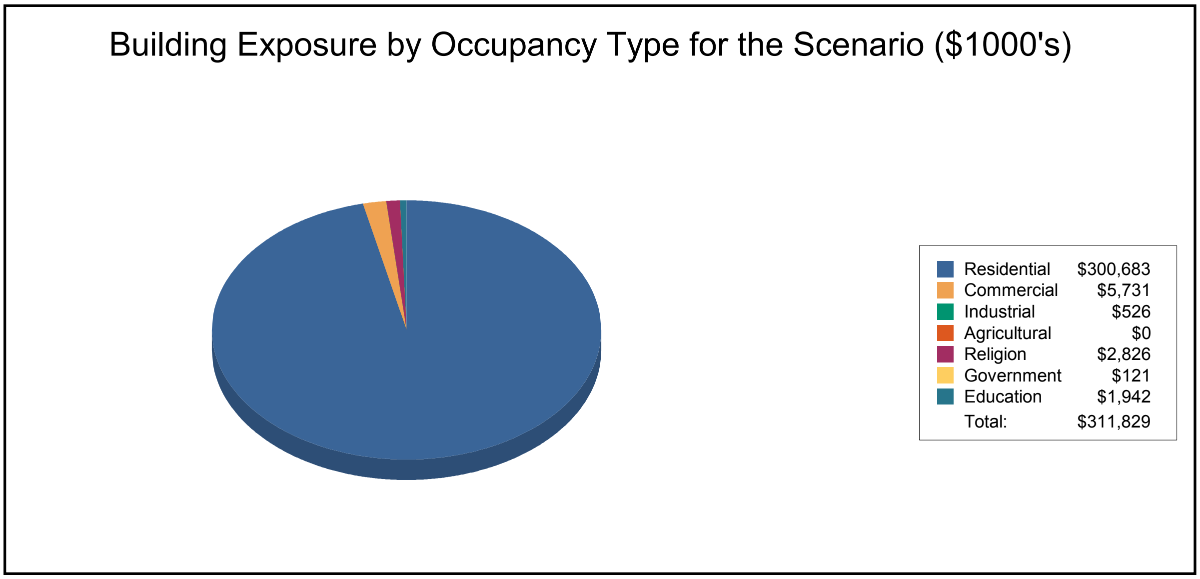


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	300,683	96.4%
Commercial	5,731	1.8%
Industrial	526	0.2%
Agricultural	0	0.0%
Religion	2,826	0.9%
Government	121	0.0%
Education	1,942	0.6%
Total	**311,829**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

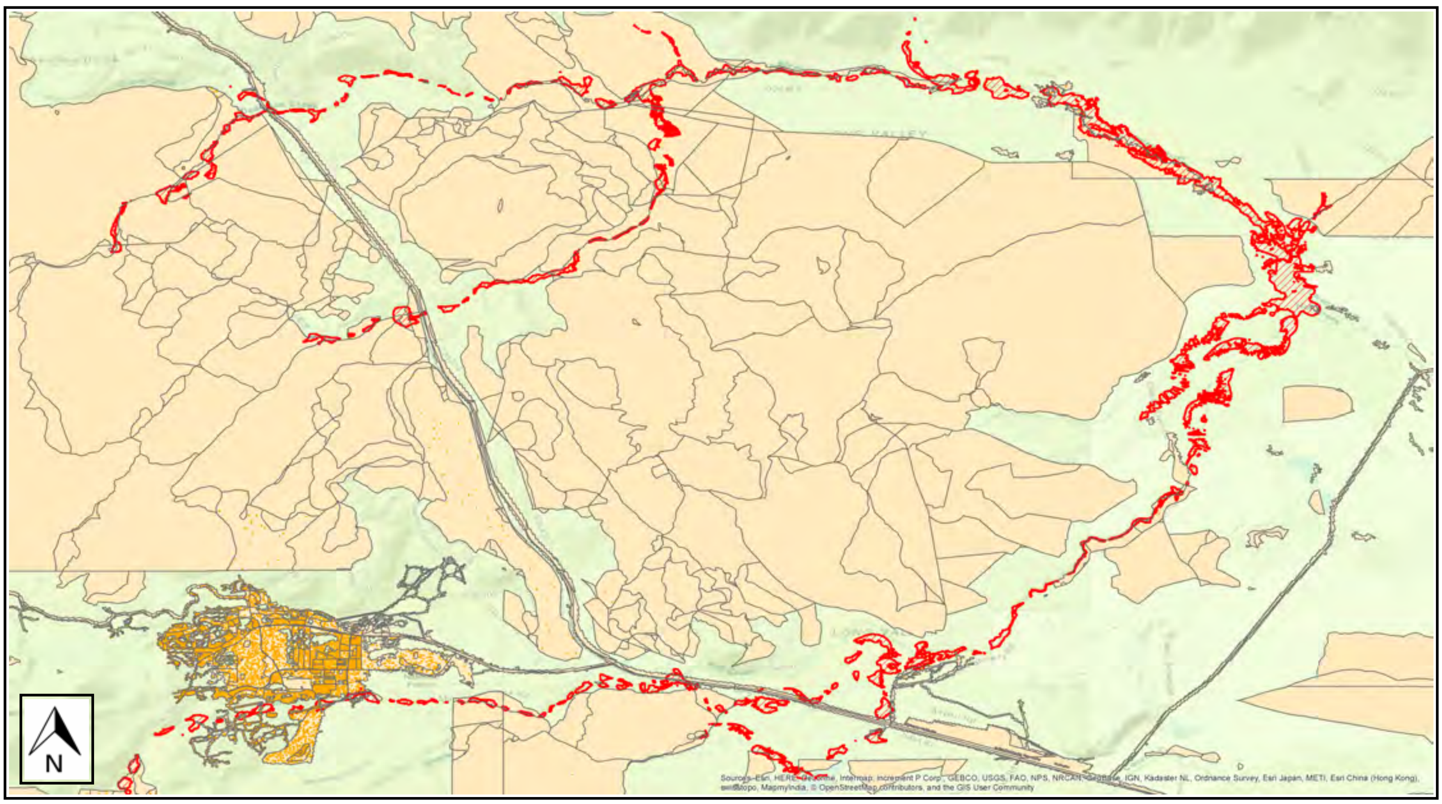
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 4
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 56% of the total number of buildings in the scenario. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

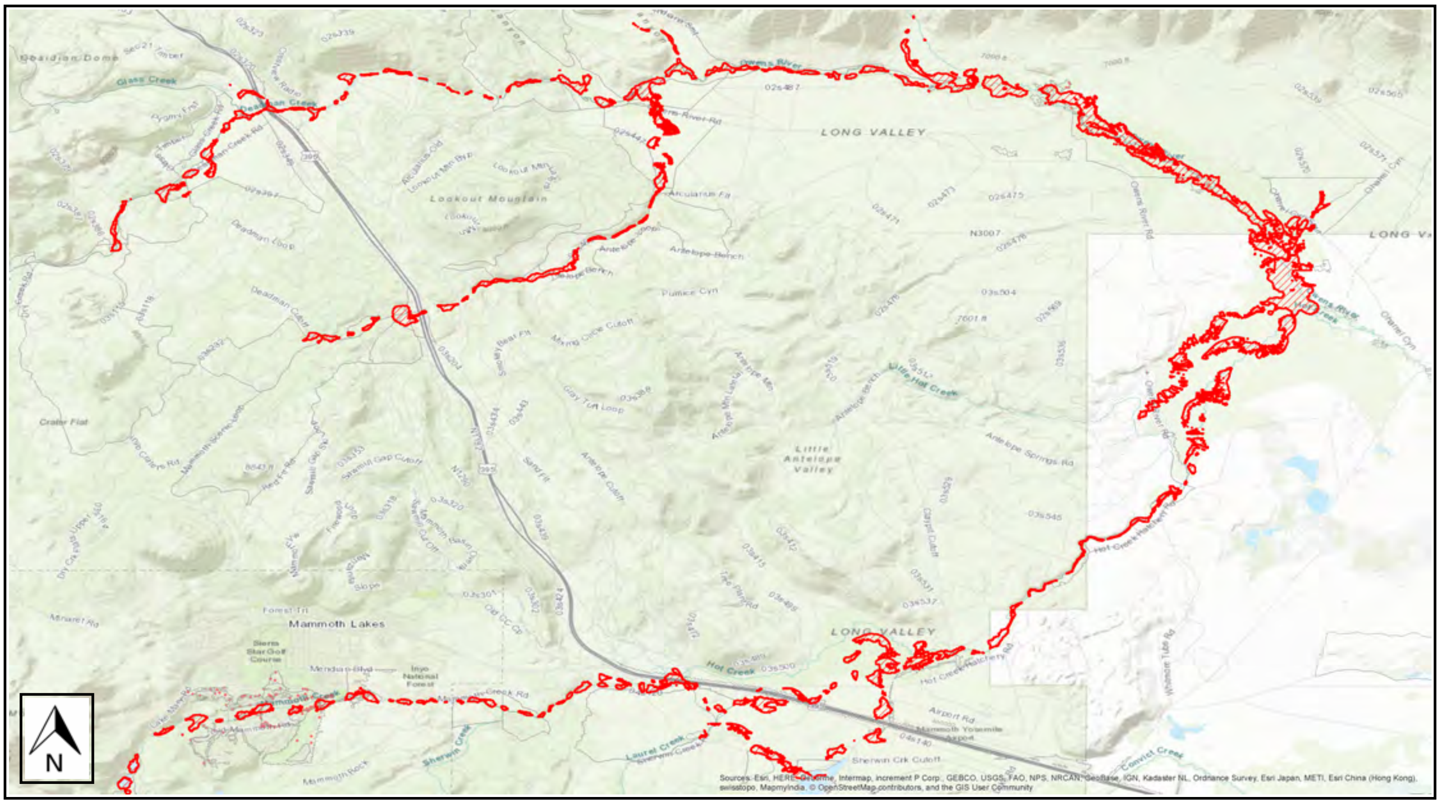


Table 3: Expected Building Damage by Occupancy

Occupancy	1-10 Count	1-10 (%)	11-20 Count	11-20 (%)	21-30 Count	21-30 (%)	31-40 Count	31-40 (%)	41-50 Count	41-50 (%)	Substantially Count	Substantially (%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	1	11.11	3	33.33	1	11.11	2	22.22	1	11.11	1	11.11
Total	**1**		**3**		**1**		**2**		**1**		**1**	

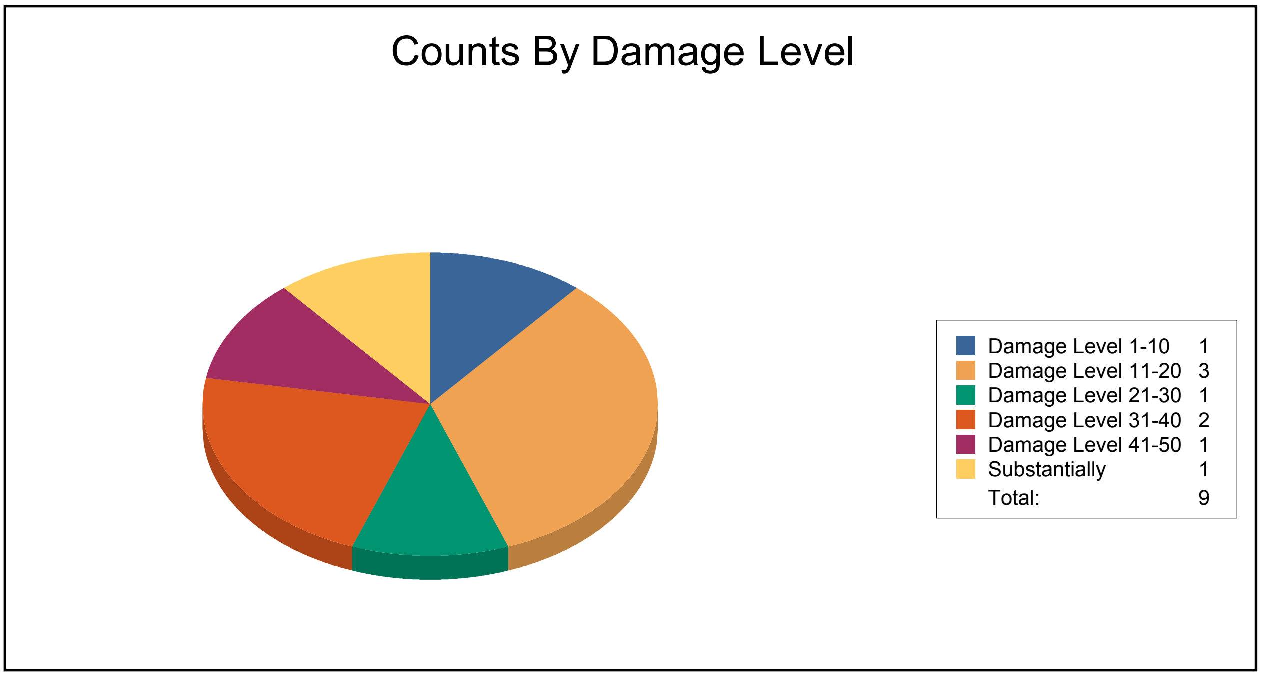


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	1	11	3	33	1	11	2	22	1	11	1	11

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

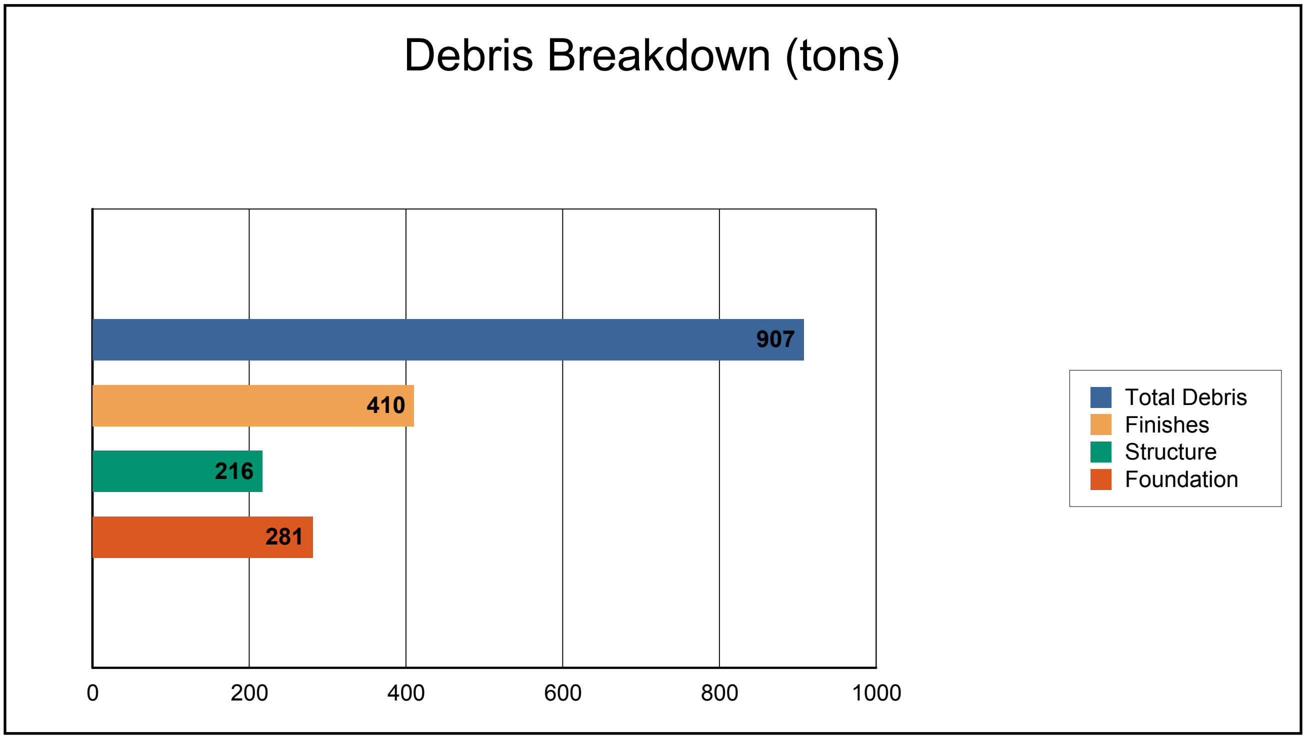
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

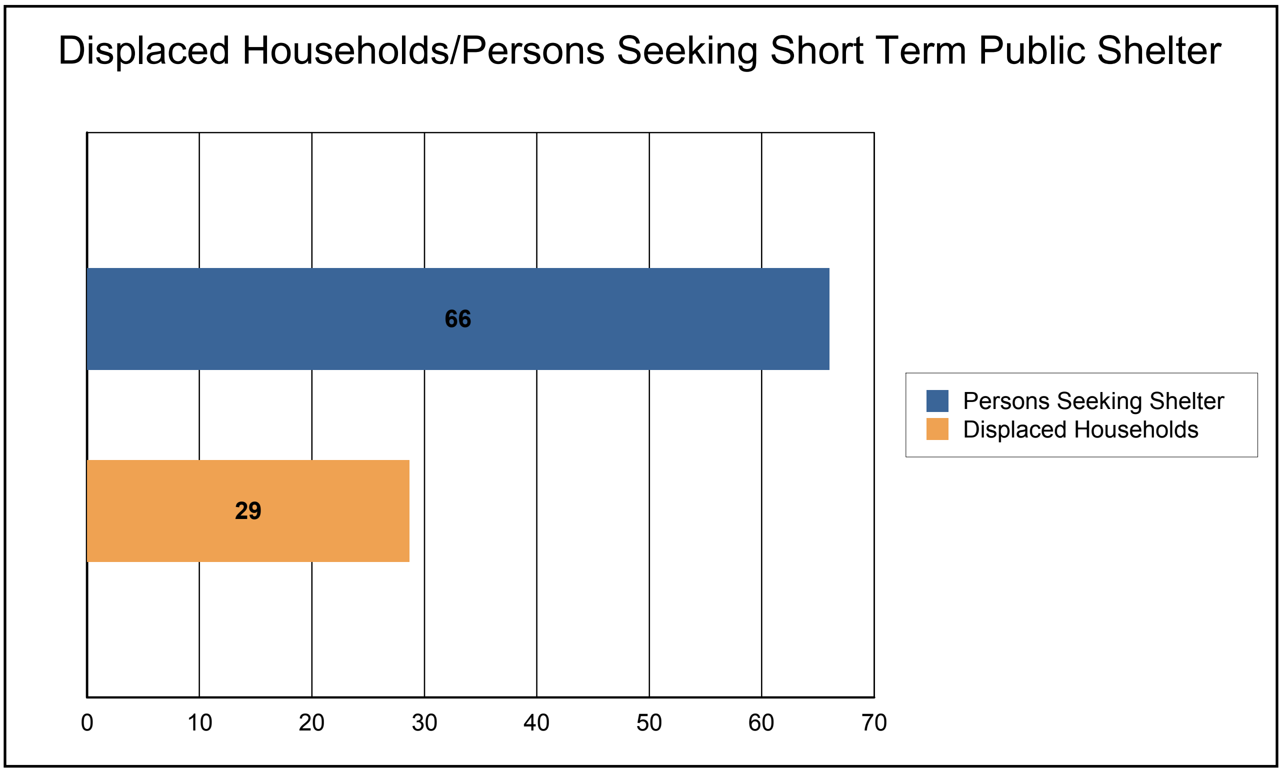


The model estimates that a total of 907 tons of debris will be generated. Of the total amount, Finishes comprises 45% of the total, Structure comprises 24% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 36 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 29 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 66 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 8.89 million dollars, which represents 2.85 % of the total replacement value of the scenario buildings.

Building-Related Losses

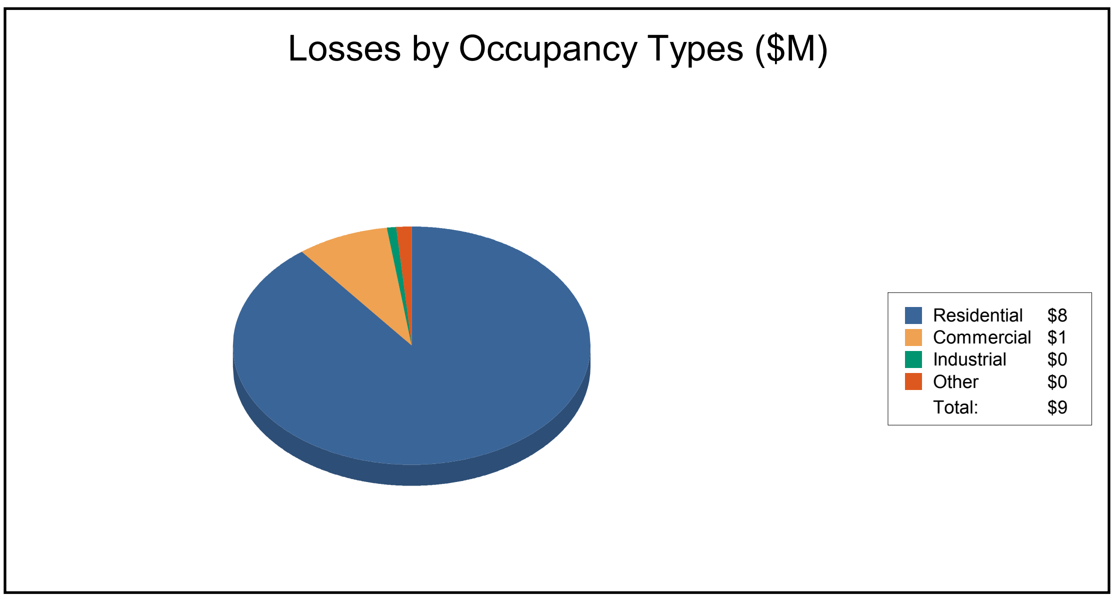
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 8.88 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 89.34% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	5.08	0.17	0.02	0.02	5.29
	Content	2.86	0.57	0.05	0.11	3.59
	Inventory	0.00	0.01	0.00	0.00	0.01
	Subtotal	**7.94**	**0.74**	**0.07**	**0.13**	**8.88**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.01**	**0.00**	**0.00**	**0.01**
ALL	**Total**	**7.94**	**0.75**	**0.07**	**0.13**	**8.89**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 5

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region .

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

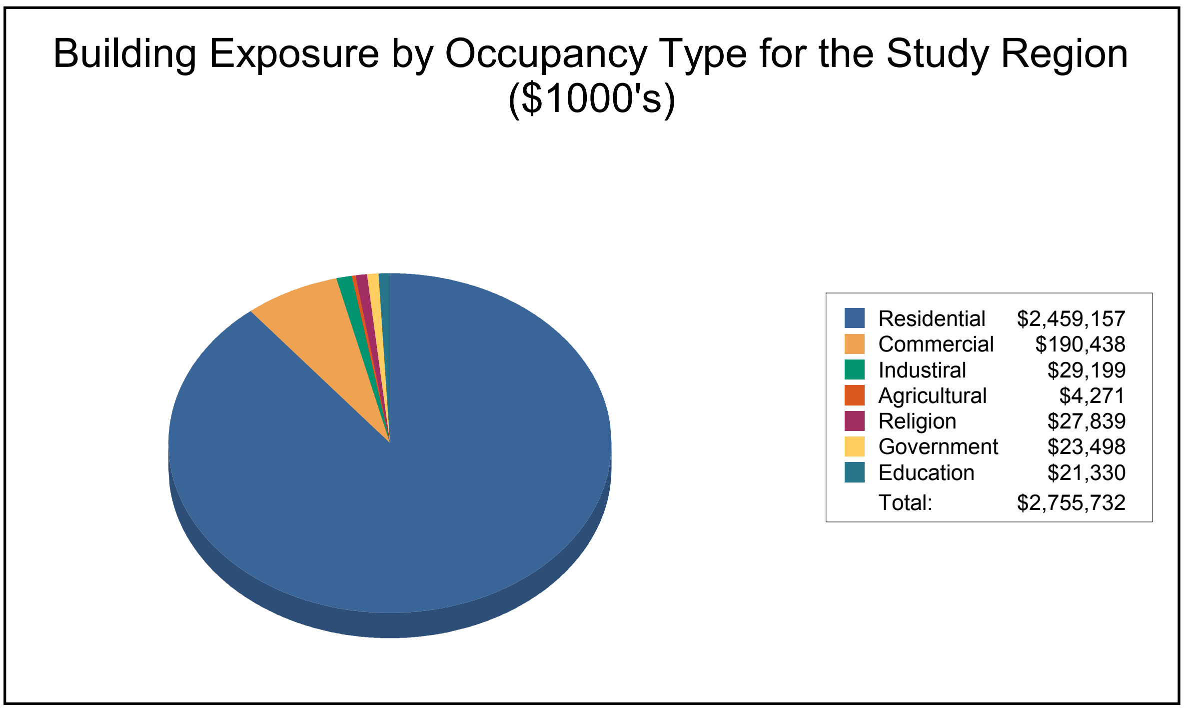
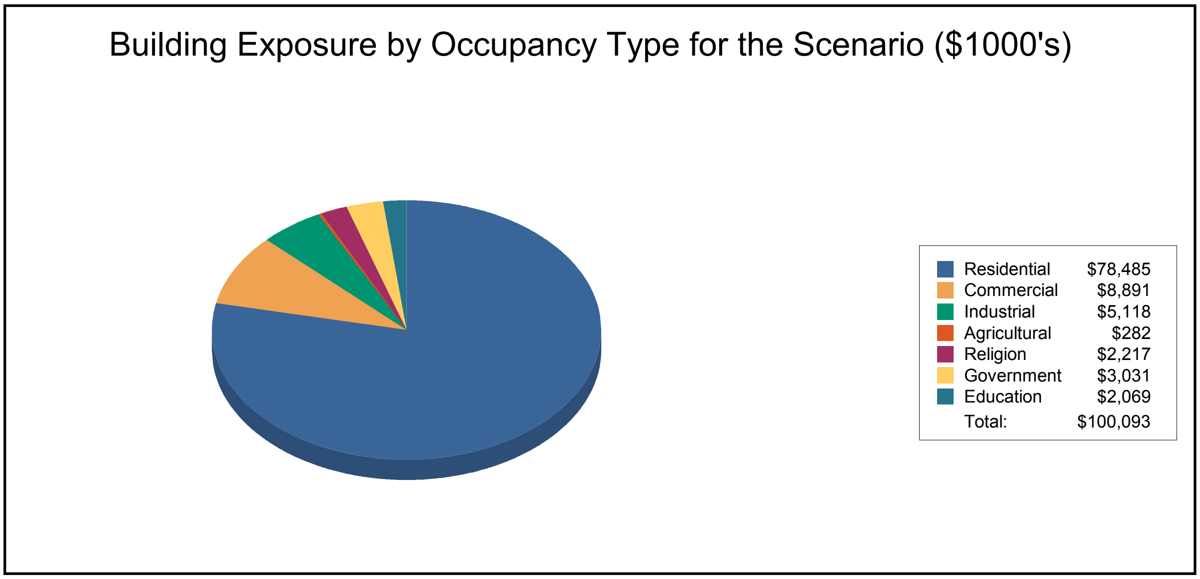


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	78,485	78.4%
Commercial	8,891	8.9%
Industrial	5,118	5.1%
Agricultural	282	0.3%
Religion	2,217	2.2%
Government	3,031	3.0%
Education	2,069	2.1%
Total	**100,093**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

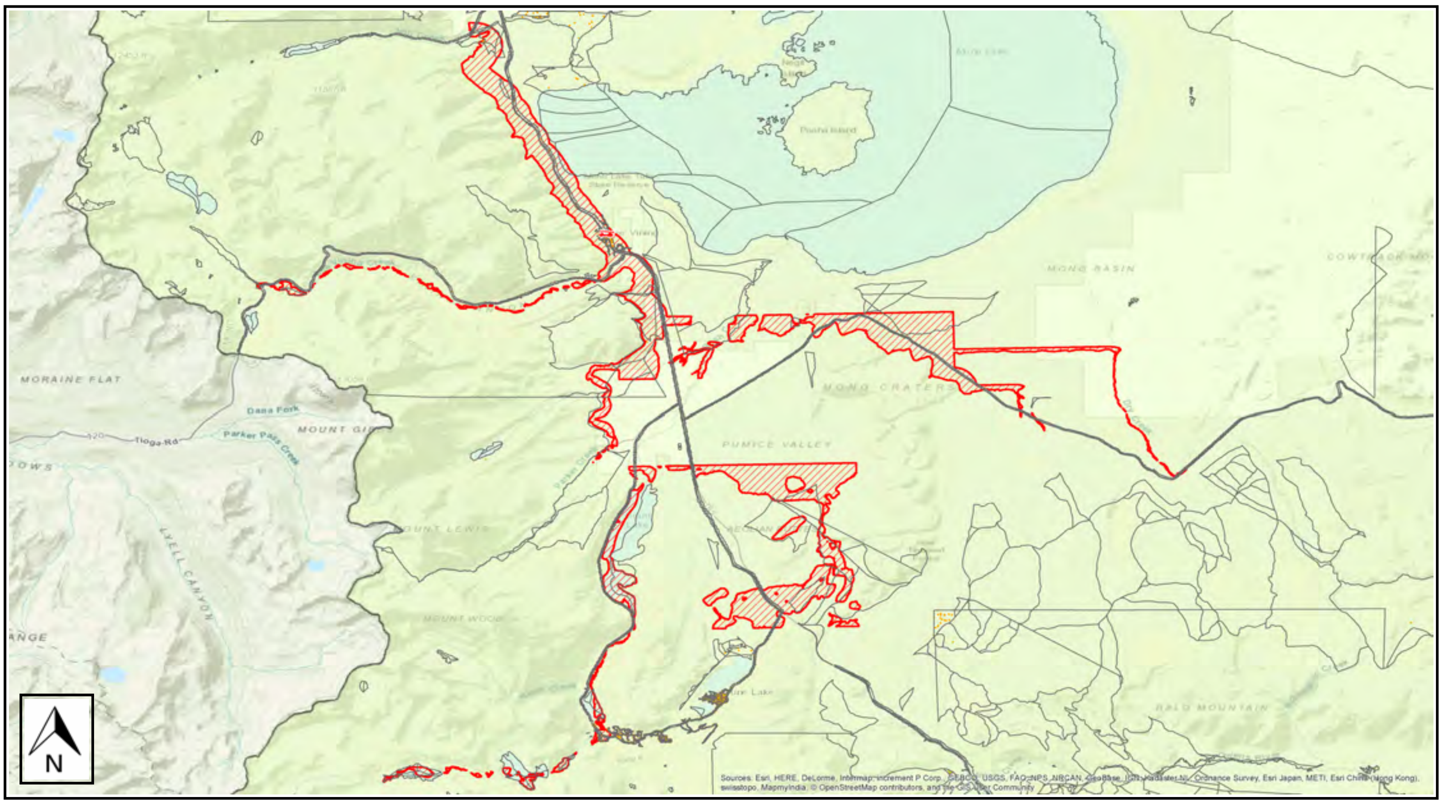
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 5
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 53 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 53 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

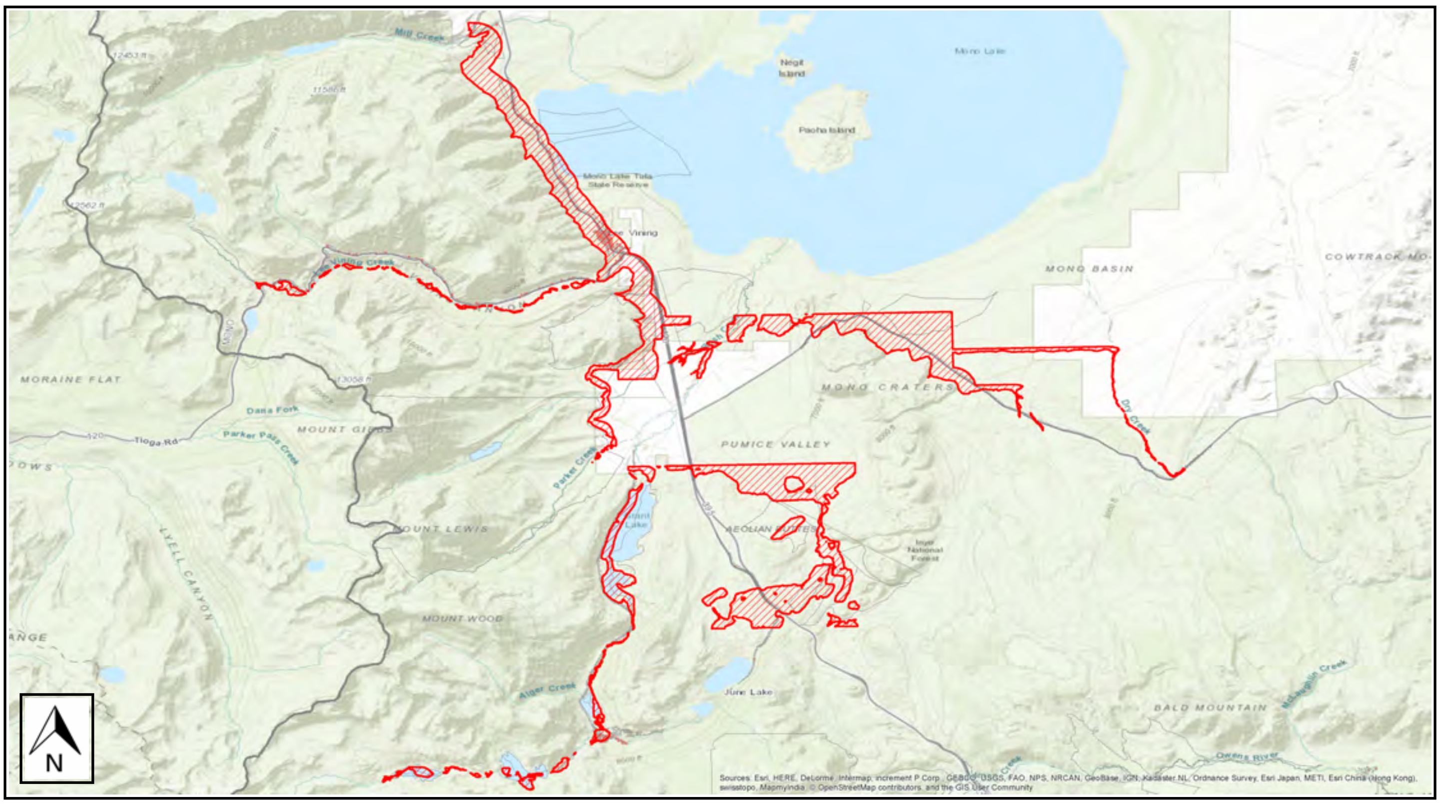


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	100.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	49	100.00
Total	**0**		**0**		**0**		**0**		**0**		**53**	

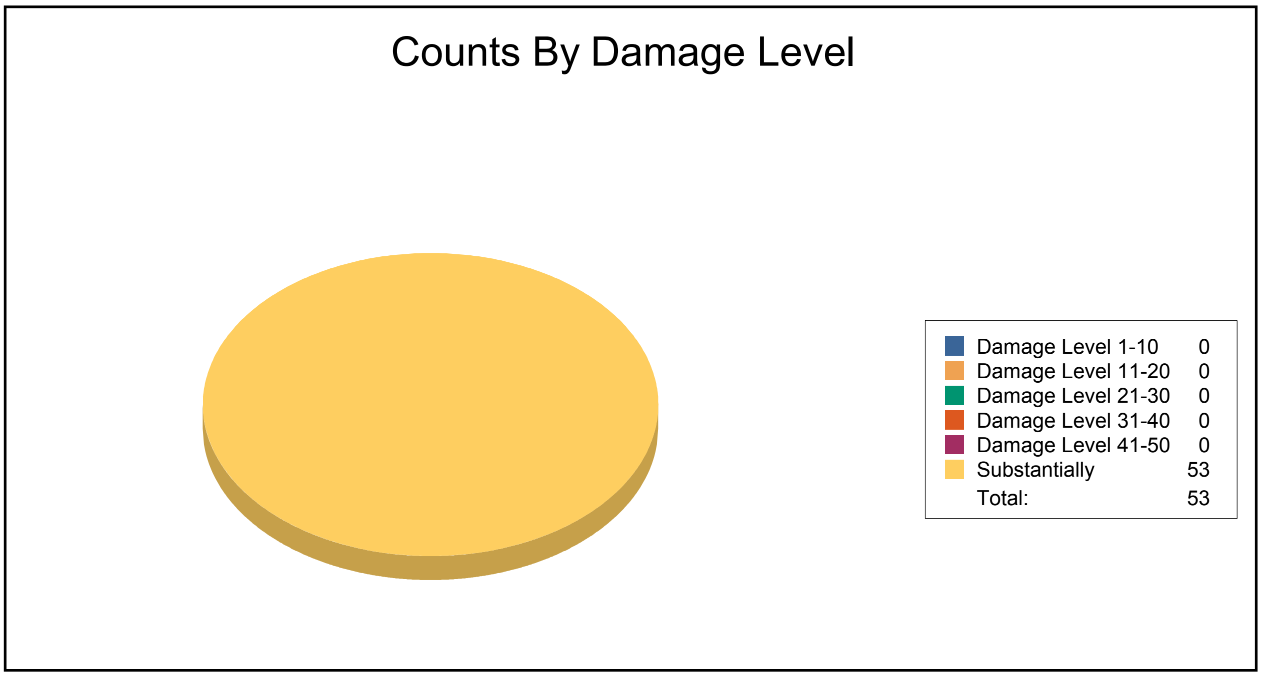


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	1	100
ManufHousing	0	0	0	0	0	0	0	0	0	0	7	100
Masonry	0	0	0	0	0	0	0	0	0	0	1	100
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	43	100

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	1	1
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

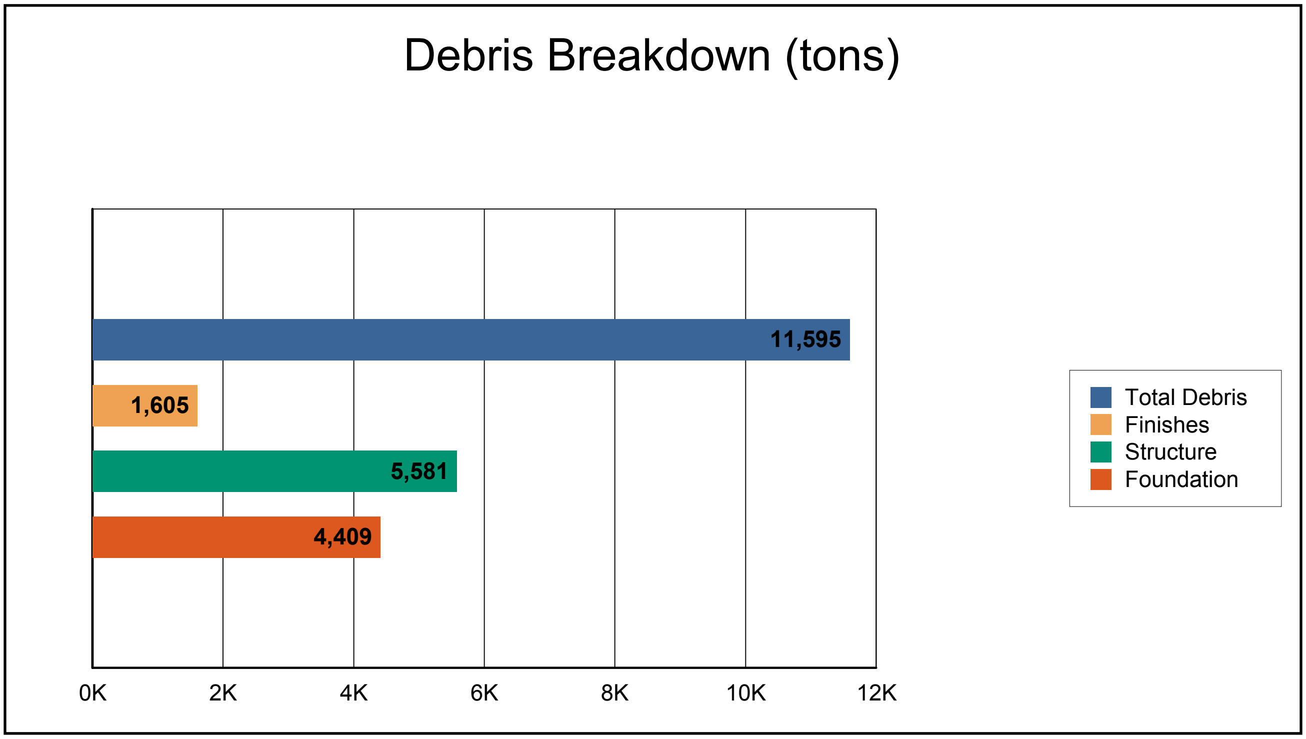
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

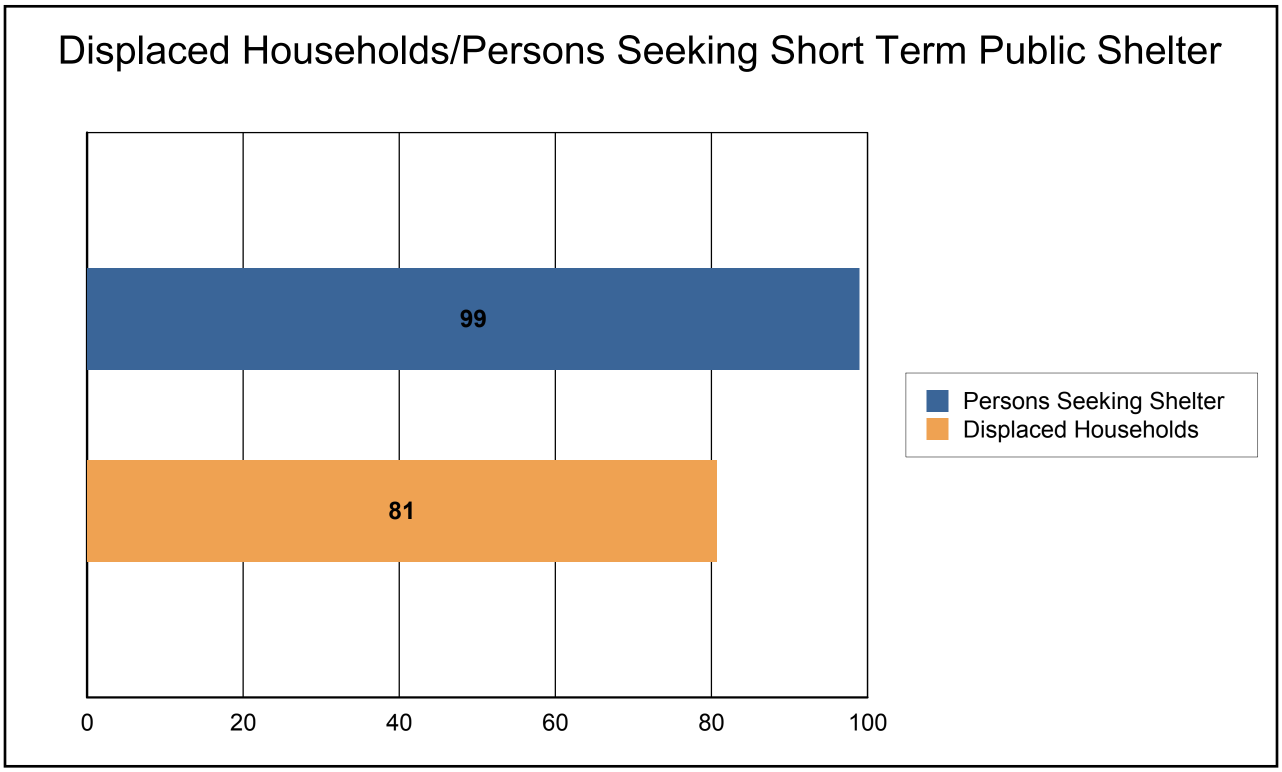


The model estimates that a total of 11,595 tons of debris will be generated. Of the total amount, Finishes comprises 14% of the total, Structure comprises 48% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 464 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 81 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 99 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 62.81 million dollars, which represents 62.75 % of the total replacement value of the scenario buildings.

Building-Related Losses

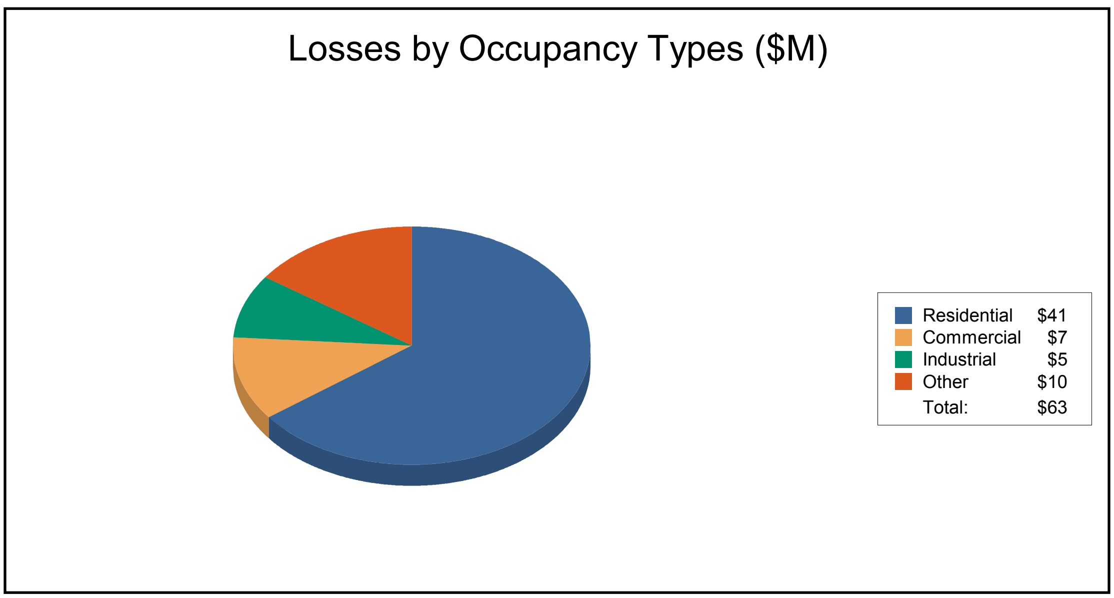
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 62.40 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 64.73% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	26.67	3.41	1.84	3.81	35.72
	Content	13.90	3.68	3.27	5.44	26.29
	Inventory	0.00	0.05	0.33	0.01	0.39
	Subtotal	**40.57**	**7.13**	**5.44**	**9.25**	**62.40**
Business Interruption						
	Income	0.02	0.02	0.00	0.01	0.04
	Relocation	0.01	0.00	0.00	0.01	0.01
	Rental Income	0.03	0.00	0.00	0.00	0.03
	Wage	0.04	0.01	0.00	0.28	0.33
	Subtotal	**0.09**	**0.03**	**0.00**	**0.29**	**0.41**
ALL	**Total**	**40.66**	**7.16**	**5.45**	**9.55**	**62.81**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 6

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

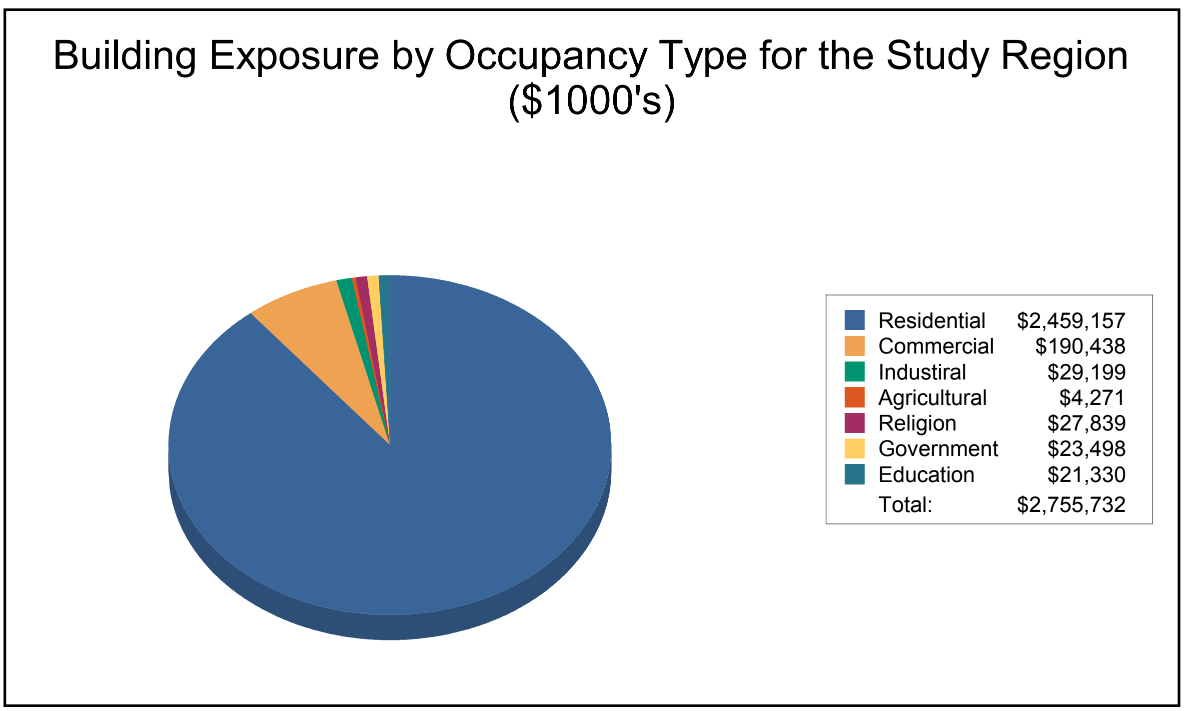
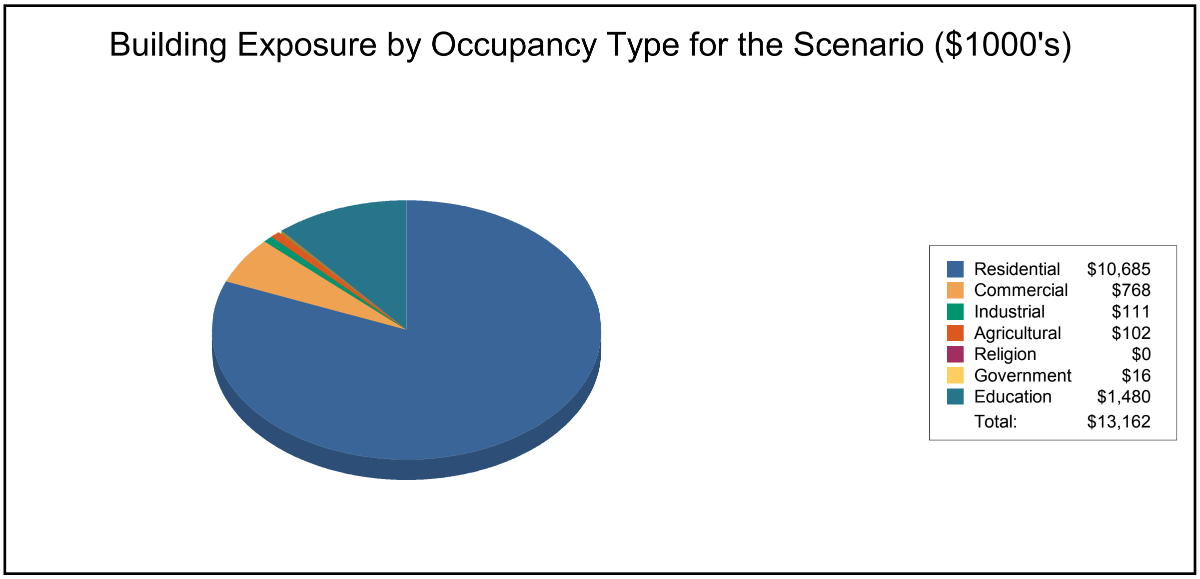


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	10,685	81.2%
Commercial	768	5.8%
Industrial	111	0.8%
Agricultural	102	0.8%
Religion	0	0.0%
Government	16	0.1%
Education	1,480	11.2%
Total	**13,162**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

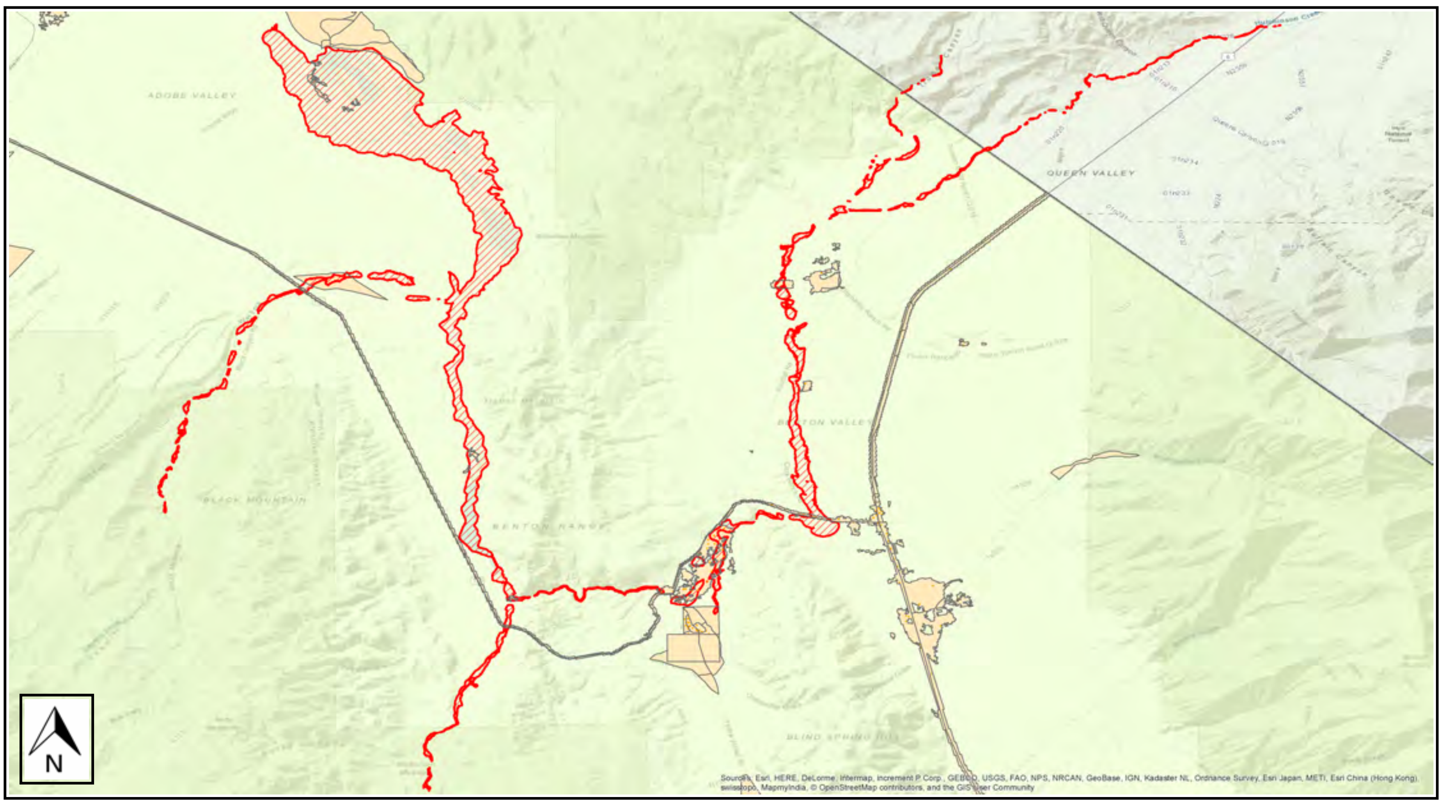
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 6
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

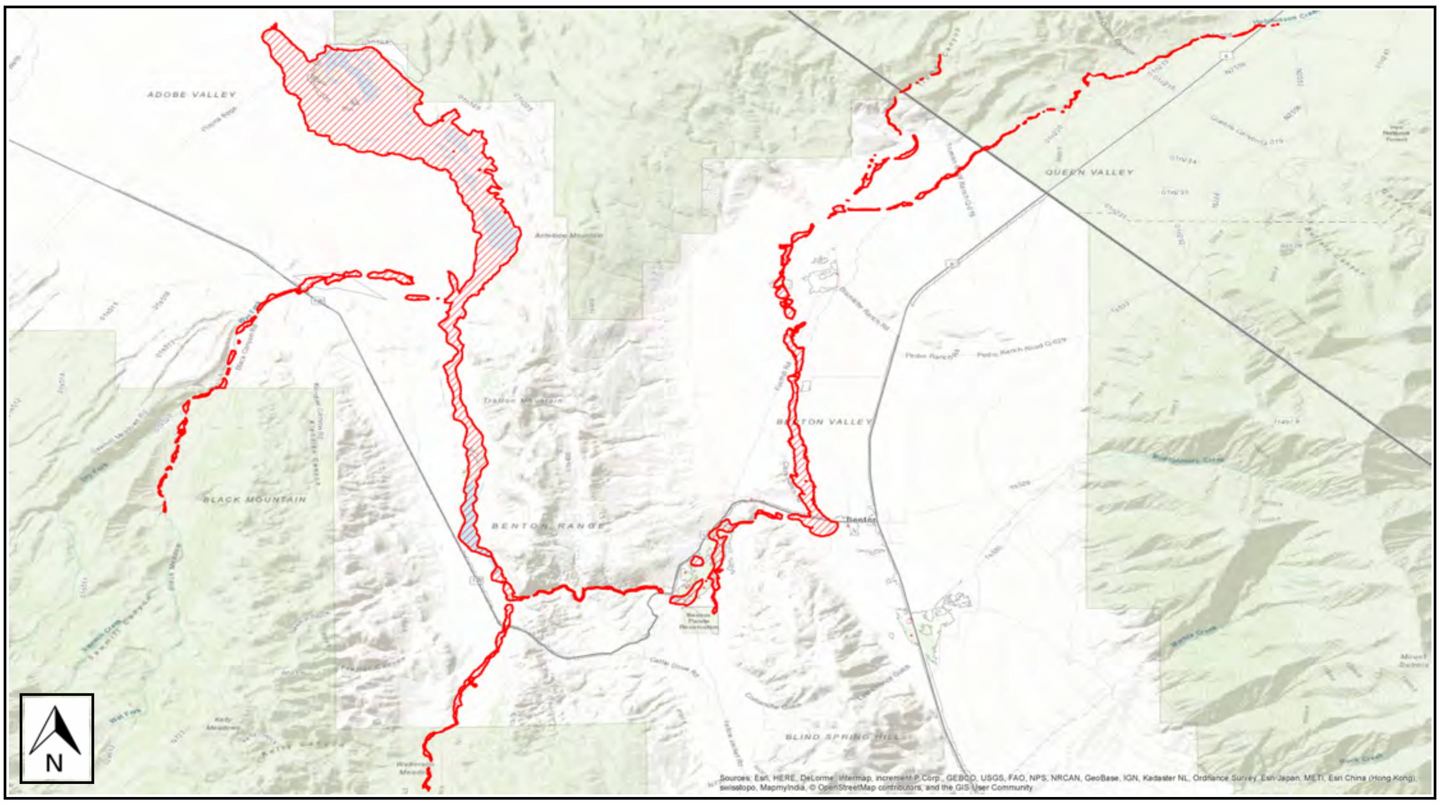


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

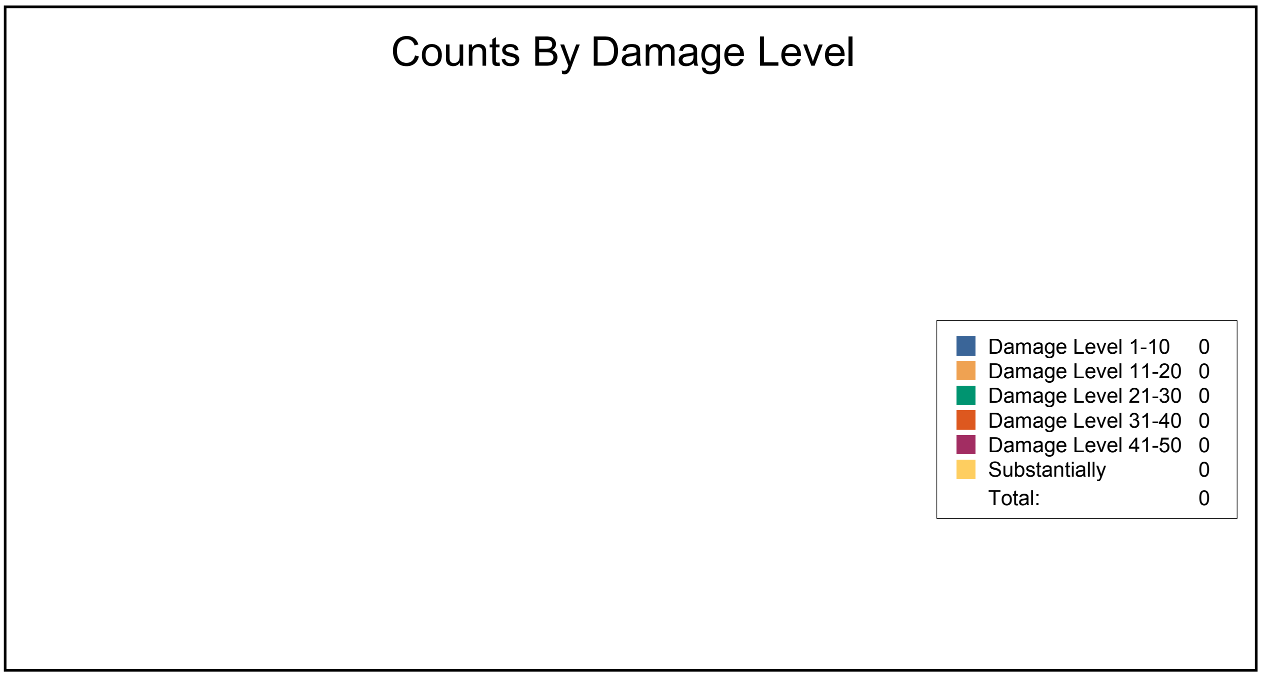


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

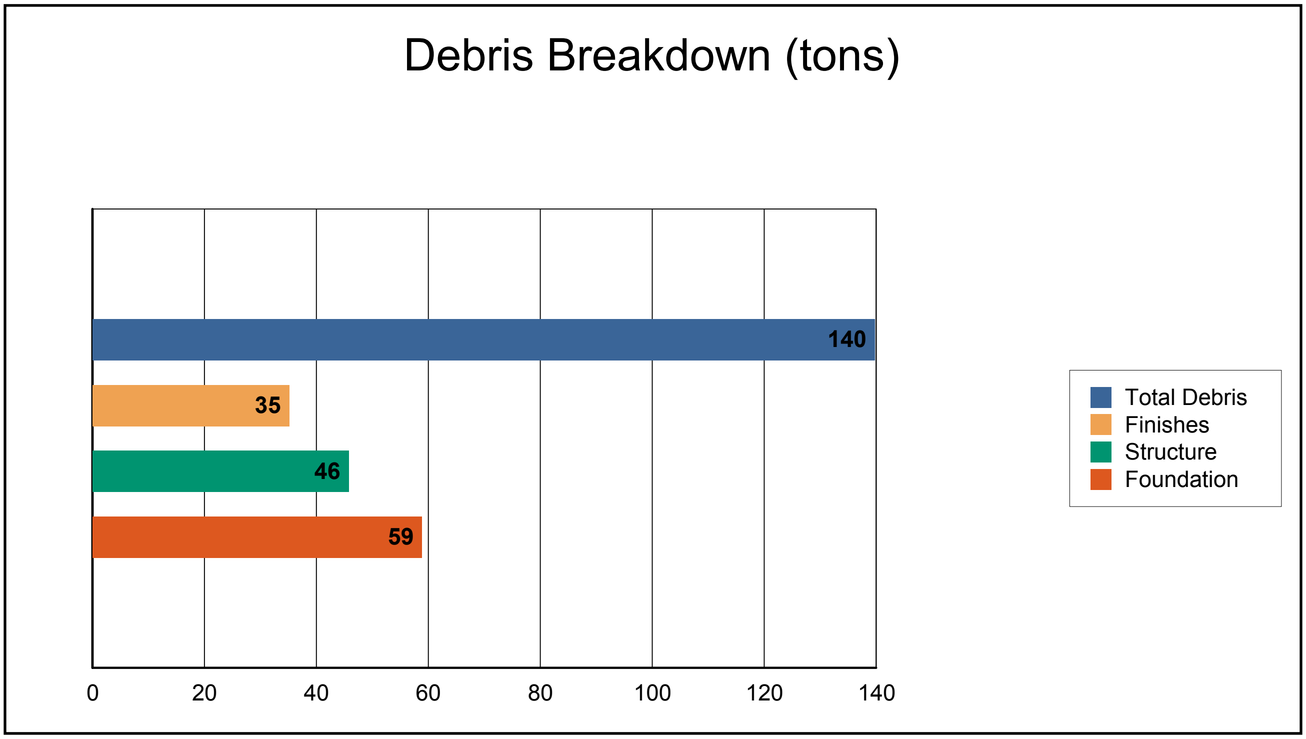
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

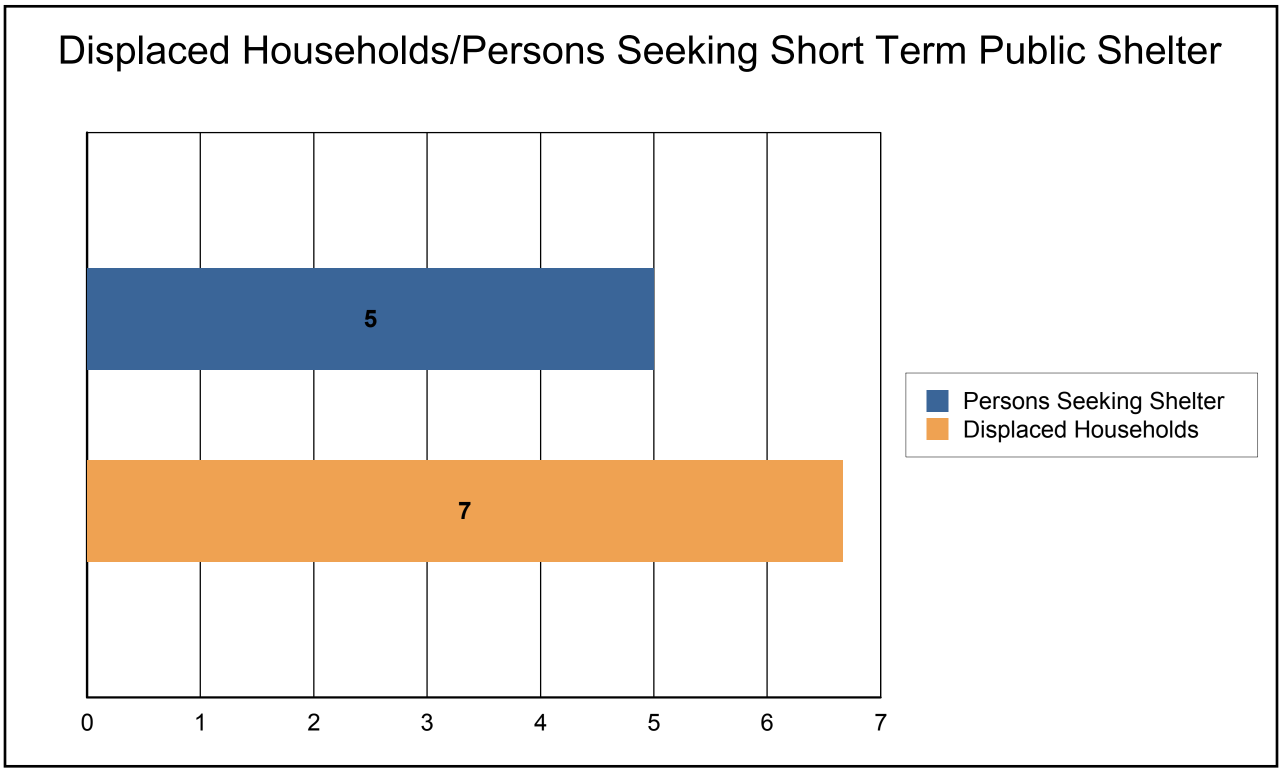


The model estimates that a total of 140 tons of debris will be generated. Of the total amount, Finishes comprises 25% of the total, Structure comprises 33% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 6 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 7 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 5 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 1.10 million dollars, which represents 8.33 % of the total replacement value of the scenario buildings.

Building-Related Losses

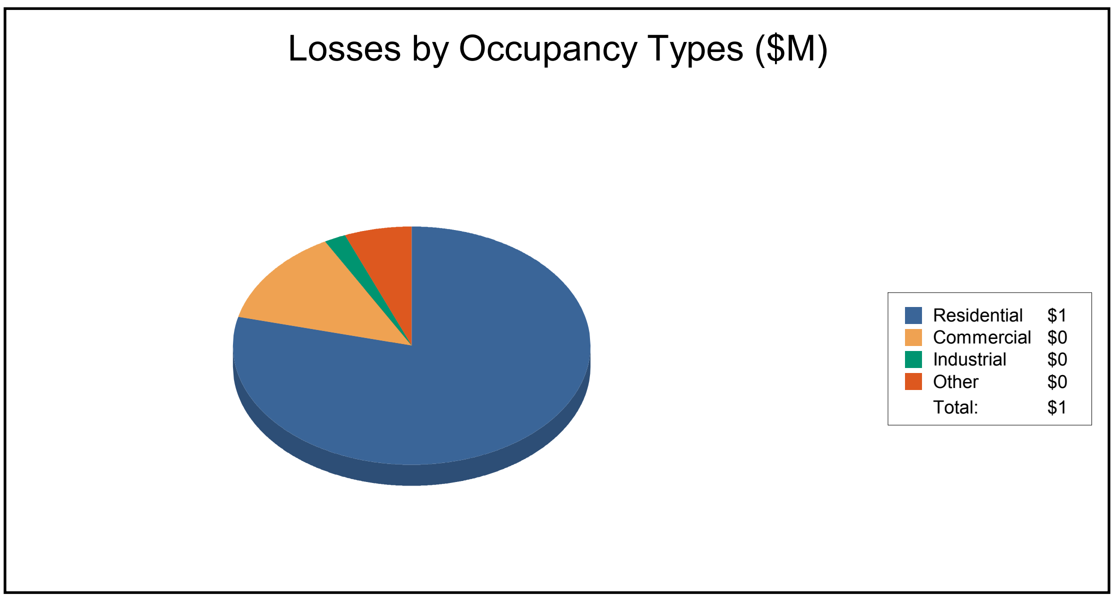
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 1.10 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 78.85% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.58	0.04	0.01	0.01	0.64
	Content	0.29	0.10	0.01	0.05	0.45
	Inventory	0.00	0.01	0.00	0.00	0.01
	Subtotal	**0.87**	**0.15**	**0.02**	**0.07**	**1.10**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.87**	**0.15**	**0.02**	**0.07**	**1.10**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 7

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region .

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

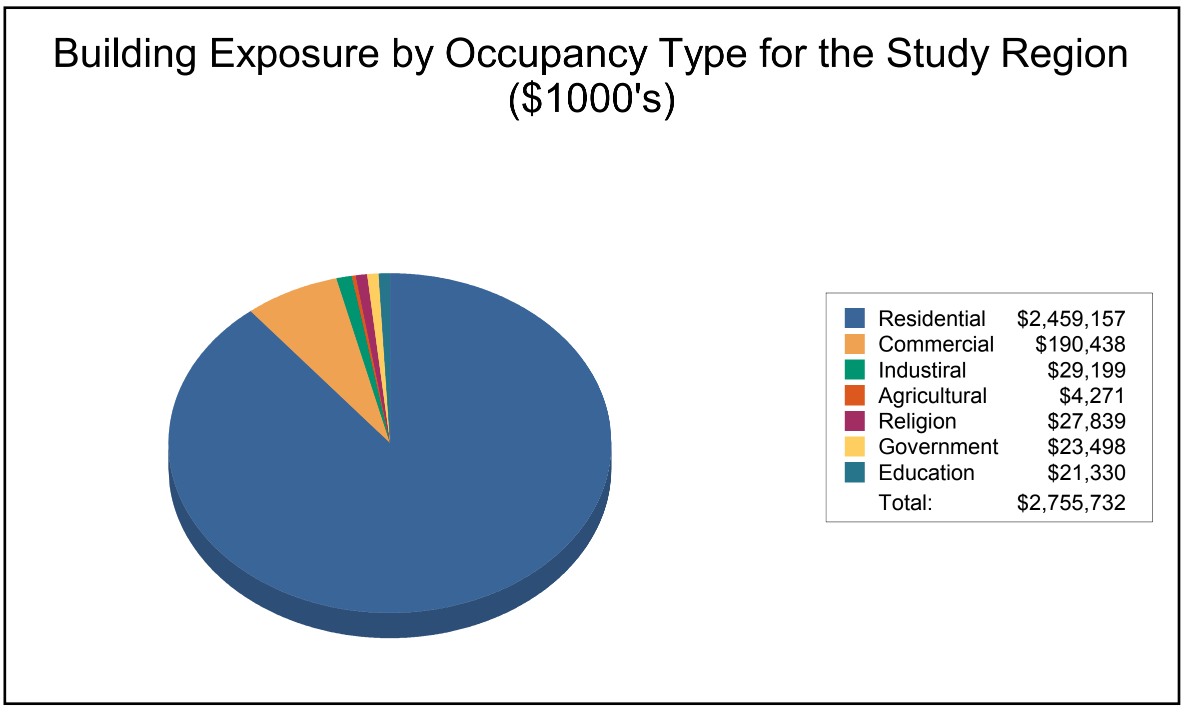
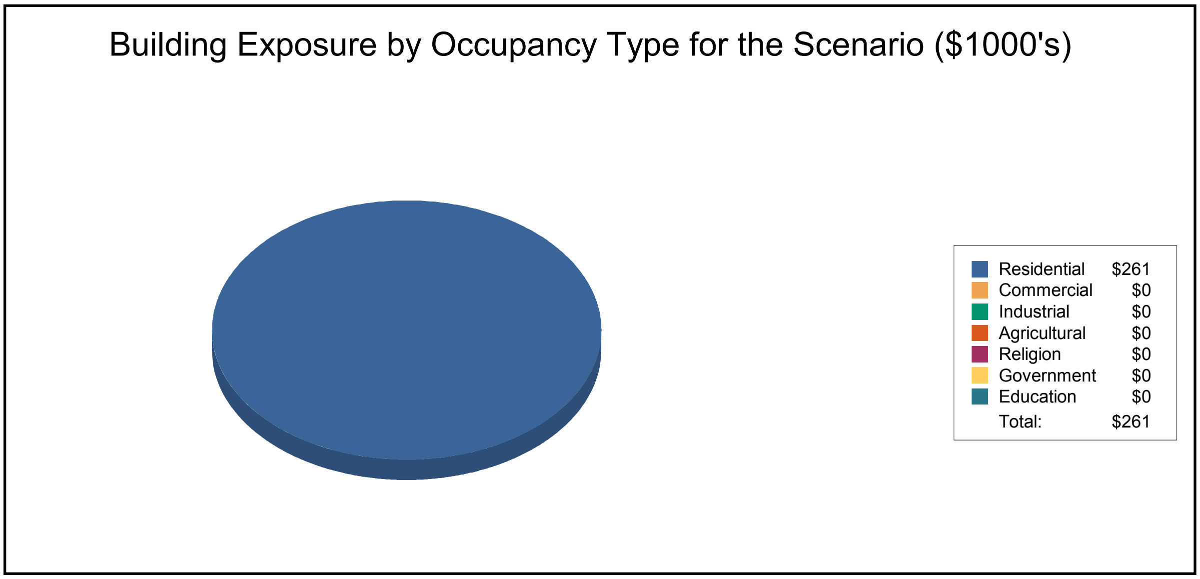


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	261	100.0%
Commercial	0	0.0%
Industrial	0	0.0%
Agricultural	0	0.0%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**261**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

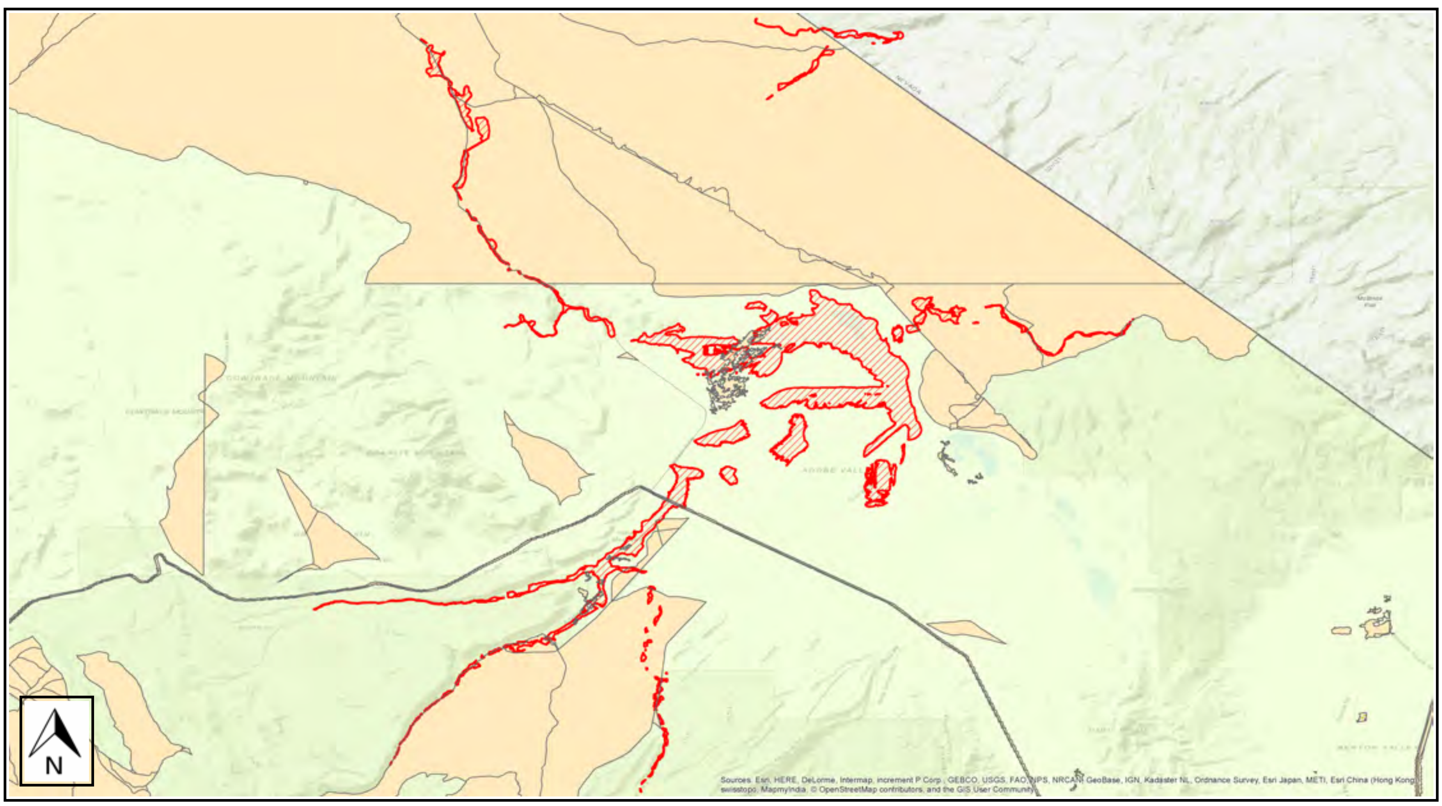
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 7
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

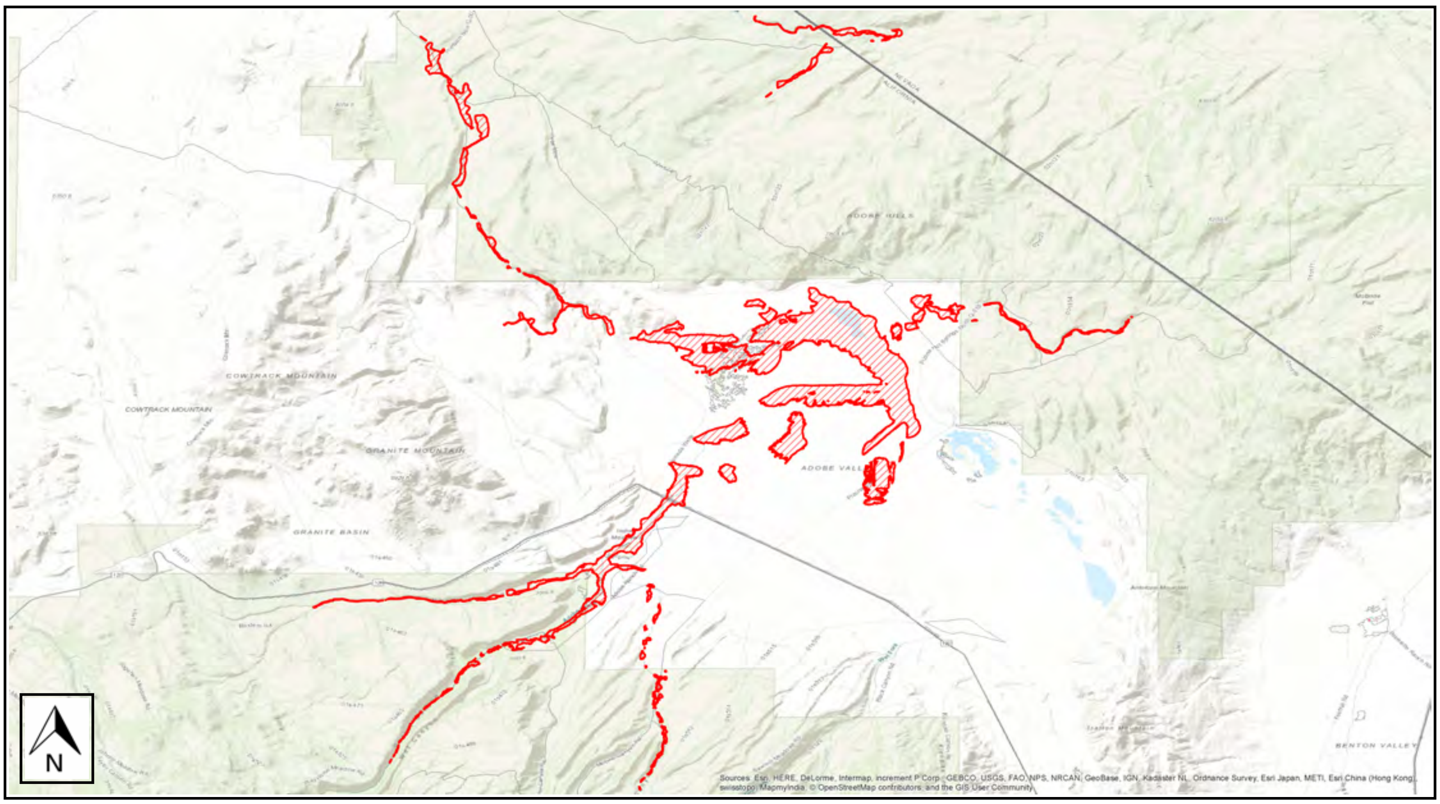


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

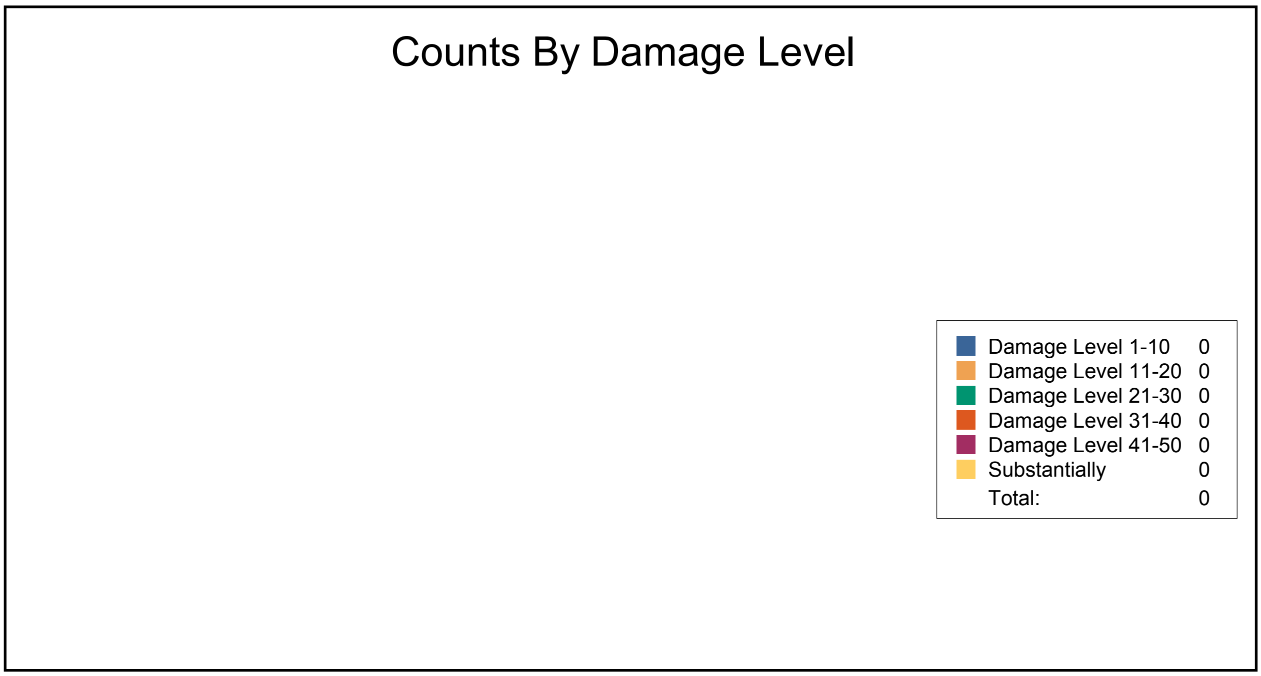


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

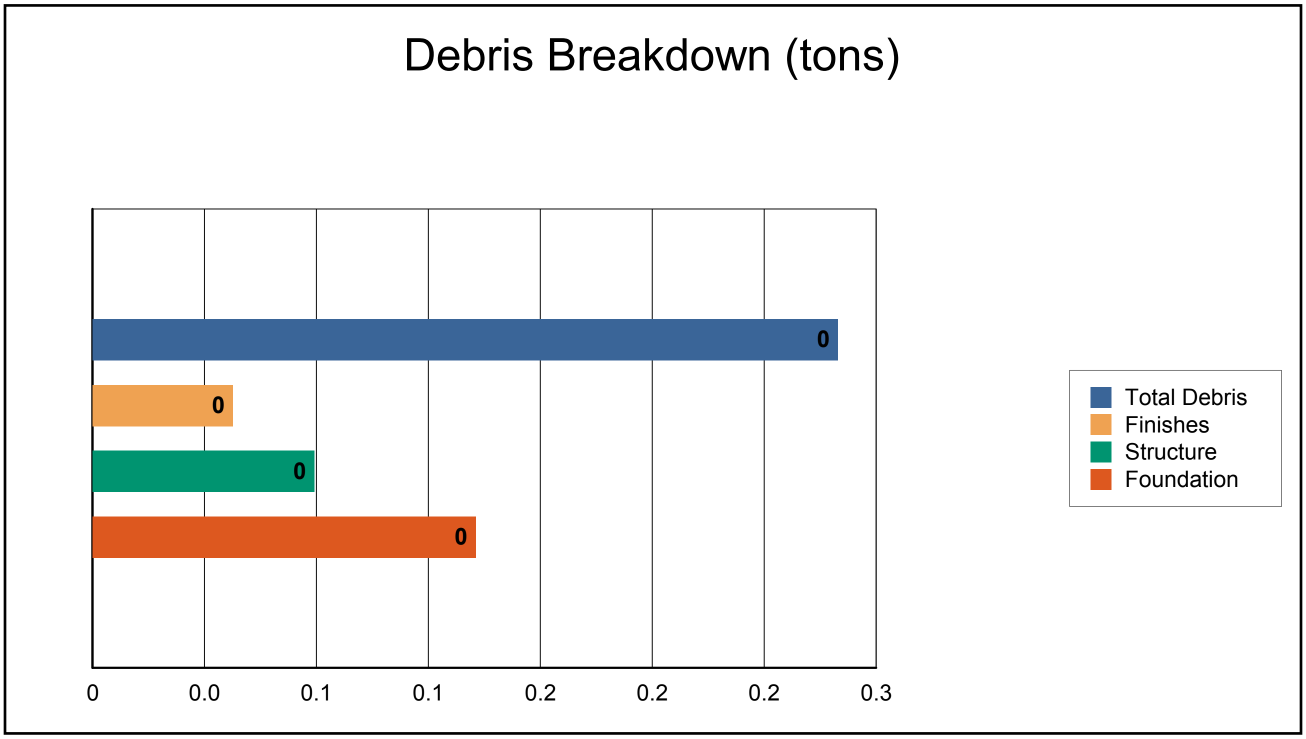
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

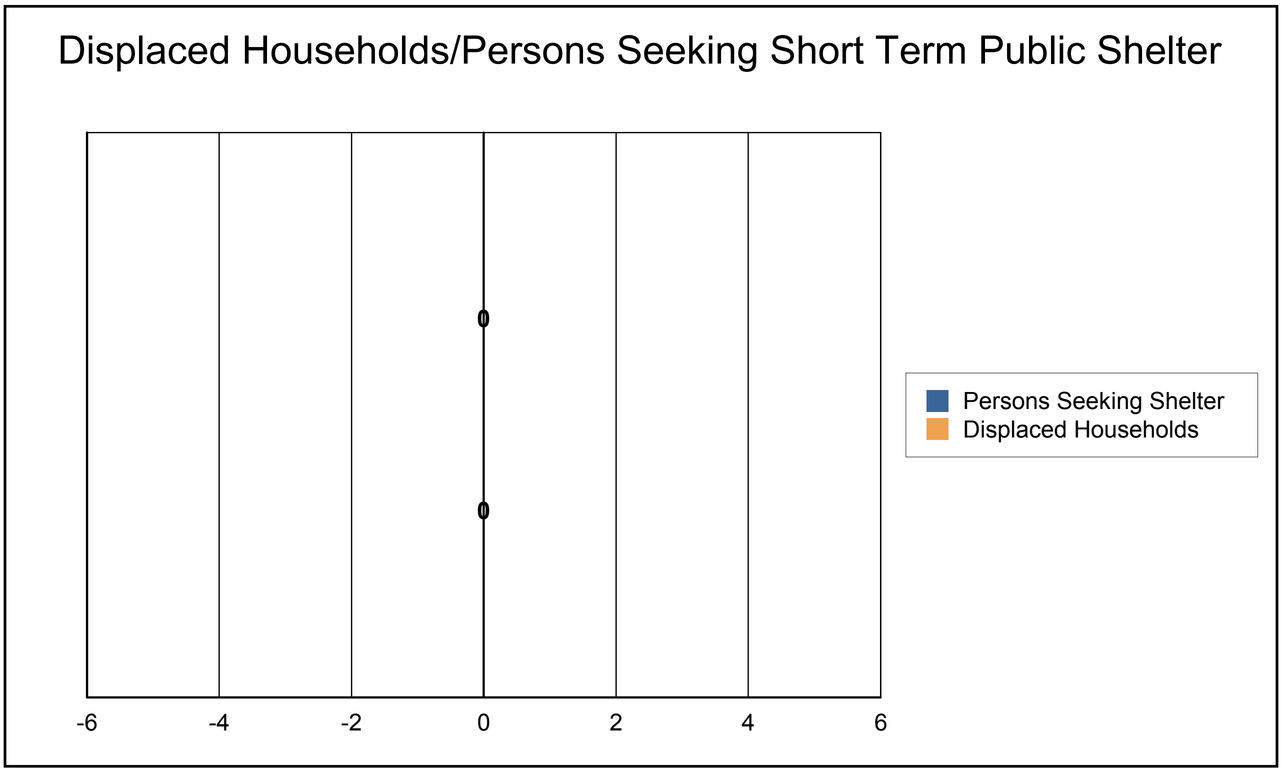


The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Finishes comprises 19% of the total, Structure comprises 30% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 0 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 0.00 million dollars, which represents 0.00 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.00 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 0.00% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

HAZUS MH
EARTHQUAKE • WIND • FLOOD

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 8

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

FEMA

RiskMAP
Increasing Resilience Together

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Note:
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There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

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Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
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Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

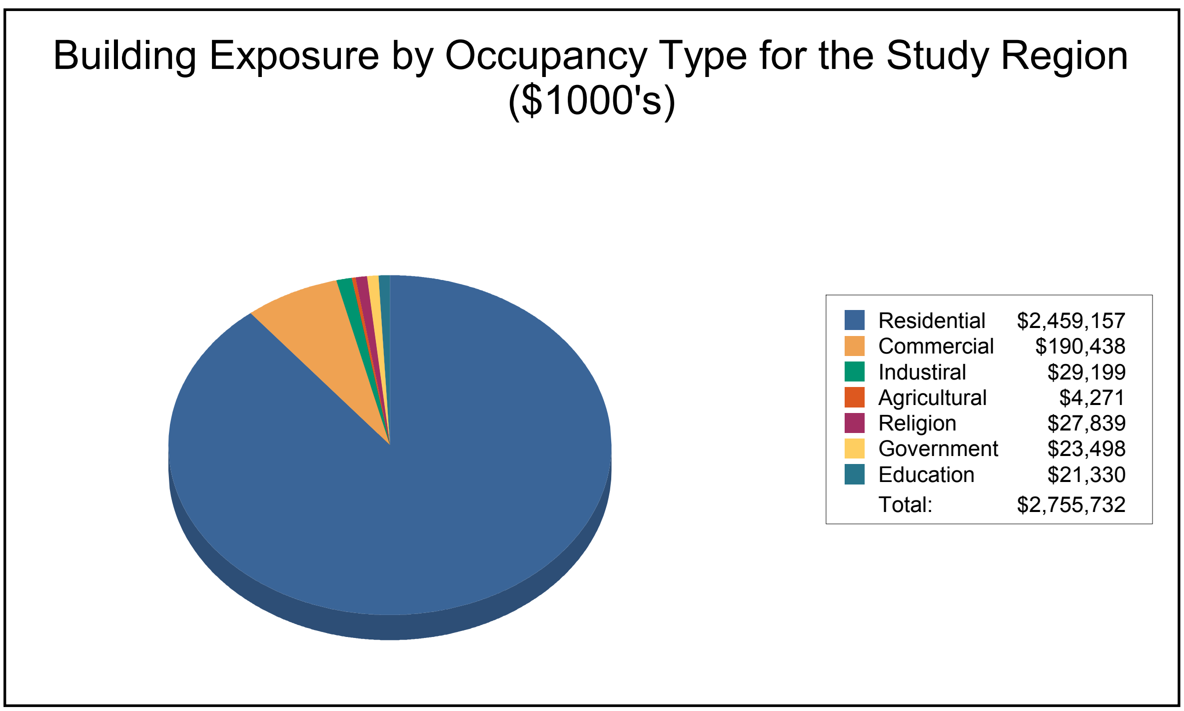
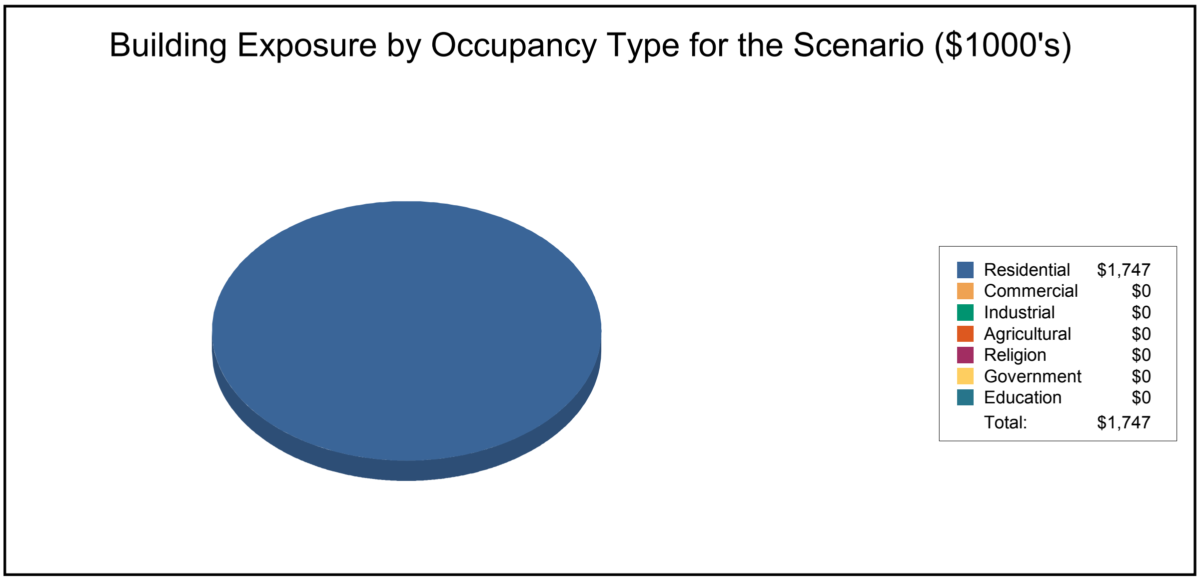


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	**Exposure ($1000)**	**Percent of Total**
Residential	1,747	100.0%
Commercial	0	0.0%
Industrial	0	0.0%
Agricultural	0	0.0%
Religion	0	0.0%
Government	0	0.0%
Education	0	0.0%
Total	**1,747**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

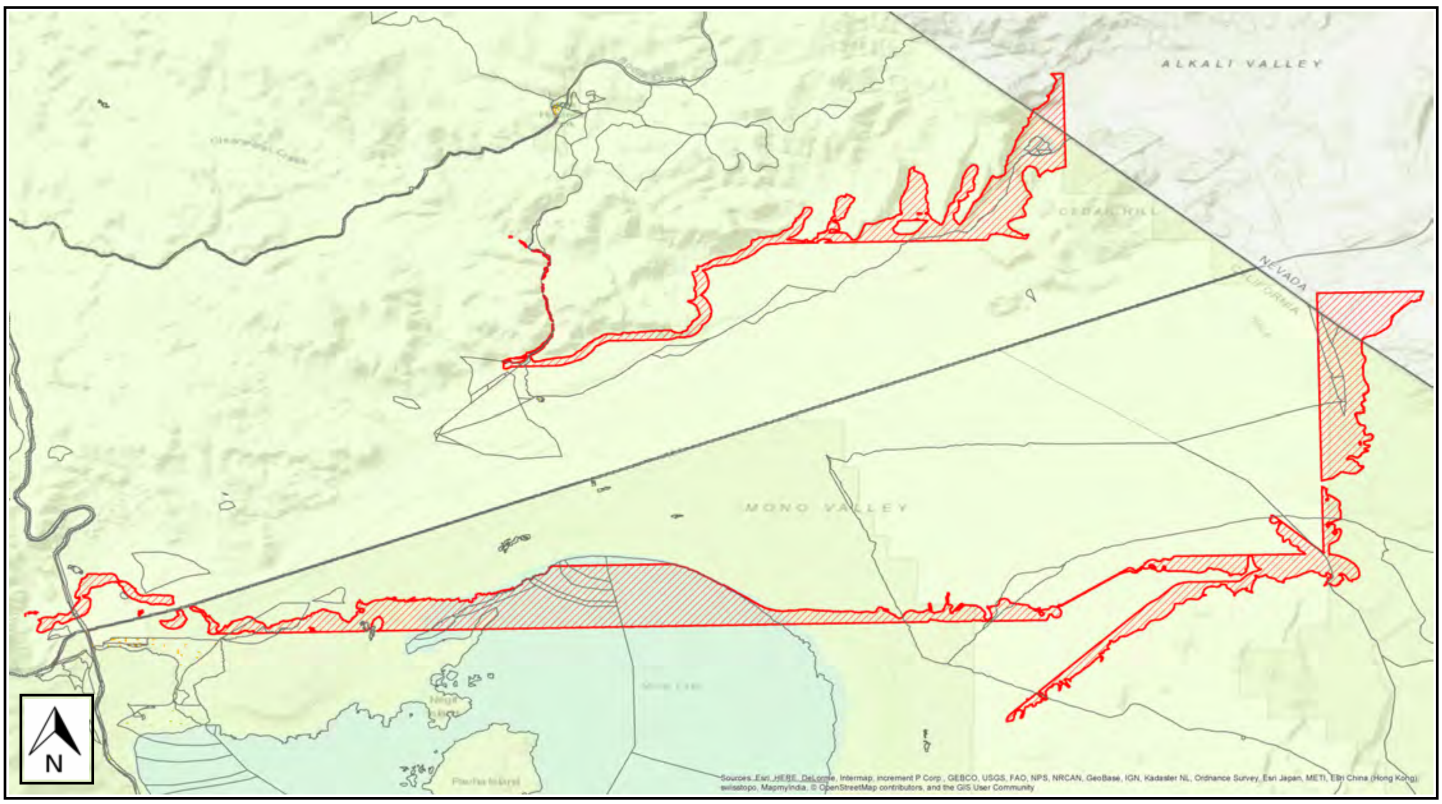
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 8
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

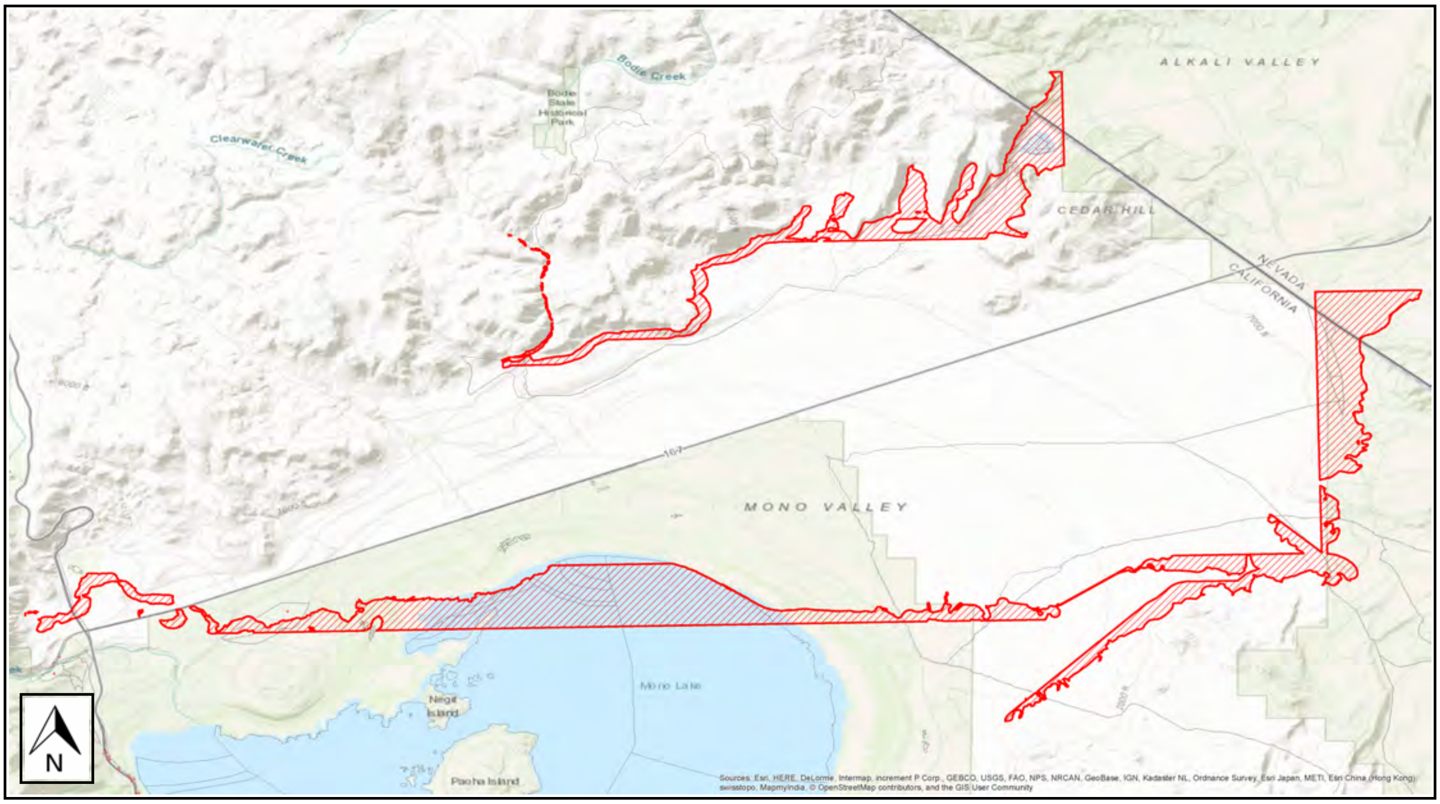


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

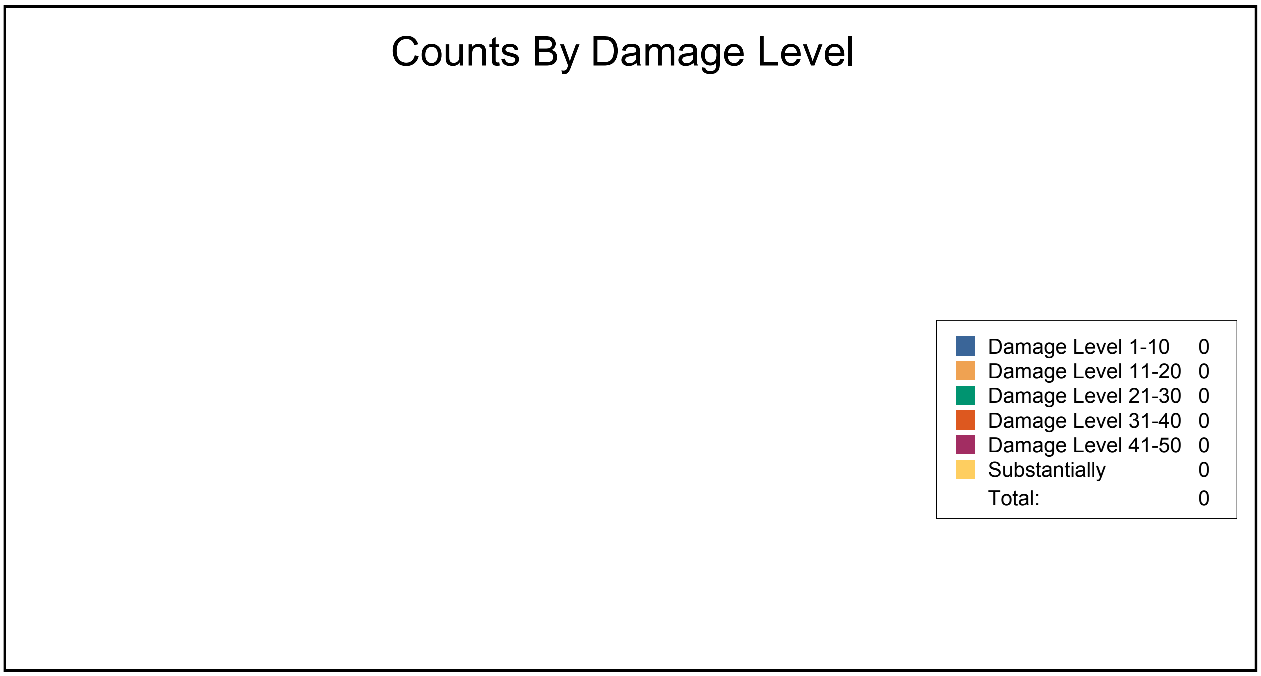


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

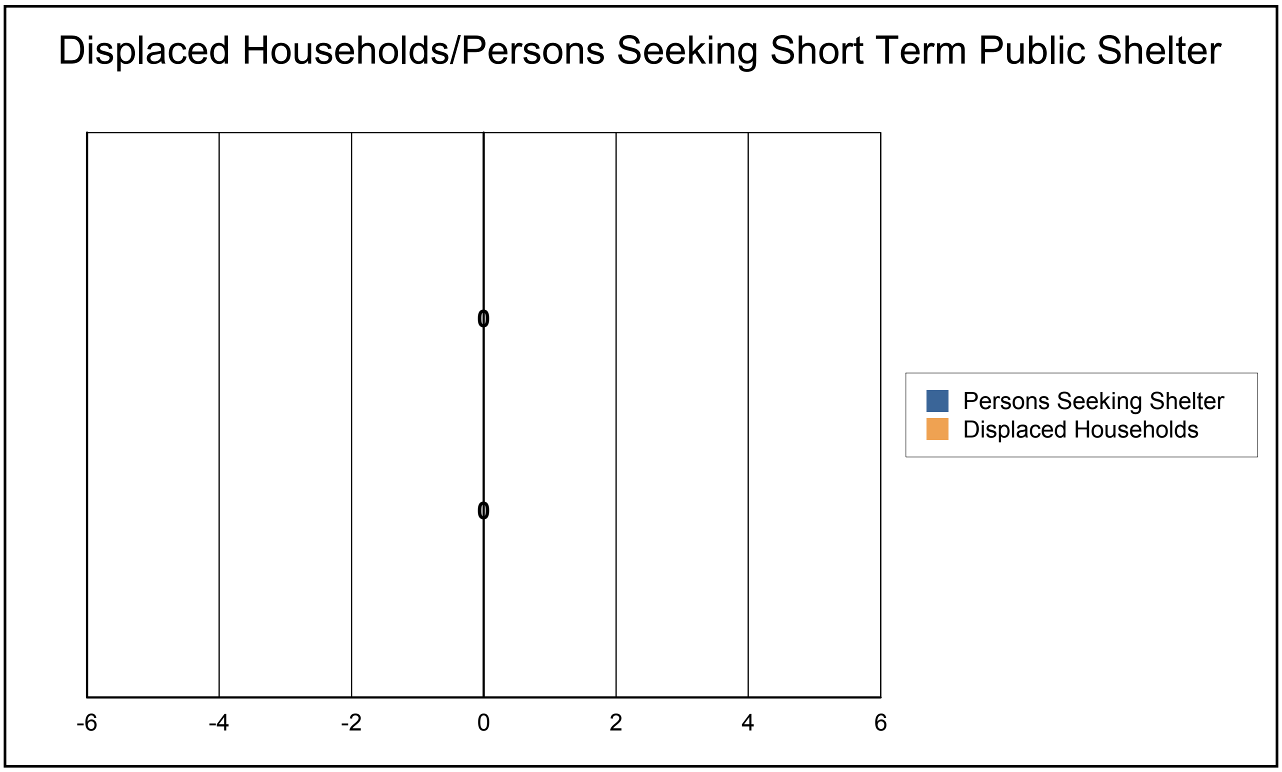
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 0 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 0.10 million dollars, which represents 5.50 % of the total replacement value of the scenario buildings.

Building-Related Losses

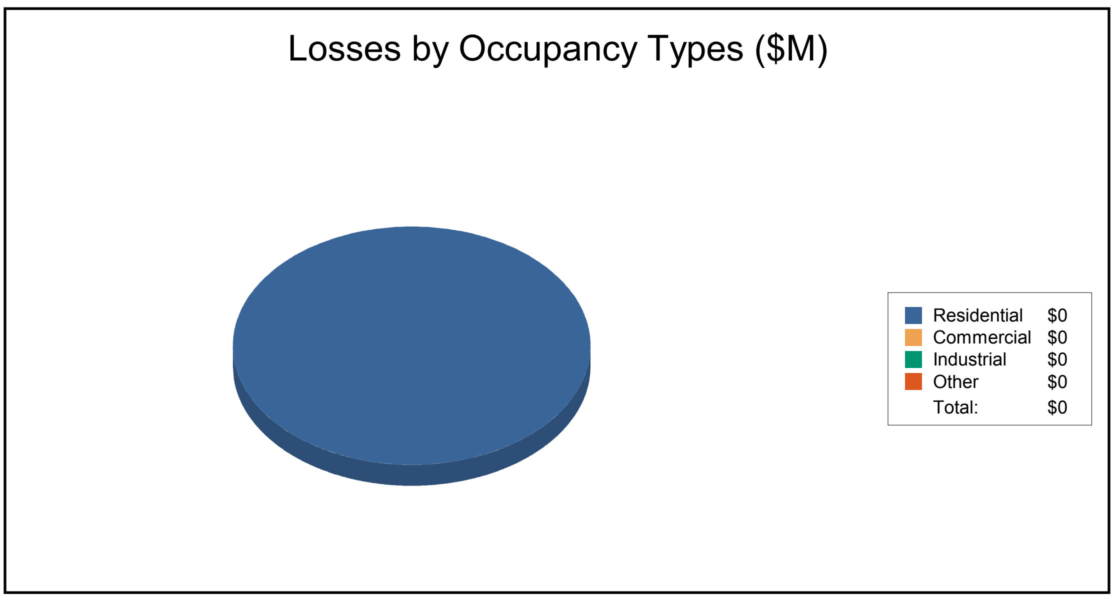
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.10 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 100.00% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.07	0.00	0.00	0.00	0.07
	Content	0.03	0.00	0.00	0.00	0.03
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.10**	**0.00**	**0.00**	**0.00**	**0.10**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.10**	**0.00**	**0.00**	**0.00**	**0.10**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 9

Print Date: Wednesday, January 24, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

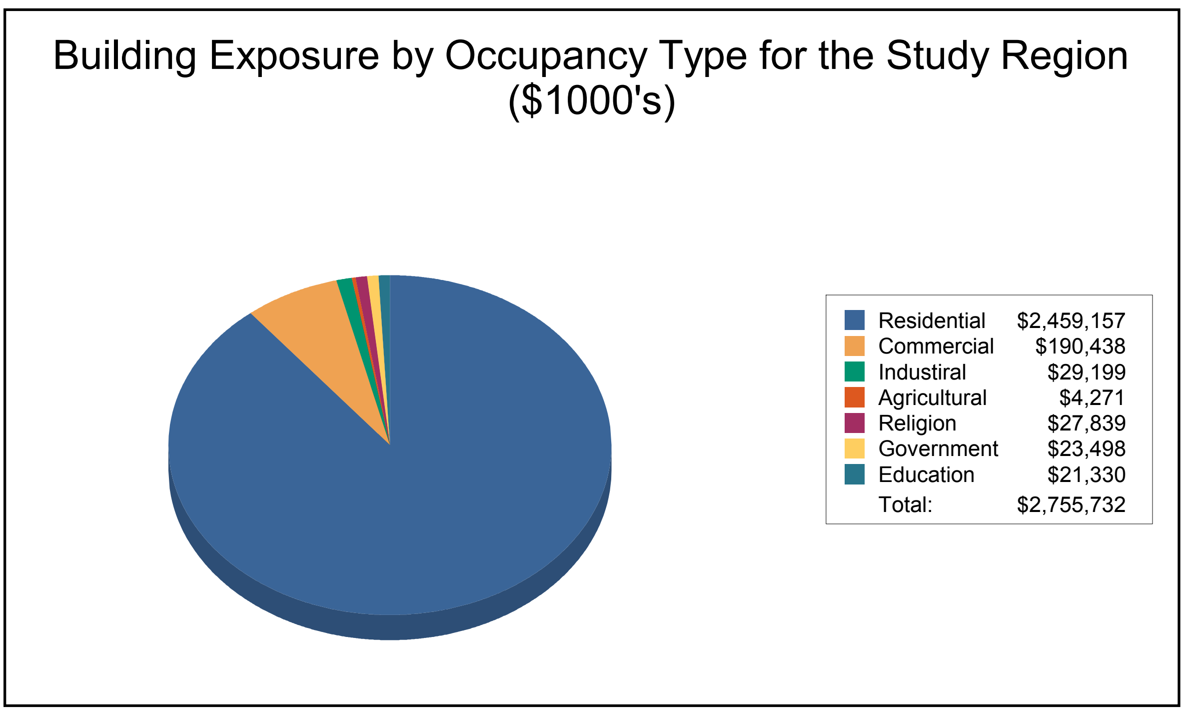
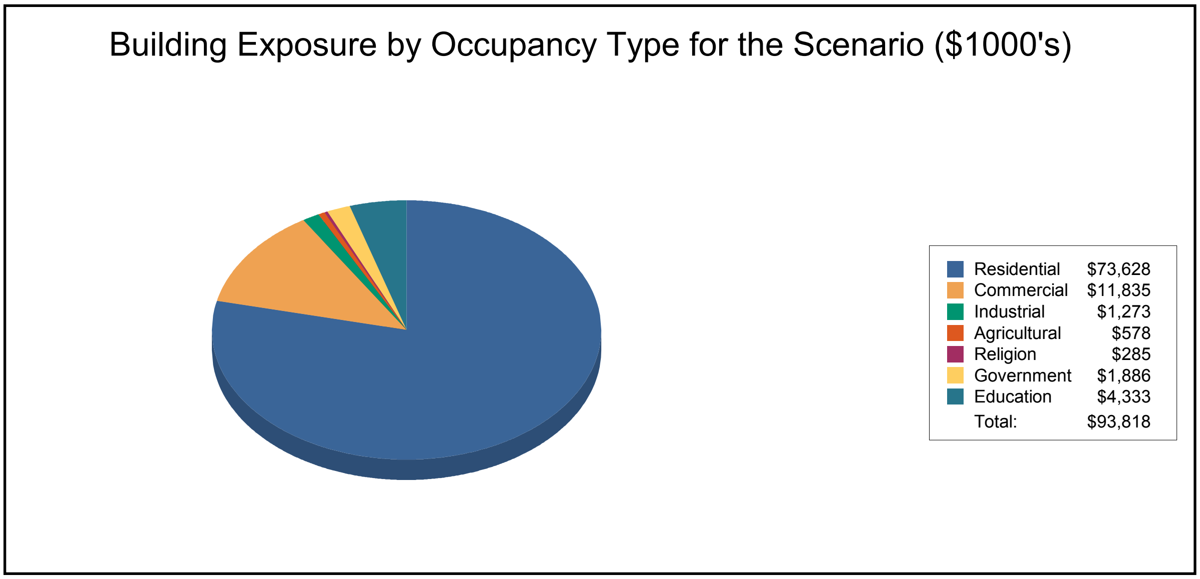


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	73,628	78.5%
Commercial	11,835	12.6%
Industrial	1,273	1.4%
Agricultural	578	0.6%
Religion	285	0.3%
Government	1,886	2.0%
Education	4,333	4.6%
Total	**93,818**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

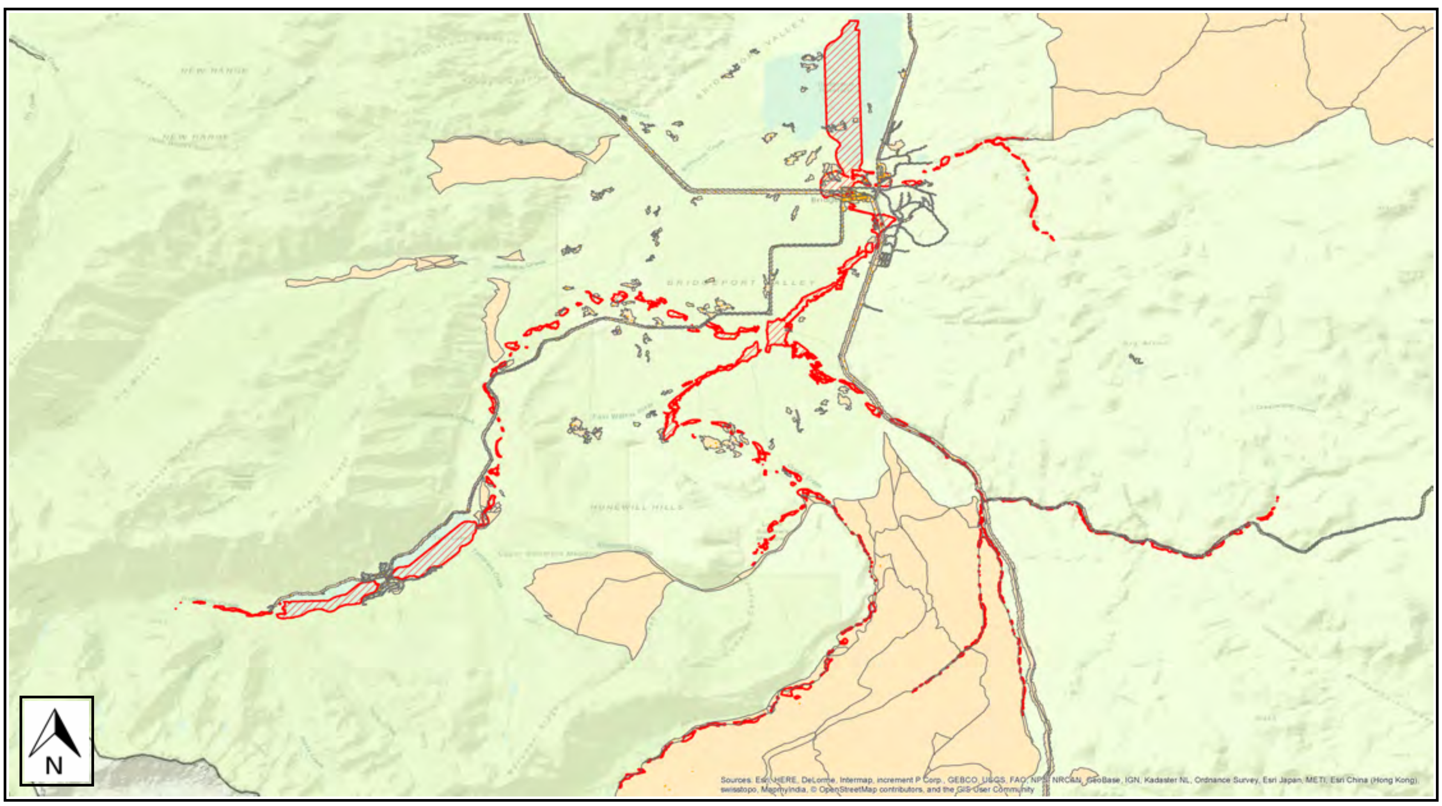
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 9
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 13 buildings will be at least moderately damaged. This is over 73% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

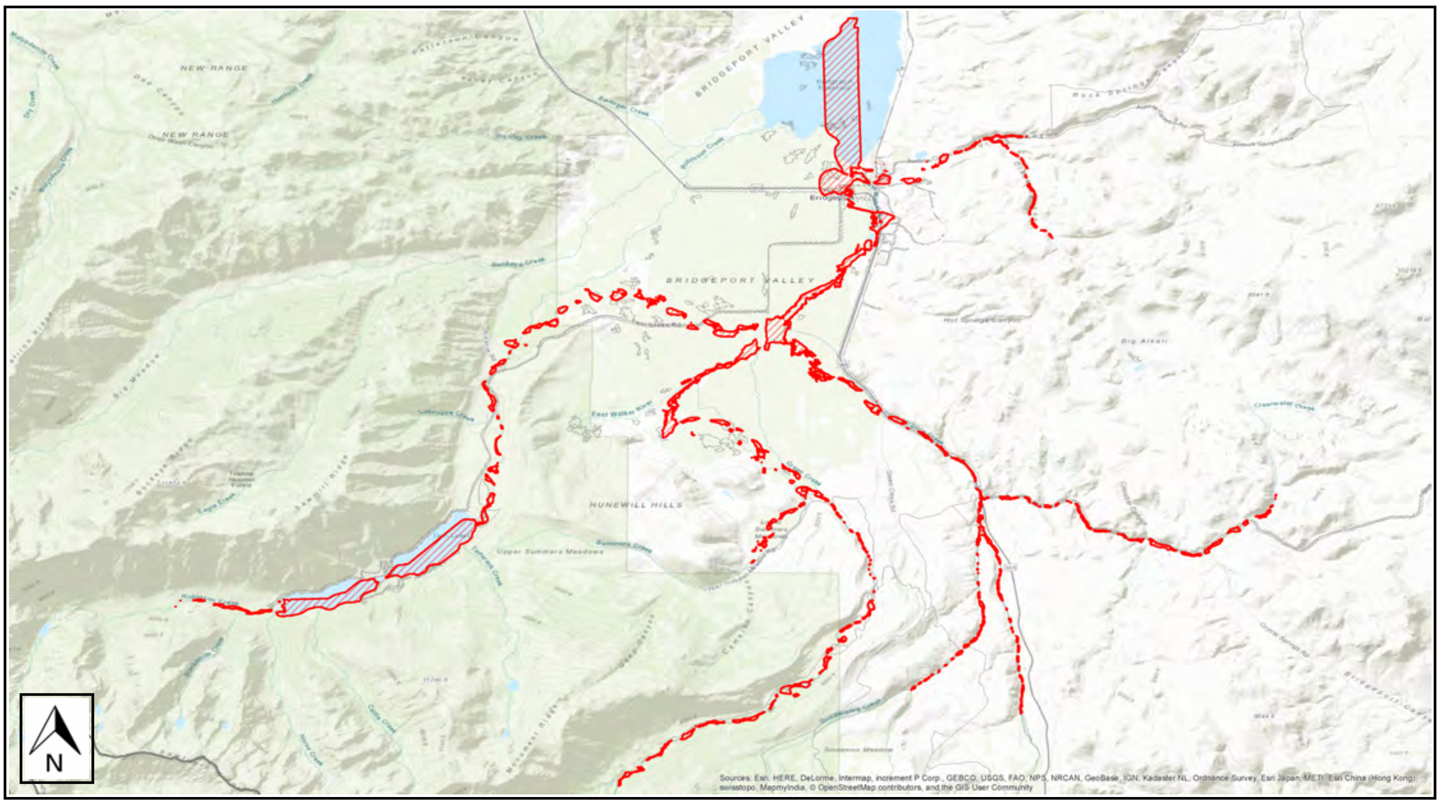


Table 3: Expected Building Damage by Occupancy

Occupancy	1-10 Count	1-10 (%)	11-20 Count	11-20 (%)	21-30 Count	21-30 (%)	31-40 Count	31-40 (%)	41-50 Count	41-50 (%)	Substantially Count	Substantially (%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	6	31.58	9	47.37	1	5.26	1	5.26	2	10.53	0	0.00
Total	**6**		**9**		**1**		**1**		**2**		**0**	

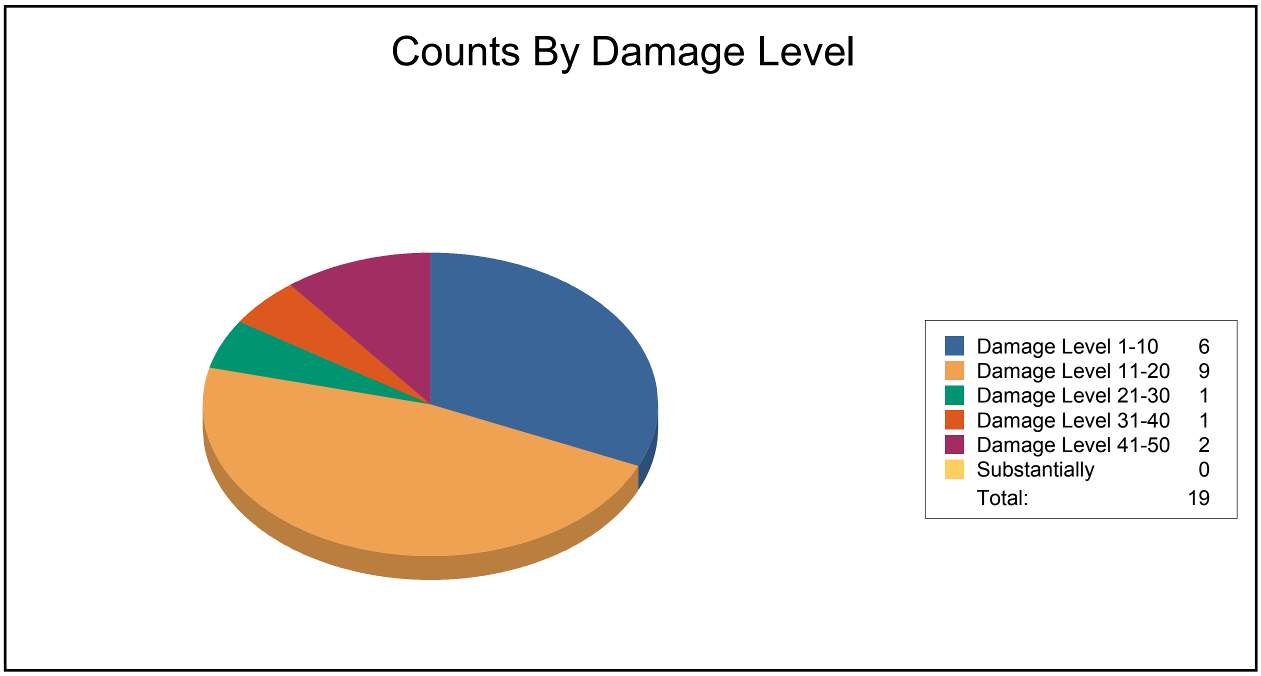


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	6	32	9	47	1	5	1	5	2	11	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

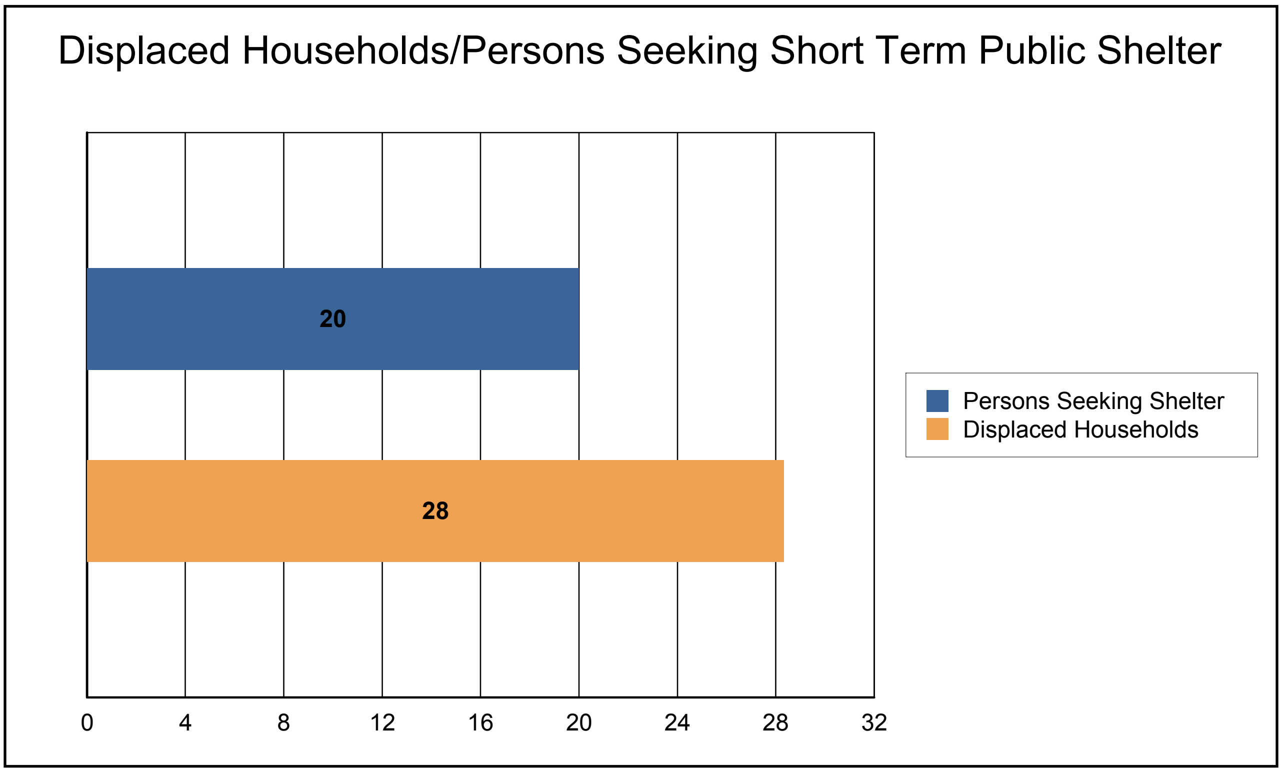
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 28 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 20 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 3.60 million dollars, which represents 3.84 % of the total replacement value of the scenario buildings.

Building-Related Losses

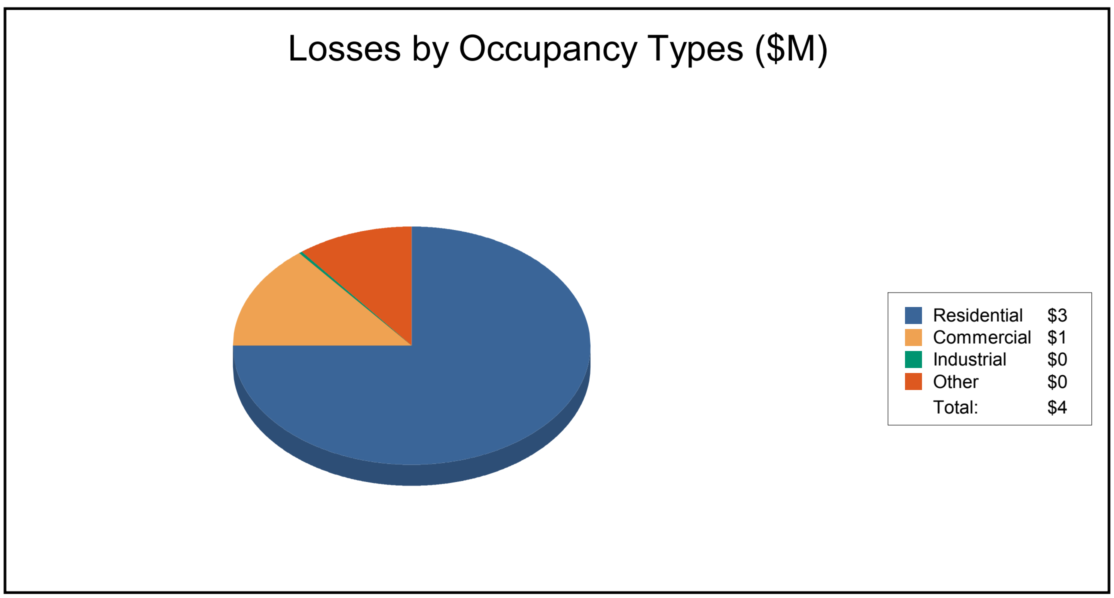
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 3.58 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 75.04% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	1.76	0.09	0.00	0.06	1.92
	Content	0.94	0.41	0.01	0.31	1.66
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**2.70**	**0.50**	**0.01**	**0.37**	**3.58**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.01	0.01
	Subtotal	**0.00**	**0.01**	**0.00**	**0.01**	**0.02**
ALL	**Total**	**2.70**	**0.51**	**0.01**	**0.38**	**3.60**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenarios 10

Print Date: Wednesday, January 24, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

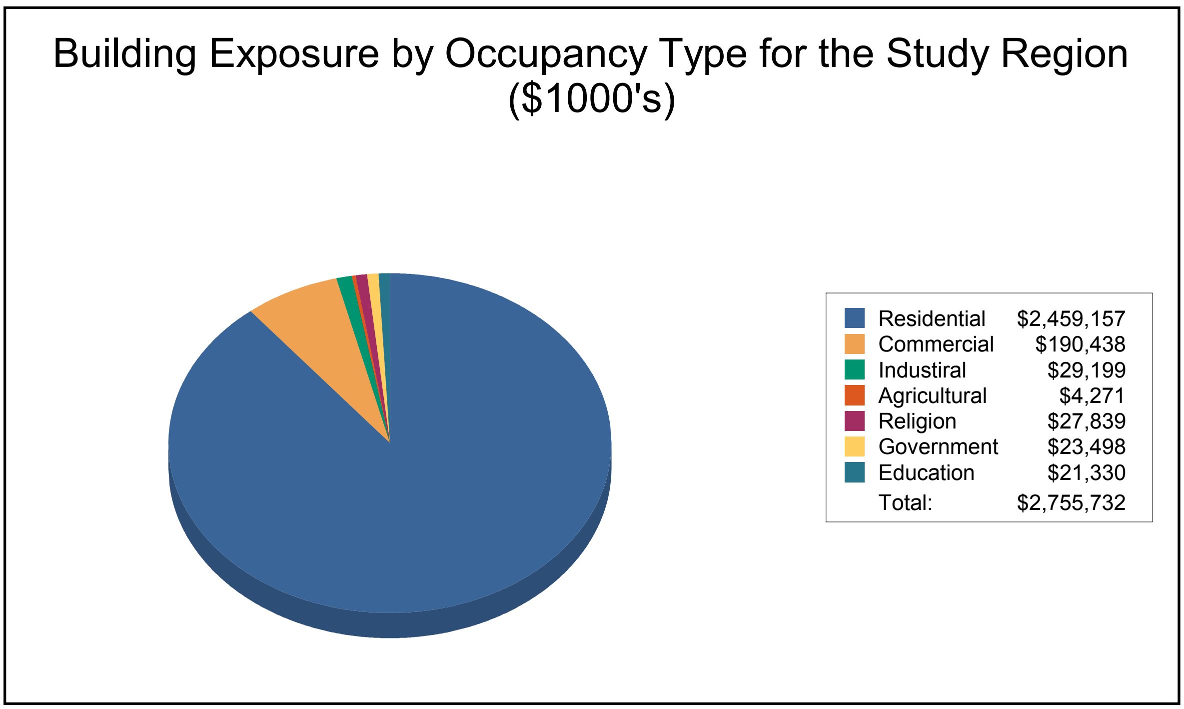
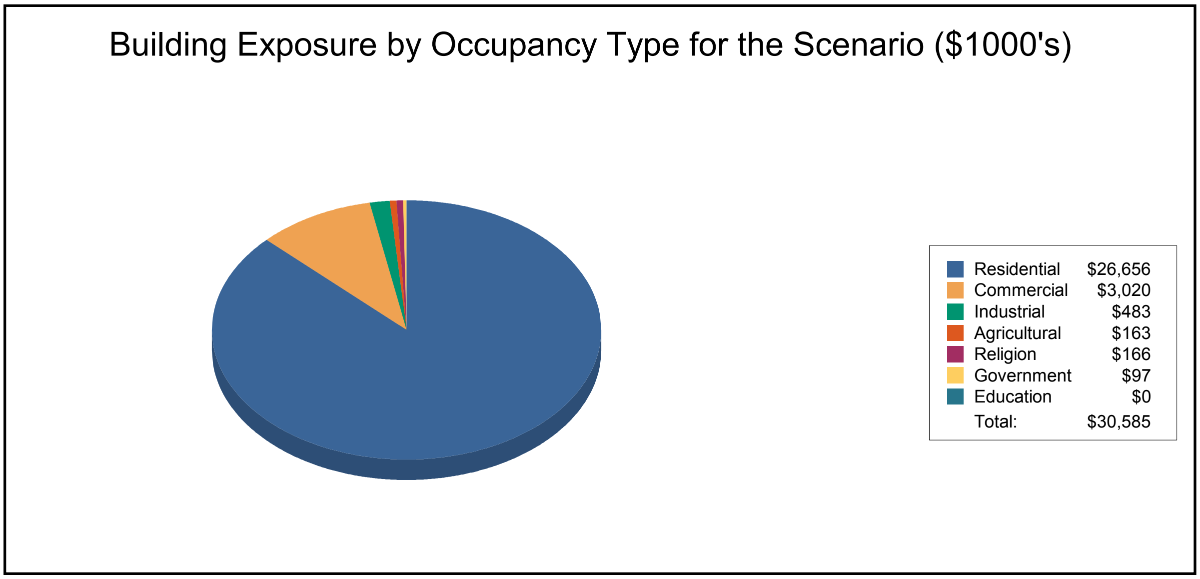


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	26,656	87.2%
Commercial	3,020	9.9%
Industrial	483	1.6%
Agricultural	163	0.5%
Religion	166	0.5%
Government	97	0.3%
Education	0	0.0%
Total	**30,585**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

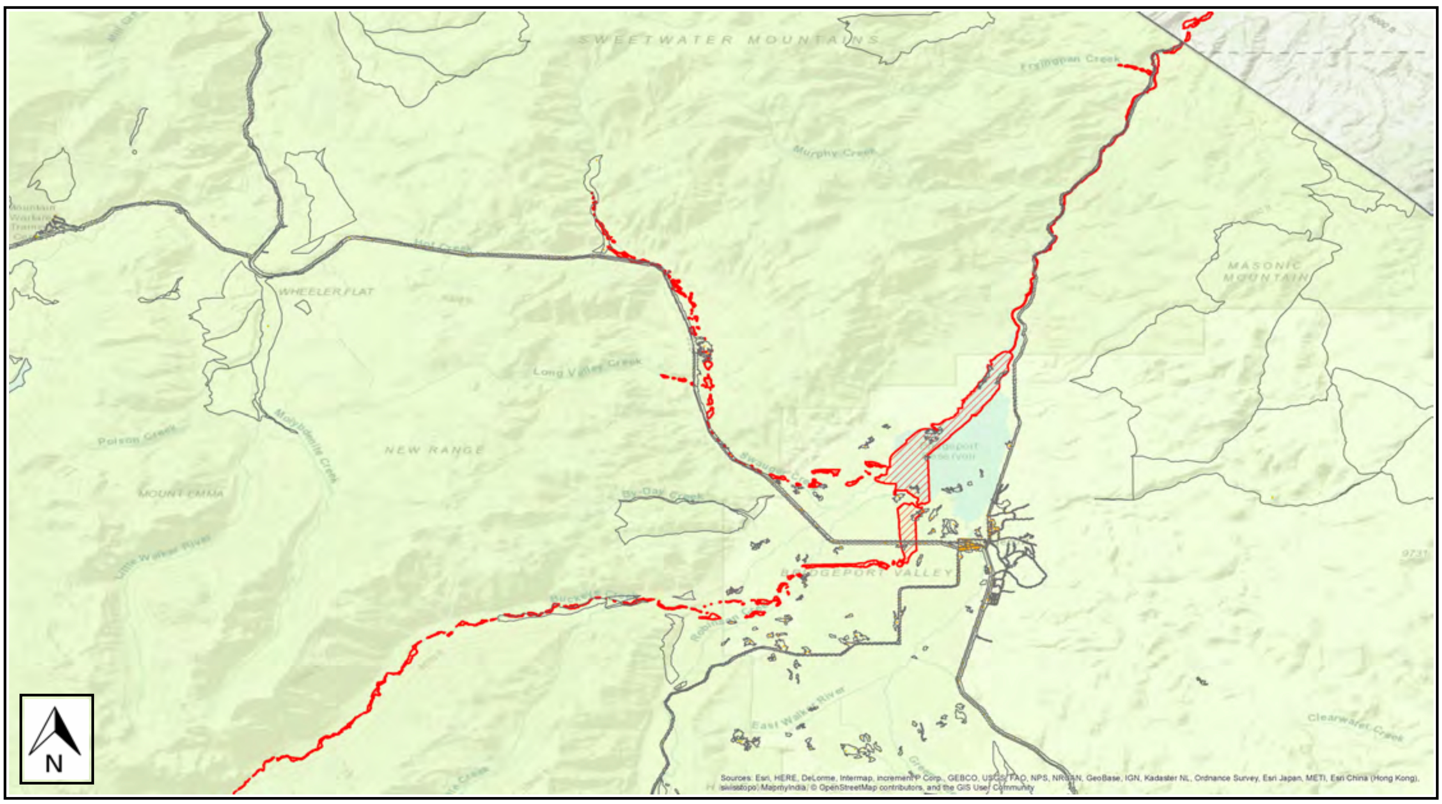
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenarios 10
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

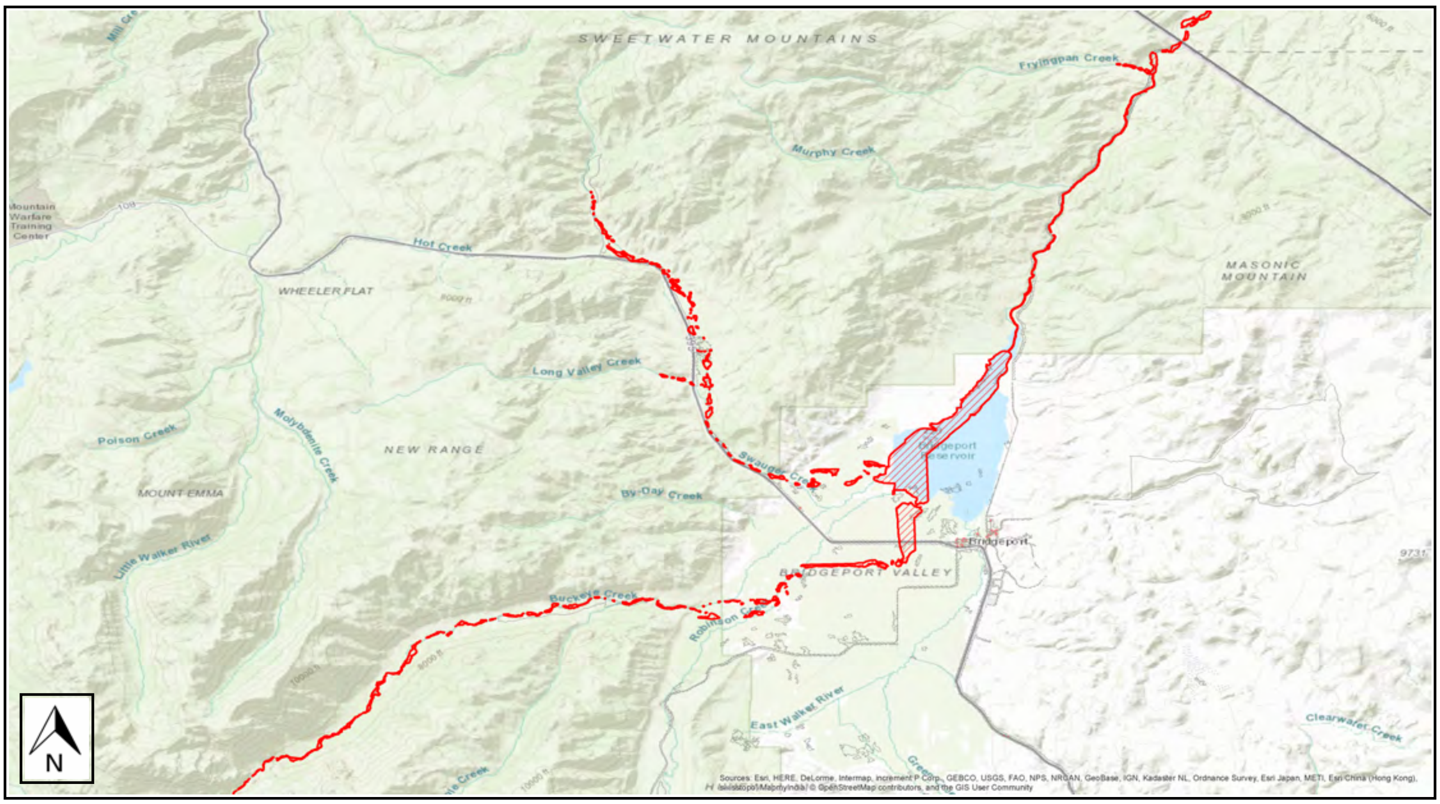


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

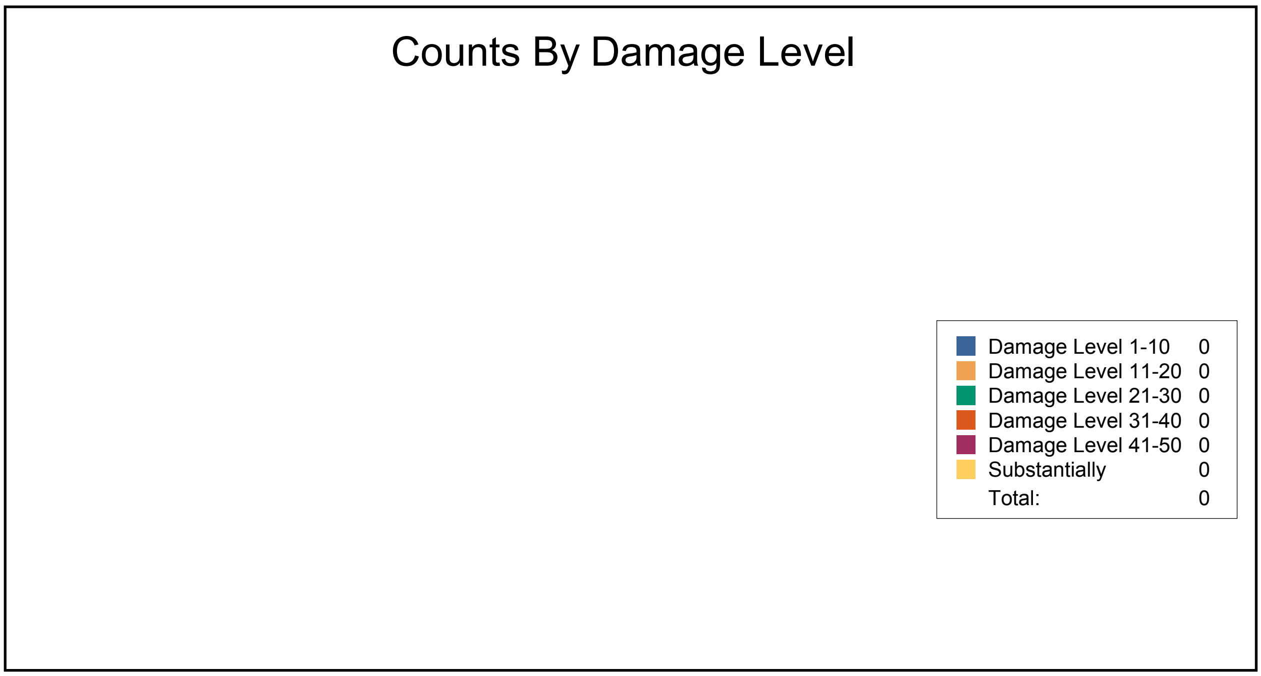


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

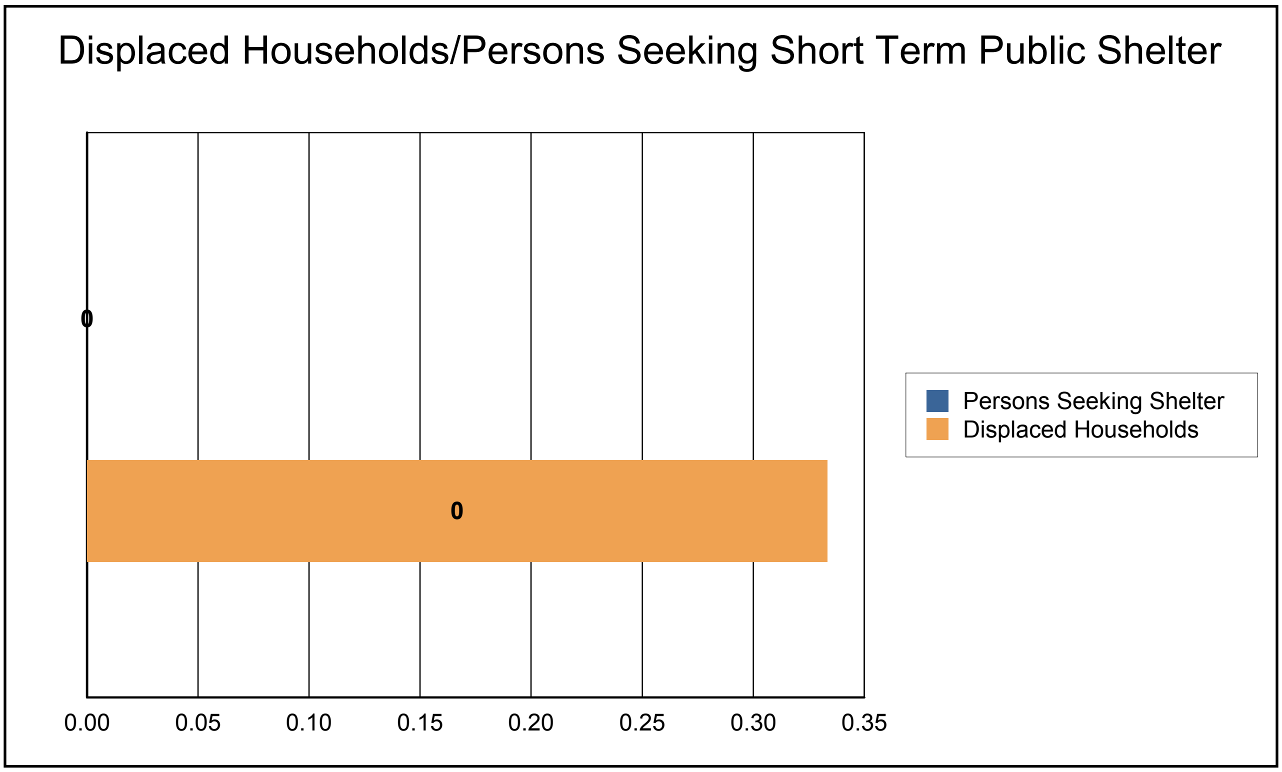
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 0 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 0.16 million dollars, which represents 0.51 % of the total replacement value of the scenario buildings.

Building-Related Losses

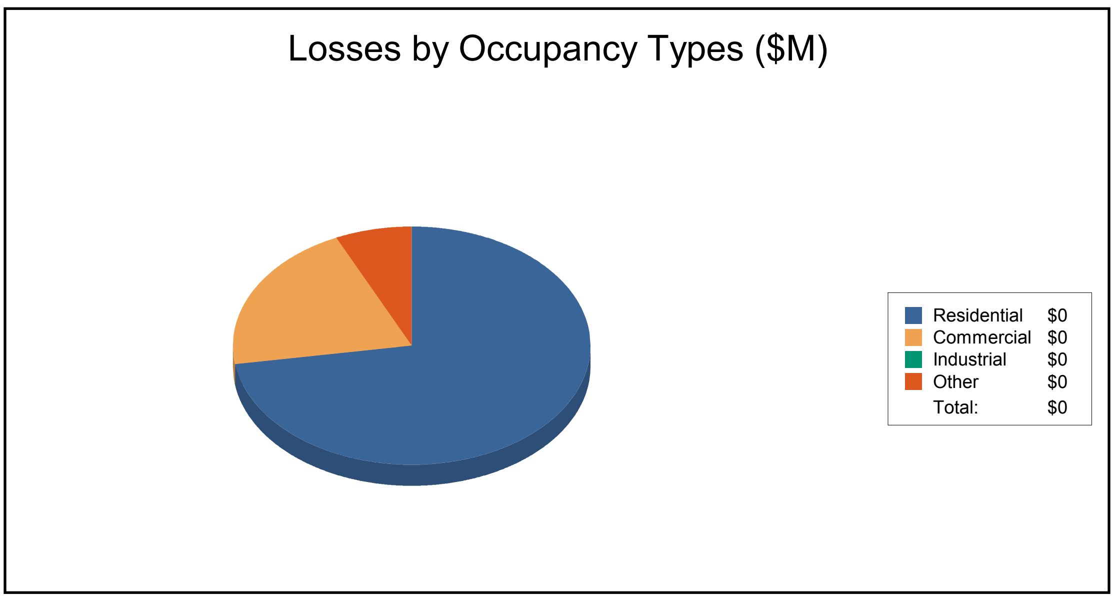
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.16 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 72.61% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.08	0.01	0.00	0.00	0.09
	Content	0.04	0.02	0.00	0.01	0.07
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.11**	**0.03**	**0.00**	**0.01**	**0.16**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.11**	**0.03**	**0.00**	**0.01**	**0.16**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

HAZUS MH
EARTHQUAKE • WIND • FLOOD

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 11

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

FEMA

RiskMAP
Increasing Resilience Together

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Note:
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There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

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Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

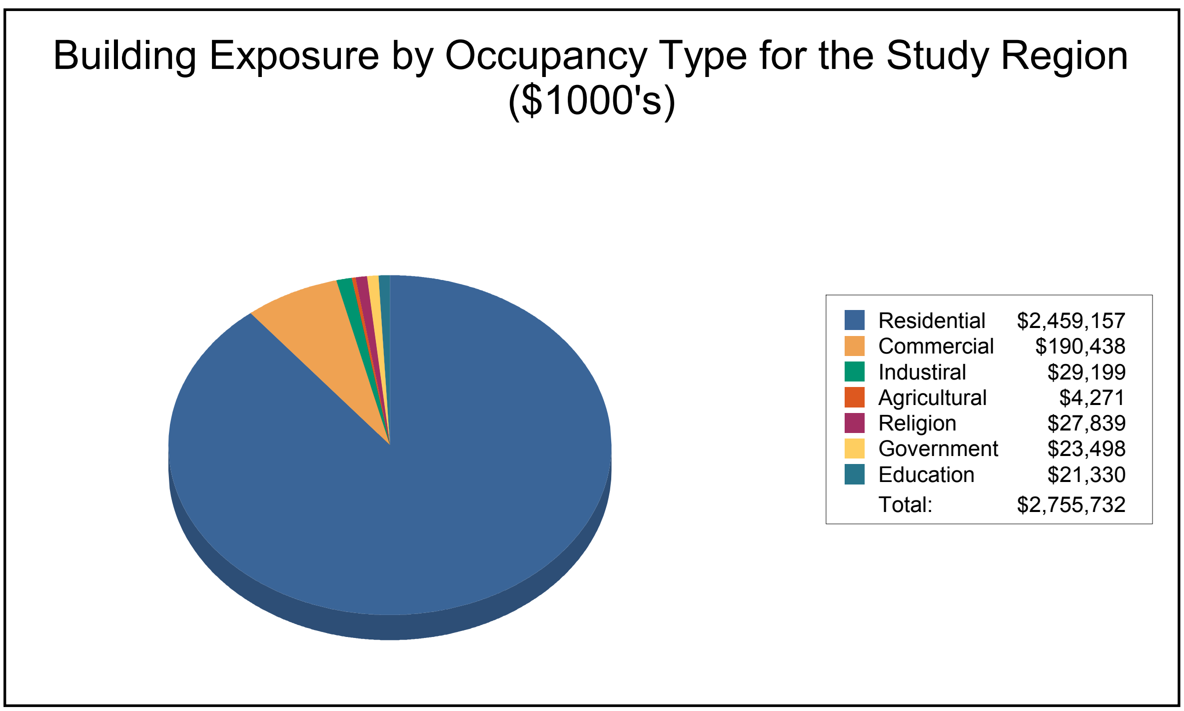
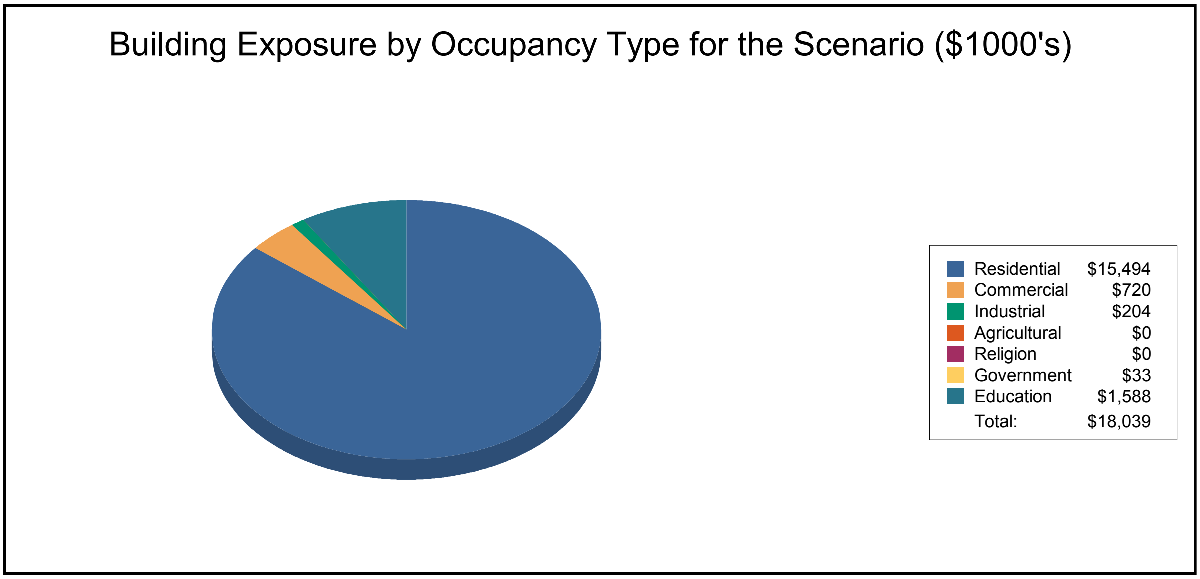


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	15,494	85.9%
Commercial	720	4.0%
Industrial	204	1.1%
Agricultural	0	0.0%
Religion	0	0.0%
Government	33	0.2%
Education	1,588	8.8%
Total	**18,039**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

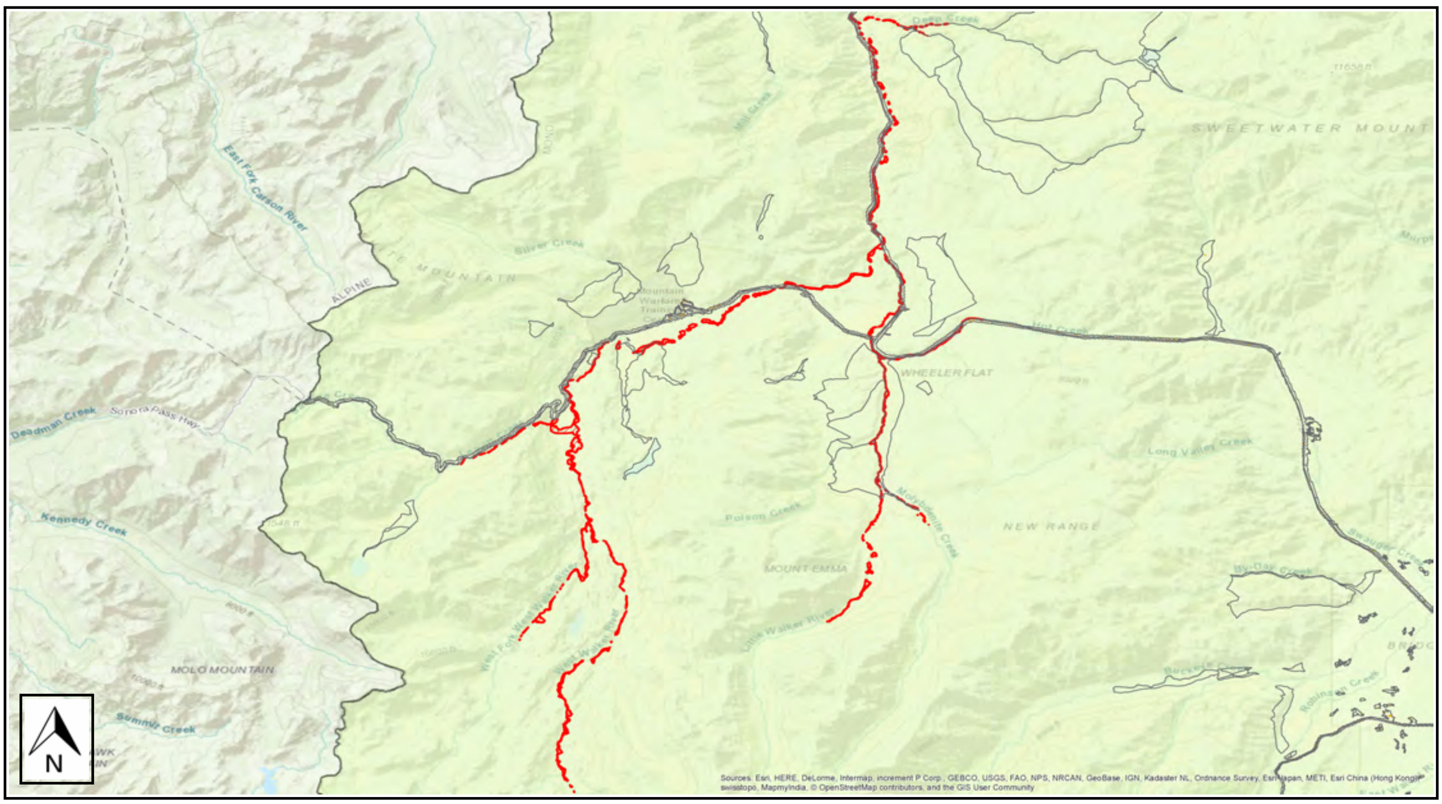
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 11
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



EARTHQUAKE • WIND • FLOOD

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

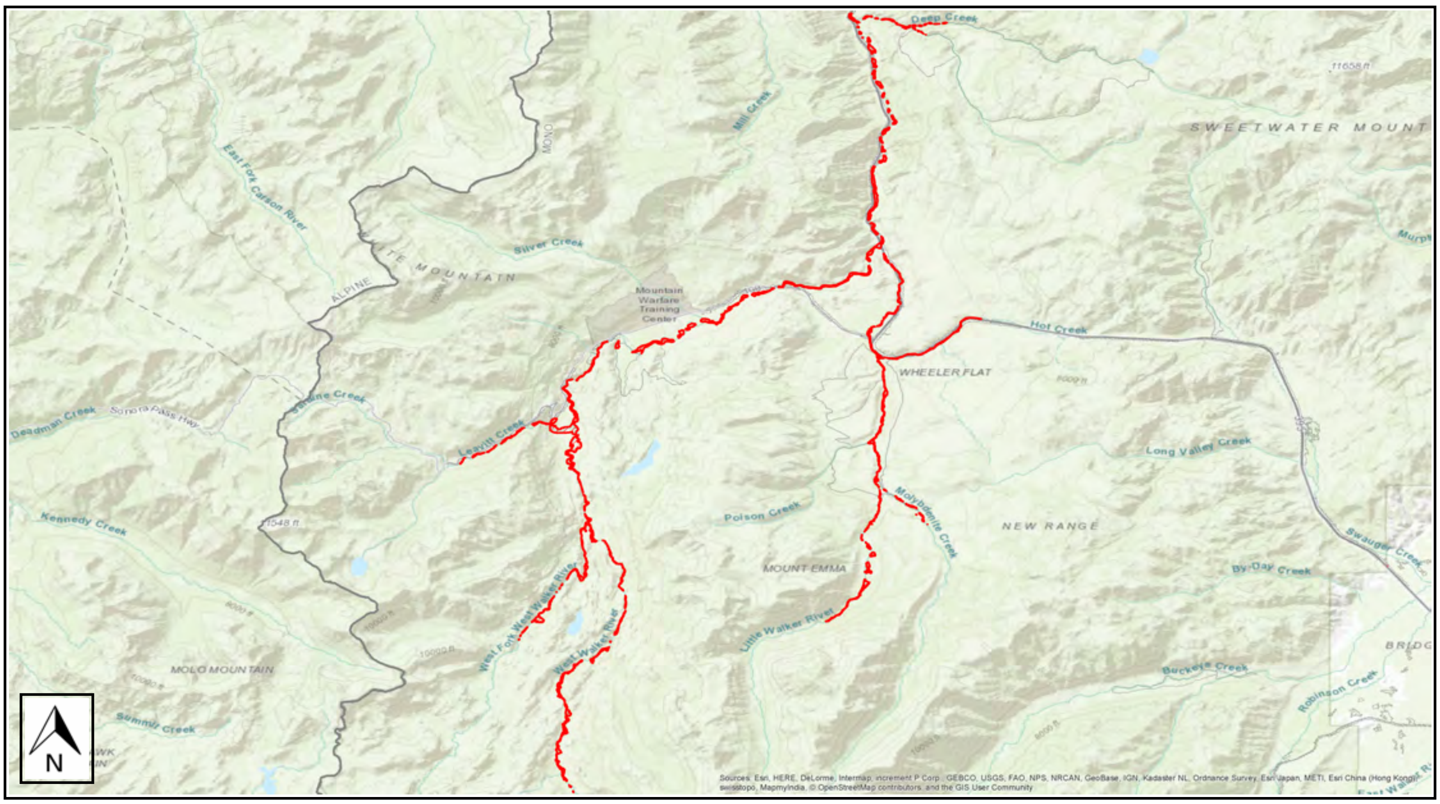


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

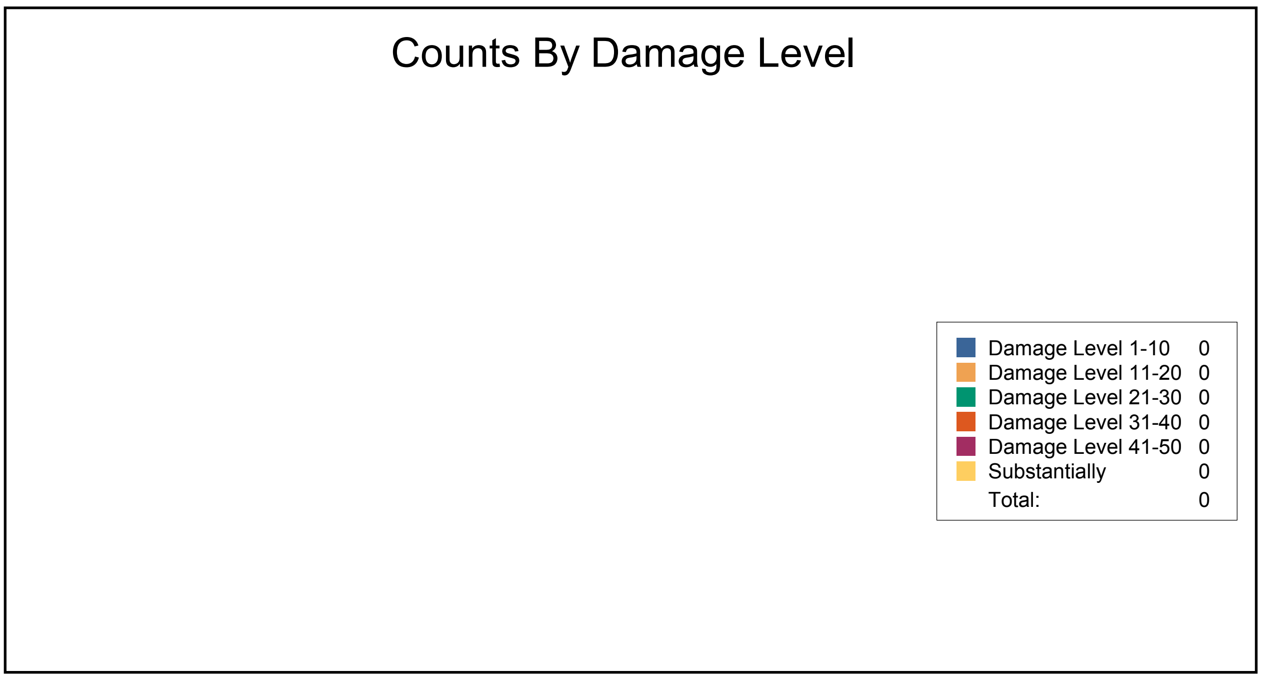


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Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

FEMA

RiskMAP
Increasing Resilience Together

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

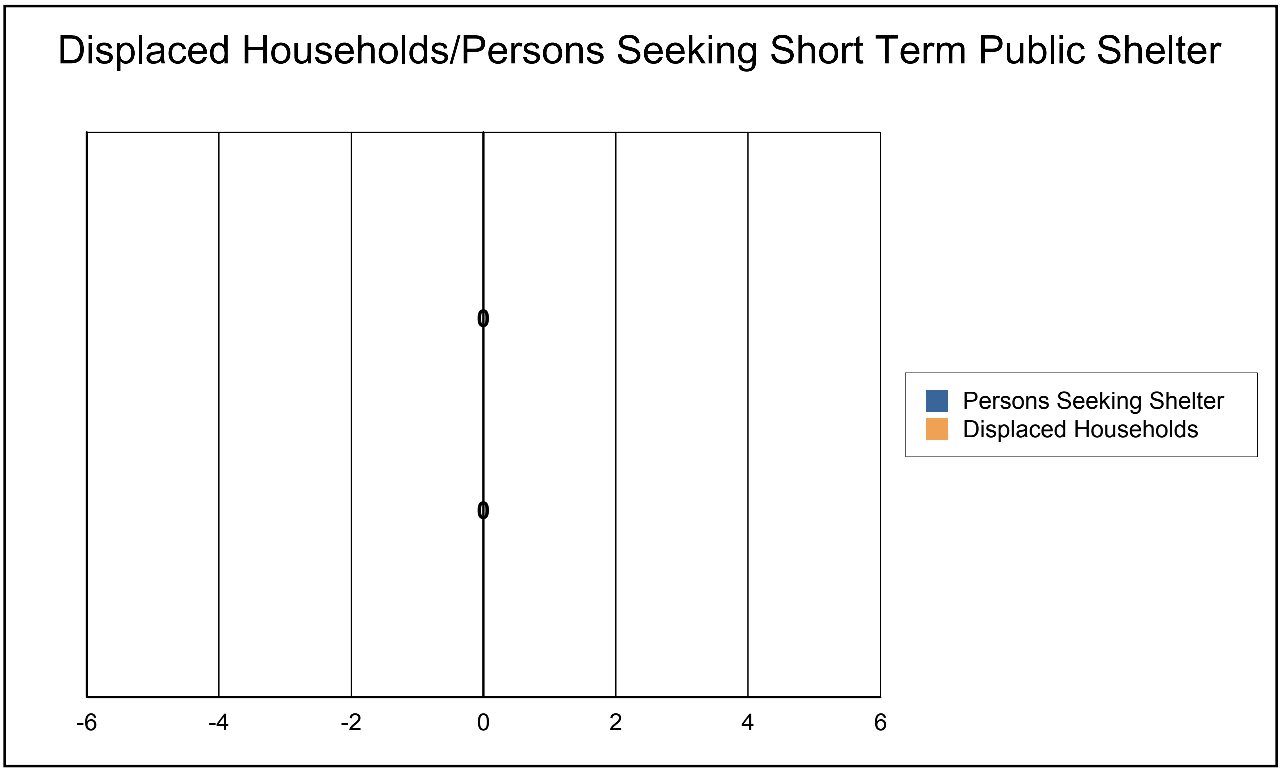
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 0 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 0 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 0.04 million dollars, which represents 0.24 % of the total replacement value of the scenario buildings.

Building-Related Losses

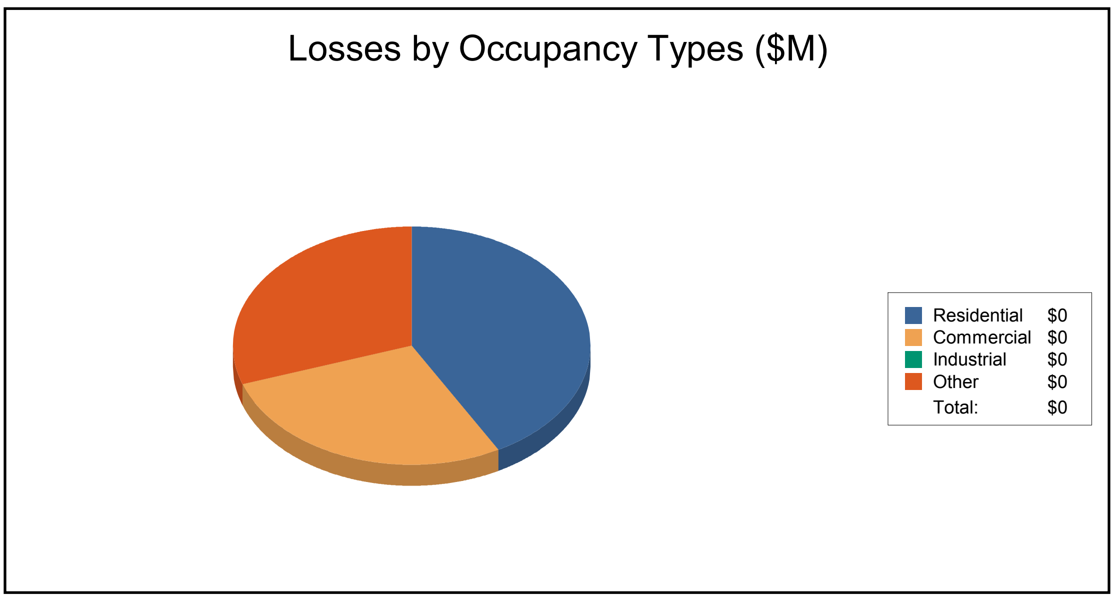
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 0.04 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 41.86% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.01	0.01	0.00	0.00	0.02
	Content	0.01	0.01	0.00	0.01	0.02
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.02**	**0.01**	**0.00**	**0.01**	**0.04**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.02**	**0.01**	**0.00**	**0.01**	**0.04**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Hazus-MH: Flood Global Risk Report

Region Name: MC_Flooding

Flood Scenario: Scenario 12

Print Date: Wednesday, January 24, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- California

Note:
Appendix A contains a complete listing of the counties contained in the region .

The geographical size of the region is 3,132 square miles and contains 3,050 census blocks. The region contains over 6 thousand households and has a total population of 14,202 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B .

There are an estimated 8,667 buildings in the region with a total building replacement value (excluding contents) of 2,756 million dollars (2010 dollars). Approximately 94.81% of the buildings (and 89.24% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 8,667 buildings in the region which have an aggregate total replacement value of 2,756 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,459,157	89.2%
Commercial	190,438	6.9%
Industrial	29,199	1.1%
Agricultural	4,271	0.2%
Religion	27,839	1.0%
Government	23,498	0.9%
Education	21,330	0.8%
Total	**2,755,732**	**100.0%**

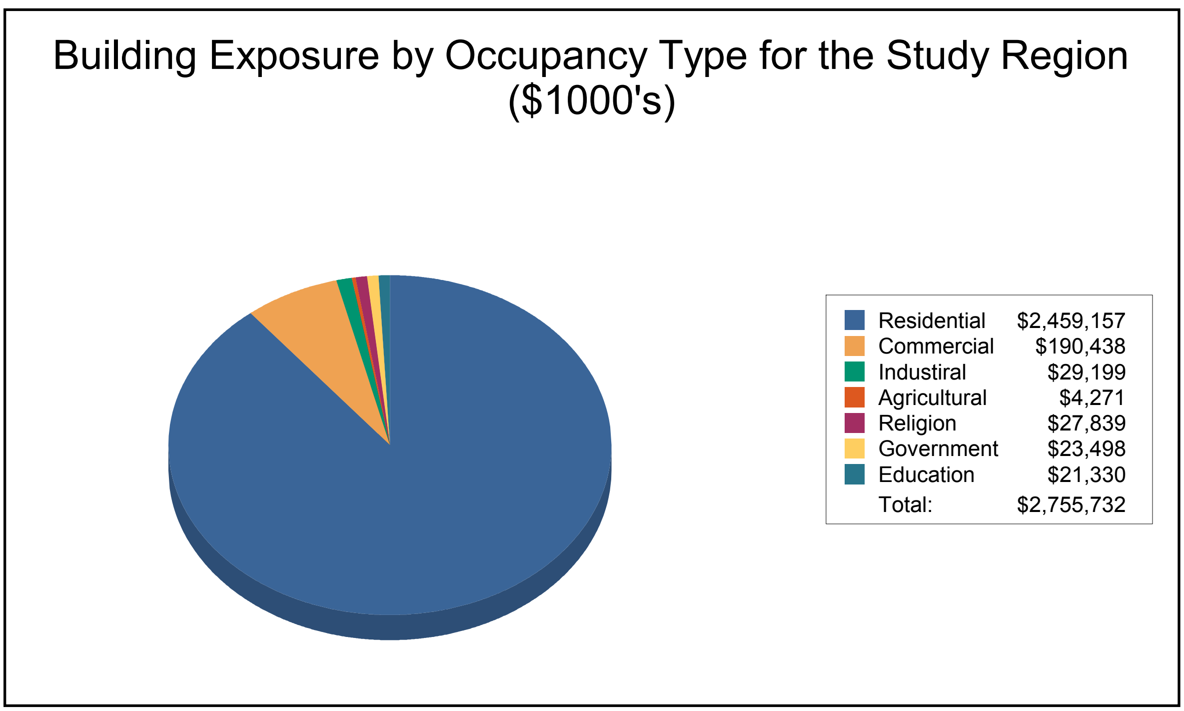
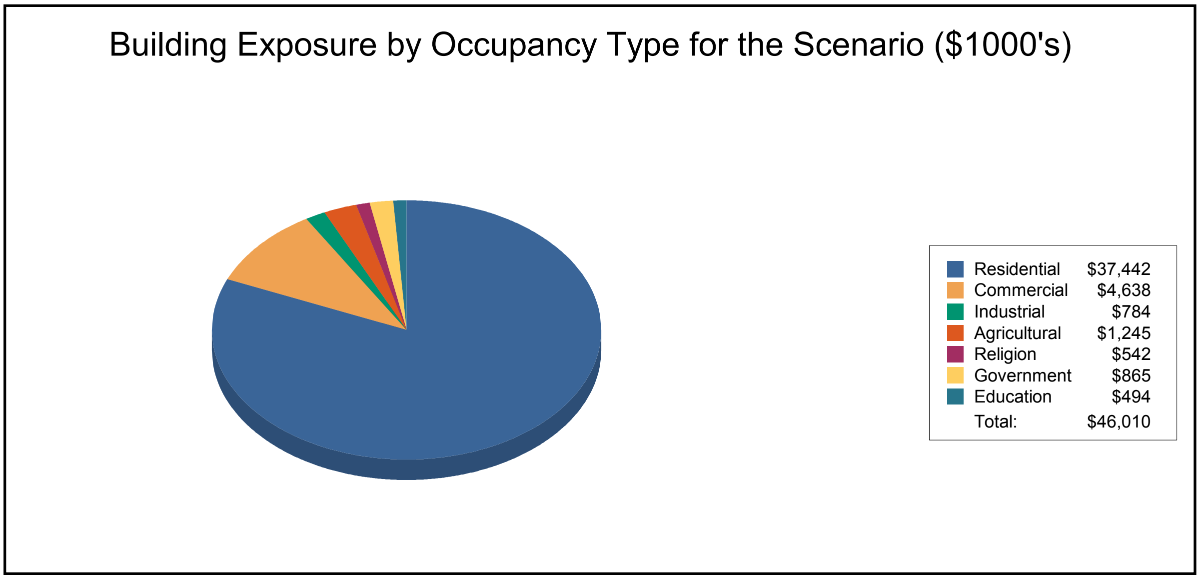


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	37,442	81.4%
Commercial	4,638	10.1%
Industrial	784	1.7%
Agricultural	1,245	2.7%
Religion	542	1.2%
Government	865	1.9%
Education	494	1.1%
Total	**46,010**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 15 beds. There are 22 schools, 10 fire stations, 3 police stations and no emergency operation centers.

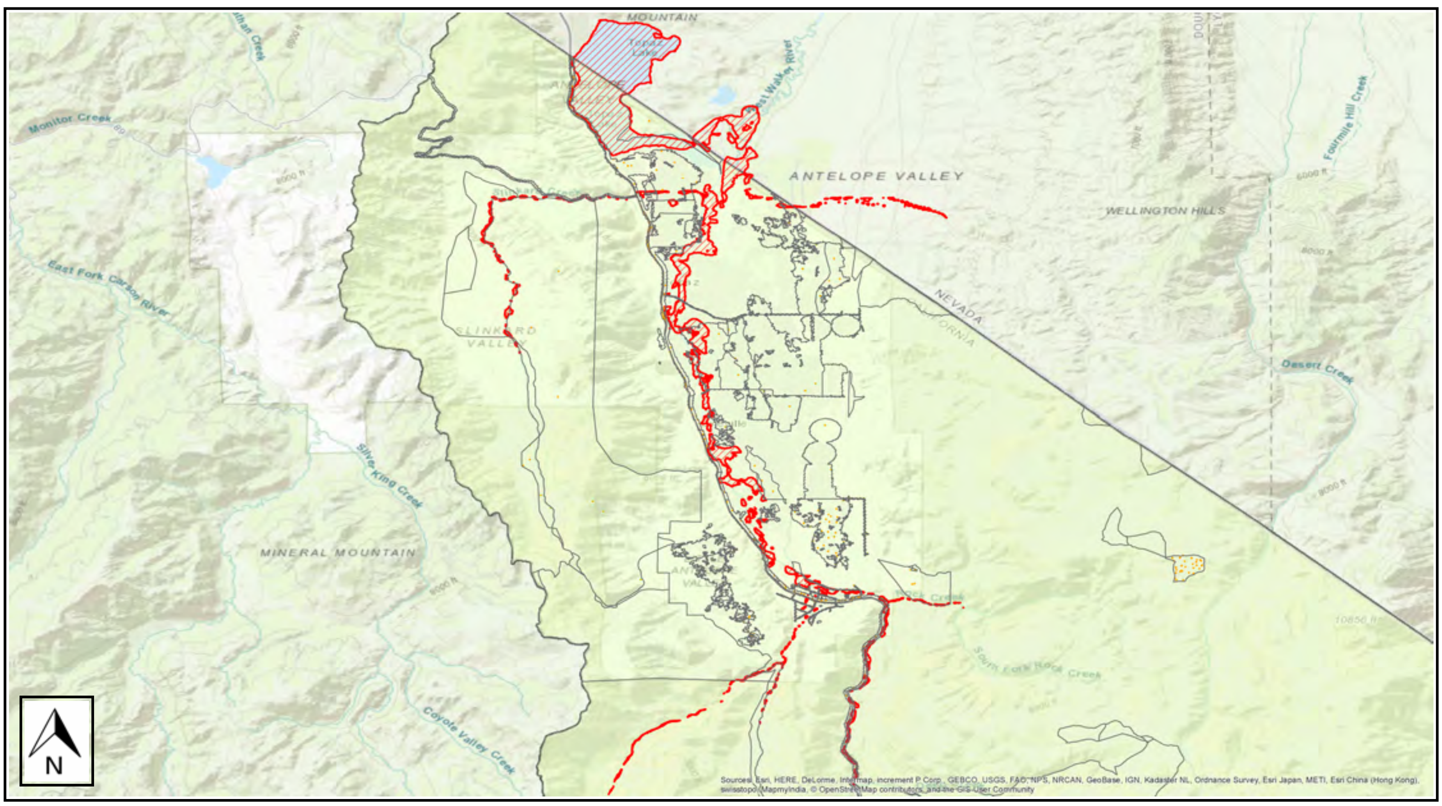
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	MC_Flooding
Scenario Name:	Scenario 12
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

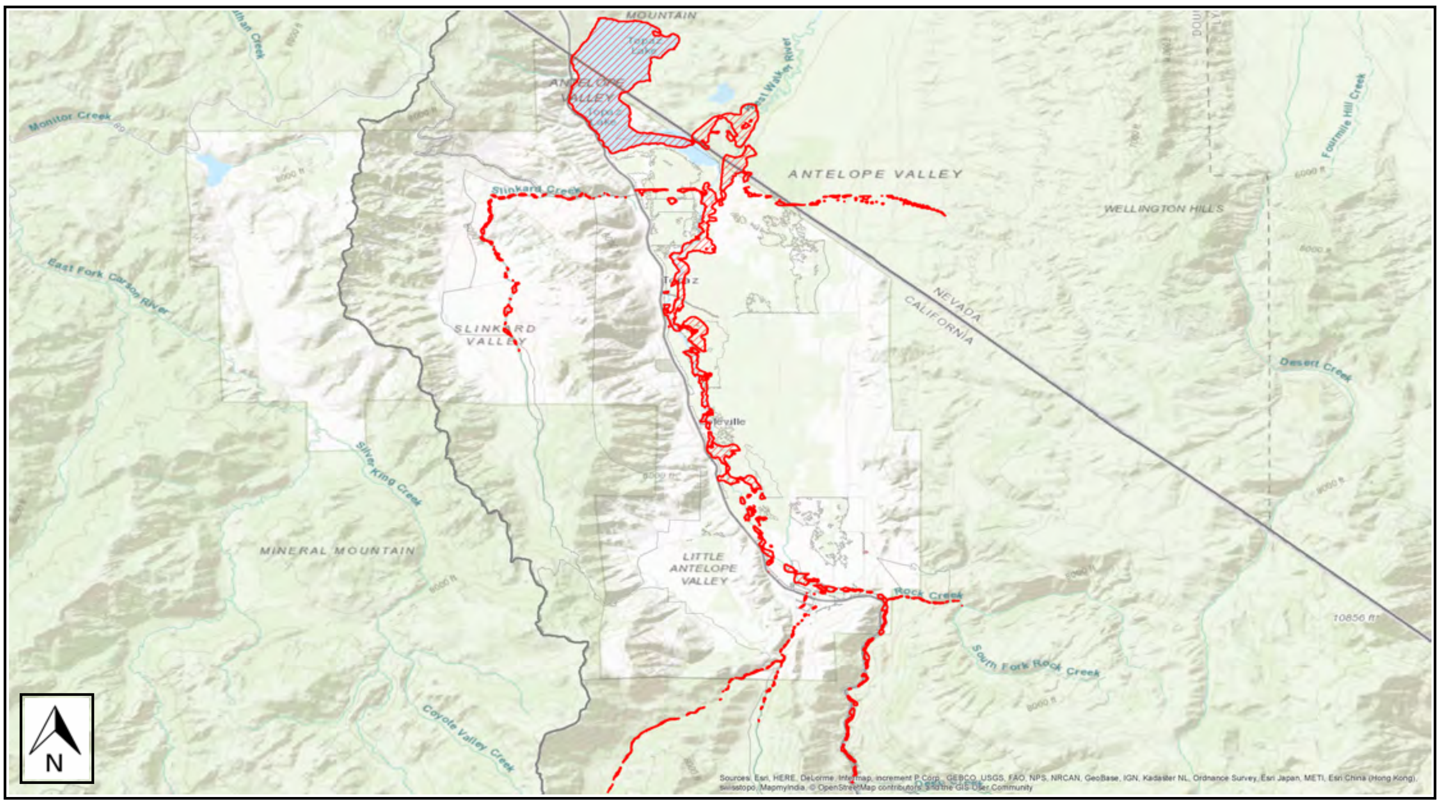


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

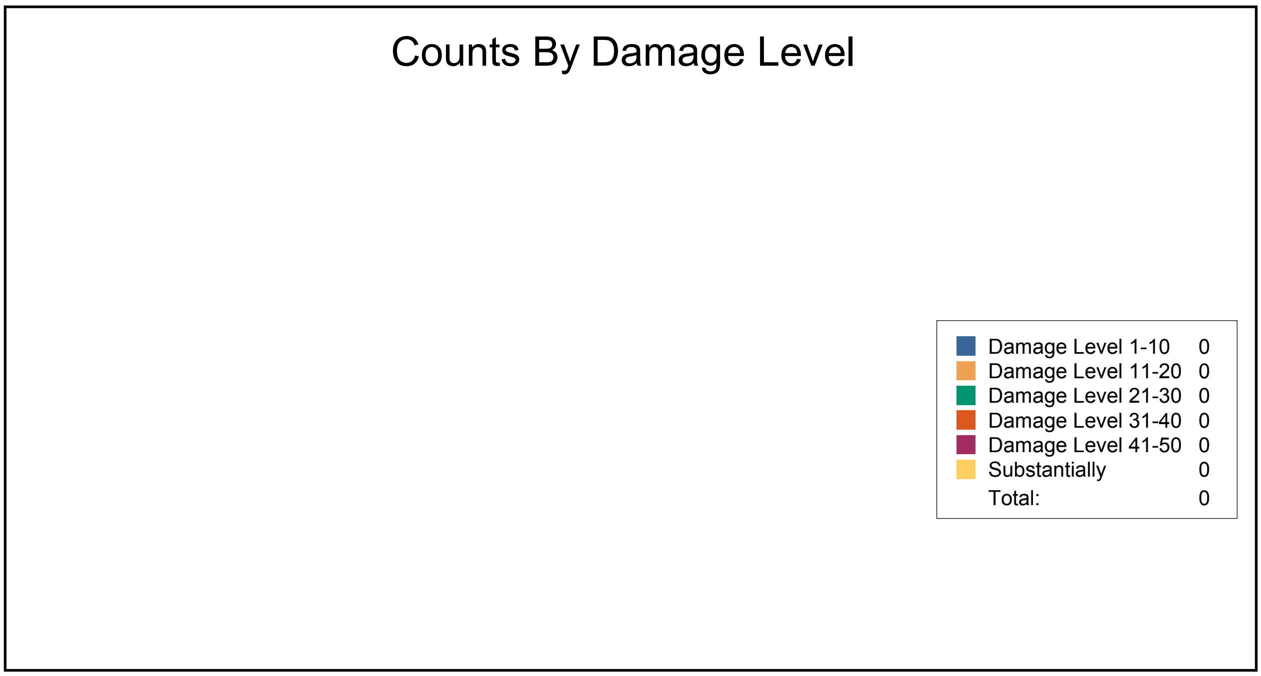


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 15 hospital beds available for use. On the day of the scenario flood event, the model estimates that 15 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	10	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	22	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

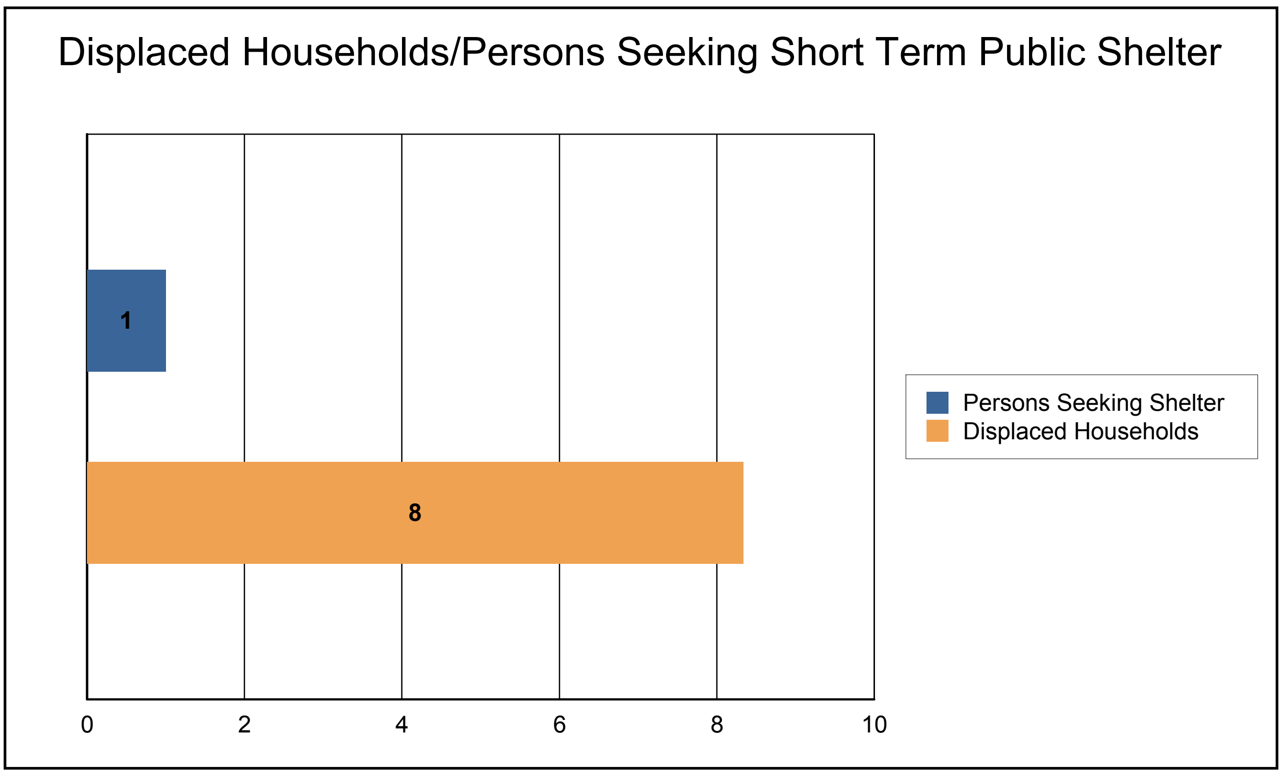
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 8 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1 people (out of a total population of 14,202) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 1.16 million dollars, which represents 2.52 % of the total replacement value of the scenario buildings.

Building-Related Losses

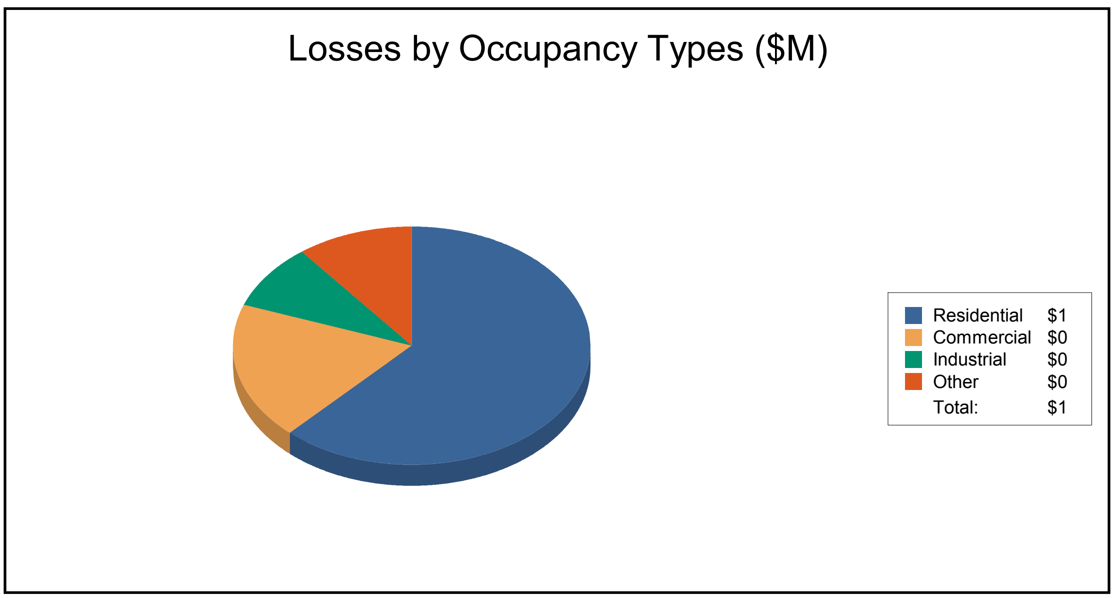
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 1.16 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 61.90% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.49	0.08	0.03	0.04	0.63
	Content	0.23	0.14	0.06	0.08	0.52
	Inventory	0.00	0.00	0.01	0.00	0.01
	Subtotal	**0.72**	**0.22**	**0.10**	**0.12**	**1.16**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**0.72**	**0.22**	**0.10**	**0.12**	**1.16**



Appendix A: County Listing for the Region

California

- Mono

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Mono	14,202	2,459,157	296,575	2,755,732
Total	**14,202**	**2,459,157**	**296,575**	**2,755,732**
Total Study Region	**14,202**	**2,459,157**	**296,575**	**2,755,732**

Appendix F:
2009 CWPP Appendices

Mono County | Town of Mammoth Lakes

Multi-Jurisdictional Hazard Mitigation Plan

Technical Appendices

APPENDIX 4: CWPP APPENDICES

Public Draft | [Date]

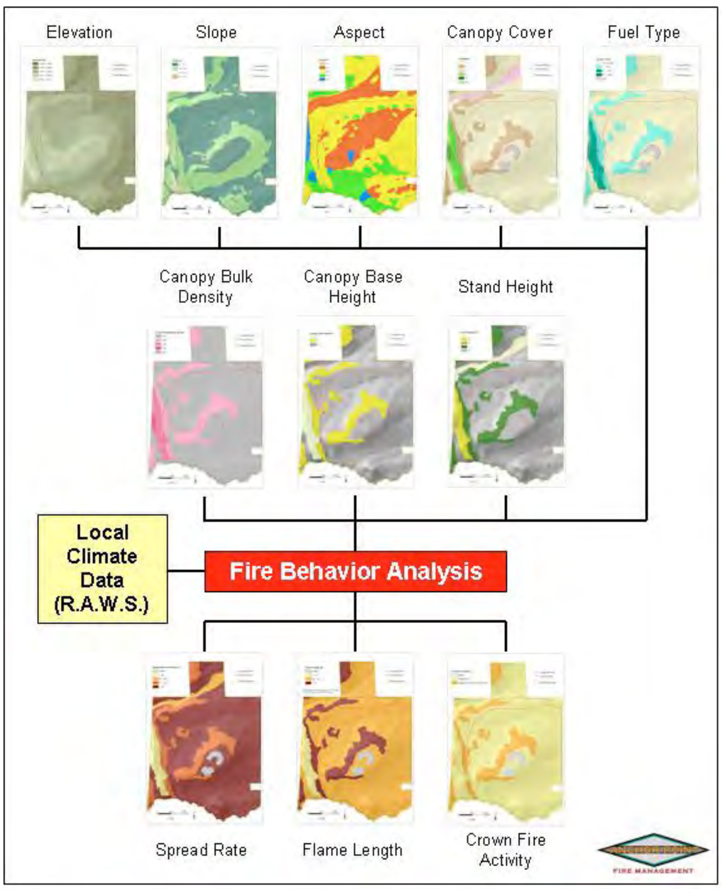
APPENDIX 4A

FIRE BEHAVIOR POTENTIAL ANALYSIS METHODOLOGY

Purpose

The purpose of this document is to describe the methodology used to evaluate the threat represented by physical hazards—such as fuels, weather and topography—to values-at-risk in the study area, by modeling their effects on fire behavior potential.

Figure 1. Flow Chart



The fire behavior potential analysis reports graphically the probable range of spread rate, flame length, and crown fire potential for the analysis area, based upon a set of inputs significant to fire behavior. The model inputs include aspect, slope, elevation, canopy cover, fuel type, canopy bulk density, canopy base height, stand height, and climate data. The model outputs are determined using FlamMap[1], which combines surface fire predictions with the potential for crown fire development. Calculations for surface fire predictions (rate of spread and flame length) are based on the USDA Forest Service's BEHAVE[2] model.

BEHAVE

The BEHAVE fire behavior prediction and fuel modeling system was employed to determine surface fire behavior estimates for this study. BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread given certain conditions of topography, fuels, and weather. The BEHAVE modeling system has been used for a variety of applications, including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, and fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space, given simple user- defined fuels, weather, and topography. Requested values depend on the modeling choices made by the user.

Assumptions of BEHAVE:

- Fire is predicted at the flaming front
- Fire is free burning
- Behavior is heavily weighted towards the fine fuels
- Continuous and uniform fuels
- Surface fires

FlamMap

Anchor Point uses FlamMap to evaluate the potential fire conditions in the fire behavior study area. Mono County encompasses 2,004,344 acres (3,131.8 square miles). The study area for the fire behavior analysis covers approximately 2,213,067 acres (3,457.9 square miles). This area includes the entire county plus a one-mile buffer in all directions. The use of this buffer provides the county with an analysis of potential fire behavior on adjacent lands. The study area is broken down into grid cells of 10-meters per side (10M). Using existing vector and raster spatial data and field data, ArcGIS spatial analysis capabilities are used to calculate model inputs for each 10M cell. These values are input into FlamMap, along with reference weather and fuel moisture (long-term weather observations statistically calculated from the Rifle Remote

---

[1] Mark Finney, Stuart Brittain and Rob Seli., The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana), the Bureau of Land Management and Systems for Environmental Management (Missoula, Montana).

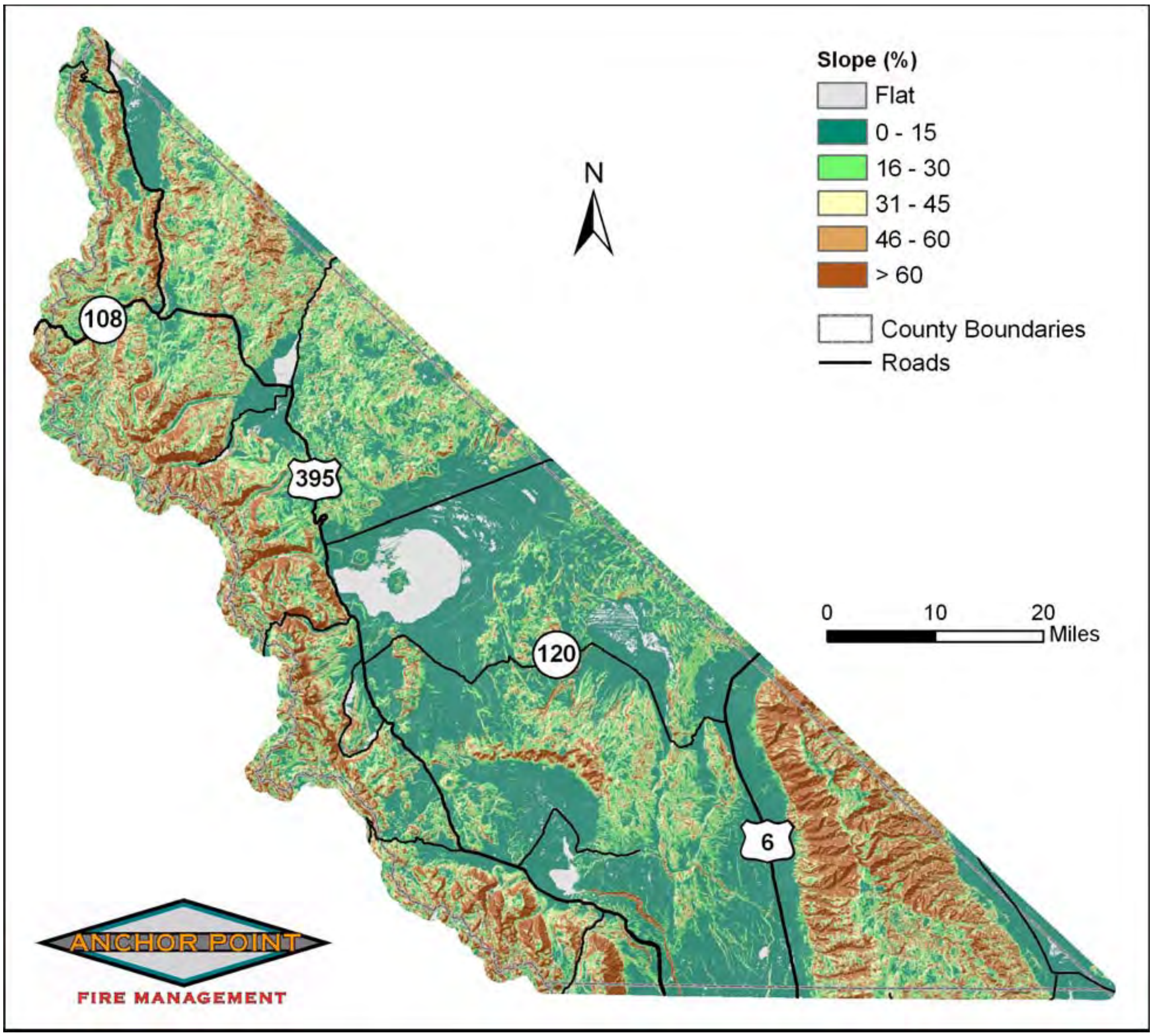
[2] Patricia L. Andrews, producer and designer, Collin D. Bevins, programmer and designer, The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) and Systems for Environmental Management (Missoula, Montana).

Automated Weather Station information). The outputs of FlamMap include the estimated Rate of Spread (ROS) (from BEHAVE), Flame Length (FL) (from BEHAVE) and Crown Fire Activity for a fire in that 10M cell. The model computes these values for each cell in the study area independently, so the data in each cell is unaffected by adjacent cells.

Fire Behavior Inputs

The major factors influencing fire behavior are fuels (type and coverage), weather, and topography (aspect, slope and elevation). The following pages contain a brief explanation of each.

Figure 2. Percent Slope



Slopes are shown here as percent (rise/run x100). Steeper slopes intensify fire behavior and thus will contribute to a higher wildfire hazard rating. Rates of spread for a slope of 30% are typically double those of flat terrain, when all other influences are equal.

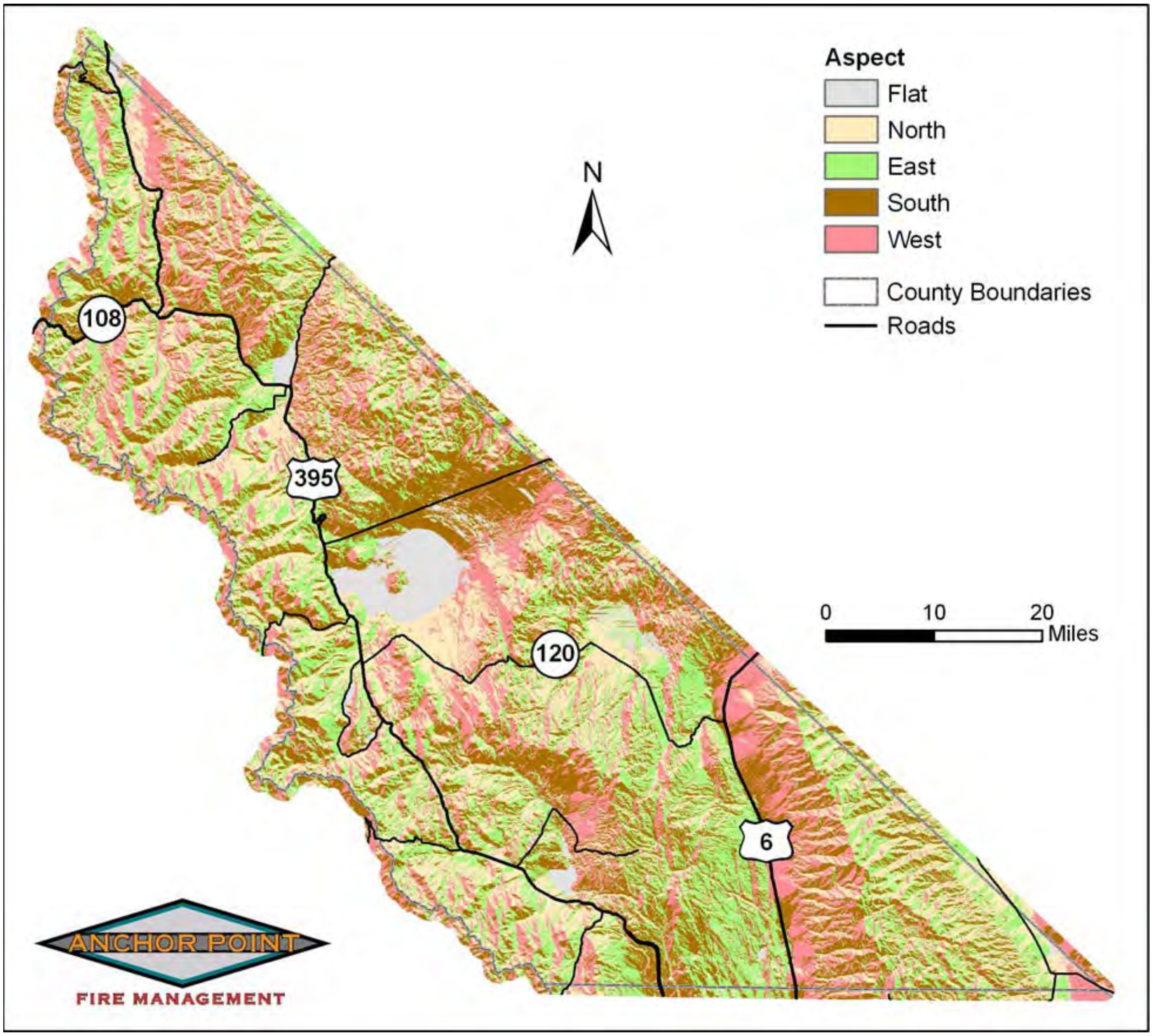


Figure 3. Aspect

Aspects are shown as degrees from north ranging from 0 to 360 according to their orientation. Aspects are influential in the type and quantity of vegetative fuels. Fuels on south facing slopes tend to be drier and more lightly loaded than fuels on north facing slopes, when all other influences are equal. Aspect also has an influence on plant species dominance.

Classification	North	East	South	West
Range (degrees)	315-45	45-135	135-225	225-315

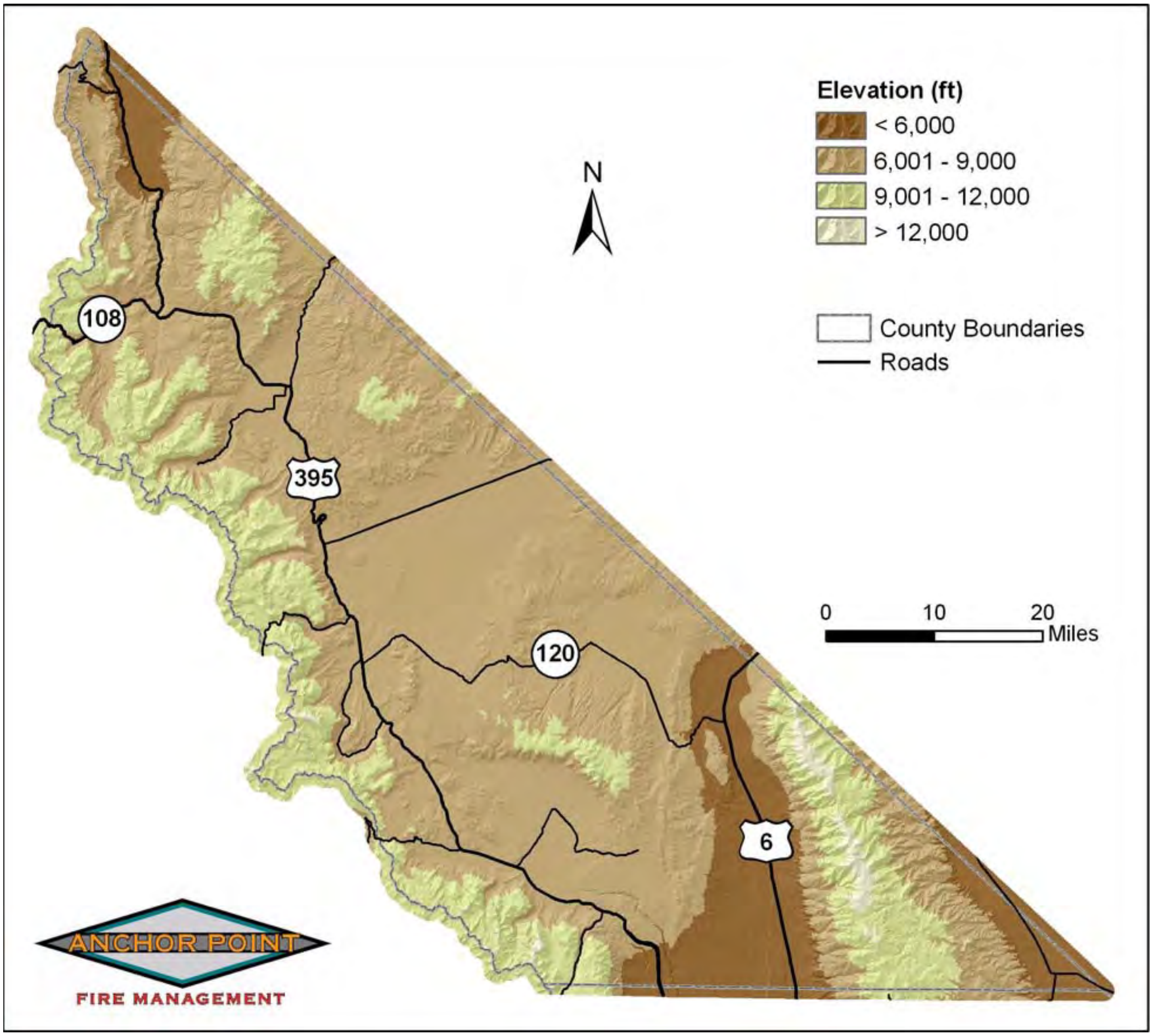


Figure 4. Elevation

Elevations within the study area range from 4,200′ to over 10,000′. As elevation increases, environmental conditions, fuel species, and characteristics change.

Fuel Models and Fire Behavior

Fire behavior fuel models are a set of numbers that describe fuels in terms that a fire behavior model, in this case FlamMap, can use. There are seven characteristics used to categorize fuel models.

- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content

Each of the major fuel types present in the study area are described below in terms of the characteristics that coincide with that fuel model. Fuel model descriptions are taken from Anderson's *Aids to Determining Fuel Models for Estimating Fire Behavior*[3], a national standard guide to fuel modeling, unless otherwise noted. **Vegetation for the project area may or may not be specifically listed in the description**. Plant species are only an aid to help visualize the characteristics of the model. The photos are taken from the project area and show where the local vegetation fits in.

The study area is represented primarily by eight fuel models (FM): FM 1, 2, 5, 6, 8, 9, 10 and 15 (a CDF custom fuel model). Other fuel models may exist, but not in quantities sufficient to significantly influence fire behavior in the Wildland Urban Interface. **Figure 5** displays the fuel types graphically for the study area.

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[3] Anderson, Hal E., *Aids to Determining Fuel Models for Estimating Fire Behavior*, National Wildfire Coordinating Group, NFES 1574, April 1982.

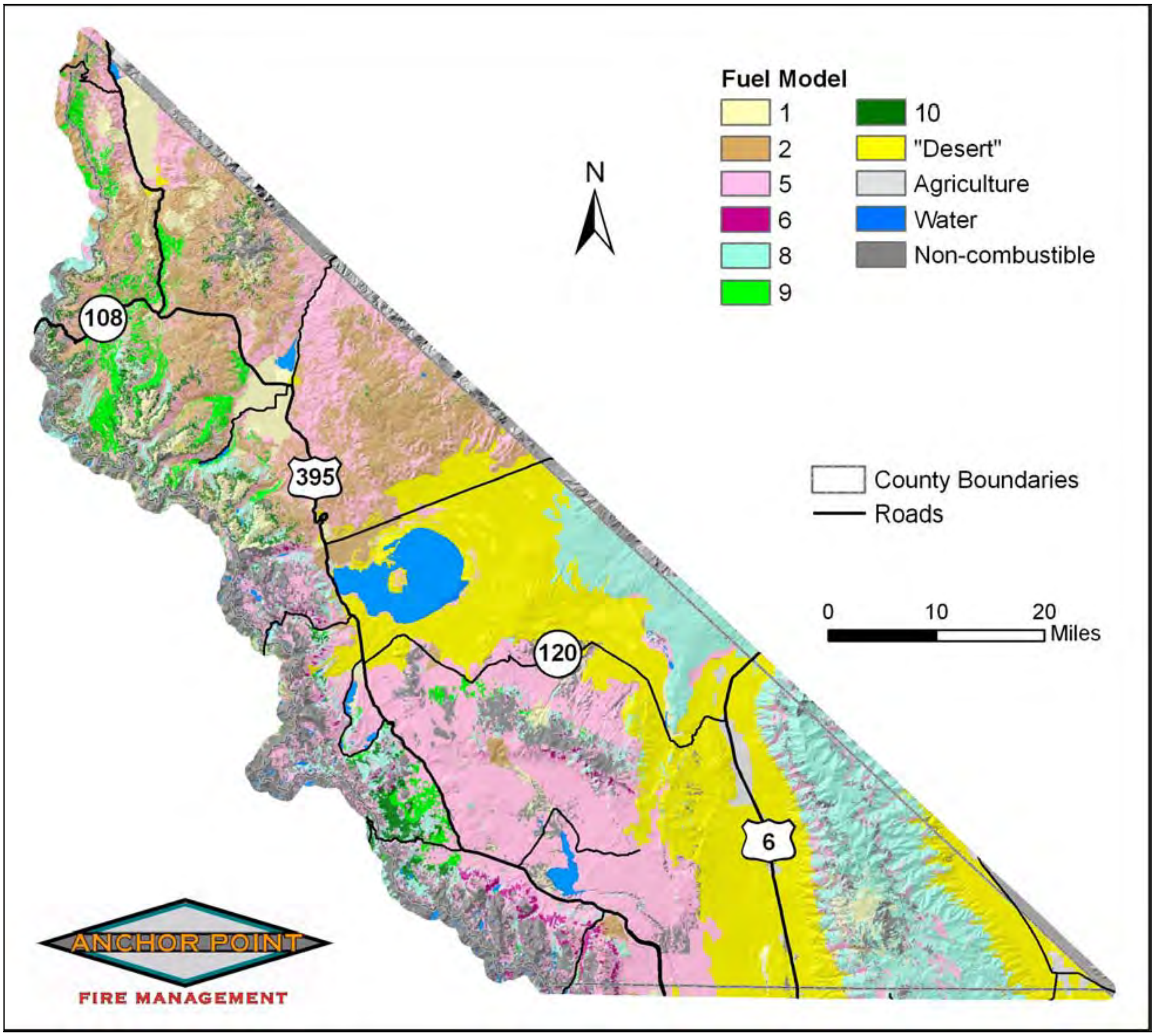

Figure 5. Mono County Fuel Models

"Desert" is a custom CDF fuel model (FM 15). Fuel models 97, 98, and 99 in the map legend indicate areas of insignificant combustibility such as water, rock, sand, etc.

FUEL MODEL 1

Figure 6. Short grasses

Characteristics

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations.

Common Types/Species

Annual and perennial grasses are included in this fuel model.

Fire Behavior

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires in this fuel model are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present—generally less than one third of the area.

FUEL MODEL 2

Figure 7. Open canopy timber and shrubs with grass understory

Characteristics

Fire spread is primarily through the fine herbaceous fuels, either curing or dead.

Common Types/Species

Open shrub lands and pine stands or scrub oak stands that cover one third to two thirds of the area may generally fit this model. Such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some Pinyon-juniper may be in this model.

Fire Behavior

These are surface fires where the herbaceous material—in addition to litter and dead-down stemwood from the open shrub or timber overstory—contributes to the fire intensity.

FUEL MODEL 5

Figure 8. Young green stands of sage and chaparral

Characteristics

This model consists of continuous stands of low brush. Generally, heights do not exceed six feet. The stands will have a grass or scattered grass understory. Usually shrubs are short and almost totally cover the area.

Common Types/Species

Young, green stands with no dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise. Mountain grasses are also associated with this type.

Fire Behavior

The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. Cured leaves retained on shrubs can cause greater intensities.

FUEL MODEL 6

Figure 9. Mixed stands of mesquite and big sage less than 6 feet high

Characteristics

Shrubs in Fuel Model 6 are older than, but not as tall as, the shrub types of Fuel Model 4. They also do not contain as much fuel as FM 4.

Common Types/Species

A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrub lands may be represented but may over-predict rate of spread except at high winds, such as 20 mi/h (32 km/h) at the 20-foot level.

Fire Behavior

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h), at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand.

FUEL MODEL 8

Figure 10. Aspen stands

Characteristics

Hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Amounts of needle and woody litter are also low.

Common Types/Species

Closed canopy stands of short-needle conifers or hardwoods. Representative conifer types are white pine, Lodgepole pine, spruce, fir and larch.

Fire Behavior

Fires in this fuel model are slow burning and low intensity, burning in surface fuels. Fuels are mainly needles and woody litter. Heavier fuel loadings from old dead and down trees or branches can cause flare-ups. Heavier fuel loads have the potential to develop crown fires in extreme burning conditions.

FUEL MODEL 9

Figure 11. Mixed conifer stands with moderate loads of dead and down

Characteristics

This stand is represented by closed canopy stands of Ponderosa pine and mixed conifer. Understory may consist of small trees and shrubs, grasses, and moderate concentrations of down, dead woody litter. High amounts of needle litter may be present. This model can exist from foothills to sub-alpine.

Common Types/Species

This model can include Ponderosa pine, Lodgepole pine, and a mixture of Douglas-fir spruce and pine. Some mountain shrubs and grasses are present.

Fire Behavior

Fires run through surface litter, torching of individual trees is possible. Under high burning conditions, crown fires can be encountered.

FUEL MODEL 10

Figure 12. Mixed conifer stands with heavy dead and regeneration in the understory

Characteristics

This model is represented by dense stands of over-mature ponderosa pine, Lodgepole pine, mixed-conifer, and continuous stands of Douglas-fir. In all stand types, heavy down material is present. There is also a large amount of dead, down woody fuels. Reproduction may be present, acting as ladder fuels. This model includes stands of budworm-killed Douglas-fir, closed stands of ponderosa pine with large amounts of ladder and surface fuels, and stands of Lodgepole pine with heavy loadings of downed trees. This model can occur from the foothills through the sub-alpine zone.

Common Types/Species

All types of vegetation can occur in this model, but primary species are Douglas-fir, ponderosa pine and Lodgepole pine.

Fire Behavior

Fire intensities can be moderate to extreme. Fire moves through dead, down woody material. Torching and spotting are more frequent. Crown fires are quite possible.

FUEL MODEL 15

Figure 13. Desert shrubs and grasses (custom fuel model from FRAP)

FM 15 is a desert grass custom model. It most closely resembles the Scott and Burgan FM 121 (GS1).[4] The following descriptions are from "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" by Joe H. Scott and Robert E. Burgan.[5]

Characteristics

The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about one foot high, grass load is low.

Common Types/Species

Dry-climate grasses and shrubs.

Fire Behavior

Spread rate is moderate: flame length is low. Moisture of extinction is low.

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[4] Source: email communication from David Sapsis, Wildland Fire Scientist, CDF Fire and Resource Assessment Program (FRAP), August 17, 2006.

[5] Joe H. Scott and Robert E. Burgan, *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, USDA Forest Service Rocky Mountain Research Station, General Technical Report RMRS-GTR-153, June 2005, page 36.

Reference Weather Used in the Fire Behavior Potential Evaluation

Inyo and Mono Counties cover an area of over 8,000,000 acres. The study area includes the highest (Mt. Whitney 14,495') and the lowest (Badwater Flats 282' below sea level) points in the continental United States. Mammoth Lakes averages 385 inches (32 feet) of snowfall per year[6] and Death Valley (2.5 inches of precipitation annually, July average temperature of 115°F)[7] is one of the hottest and driest places in the western hemisphere. No single set of weather inputs can capture the range of variability that exists in the study area and no single weather station is adequate to provide the weather inputs for the fire behavior analysis. Seasonal percentile weather reports were generated for all of the available Remote Automated Weather Stations (RAWS) and reviewed by our staff Fire Behavior Analyst (FBAN). Sites with poor data or significant errors were eliminated. Data from 10 RAWS were used to create fire weather zones for use in the fire behavior potential analysis. Site information for these stations is displayed in **Table 1**.

After evaluating the RAWS data, three fire weather zones were created for use in the fire behavior potential analysis. Percentile weather observations were calculated from each station using the Fire Family Plus software package to generate a moderate fire weather conditions class and an extreme fire weather conditions class. The moderate conditions class (16th to 89th percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed). This weather condition class most closely represents an average fire season day. Conditions class data from the stations within each zone were then averaged together to create an aggregate value for calculating the weather inputs for **FlamMap** for each fire weather zone.

The extreme conditions class was calculated using 97th percentile weather data. In other words, the weather conditions existing on the three to five most severe fire weather days (sorted by Spread Component) in each season were averaged together. It is reasonable to assume similar conditions may exist for at least five days of the fire season during an average year. During extreme years, such conditions may exist for significantly longer periods. These calculations may be conservative compared to observed fire behavior. Each weather zone is described below. Elevation ranges and vegetation descriptions are approximate.

Mountain Weather Zone (Fire Weather Zone 1) - Elevation 7,000' to 14,495', RAWS sites used: Crestview CA, Gaylor Meadow (Tuolumne) CA. The mountain fire weather zone contains the high elevations of the Sierra Nevada, Inyo, White and Sweetwater mountain ranges. Although high elevations exist in other portions of the study area, most notably in the Panamint and Amargosa mountain ranges in Death Valley National Park, the areas included in the mountain weather zone are typically substantially wetter and cooler than the high elevations of the desert areas. The presence of heavy to moderate coverage of timber makes surface fuels in the mountain zone the most shaded of the three weather zones. The values used in **FlamMap** for the mountain weather zone are shown in **Table 2**.

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[6] http://www.sfgate.com/cgi-bin/document.cgi?file=/sports/skiing/pages/resorts/mammoth.DTL

[7] http://www.nps.gov/archive/deva/weather.htm

High Valleys Weather Zone (Fire Weather Zone 2) – Elevation 3,000' to 7,000', RAWS sites used: Walker CA, Bridgeport CA, Benton CA, Rock Creek CA, Owens Valley CA and Oak Creek CA. This fire weather zone contains the high valleys of the US 395 and US 6 corridors including Antelope Valley, Mono Valley, Chalfant Valley and the Owens Valley. The majority of WUI communities in the study area occur in this weather zone. Vegetative cover includes irrigated agricultural, Pinyon-juniper stands, sage and annual grasses. The values used in **FlamMap** for the high valleys weather zone are shown in **Table 3**.

Desert Weather Zone (Fire Weather Zone 3) – Elevation -282' to 11,000', RAWS sites used: Panamint CA, Oriental Wash NV. This fire weather zone includes Death Valley National Park, China Lake and portions of the Amargosa desert. Although elevations vary widely in this weather zone, the weather inputs used reflect the conditions below 7,000 feet. The high peaks have greater vegetation, usually Pinyon and other pine species, and more moisture but the vast majority of this zone is hot, dry and sparse in vegetation. That being said, however, wildland fires do occur in Death Valley (the Calico fire occurred just shortly before the data collection was done for this report) and WUI communities exist in this weather zone. The values used in **FlamMap** for the desert weather zone are shown in **Table 4**.

Table1: RAWS Site Information (listed north to south) Walker, CA (Station ID # 043707)

Latitude (dd mm ss)	38° 33' 55" N
Longitude (dd mm ss)	119° 27' 33" W
Elevation (ft.)	5,440

Bridgeport, CA (Station ID # 043702)

Latitude (dd mm ss)	38° 16' 19" N
Longitude (dd mm ss)	119° 17' 21" W
Elevation (ft.)	6,650

Gaylor Meadow, CA (Station ID # 043611)

Latitude (dd mm ss)	37° 52' 06" N
Longitude (dd mm ss)	119° 19' 06" W
Elevation (ft.)	9,270

Benton, CA (Station ID # 043708)

Latitude (dd mm ss)	37° 50' 35" N
Longitude (dd mm ss)	118° 28' 40" W
Elevation (ft.)	5,450

Crestview, CA (Station ID # 043709)

Latitude (dd mm ss)	37° 44' 42" N
Longitude (dd mm ss)	118° 59' 00" W
Elevation (ft.)	7,600

Rock Creek, CA (Station ID # 043710)

Latitude (dd mm ss)	37° 33' 05" N
Longitude (dd mm ss)	118° 40' 02" W
Elevation (ft.)	7,040

Owens Valley, CA (Station ID # 044803)

Latitude (dd mm ss)	37° 23' 24" N
Longitude (dd mm ss)	118° 33' 02" W
Elevation (ft.)	4,640

Oriental Wash, NV (Station ID # 261502)

Latitude (dd mm ss)	37° 14' 07" N
Longitude (dd mm ss)	117° 29' 47" W
Elevation (ft.)	4,100

Oak Creek, CA (Station ID # 044804)

Latitude (dd mm ss)	36° 50' 33" N
Longitude (dd mm ss)	118° 15' 34" W
Elevation (ft.)	4,100

Panamint, CA (Station ID # 044806)

Latitude (dd mm ss)	36° 07' 13" N
Longitude (dd mm ss)	117° 05' 16" W
Elevation (ft.)	6,880

Table 2: FlamMap Weather Inputs, Alpine Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	15 mph
Herbaceous fuel moisture	67%
Woody fuel moisture	98%
100-hr fuel moisture	12%
10-hr fuel moisture	7%
1-hr fuel moisture	5%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	23 mph
Herbaceous fuel moisture	30%
Woody fuel moisture	71%
100-hr fuel moisture	8%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

Table 3: FlamMap Inputs High Valleys Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	18 mph
Herbaceous fuel moisture	31%
Woody fuel moisture	61%
100-hr fuel moisture	6%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	36 mph
Herbaceous fuel moisture	31%
Woody fuel moisture	59%
100-hr fuel moisture	6%
10-hr fuel moisture	3%
1-hr fuel moisture	3%

Table 4: FlamMap Inputs Desert Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	19 mph
Herbaceous fuel moisture	34%
Woody fuel moisture	60%
100-hr fuel moisture	5%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	30 mph
Herbaceous fuel moisture	34%
Woody fuel moisture	57%
100-hr fuel moisture	4%
10-hr fuel moisture	3%
1-hr fuel moisture	2%

Note:

Winds at 20 ft will be significantly less noticeable at ground level. Therefore, a “gentle breeze” may actually constitute an 11 MPH 20-foot wind, adding one of the components necessary for extreme weather conditions.

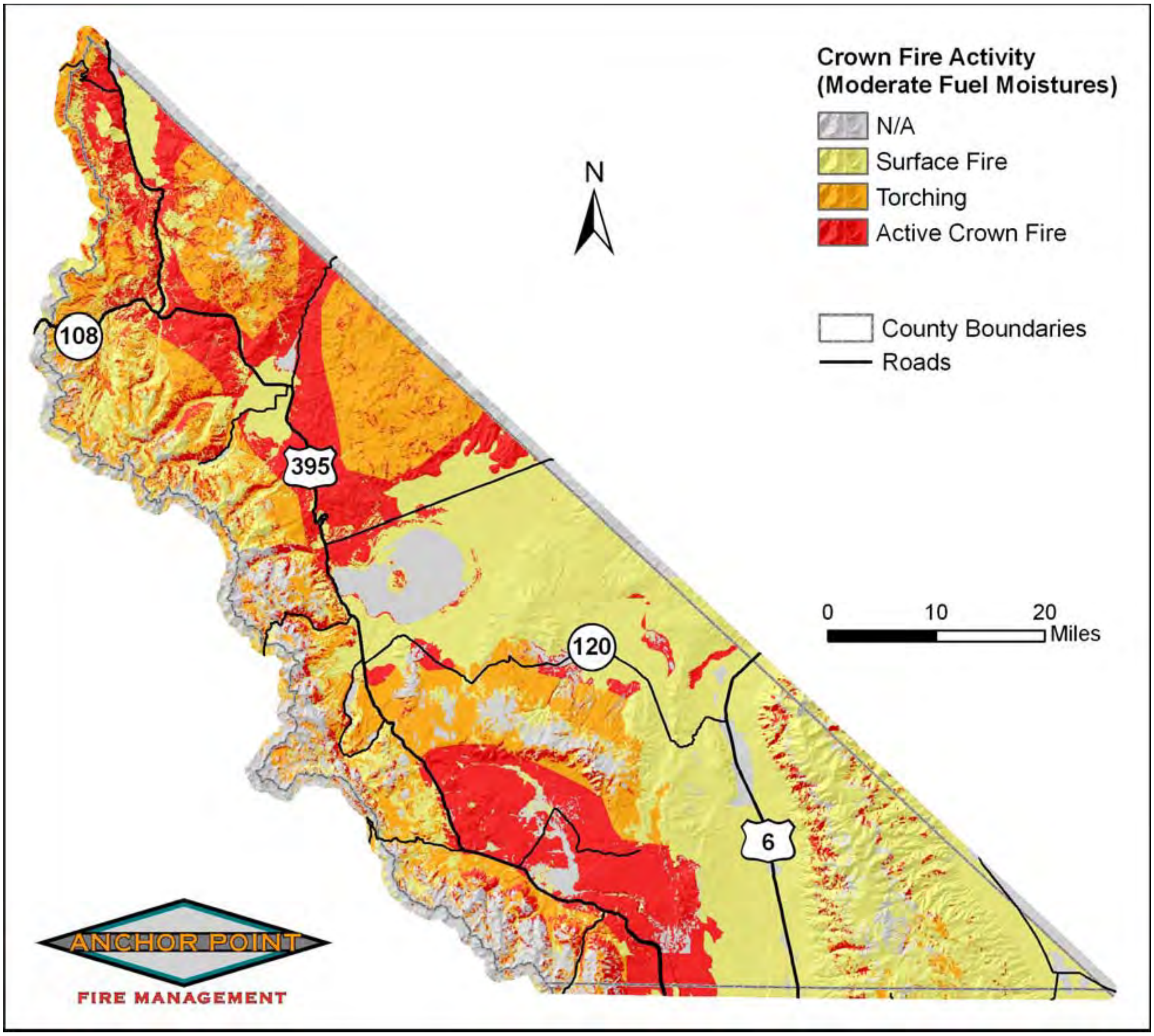


Figure 14. Predictions of Crown Fire Activity (Moderate Weather Conditions)

Fire Behavior Analysis Outputs

Crown fire activity, rate of spread, and flame length are derived from the fire behavior predictions. The following maps graphically display the outputs of **FlamMap** for both average and extreme weather conditions.

Crown fire activity values are generated by the **FlamMap** model and classified into four categories based on standard ranges: Active, Passive, Surface, and Not Applicable. In the surface fire category, little or no tree torching will be expected. During passive crown fire activity, isolated torching of trees or groups of trees will be observed and canopy runs will be limited to short distances. During active crown fire activity, sustained runs through the canopy will be observed that may be independent of surface fire activity.

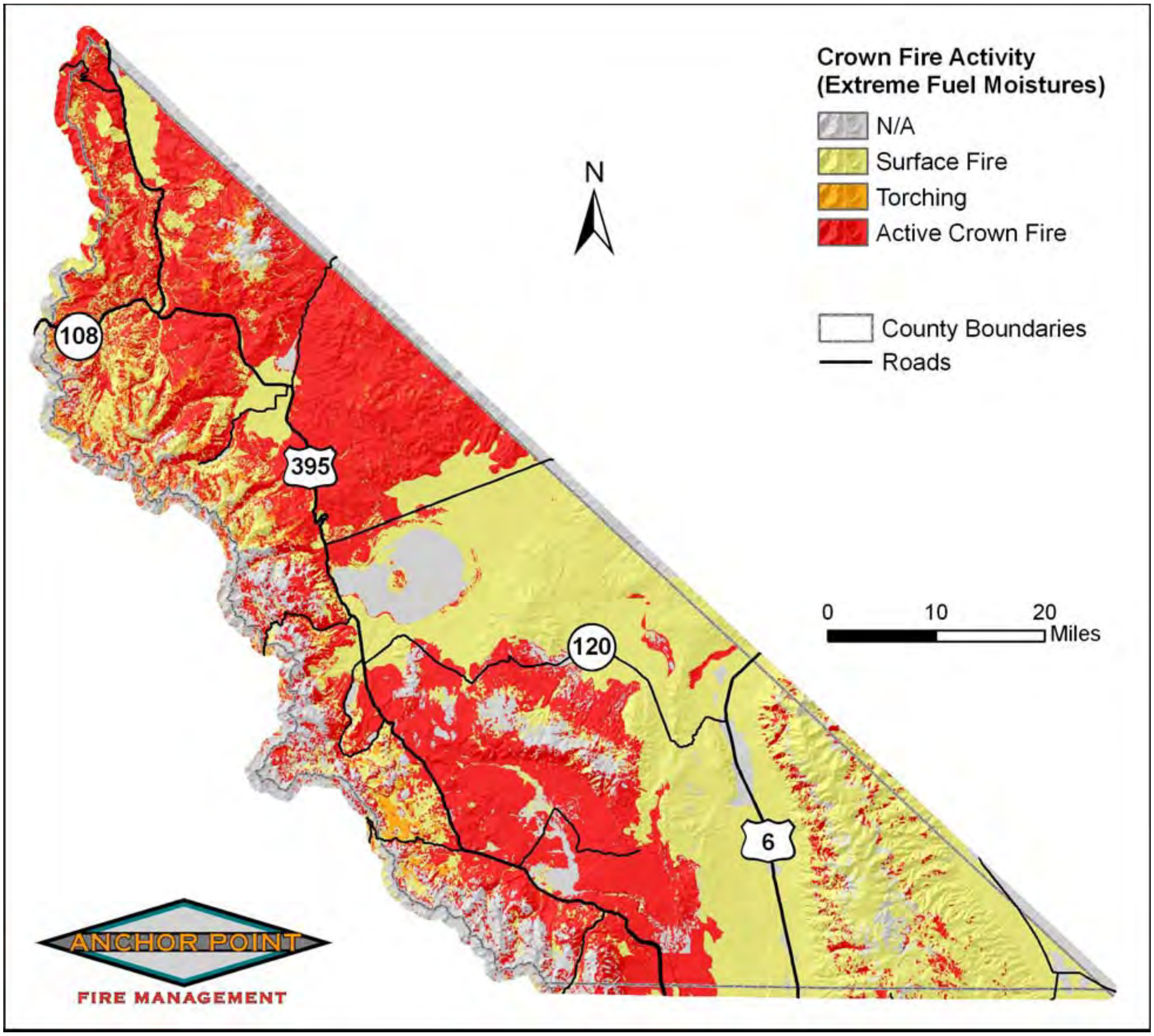


Figure 15. Predictions of Crown Fire Activity (Extreme Weather Conditions)

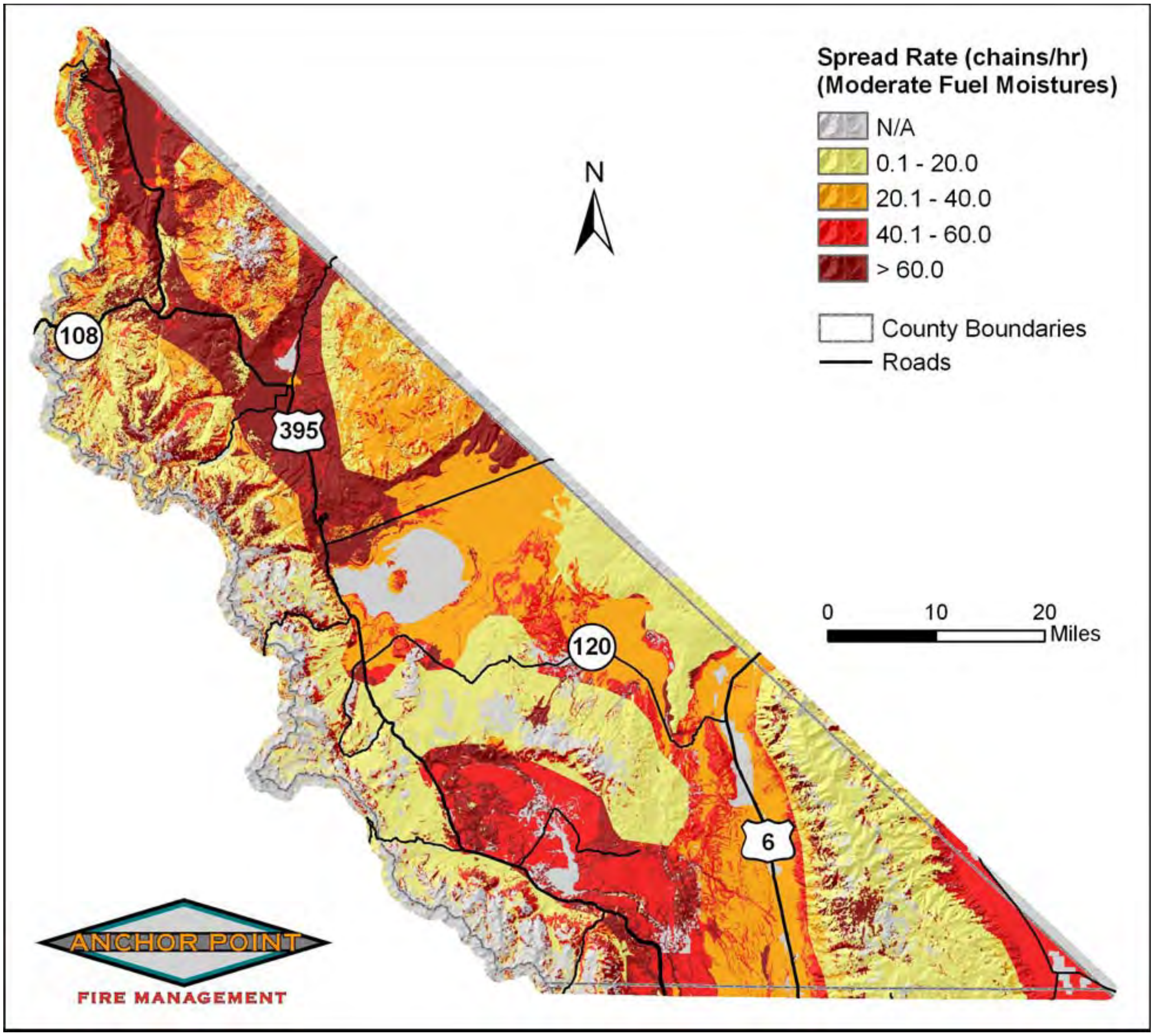


Figure 16. Rate of Spread Predictions (Moderate Weather Conditions)

Rate of spread in chains/hour

(1 chain=66 ft) (80 chains/HR = 1 MPH)

Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains. 1 ch/h equals approximately 1 foot/minute or 80 chains per hour equals 1 mile per hour.

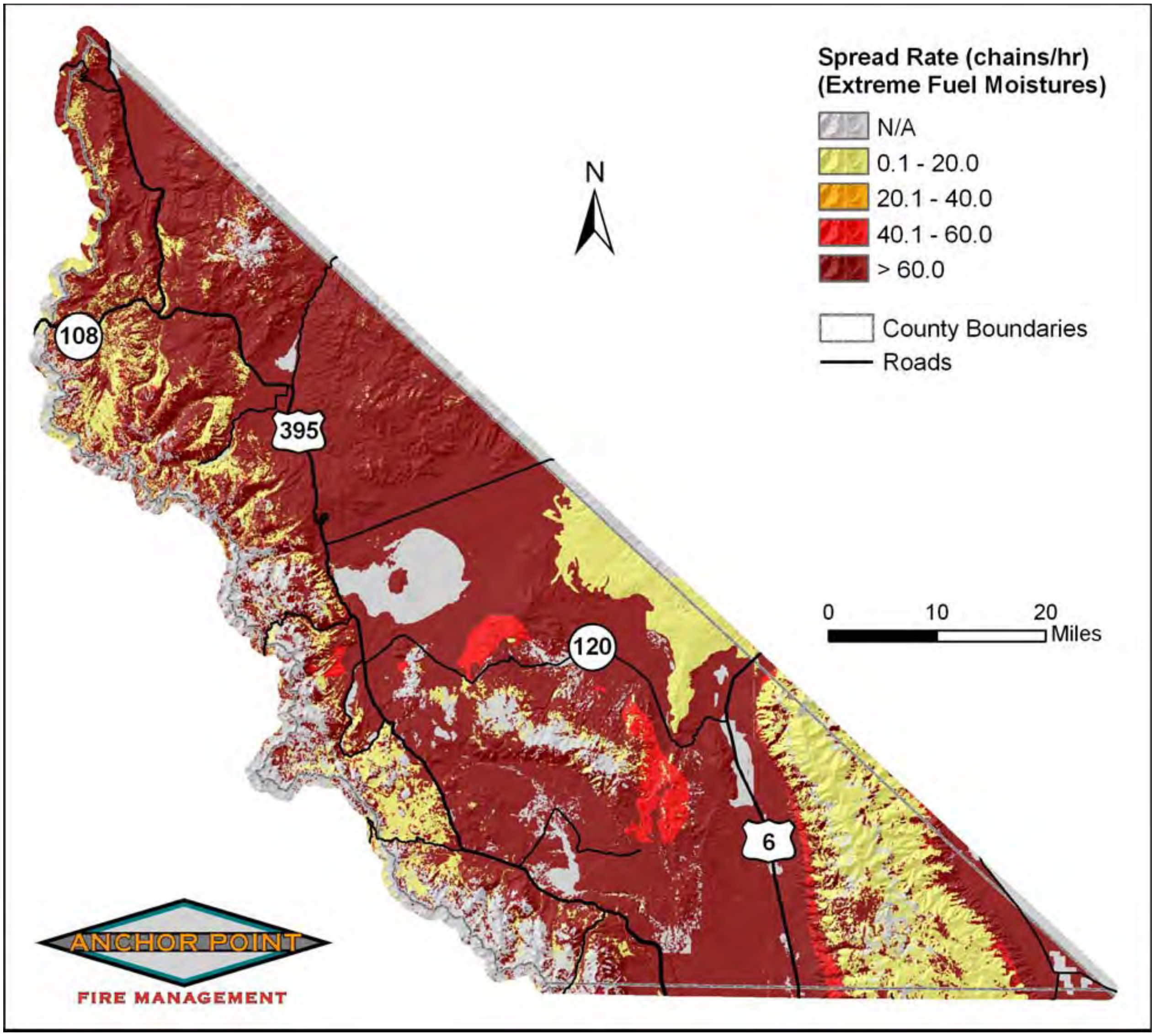


Figure 17. Rate of Spread Predictions (Extreme Weather Conditions)

Rate of spread in chains/hour

(1 chain=66 ft) (80 chains/HR = 1 MPH)

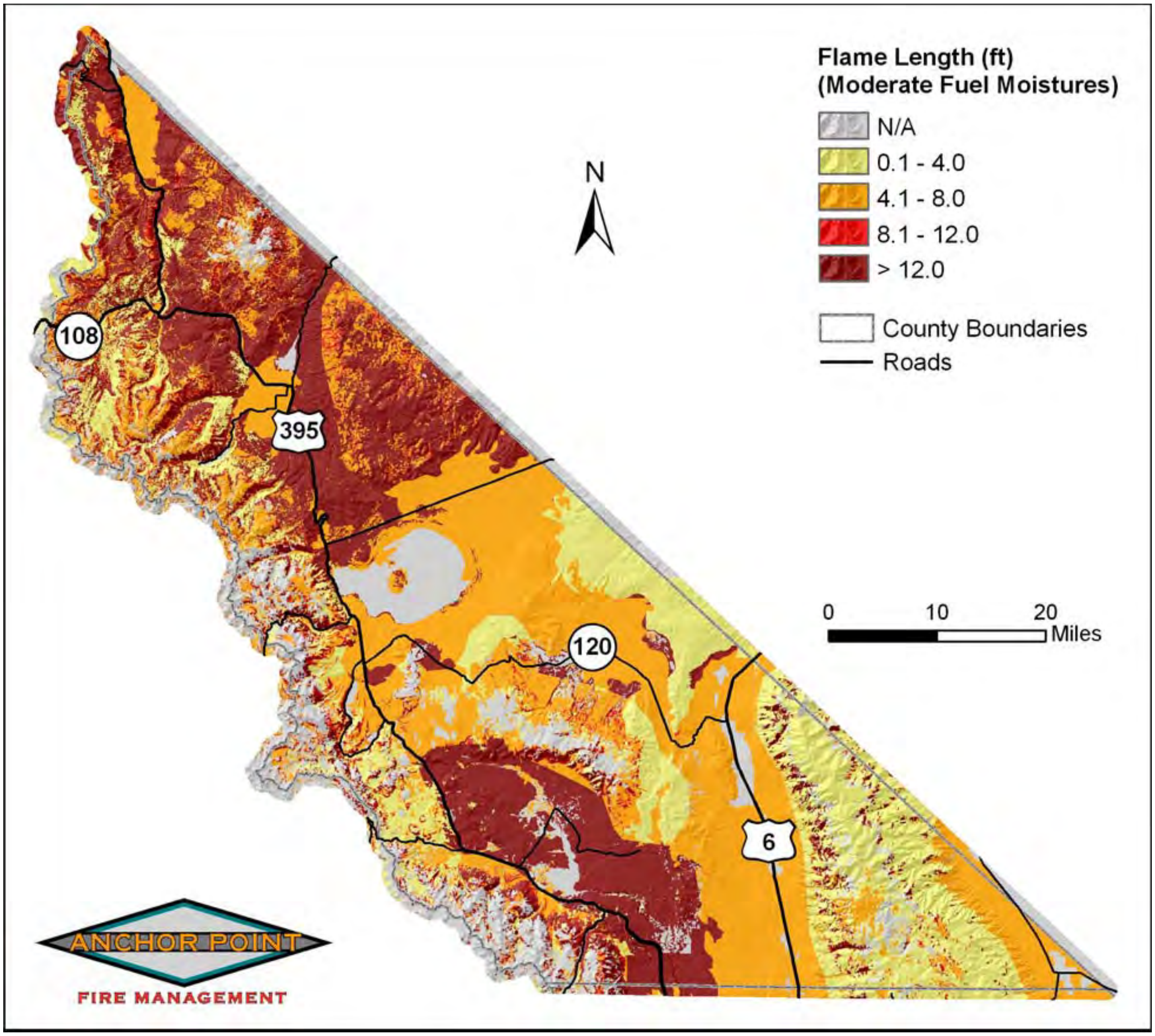


Figure 18. Flame Length Predictions (Moderate Weather Conditions)

Flame length values are generated by the **FlamMap** model and classified in the four categories based on standard ranges: 0-4 feet, 4.1-8 feet, 8.1-12 feet and 12.1-60 feet. Flame lengths of 4 feet and less are acceptable for direct attack by hand crews. Flame lengths of 8 feet and less are suitable for direct attack by machinery. With flame lengths of greater than 8 feet, indirect attack and aerial attack are the preferred methods.

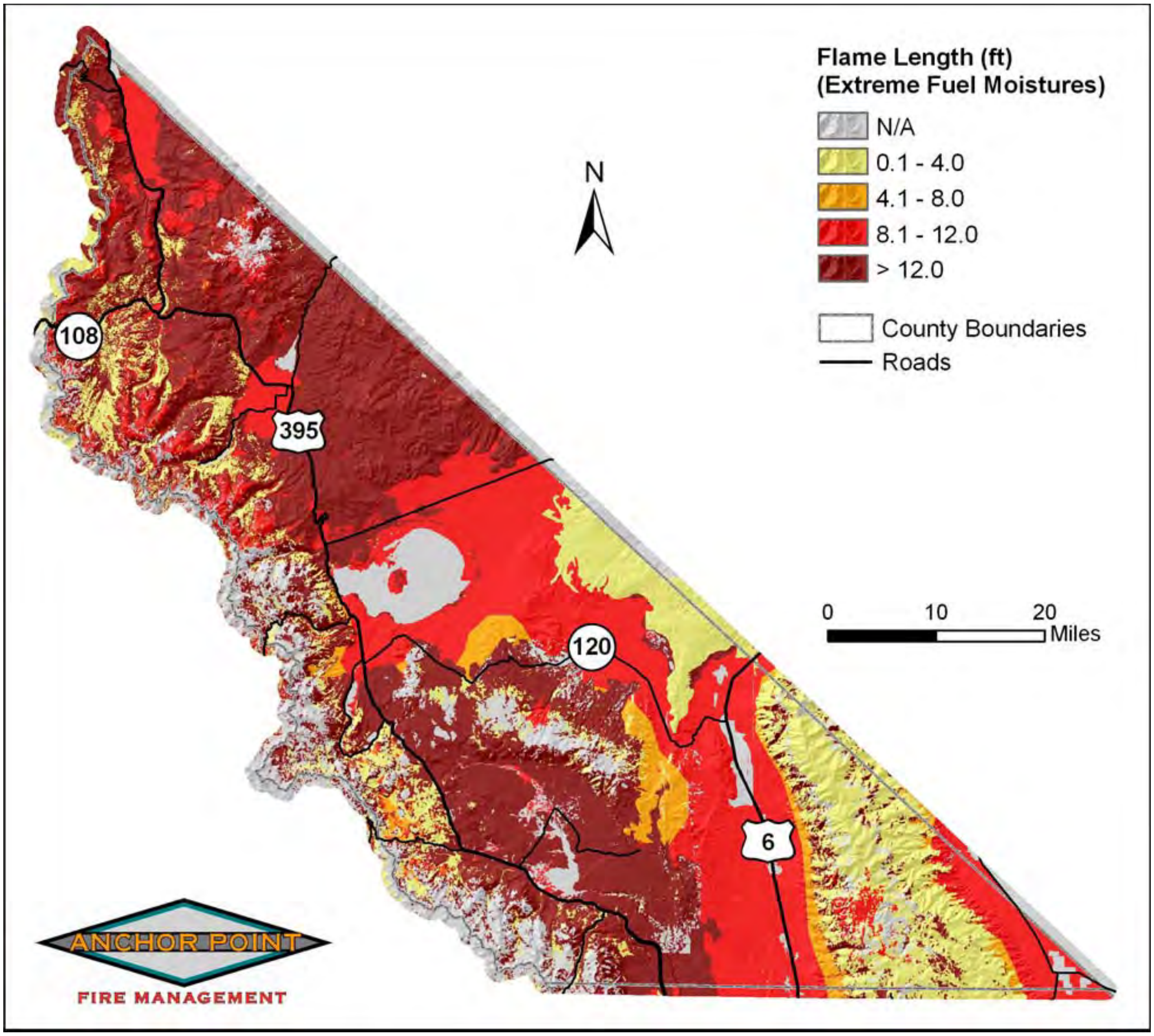


Figure 19. Flame Length Predictions (Extreme Weather Conditions)

Fire Behavior Interpretation and Limitations

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point source ignition at every point. It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability that a wildfire will occur. It assumes an ignition occurrence for every cell (each 10 x 10 meter area).

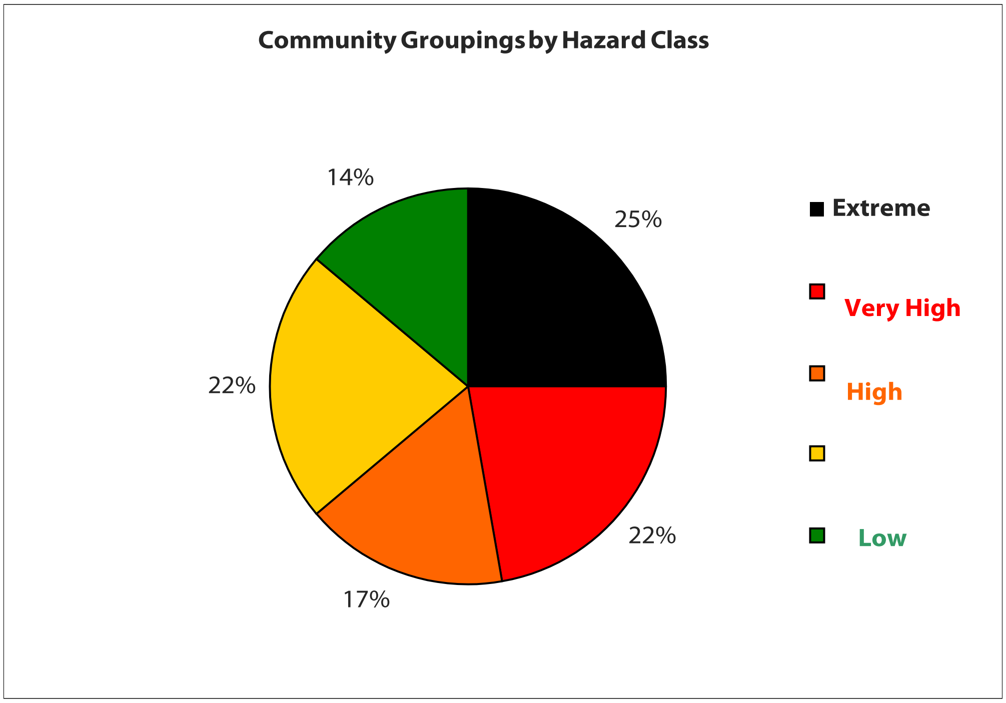
Weather conditions are extremely variable and not all combinations are accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical planning. Whenever possible, fire behavior calculations should be done with actual weather observations during the fire. The most current ERC values should also be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

APPENDIX B: NEIGHBORHOOD IGNITABILITY ANALYSIS AND RECOMMENDATIONS

Purpose

The purpose of this appendix is to examine in greater detail the communities in the study area. Of the 36 WUI communities in Mono County, nine were found to represent an extreme hazard; eight were rated as very high hazard; six as high hazard; eight as moderate hazard; and five as low hazard. **Figure 1** below represents this in pie chart format for easy visual reference. On the following pages, maps, charts and tables using these same statistics can be found, and should be used for reference throughout this document.

Figure 1. Community Groupings by Hazard Class



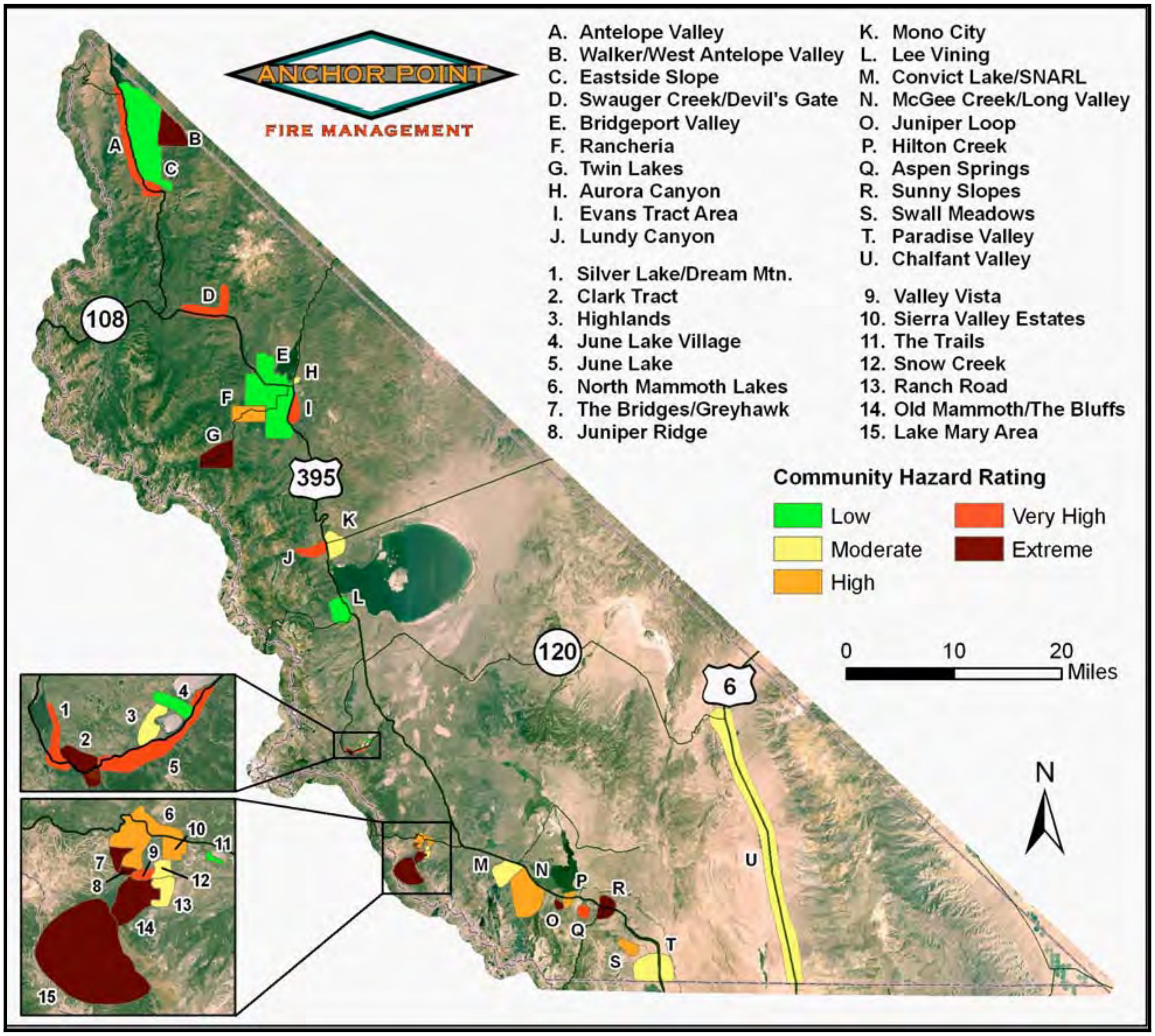


Figure 2. Mono County Community Hazard Rating Map

Figure 3. Mono County Communities by Hazard Rating

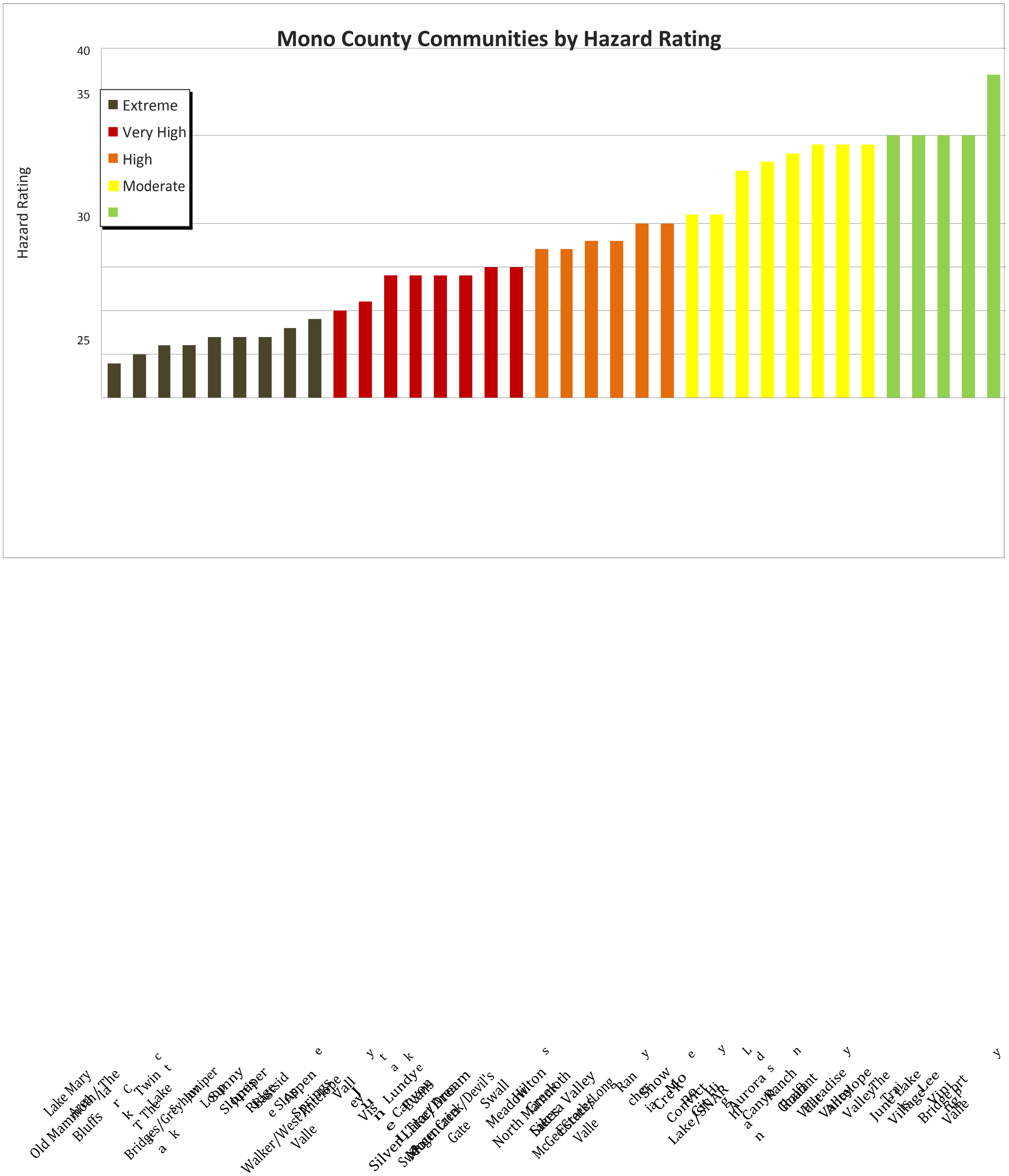


Table 1. Mono County Communities by Hazard Rating

1. Lake Mary Area	19. Hilton Creek
2. Old Mammoth/The Bluffs	20. North Mammoth Lakes
3. Clark Tract	21. Sierra Valley Estates (Mammoth area)

4. Twin Lakes (and Virginia Lakes)	22. McGee Creek/Long Valley
5. The Bridges/Greyhawk	23. Rancheria (Bridgeport area)
6. Juniper Loop (Crowley Lake area)	24. Snow Creek
7. Sunny Slopes	25. Mono City
8. Juniper Ridge (Mammoth Lakes area)	26. Convict Lake/SNARL
9. East Side Slope (Antelope Valley)	27. Highlands
10. Aspen Springs	28. Aurora Creek
11. Walker/West Antelope Valley	29. Ranch Road (Mammoth Lakes area)
12. Valley Vista	30. Chalfant Valley
13. June Lake	31 Paradise Valley
14. Lundy Canyon	32. Antelope Valley
15. Evans Tract Area	33. The Trails
16. Silver Lake/Dream Mountain	34. June Lake Village
17. Swauger Creek/Devils Gate	35. Lee Vining
18. Swall Meadows	36. Bridgeport Valley

GENERAL RECOMMENDATIONS

A combination of adequate access, ignition resistant construction, and fuels reduction should create a safe environment for emergency service personnel and provide reasonable protection to structures from a wildfire. These techniques should also significantly reduce the chances of a structure fire becoming an ignition source to the surrounding wildlands.

In addition to the suggested mitigations listed for the individual communities, several general measures can be taken to improve fire safety. The following recommendations should be noted and practiced by anyone living in the Wildland-Urban Interface:

- Be aware of the current fire danger in the area.
- Clean your roof and gutters at least two times a year, especially during cure-up in autumn.
- Stack firewood uphill or on a side contour, at least 30 feet away from structures.
- Don't store combustibles or firewood under decks.
- Maintain and clean spark arresters on chimneys.
- When possible, maintain an irrigated greenbelt around the home.
- Connect, and have available, a minimum of 50 feet of garden hose.
- Post reflective lot and/or house numbers so that they are clearly visible from the main road. Reflective numbers should also be visible on the structure itself.
- Trees along driveways should be limbed and thinned as necessary to maintain a minimum 13’6” vertical clearance for emergency vehicle access.
- Maintain your defensible space constantly.
    - Mow grass and weeds to a low height.
    - Remove any branches overhanging the roof or chimney.
    - Remove all trash, debris, and cuttings from the defensible space.

Note

All communities rated as extreme to high hazard level were recommended for a parcel-level analysis. In the moderate level communities a parcel-level analysis was recommended only if the evaluator found that a significant number of homes had no, or ineffective, defensible space or a significant number of hazards near homes was detected. In short, the recommendation was made if the evaluator felt a parcel-level analysis would generate a noticeable improvement in the community's defensibility.

Technical Terms

The following definitions apply to terms used in the "Description" and "Comments and Mitigation" sections of this appendix.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from the structure. The design and extent of the defensible space is based on fuels, topography, and the design and materials of the structure.

Extended Defensible Space (also known as Zone 3): In this defensible space zone, treatment is continued beyond the recommended minimum boundary for defensible space. This zone focuses on forest management, with fuels reduction being a secondary function.

Shelter-in-Place Areas: There are several ways to protect the public from an advancing wildfire. One of these methods is evacuation, and involves relocation of the threatened population to a safer area. Another is to instruct people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response, where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia, where fast moving, non-persistent fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed pre-plan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior.

Citizen Safety Zone: An area that can be used for protection by residents in the event that the main evacuation route is compromised. The area should be maintained, cleared of fuels, and large enough for all residents of the area to survive an advancing wildfire without special equipment or training.

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to segregate, stop, or reduce the spread of fire. As a practical matter, fuelbreaks in the WUI are most effective against crown fires.

Community Assessment Methodology

The community level methodology for this assessment uses a Wildfire Hazard Rating (WHR) that was developed specifically to evaluate communities within the Wildland Urban Interface (WUI) for their relative wildfire hazard.[1] The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. This methodology has been proven and refined by use in rating over 1,400 neighborhoods throughout the United States.

Many knowledgeable and experienced fire management professionals were queried about specific environmental and infrastructure factors, and wildfire behavior and hazards. Weightings within the model were established through these queries. The model was designed to be applicable throughout the western United States.

The model was developed from the perspective of performing structural triage on a threatened community in the path of an advancing wildfire with moderate fire behavior. The WHR survey and fuel model ground truthing are accomplished by field surveyors with WUI fire experience. The rating system assigns up to a maximum of 60 points based on seven categories: average lot size, slope, primary aspect, average fuel type, fuel continuity, dominant construction type and surface fuel loading. The higher the community scores, the lower its wildfire hazard. For example, a community with an average lot size of less than 1 acre and slopes of greater than 30% would receive 0 points for those factors, whereas a community with an average lot size of 5 acres and slopes of less than 15% would receive 16 points for the same factors. Additional hazards are then subtracted from the subtotal of points earned in the seven categories to give a final numeric value. The final value is then used to group communities into one of five hazard ratings: Extreme, Very High, High, Moderate, or Low.

It is important to note that not all groupings occur in every geographic region. There are some areas with no low hazard communities, just as there are some areas with no extreme communities. The rankings are also related to what is customary for the area. For example, a high hazard area on the plains of Kansas may not look like a high hazard area in the Sierra Nevada. The system creates a relative ranking of community hazards in relation to the other communities in the study area. It is designed to be used by experienced wildland firefighters who have a familiarity with structural triage operations and fire behavior in the interface.

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[1] C. White, "Community Wildfire Hazard Rating Form" *Wildfire Hazard Mitigation and Response Plan*, Colorado State Forest Service, Ft. Collins, CO, 1986.

COMMUNITIES

1. Lake Mary Area

Hazard Rating Extreme

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8, 10, 5
Water supply:	Draft from lakes

Steep slopes, ravines, inadequate roads, propane tanks, power lines, wood roofs

Description: The Lake Mary Area community consists of forest service lease cabins and resort properties in heavy timber surrounding an alpine lake. Most structures are widely spaced. The dominant construction type is small cabins with flammable or log siding and asphalt or metal roofs; however, there are several wood roofs in this community. There are some narrow, steep roads and driveways. Addressing here is poor. Most homes are within two miles of the nearest fire station (Station 2, Mammoth Lakes Fire Department). There are no hydrants, but it is possible to draft from lakes in this community. Fuels are heavy loads of mixed conifer. There are few defensible spaces here. Topography is steep and complex.

LAKE MARY AREA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for most homes due to position, fuels and terrain.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Consider creating a shelter-in-place plan that includes preplanned escape routes from homes with flammable construction types to homes designated as last resort shelter-in- place areas. Concentrate thinning efforts on fuels below the access to these homes. Shelter-in-place tactics are only recommended for ignition-resistant homes with conforming extended defensible space, and even then only as a last resort, due to the dangerous fuels and topography in this community.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.
- Consider adding dry hydrant installations to the lakes in this community to improve the speed of water handling.

2. Old Mammoth/The Bluffs

Hazard Rating	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	10, 9, 5
Water supply:	Hydrants

Steep slopes, ravines, inadequate roads, natural chimneys, propane tanks, power lines, wood roofs

Description: This community contains moderate to large homes on small lots. Dominant construction is wood siding with a mix of asphalt and wood shake roofs. This is a high density community. Access is poor in some areas. There are several dead-end roads and some very narrow roads with poor surfaces. Poor address markers are common, many with missing or inconsistent placement and low visibility. Many homes have wood decks and projections. In Old Mammoth in particular, there are overhead power lines and propane tanks (many overgrown with vegetation). Very few homes have defensible space. Many yards have flammable clutter including wood stacked against the structure. There are hydrants every 300 feet throughout most of this area. Fuels are primarily heavy loads of mixed conifers (FM 10). The topography in this community is steep and complex.

OLD MAMMOTH/THE BLUFFS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Consider creating a shelter-in-place plan that includes preplanned escape routes from homes with flammable construction types to homes designated as last resort shelter-in- place areas. Concentrate thinning efforts on fuels below the access to these homes. Shelter-in-place tactics are only recommended for ignition-resistant homes with conforming extended defensible space, and even then only as a last resort, due to the dangerous fuels and topography in this community.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

3. Clark Tract

Hazard Rating	Extreme
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8, 10
Water supply:	Hydrants

Steep slopes, ravines, inadequate roads, natural chimneys, power line, wood roofs

Description: The Clark Tract community is comprised of small homes on small lots. Homes are mostly wood siding construction with a mix of asphalt, metal and wood roof types. Construction is generally older in this community, and some homes have wood decks or projections. Most homes do not have visible address markers, and the few that do are not reflective. Access is generally poor. Roads are rough, steep and narrow. Most roads and driveways are dirt and rutting and washboarding is typical. Although there are two ways in and out of this community, there are also several dead-end roads. There are fire hydrants in this community. Very few homes have any defensible space. Overhead power lines may represent a hazard to fire apparatus. Fuels are heavy to moderate loads of mixed conifer and shrubs often with sage in the understory. Topography is steep and complex.

CLARK TRACT RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

4. Twin Lakes (includes Virginia Lakes Area)

Hazard Rating	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	8, 2, 9
Water supply:	Hydrants

Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, wood roofs

Description: These two communities are very similar, even though they are separated by several miles. They each contain cabins built in the 1930s and 1940s with modern construction mixed in. Most homes are moderate size on small lots. Wood siding with an asphalt or metal roof is the most common construction type; however, there are almost as many wood shake roofs in this community as ignition resistant roofs. Street signs are non-reflective wooden markers and some are broken. Most would be hard to see in dark or smoky conditions. Most homes have address markers on the home and at the street, but they are generally not reflective and may be difficult to spot in dark or smoky conditions. There are some very poor roads in these communities and some long narrow driveways. There are a few homes with minimum defensible space, but most have vegetation growing right up to the structure.

Fuels are moderate to heavy loads of mixed conifers and aspen stands with shrubs and grasses in the understory. There are also heavy loads of standing dead fuels present. These communities have overhead power lines which may be a hazard to fire apparatus. There are also areas of heavy recreational use throughout both communities. This increases both the likelihood of an ignition and the difficulty of evacuation and access. The topography in these areas is complex and steep.

TWIN LAKES / VIRGINIA LAKES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Improving the water supply to increase hydrant pressure and flow should be a priority project.
- Replacing broken and non-reflective street signs should also be considered a priority project.
- Add reflective addressing to all driveways and homes.
- A fuels reduction grant project (#09USFS-SFA0059) has been funded by the USFS. The project will begin during the summer of 2009, and substantial fuels reduction will occur within private residential and recreational properties of Upper Twin Lakes bordering the Humboldt-Toiyabe National Forest. The fuels reduction work includes a combination of understory thinning, trimming, and chipping of dead trees and brush along the south shore of Upper Twin Lakes, and along the western boundary of Mono Village Resort. All fuels reduction recommendations should be coordinated with private and federal agencies, regardless of jurisdictional ownership to ensure best value and functionality.

5. The Bridges/Greyhawk

Hazard Rating	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8
Water supply:	Hydrants

Steep slopes, ravines, inadequate roads, inadequate water supply, wood roofs

Description: This community consists primarily of newer construction, condo complexes and large to moderate size homes on small lots. This is a high density community surrounded by wildland fuels. The dominant construction type is wood siding with asphalt or metal roofs, but there are also some wood shake roofs in this community. The homes have address markers, but most are not reflective. Road surfaces are good, although there are some narrow streets and steep grades (>10%) which make both evacuation and firefighter access more difficult.

Most homes do not have adequate defensible space. Hydrants are good except for along John Muir Road, where the spacing is approximately ¼ mile and the hydrant flows are low. This community has heavy loads of mixed conifer and shrub fuels. The topography is steep and complex.

THE BRIDGES/GREYHAWK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate improving the water supply to increase pressure and flow of the hydrants along John Muir Road.
- Add reflective addressing to all driveways and homes.

6. Juniper Loop

Hazard Rating **Extreme**

Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8
Water supply:	None

Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, wood roofs

Description: This community is a mix of old and new construction. The dominant construction type consists of wood siding with asphalt or metal roofs; however, there are some wood shake roofs in this community. Addressing is poor in this community. Address markers are difficult to locate on many homes, and in some cases, they are missing entirely. Roads are steep and narrow with no pullouts or turnarounds for fire apparatus. Many driveways are rough and narrow with vegetation encroaching upon the drivable surface. There is no water supply for fire suppression and few homes have any defensible space. This community has overhead power lines which may be a hazard to fire apparatus. There are heavy loads of mixed timber and shrub fuels including Pinyon-juniper, Jeffrey pine, bitterbrush and sage. In the drainages, aspen with sage and other shrubs in the understory become dominant. Dead and down material loads are moderate to heavy in some parts of this community. The general topography is complex and moderate to steep.

JUNIPER LOOP RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Investigate the possibility of improving and widening the road surface of the primary access roads into this community. High density and poor roads will make this community difficult to evacuate quickly in the event of a rapidly moving fire.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding at least two large (10,000 - 30,000 gallon) community cisterns for fire suppression use. *Improving water supply is a critical need in Juniper Loop.*
- Add reflective addressing to all driveways and homes.

7. Sunny Slopes

Hazard Rating	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8
Water supply:	Hydrants

Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, wood roofs

Description: This community is a mix of year-round private cabins and USFS lease cabins, some dating back as far as 1916. Construction is generally wood siding or log with wood shake roofs, but approximately 40% of the structures have ignition-resistant (metal or asphalt) roofs. Cabins are small to moderate size on small lots making this a fairly dense community. Some residences in this community are more than five miles from the nearest fire station. There is a good hydrant network in some parts of Sunny Slopes, but the hydrant network and the Sunny Slopes water supply does not service any of the USFS lease properties. There are several steep, narrow roads and some are little more than rough dirt tracks. This community has overhead power lines which may be a hazard to fire apparatus. Few properties have any defensible space. Fuels are moderate loads of open canopy Jeffery pine with sage and other shrubs in the understory. Topography is complex and moderate to steep. There are many outcroppings of volcanic rock, which will be a hazard to firefighters, especially at night or in smoky conditions.

SUNNY SLOPES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Investigate the possibility of improving and widening the road surface of the primary access roads accessing the forest service lease cabins on the north side of highway 395. This will improve evacuation for residents and access for firefighters.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- For fire suppression in areas not serviced by the hydrant network, investigate the possibility of adding cisterns (2,500 gallons or greater) at least every ¼ mile.
- Add reflective addressing to all driveways and homes.

8. Juniper Ridge

Hazard Rating	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8, 10
Water supply:	Hydrants

Steep slopes, ravines, natural chimneys, inadequate roads, wood roofs

Description: Not to be confused with Juniper Loop (community #6), Juniper Ridge is a subdivision in Mammoth Lakes. This is a dense community of moderate to large homes on small lots. All these homes are of newer wood siding construction, but approximately 50% have wood shake roofs. Addressing is present for all of the residences, but is not reflective. This community does have a good hydrant network. The road surfaces are all good, but there are some steep grades (>10%). There are no pullouts or turnarounds for fire apparatus and this community has only one way in and out. Most homes do not have adequate defensible space. Fuels are heavy loads of mixed conifer and shrubs with heavy ladder fuels and moderate loads of dead and down materials. The general topography is steep and complex.

JUNIPER RIDGE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segment.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

9. East Side Slope – Antelope Valley Area (also known as East Side Lane)

Hazard Rating	Extreme
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<5 Acre
Fuel models found in the neighborhood:	6, 5, 1
Water supply:	None

Steep slopes, ravines, no water supply, inadequate roads, power lines, propane tanks, wood roofs

Description: This is a community of approximately 50 homes on large lots. This area was threatened by the Jackass Flats Fire in 2006. Access could be challenging due to complex terrain. There is no water for fire suppression in this community and there are power lines and propane tanks which may be a hazard to firefighters. Fuels are primarily heavy loads of Pinyon- juniper, sage and grass. The general topography is steep and complex.

EASTSIDE SLOPE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding at least two large (10,000 - 30,000 gallon) cisterns for fire suppression use in this community. *Water supply is a critical need in Eastside Slope*.
- Add reflective addressing to all driveways and homes.

9. Aspen Spring

Hazard Rating **Very High**

Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	5, 8
Water supply:	One cistern (60,000 gallons)

Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, wood roofs

Description: This is a community of large homes on moderate to large lots. Homes are of mixed ages, but older wood siding construction is dominant. Approximately 50% of the homes in Aspen Spring have wood shake roofs. Addressing is poor in this community. Some homes have no address markers and others are not easily visible. None of the address markers that are present are reflective. Road surfaces are generally good, but most of the roads and driveways are steep and narrow (some up to 16% grade). There is only one large cistern for fire suppression and it is in need of repair. Few homes have adequate defensible space. Fuels are moderate to heavy loads of Pinyon-juniper, sage, bitterbrush and other shrubs. Topography is steep and complex.

ASPEN SPRING RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- *Repairing the existing cistern should be considered a priority project for this community*. Investigate the possibility of adding an additional cistern to further improve the water supply.
- Add reflective addressing to all driveways and homes.

10. Walker/West Antelope Valley

Hazard Rating **Very High**

Does the neighborhood have dual access roads? No

Are there road grades > 8%? Yes

Are all access roads of adequate width? No

Average lot size: 1-5 Acres

Fuel models found in the neighborhood: 15, 5, 2, 1

Water supply: Possible draft from river and stock ponds

Ravines, natural chimneys, inadequate roads, inadequate water supply, power lines, propane farm, wood roofs

Description: Homes on the west side of highway 395 through Antelope Valley are primarily small to moderate size, on moderate to large lots. This area has an active fire history and steep complex terrain; however, most of the homes are located near the highway where the terrain is more moderate. Access for homes located near the highway is generally good, but addressing is generally poor. Homes south of highway 395 in the Walker area are built on moderate to steep slopes and in ravines. The density is higher here and most of the residences in this community are on small lots. Access roads are steeper here and driveways are longer, but like the rest of this community, access roads and driveways running off highway 395 are narrow with rough dirt surfaces. There are several dead ends and few turnarounds adequate for fire apparatus. There is no apparent water supply for fire suppression, although it may be possible to draft from the Walker River at some points. There are overhead power lines and propane tanks which may be a hazard to fire apparatus. Few homes have adequate defensible space.

Fuels are much heavier here than on the east side of Antelope Valley (east of Hwy 395) and consist primarily of moderate to heavy loads of Pinyon-juniper, sage and other shrubs. The general topography is complex and moderate to steep.

WALKER/WEST ANTELOPE VALLEY RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding some large (20,000 - 30,000 gallon) cisterns especially in the Walker area. A reliable water supply for fire suppression is a critical need in this community.
- Add reflective addressing to all driveways and homes.

11. Valley Vista

Hazard Rating **Very High**

Does the neighborhood have dual access roads? No

Are there road grades > 8%? No

Are all access roads of adequate width? Yes

Average lot size: <1 Acres

Fuel models found in the neighborhood: 5, 9

Water supply: Hydrants

Hazards: Ravines, steep slopes, power lines, wood roofs

Description: This community consists of condos and moderate size homes on small lots. Construction is primarily newer wood siding with asphalt or metal roofs, although many homes still have wood shake roofs. Many also have flammable projections and decks. Roads are generally wide enough with good surfaces, but there are some steep grades. Addressing is present on most homes, but not reflective and difficult to locate in many cases. There is a good hydrant network, but few homes have any defensible space and most have vegetation growing right up to the structure. There are overhead power lines which may be a hazard to fire apparatus. Fuels are heavy loads of mixed conifers with plentiful ladder fuels. Terrain is generally moderate to steep and complex.

VALLEY VISTA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

12. June Lake

Hazard Rating **Very High**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	9, 5
Water supply:	Hydrants

Steep slopes, inadequate roads, power lines, wood roofs

Description: Small houses and cabins on small to moderate size lots. Wood siding construction with metal and asphalt roofs is dominant, although there are still some homes with wood shake roofs in this community. Most of the construction is older and many of these properties were USFS lease cabins which have been converted to private ownership. Many homes do not have address markers. Markers are inconsistent and generally non-reflective on the homes where they are present. Many street signs are also missing in this community, but there is a program being considered to correct this problem. Roads are generally poor, consisting of rough, narrow dirt tracks, and they are steep in spots. There are several dead ends in this community and there are no pullouts and few turnarounds suitable for fire apparatus. This community does have a good hydrant network. Few homes have any defensible spaces and there are many properties with flammable yard clutter. There are overhead power lines which may be a hazard to fire apparatus. Fuels are predominately heavy loads of Jeffrey pine with grass and shrubs in the understory. Ladder fuels are plentiful. The general topography is steep.

JUNE LAKE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

13. Lundy Canyon

Hazard Rating **Very High**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 2, 8, 1

Drafting from streams may be possible, but not likely

Steep slopes, ravines, inadequate roads, inadequate water supply, no fire protection

Description: The Lundy Canyon community consists of moderate size homes on small lots. Most homes are wood siding with metal roofs and are newer construction. Addressing and roads are generally good. There is no water for fire suppression and this community is not covered by a fire protection district. There is a BLM fire station that may respond to this area, and Mono City FD may respond here as well. Heavy recreational use could result in a higher risk of ignition and potential evacuation difficulties in this community. Fuels are continuous beds of sage and other shrubs with ornamental plantings of conifer near homes. Fuels in the drainages consist of a mix of conifers and riparian hardwoods. Fuel loading is generally moderate, but flammable ornamental plantings and the lack of defensible space make these fuels more hazardous. Although the topography near the homes is generally low to moderate, the overall topography of the area is steep and complex.

LUNDY CANYON RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- If there is no agreement already in place, this community should contract with the nearest fire department (most likely Mono City FD) for structure protection in the event of a wildfire.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding one or two large (20,000 - 30,000 gallon) cisterns in this community. *A reliable water supply for fire suppression is a critical need in Lundy Canyon.*
- *An evacuation plan for this community is highly recommended.* Heavy recreation traffic during the summer could hamper evacuation efforts in this single-access community.
- Add reflective addressing to all driveways and homes.

14. Evans Tract Area

Hazard Rating	Very High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 2, 1
Water supply:	Hydrants

Ravines, inadequate roads, power lines, propane tanks, wood roofs

Description: The Evans Tract Area community consists of small homes on small lots with a mix of old and new construction. The dominant construction type is wood siding with asphalt roofs, but there are some wood shake roofs in this community. Most homes have some type of address marker, but generally they are not reflective and hard to find on some properties. Most access roads have good surfaces, but are steep and narrow. Most of the driveways are short and offer good access to the structure, but there are no pullouts and few turnarounds adequate for fire apparatus. This community has an adequate hydrant network. Few homes have any defensible space and there are some properties with flammable yard clutter including firewood stacked against the home. There are overhead power lines and propane tanks surrounded by vegetation which may be a hazard to fire operations. Fuels are moderate to heavy loads of sage and Pinyon-juniper near the homes, transitioning to heavy Pinyon-juniper on the upper slopes. Topography is moderate to steep and complex.

EVANS TRACT AREA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

15. Silver Lake & Dream Mountain

Hazard Rating	Very High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 9, 8, 1
Water supply:	Hydrants
Hazards:	Inadequate roads, wood roofs

Description: Most of the residences in this community are small forest service lease cabins on small lots. Most construction is older; wood or log siding with metal or asphalt roofs is dominant. There are, however, several cabins with wood roofs in this community. Roads in this community are narrow with poor, rutted dirt surfaces. Addressing is also poor and many homes do not have any address marker. There is an adequate hydrant network in this community. Most homes do not have any defensible space. Fuels are heavy loads of decadent aspen and mixed conifer with heavy dead and down in the understory. Shrubs and other ladder fuels are also heavy throughout this community. Topography is generally moderate to low.

SILVER LAKE & DREAM MOUNTAIN RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Wherever possible road surfaces should be improved and vegetation thinned along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

16. Swauger Creek & Devil's Gate

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	2, 5
Water supply:	Draft sites marked and mapped by USFS
Hazards:	Inadequate roads, wood roofs

Description: This community contains moderate to large homes on large lots (minimum 40 acres). Dominant construction is wood siding with metal or asphalt roofs, but there are some wooden roofs and many homes have flammable projections and decks. Addressing is poor. Most homes do not have address markers at the driveway and if there are markers on the homes they are not visible from the road. Access roads are dirt and are narrow in spots. There are several long, narrow driveways with no pullouts or turnarounds suitable for apparatus. There are marked draft sites for fire suppression in this community. There has been some mitigation work in this area, but there are still several homes with vegetation growing right up to the structure. Fuels are primarily conifers with grasses and sage in the understory, becoming sage- dominant in the bottoms. There are also significant stands of aspen and mixed conifers in the riparian drainages. Topography varies widely from broad flat areas to steep slopes complicated by ravines and chimneys.

SWAUGER CREEK & DEVIL'S GATE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the Home Mitigation section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

The following recommendations have been taken from the **Devil's Gate Swauger Creek Fire Safe Council's board report** and has been included here at their request. The report lists fuels reduction projects to be completed in order to lessen the fire hazard and provide better access for Fire Equipment in the Devil's Gate Swauger Creek Fire Safe Council's area

These projects, specifications and recommendations have not been evaluated or prioritized by Anchor Point. They are reprinted here verbatim.

- Create a fuel shaded fuel break interface between U. S. Forest Service, Bureau of Land Management Lands and private lands. 200 foot wide shaded fuelbreak between these boundaries. Approximately eight miles.
- Create a shaded fuelbreak along existing driveways, 100 feet each side, enlarging driveway width to allow for large fire trucks and apparatus to pass. On long driveways over 300 feet long, provide for turnouts every 300 feet for passing and at the ends create "Y" or "Hammerhead turnarounds" for driveways that do not have space to turnaround.

    - Install reflective street sign numbers at the entrance of each driveway coming off the main roadway. This will create a north-south fire break in the area. Approximately 4 miles.

- Clear around existing homes and create shaded fuelbreaks, minimum 150 feet. This could be more depending on the terrain and slopes.
- Road maintenance making the road easier access with Fire Equipment and create shaded fuel break on existing fire road going west from Valdez property, to United States Forestry land. Approximately 1.5 miles.
- Aspen Grove restoration and shaded fuel break, South end of Valdez Property. Approximately 3 Acres.
- Create 200 foot wide, 100 feet each side of road, shaded fuel break along Highway 395 Corridor from Rattlesnake bend to 1 mile west of Devil's gate rocks. Approximately 3.5 miles. Heavily traveled road and vulnerable for manmade fires, lighted cigarettes thrown from vehicles etc.
- Create signs and show place for shaded fuel break when completed on Highway 395 a major Highway with large volumes of traffic. Leave small section as it was to start with, showing major difference and potential fire hazard removal.
- Create shaded fuel break along Power Line Road 100 feet each side, widen areas to permit large Fire Equipment access. Approximately 2 miles long.
- Create a North South shaded fuel break on "Woods" Property, most winds come from the westerly direction. Approximately 1.5 miles long. Along his driveway to meet width and turn around requirements and West property line.
- Aspen Grove restoration and shaded fuel break, on "Woods" Property. Approximately 25 acres.
- Obtain water tender, storage facility and training of residents for operation of this unit for wildland fires initial attack until back up units arrive.
- Install 25,000 gallon water storage tank along Highway 395, to provide a quick source of water to refill fire apparatus, areas not close to Swauger Creeks existing draft points.
- 300 acres ladder fuels reduction on private property, various locations within Devil's Gate Swauger Creek Fire Safe Council's area.
- Create shaded fuel break, on Quartz Mine Road 150 feet each side and improve road width for approximately 1.5 miles.
- Finish Swauger Creek Road widen shaded fuel break to existing dedicated road right-of- way.
- Review all created shaded fuel breaks for maintenance every 5 years.

17. Swall Meadows

Hazard Rating	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8
Water supply:	Hydrants

Inadequate roads, steep slopes, ravines, power lines

Description: There have been two large fires in this community since 1982. Most homes are moderate to small size on moderate lots, with a mix of old and new construction. Wood siding with metal or asphalt roofs is the dominant construction type. There are a few homes with some defensible space, but there are also many homes with vegetation growing right up to the structure. There are also some properties with flammable yard clutter. There is one way in and out of this community and the access road is narrow, winding and constructed mid-slope for a considerable distance. There are some steep narrow driveways and some poor dirt roads in this community. Addressing is generally poor (missing and inconsistent markers, few reflective).

Overhead power lines exist which may be a hazard to fire apparatus. There are hydrants in this community and there is a fire station located on Willow Drive. Fuels are primarily sage and Jeffery pine, with sage in the understory (except in drainages where a mix of hardwood, shrubs and cedars is dominant). Topography is moderate to steep.

SWALL MEADOWS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Investigate the possibility of improving and widening the road surface of the rougher dirt access roads.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

18. Hilton Creek

Hazard Rating **High**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5
Water supply:	Hydrants

Inadequate roads, steep slopes, ravines, wood roofs

Description: Delta Drive serves as the dividing line between this community and the more hazardous Juniper Loop community. Most of the homes were built in the 1980s and the dominant construction type is wood siding with asphalt or metal roofs. There are some wood roofs in this community and few homes have adequate defensible spaces; however, the fuels are not as dense and the topography not as steep as in Juniper Loop. There are several dead- end roads in this community. Most, but not all, of the access roads are of adequate width, but some are steep. Addressing is generally present, but not reflective, and some markers are hard to locate. There is a good water supply in this community. Fuels are moderate loads of Pinyon- juniper and sage. Topography is moderate to steep.

HILTON CREEK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

19. North Mammoth Lakes

Hazard Rating **High**

Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 9, 10
Water supply:	Hydrants
Hazards:	Power lines, propane tanks, wood roofs

Description: This is a high density community of small to moderate size homes and condo complexes. Most construction is wood siding with a metal or asphalt roof, but some shake roofs are present. Most homes do not have adequate defensible space and many have vegetation growing right up to the structure. Roads are generally good and most driveways are short.

Addressing is present, but not reflective, and some markers are hard to find. There is a good hydrant network in this neighborhood and most homes are within two miles of a fire station. Fuels are moderate to heavy loads of shrubs and mixed conifer with moderate dead and down material and plentiful ladder fuels. Topography is moderate to low.

NORTH MAMMOTH LAKES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

20. Sierra Valley Estates (Mammoth Lakes area)

Hazard Rating **High**

Does the neighborhood have dual access roads? Yes

Are there road grades > 8%? No

Are all access roads of adequate width? Yes

Average lot size: <1 Acre

Fuel models found in the neighborhood: 5, 9, 10

Water supply: Hydrants

Hazards: Power lines, propane tanks, wood roofs

Description: This is a high density community of small homes and apartments on small lots. Most construction is older and quite a bit of it is very hazardous. Wood A-frames with cedar shake roofs that go almost all the way to the ground are common. Wood siding is dominant and roofs are a mix of asphalt and wood shake. There are no homes with adequate defensible spaces and many residences have flammable yard clutter. Addressing is poor and most homes do not have any address markers. There are power lines and propane tanks which can create a hazard for firefighters. There is a good hydrant network and most homes are within 2 miles of a fire station. Fuels are heavy to moderate loads of mixed conifer. Topography is low to flat.

SIERRA VALLEY ESTATES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

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21. McGee Creek/Long Valley

Hazard Rating	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 6
Water supply:	Hydrants, one creek-fed cistern
Hazards:	Ravines, wood roofs

Description: This is a community of small to moderate sized homes on small lots. Homes are in clusters interspersed with LADWP and public lands. Construction is a mix of new and older types and some areas are still being built out. Wood siding is dominant and roofs are a mix of asphalt and metal with some wood shakes. There are a few homes with defensible spaces but many residences have vegetation growing right up to the structure and some have flammable yard clutter. Access roads are generally good, but there are some steep grades and long narrow driveways. Most homes do not have address markers that are visible from the street. The McGee Creek area has a good hydrant network and there is a creek-fed cistern with a standpipe connection in the Long Valley area that can supply adequate flows. Fuels are light to moderate loads of shrubs, predominately sage, and short grasses with ornamental plantings near homes. Topography is low to moderate with some ravines in the McGee Creek area.

MCGEE CREEK/LONG VALLEY RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

22. Rancheria – Bridgeport Area

Hazard Rating	**High**
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	10, 1, 5
Water supply:	Creek weir (portable pump only)
Hazards:	Inadequate roads, wood roofs

Description: This is a community of small to moderate size homes on moderate sized lots. Wood siding construction is dominant and roofs are approximately half wood shake and half ignition-resistant construction, primarily asphalt. A few homes have some defensible space, but most have vegetation growing right up to the structure. There are many homes with flammable decks and projections and some homes with flammable yard clutter. Most roads are paved and relatively flat but many are narrow and overgrown. There is a secondary access off of Hackmore, but this narrow dirt road is overgrown and would need fuels reduction and surface improvement to be a good escape route. Address markers are generally present, but not reflective and difficult to see on most homes. The only water for fire suppression in this community is from a six-foot concrete creek weir. Fuels are heavy mixed conifer with aspen and riparian shrubs in the creek bottoms. Topography is generally low, but some homes back up to steeper slopes and rolling materials could be a hazard.

RANCHERIA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Extended defensible space is recommended for homes located at the bottom of steep slopes with heavy fuels above to prevent rolling burning materials from igniting structures.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Consider a shaded fuelbreak or linked defensible spaces for homes adjacent to the heavier conifer fuel beds.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- The secondary access off Hackmore should be thinned to conform to shaded fuelbreak recommendations (see the main report for details) and the surface improved to provide a viable escape route.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

23. Snow Creek

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 9
Water supply:	Hydrants
Hazards:	Wood roofs

Description: This is a high density community of primarily town homes and condos. Single family homes are small on small lots. Wood siding with shake roofs is the dominant construction type. Some homes have wood piles and other flammable materials too close to the structure and/or under flammable projections and decks. Some homes have defensible space. Roads are good and most driveways are short and paved. Most homes have address markers but many are not visible (covered by vegetation). This area has a good hydrant network and is less than one mile from Mammoth Lakes FD Station 2. Fuels are conifers with grass and shrubs in the understory broken by irrigated lawns. Topography is low to flat.

SNOW CREEK RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes. Clean all vegetation away from existing address markers.

24. Mono City

Hazard Rating **Moderate**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	2
Water supply:	Hydrants (but poor flows)

Inadequate water supply, power lines, wood roofs

Description: This is a community of small homes on small lots. Most construction is older wood siding with metal or asphalt roofs, although there are several wood shake roofs in this community. Few homes have any defensible space. Roads and driveways are generally good. Some are dirt, but most have good surfaces and are of adequate width. Some homes are missing address markers and most others are present but not reflective and may be difficult to locate. Hydrants are present but flows are poor. Mono City has a volunteer fire department.

Overhead power lines are present which may be a hazard to firefighters. Fuels are primarily sage, mesquite and other shrubs and are continuous except for some irrigated lawns.

Topography is low to flat.

MONO CITY RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non- combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- A second means of ingress/egress is needed for this community. A committee with the Mono Basin RPAC is currently working on this issue as of the writing of this report.
- Consider supplementing the poor hydrant network with a large (10,000 - 30,000) community cistern.
- Install a generator to keep the current water system operating during power outages.
- Add reflective addressing to all driveways and homes.

25. Convict Lake/SNARL

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 6
Water supply:	Hydrants (Convict Lake only)

Inadequate water supply, inadequate access roads, ravines

Description: SNARL (Sierra Nevada Aquatic Lab) has residential housing for the research lab. The residences are wood and metal siding with metal roofs. This is an isolated area and address markers are not applicable, although the buildings are numbered. This area is a long distance from the nearest fire station. The only water for fire suppression is a pump system fed by a small reservoir, which is inadequate for this community. Fuels are a mixture of shrubs and short grasses. Topography is low to flat.

The residences at Convict Lake are predominately cabins and duplex units with one large summer resort property. There is a mix of old and new construction. Most residences are wood siding with metal or asphalt roofs. Addressing is poor and this area is a long distance from the nearest fire station. This community has a network of 2 ½" standpipe hydrants gravity fed by a 60,000 gallon cistern. Fuels are moderate loads of shrubs as much as four to six feet high in some areas. Near residences, aspen with sage and other shrubs in the understory is dominant. Topography is low to moderate with some ravines.

CONVICT LAKE/SNARL RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider supplementing the small reservoir at SNARL with a large (10,000 - 30,000) community cistern.
- Add reflective addressing to all driveways and homes in Convict Lake (not applicable to SNARL).

26. Highlands

Hazard Rating **Moderate**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5, 6
Water supply:	Hydrants
Hazards:	Propane tanks

Description: This is a community of moderate size homes on small lots. This community is still being built out and is likely to become a high density area. Most construction is newer rock and wood siding with ignition resistant roofs. Some homes have defensible spaces, but most have shrubs and ornamental vegetation too close to the structure. Most roads are good and addressing is generally present, but not reflective, and may be difficult to locate at some residences. This community has a good hydrant network. Fuels are moderate loads of primarily sage and other short shrubs. Fuel beds are generally continuous throughout this community.

Topography is low to moderate.

HIGHLANDS RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

27. Aurora Canyon

Hazard Rating | **Moderate**

Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	15, 2
Water supply:	Hydrants
Hazards:	Power lines, propane tanks

Description: This is a community of small homes on small lots. The dominant construction type is wood siding with asphalt roofs. Some homes have defensible spaces but most have ornamental plantings, grasses and/or sage too close to the structure. Roads are generally good and most homes have addressing present on the structure, but most markers are not reflective and some are difficult to locate. There are no address markers on the street, but most driveways are short. Power lines and propane tanks exist, which can be hazardous to firefighters. There is an adequate hydrant network in this community. Fuels are light loads of small sage and grasses (CDF desert fuel model, FM 15). Fuels change to Pinyon-juniper dominant further up canyon.

Topography is low to moderate.

AURORA CANYON RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

28. Ranch Road – Mammoth Lakes area

Hazard Rating **Moderate**

Does the neighborhood have dual access roads? No

Are there road grades > 8%? No

Are all access roads of adequate width? Yes

Average lot size: <1 Acres

Fuel models found in the neighborhood: 5, 1

Water supply: Hydrants

Hazards: Wood roofs, power lines, propane tanks

Description: This is a high density community of newer homes. Homes are small to moderate size on small lots. The dominant construction type is log, wood siding or wood siding with partial rock veneer. Roofs are predominately wood shake, although there are also many asphalt roofs. Many homes have flammable projections and decks. Most homes do not have any defensible space, and flammable ornamental plantings too close to the structure are common. All homes have address markers, but most are not reflective and there are no address markers at the street. There is a good hydrant network in this community (hydrants every 300 to 500 feet) and all of the homes are less than one mile from a fire station. Fuels are moderate to light loads of sage, riparian shrubs and grasses. Topography is flat to gently rolling.

RANCH ROAD AREA RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

29. Chalfant Valley

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	15
Water supply:	None

No water supply, ravines, power lines, propane tanks

Description: Residences in this community are primarily ranch and farm properties with small to moderate size homes on moderate to large lots. There is a mix of old and new construction with wood siding and asphalt or metal roofs as the dominant type, although there are also many trailer homes in this community. Many properties have flammable outbuildings and several have cluttered yards. Although there are some homes with defensible space (mostly resulting from agricultural irrigation), there are many homes with native vegetation and ornamental plantings too close to the structure. Some access roads and long driveways are dirt, but most are flat and of adequate width. Addressing is poor. Many homes do not have markers, there are several long driveways with no marker at the street, and some homes only have a mailbox as a marker. Most of the markers that do exist are not reflective and some are difficult to locate. There is no water supply for fire suppression and many of the homes are a long way from the nearest fire station. Power lines and propane tanks exist which may be a hazard to firefighters. Fuels are light loads of small sage and grasses (CDF desert fuel model, FM 15). Fuels are discontinuous, broken by irrigated agricultural fields and lawns. The general topography is low to flat. However, topography does increase closer to the White Mountains, and there are some ravines in this area.

CHALFANT VALLEY RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Water supply is a critical need in Chalfant Valley. This community is very spread out along Highway 6. Consider adding at least one large (10,000 - 30,000 gallon) cistern in each of the most populated areas (Benton, Hammil and Chalfant Valley) for fire suppression use in this community.
- Add reflective addressing to all driveways and homes.

30. Paradise Valley

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 15
Water supply:	Hydrants
Hazards:	Ravines, wood roofs, propane tanks

Description: Approximately 175 people live in this community of small to moderate size homes on small lots. Most of the construction is newer with wood siding and asphalt roofs, but there are at least two wood shake roofs in this community. There are 83 homes currently built with plans to increase to 138 at maximum build out. Some homes have defensible space, but some have ornamental plantings and sage too close to the structure. Roads are good, paved and of adequate width. Most driveways are short. Address markers are present, but not reflective except for some reflective numbers on mailboxes. There is a good hydrant network in this community and all of the homes are within one mile of a fire station. Propane tanks exist which may be a hazard to firefighters, although most of the tanks are fairly new. Fuels are light loads of sage and desert grasses. Plants are generally widely spaced except for willow and aspen present in some drainages. Topography is low to moderate with some ravines.

PARADISE VALLEY RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Extended defensible space is recommended for homes with heavy fuel loads near or below the home and for homes above ravines or other hazardous topographic features.
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

31. Antelope Valley

Hazard Rating **Low**

Does the neighborhood have dual access roads? Yes **Are there road grades > 8%?** No

Are all access roads of adequate width?	No
Average lot size:	1-5 Acre
Fuel models found in the neighborhood:	1, 5
Water supply:	Hydrants

Inadequate access roads, no water supply, power lines, propane tanks

Description: This community, which is primarily located in the central portion of Antelope Valley, is dominated by agricultural properties. There are also some homes around Topaz Lake, which is an area of heavy recreational use. Except for the homes around the Lake and in the town of Topaz (population 100), most of the homes are small to moderate size on large lots.

Near the lake and in Topaz, homes are closer together, but still tend to be on moderate size lots. Most of the homes in this area are older and the dominant construction type is wood siding with an asphalt or metal roof. Many homes have defensible space mostly due to agricultural irrigation, but there are some with sage and ornamental plantings growing right up to the structure. There is a volunteer fire station and a BLM fire station in Topaz. There is no water for fire suppression in this community, although there are likely to be places on Topaz Lake or the Walker River where it will be possible to draft depending on the water levels. Other than Highway 395, most of the roads are improved dirt. Widths are generally good, but there are some long narrow driveways. Addressing is poor, with many homes not marked at the driveway or the structure. Fuels are generally light loads of sage and short grasses except for scattered riparian shrubs and hardwoods in drainages and planted near some homes. Fuels are discontinuous due to large irrigated agricultural plots. Topography is generally low to flat.

ANTELOPE VALLEY RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Inventory and preplan all draft sites and any stock tanks or other water sources which could be useful for fire suppression.
- Add reflective addressing to all driveways and homes.

32. The Trails

Hazard Rating Low

Does the neighborhood have dual access roads? Yes **Are there road grades > 8%?** No

Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 28
Water supply:	Hydrants
Hazards:	Heavy ornamental plantings

Description: This is a community of primarily moderate size homes on small lots. Most of the construction is newer and this community is still being built out. Wood siding with an asphalt or metal roof is dominant. Flammable decks and projections are common. Although the native fuels are light, most homes do not have any defensible space, because conifers and flammable ornamentals are planted too close to (in most cases right up to) the structure. Ornamental plantings are the biggest threat to the homes in this community. Roads are good and driveways are short. Address markers are present, but not reflective. The homes in this community are approximately two miles from the nearest fire station (Mammoth Lakes Station 1). Fuels are primarily light loads of short sage with occasional conifers, except for the heavy ornamental plantings near the homes noted above. This community backs up to a cleared industrial park which is a significant fuelbreak. Topography is low to flat.

THE TRAILS RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

33. June Lake Village

Hazard Rating **Low**

Does the neighborhood have dual access roads? Yes **Are there road grades > 8%?** No

Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5
Water supply:	Hydrants
Hazards:	Power lines, wood roofs

Description: This is a community of small houses on small lots. Most of the construction is older and in various states of repair. Wood siding with an asphalt or metal roof is dominant, but there are some wooden roofs in this community. Flammable decks and projections are common. Roads are narrow but the surfaces are generally good and driveways are short.

Addressing is poor. Many homes do not have markers. Most of the markers that do exist are not reflective and some are difficult to locate. This area has a good hydrant network and is close to the June Lakes fire station. Power lines and propane tanks exist which may be a hazard to firefighters. Fuels are riparian shrubs and grasses broken by irrigated lawns. Topography is moderate to low.

JUNE LAKE VILLAGE RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

34. Lee Vining

Hazard Rating **Low**

Does the neighborhood have dual access roads? Yes **Are there road grades > 8%?** No

Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	Hydrants
Hazards:	Power lines, wood roofs

Description: This is a community of small houses on small lots. Most of the construction is older and in various states of repair. Wood siding with an asphalt or metal roof is dominant, although there are some wooden roofs in this community. Flammable decks and projections are common. Roads are generally good and driveways are short. Addressing is poor. Many homes do not have markers. Most of the markers that do exist are not reflective and some are difficult to locate. This area has a good hydrant network and there is a volunteer fire station in this community. There is also a USFS fire station in Lee Vining. Power lines and propane tanks exist which may be a hazard to firefighters. Fuels are light loads of small sage and grasses (CDF desert fuel model, FM 15). Fuels are discontinuous, broken by irrigated lawns. Topography is moderate to low.

LEE VINING RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

35. Bridgeport Valley

Hazard Rating **Low**

Does the neighborhood have dual access roads? Yes **Are there road grades > 8%?** No

Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acre
Fuel models found in the neighborhood:	1, 5
Water supply:	Hydrants
Hazards:	Power lines, propane tanks

Description: This community is dominated by agricultural properties. Lot sizes vary from small lots in the town of Bridgeport to large agricultural properties. Homes in this area are a mix of new and old construction. The dominant construction type is wood siding with asphalt or metal roofs. Most homes have defensible space primarily due to agricultural irrigation and the lack of native fuels. Some roads are dirt, but most are flat and of adequate width. There are some long driveways with no pullout or turnaround for apparatus. Addressing outside of the town of Bridgeport is poor, with many homes not marked at the driveway or the structure. Homes in Bridgeport generally have address markers, but most are not reflective and some are difficult to locate. There is a good hydrant network in Bridgeport. There is also a volunteer fire station and a USFS fire station in Bridgeport. Fuels are generally light loads of short grasses and sage which are quite discontinuous due to large irrigated agricultural plots and irrigated lawns.

Although surrounded by hills, this community is in a flat valley bottom.

BRIDGEPORT VALLEY RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see the **Home Mitigation** section in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire and drought tolerant plants for ornamental plantings especially within 30 feet of homes (see the **Home Mitigation** section in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

APPENDIX 4C

STRUCTURAL TRIAGE AND PREPARATION

SIZE UP CONSIDERATIONS

- What is the current and expected weather?
- Are fuels heavy, moderate, or light? What is the arrangement and continuity of fuels?
- Note any hazardous topography.
- What have fires in this area done before?
- What is the fire's current and expected behavior?
  - What is the rate and direction of spread?
  - What is the potential for spotting and firebrands?
  - Will topographical features or expected weather changes affect the rate of spread?
- What are the number and density of structures threatened?
- What are the available resources?
- Will you have to evacuate people or animals?
  - Are there residents who will not evacuate?
- How hazardous is the structure?
  - What is the roofing material?
  - Are the gutters full of litter?
  - Are there open eves and unscreened vents?
  - Does the structure have wooden decking?
  - Is there defensible space?
  - Are there large windows with flammable drapes or curtains?
  - What is the size and location of propane tanks and/or fuel storage tanks?

FIREFIGHTER SAFETY

- What are the routes of egress and ingress?
  - What is the largest engine that can access the structure safely?
  - Are the roads two-way or one-way?
  - Are there road grades steeper than 8%?
  - Are the road surfaces all-weather?
  - Are there load-limited bridges?

- Are there anchor points for line construction?
- Are there adequate safety zones?
- What are the escape routes?
- Are there special hazards such as hazardous materials, explosives, high-voltage lines, or above- ground fuel tanks?
- Are communications adequate?

STRUCTURAL TRIAGE CATEGORIES

Sort structures into three categories:

1. **Stand Alone or Not Threatened**
2. **Defendable**
3. **Not Defendable**

- Factors that may make an attempt to save a structure too dangerous or hopeless:
  - The fire is making sustained runs in live fuels and there is little or no defensible space
  - Spot fires are too numerous to control with existing resources
  - Water supply will be exhausted before the threat has passed
  - The roof is more than ¼ involved in flames
  - There is fire inside the structure
  - Rapid egress from the area is dangerous or may be delayed

APPARATUS PLACEMENT CONSIDERATIONS

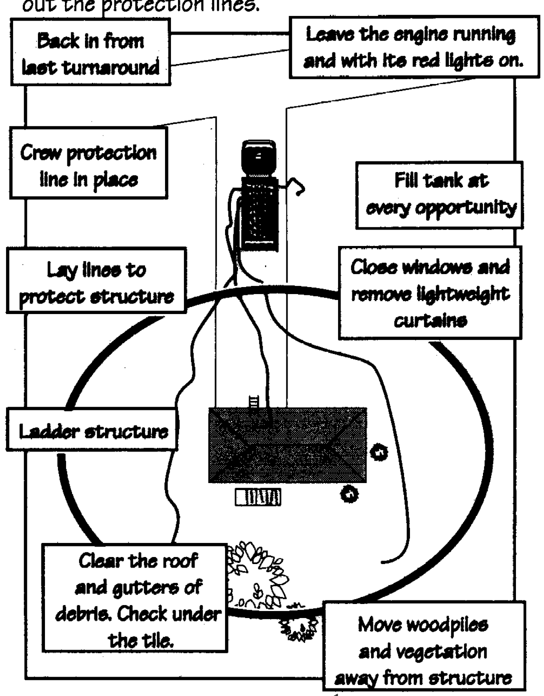
Common Ignition Points (remember, in windy conditions, firebrands can enter almost any opening)

- Flammable roof coverings and debris
- Unscreened vents, windows, or holes
- Open doors, windows, or crawl spaces
- Wooden decks, lawn furniture, stacked wood, and trash piles
- Openings under porches or patio covers

Note: See diagram for Engine Positioning and Setup on the next page.

ENGINE POSITIONING AND SETUP

It is critical that you position you, your personnel and apparatus in positions to protect the structure, but also so that you can make a quick move, if necessary. Prepare the structure and lay out the protection lines.



[1]

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[1] Teie,William C.,1995, Firefighter's Guide, Urban/Wildland Situations. Deer Valley Press

APPENDIX 4D

ACCESS AND WATER SUPPLY RECOMMENDED GUIDELINES

INTRODUCTION

This appendix has been designed with public education in mind, and is intended to help familiarize homeowners, contractors, and developers with the general principles of the access and water supply needs of firefighters. The recommendations in this section are based on proven practices. However, they are not meant to be a substitute for locally adopted codes.

Emergency response personnel do their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for residents and their families, as well as that of the firefighters and emergency medical technicians that will arrive on scene. This is especially important in rural areas, where response times may be considerably longer than in cities.

ACCESS GUIDELINES

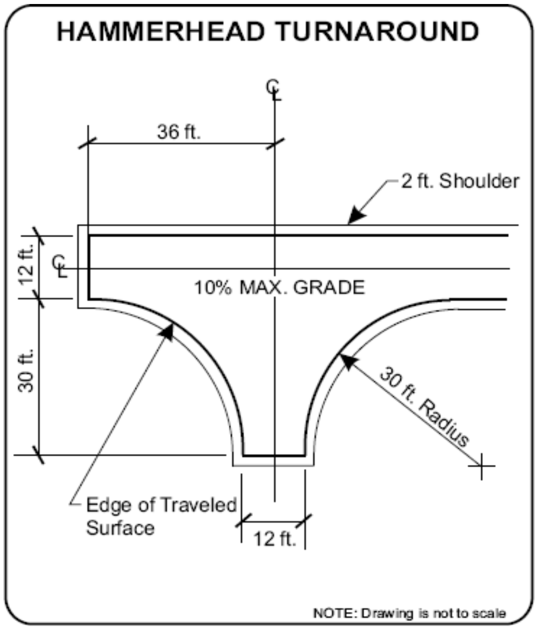
Driveway Turnarounds

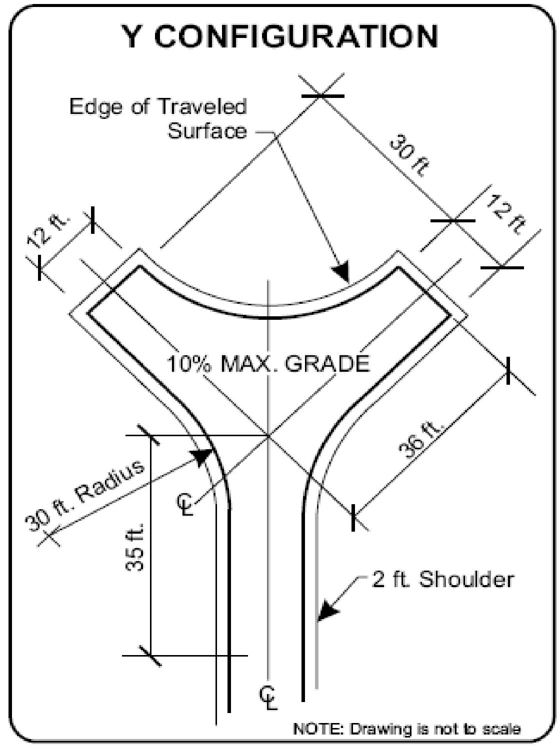
Turnarounds unobstructed by parked vehicles should be located at the end of every driveway. They should be designed to allow for the safe reversal of direction by emergency equipment. The "Y" and "Hammerhead" turnarounds shown below are preferred because they provide the necessary access, while minimizing disturbance to the site.

Driveway Width and Height

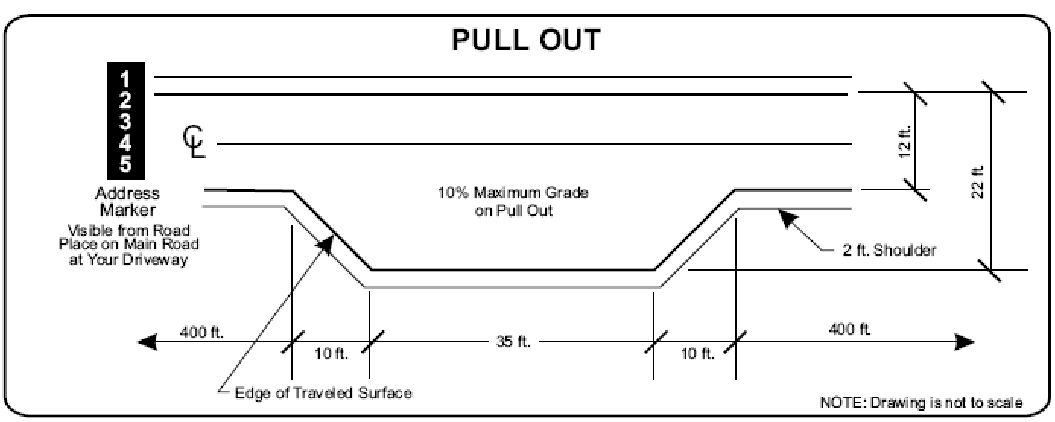
Driveways should have an unobstructed vertical clearance of 13 feet 6 inches. Trees may need to be limbed and utility lines relocated, to provide the necessary clearance. Driveways should have a 12 foot-wide drivable surface and 14 feet of horizontal clearance.

Note: Diagrams illustrating these guidelines can be seen on the next page.





Driveway pullouts should be designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400-foot intervals along driveways and private access roads (community driveways). The location of pullouts may be modified slightly to accommodate physical barriers such as rock outcroppings, wetlands, and other natural or manmade features.



Address Markers

Every building should have a permanently posted, reflective address marker mounted on a non-combustible pole. The sign should be placed and maintained at each driveway entrance. Care should be taken to ensure that the location will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location and markings be adequate for easy night-time viewing. It is preferable to locate markers in a consistent manner within each community. A good guideline for this practice is to place the markers five feet above ground level on the right side of every driveway. Where access to multiple homes is provided by a single driveway, all addresses accessed via that driveway should be clearly listed on the driveway marker. Where multi-access driveways split, each fork should indicate all residences accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate simply to mark addresses on a common pole in the center of the fork. Further, residential homes should have an additional reflective address marker permanently attached to the home, in clear view of the driveway or access road. Homes that are marked by lot number while under construction should have the lot number removed and a permanent address marker posted before granting a certificate of occupancy.

Bridge Load Limits

Bridge load limits should be posted with a permanently mounted, reflective marker at both entrances to the bridge. Care should be taken to ensure that these markers will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location of the markings and the markings themselves be adequate for easy night- time viewing.

ALTERNATIVE WATER SOURCES

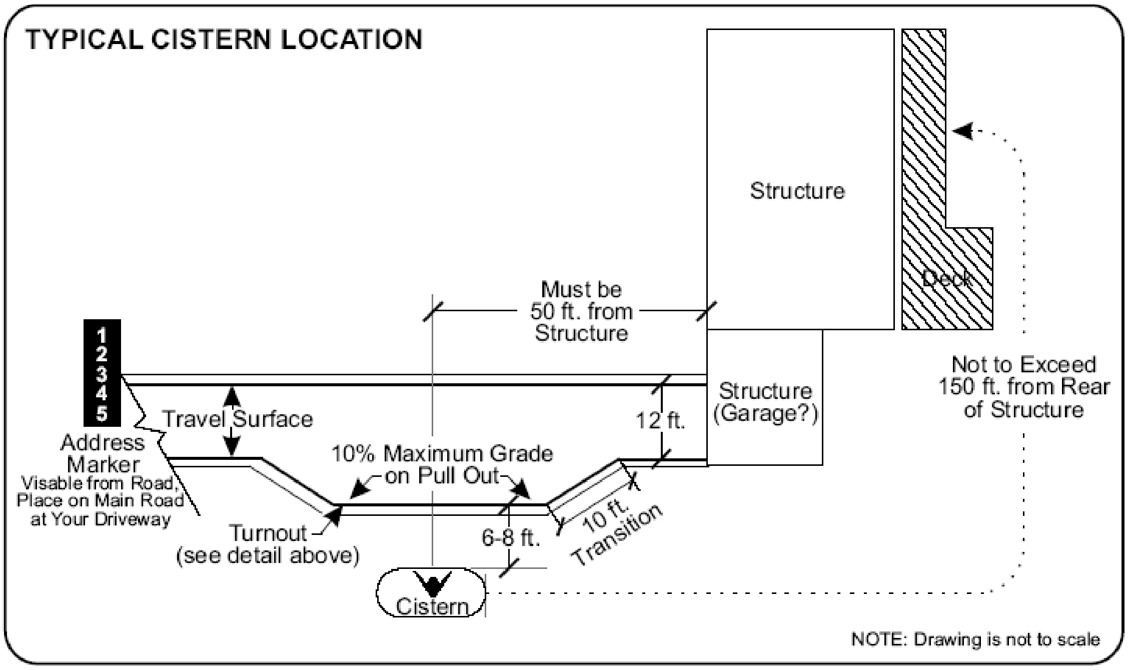
In the study area, like in many WUI areas in the west, water is a critical fire suppression issue. Although some communities in Mono County have a good network of pressurized hydrants, the hazard assessment revealed several communities in the study area which are a considerable distance from reliable water sources for fire suppression. The following information on the use of cisterns and dry hydrant installations has been included to provide information regarding supplementing existing pressurized hydrants, cisterns and natural water sources. It is not intended to be a replacement for existing water supplies. For more detailed recommendations regarding enhancement of the existing water supply system, please see the **Water Supply** section of the main report.

CISTERNS

Once emergency vehicles have arrived on site, they will need a dependable supply of water to help control the fire. Although residential wells with outdoor taps can be used by fire crews to help fill engine tanks, they are not adequate for fire control. If the property is a significant distance from a reliable water supply or fire station, it may be advisable to employ one of the following water supply options:

- An on-site 1,800 - 2,500 gallon cistern for each residence.
- A monetary contribution to a large community cistern fund.

For more information about local standards and regulations, please contact your local fire department.



DRY HYDRANTS

Dry hydrant installations allow much faster and more reliable access to ponds and tanks than conventional drafting. Specific recommendations for dry hydrant locations may be found in the **Water Supply** section of the main report. Guidelines for the construction and maintenance of dry hydrants may be found in the *Dry Hydrant Manual* included as a supplement to this report.

It is always helpful to discuss any potential construction project with the fire department. Local fire department officials or the CDF can help determine what kind of access and water supply options will work best for your site. While the guidelines in this appendix have been assembled by querying firefighters with extensive Wildland-Urban Interface firefighting and fire code experience, local fire officials are in the best position to offer site-specific information.

APPENDIX E

DRY HYDRANT MANUAL

A Guide for Developing Alternative Water Sources for Rural Fire Protection From code originally developed for Summit County, Colorado.

ALTERNATE WATER SUPPLY POLICY

SCOPE

This policy is intended to offer guidance and assistance to the property owner, contractor, or developer for meeting the requirements of the Uniform Fire Code and Chapter 14 (as amended) of the Uniform Building Code for the provision of adequate water supplies for rural firefighting. This policy does not necessarily meet ISO requirements for installation of a draft fire hydrant.

GOALS

1. To reduce ISO ratings
2. To design each installation with the capability of flowing 1,000 gpm
3. To obtain points for fire mitigation
4. To function to protect life and property

DEFINITION

A draft fire hydrant is a specially designed and constructed fire hydrant, which has been approved by the Fire Department having jurisdiction. A draft fire hydrant must be connected to a year-round draft water source of sufficient capacity to meet any fire- fighting needs for the property or properties involved. Fire hydrants which are connected to a pressurized municipal watercourse are not covered by this policy.

PERMITS

A. A review of the draft fire hydrant plans must be completed by the Fire Department having jurisdiction prior to issuing a grading permit to allow construction of a draft hydrant. A site plan review is used to determine site- specific requirements including, but not limited to, depth of pipe, required insulation materials, backfill requirements, and draft site requirement. Additionally, it may be necessary to submit information about drought conditions for the past 50 years.

B. A statement authorizing access to and use of the draft fire hydrant by the Fire Department and its agents must be signed by the owner of the property on which the draft hydrant will be located. The Fire Department having jurisdiction will be using water under the presumption of non-injury/non-consumption for fire emergency use.

ACCEPTANCE TESTING

All draft hydrants are subject to acceptance testing approved by the Fire Department having jurisdiction, prior to being accepted as a water source. Acceptance testing must include GPM verification of the water source. Maintenance and testing will return water within 200 feet of its drainage.

MAINTENANCE

A. Draft fire hydrants require bi-annual testing and maintenance. The hydrants should be tested with a pumper. Back-flushing followed by a pumper test at a maximum designed flow rate is required, and records of each test need to be kept. Tests of this kind will not only verify that the hydrant is in proper condition, but will also ensure that the line and strainer are clear of silt, thus keeping water supply available for any fire emergency.

B. A homeowner using the draft hydrant who has obtained points for mitigation or an ISO classification is responsible at all times for maintaining the draft hydrant. This maintenance includes keeping the draft hydrant and its protective barriers free from obstruction by vehicles, materials, structures, snow, or other obstructions, and ensuring that the draft hydrant is in a serviceable condition at all times.

C. It is the responsibility of the property owners using the hydrant for mitigation of ISO classification purposes to immediately notify the Fire Department having jurisdiction of any draft hydrant which is obstructed, damaged, or out of service for any reason.

DESIGN REQUIREMENTS

A. All draft hydrants must be located within 8 feet of a road with year-round maintenance. Access to the system must conform to the road and bridge standards in Appendix D, Access and Water Supply.

B. All draft hydrants must have a single draft connection located no more than 30" from the fire apparatus, measured from the grade level of the roadway where the fire apparatus will be parked, to the top of the draft hydrant's threaded connection. Additionally, life is determined by measuring from year-round low level of the water surface to the truck intake.

C. All draft hydrants must have a draft tube running horizontally from the water source to the base of the riser, constructed of PVC no smaller than six inches in diameter. PVC pipe meeting AWWA specification C9000 with a SDR of 18 or less may be required through or under foundations and under driveways (schedule 80 pipe or its equivalent may be deemed necessary in some instances). All joints must be sealed to ensure that they are watertight, airtight, and root proof.

A. The piping must be placed in bedding material of ¾-inch washed or screen rock, or in native soils, providing that the native soils contain no sharp materials or stones larger than 2½ inches that may damage the piping.
B. The bedding material must be placed to a depth of 4 inches below the pipe and 6 inches above the top of the pipe.
C. The draft hydrant pipe extending from the water source to the rise pipe connection must have a minimum grade of .5% to a maximum of 2% toward the water source. (This excludes the riser section immediately preceding the fire department connection).
D. All draft fire hydrants must have a single draft connection consisting of an approved fitting and cap with 6-inch male NST threads. (Size of connection is determined by the Fire Department having jurisdiction.)
E. No more than two elbows are recommended. Elbows may be 90 or 45 degree bends. (See Figure 1.)

INSTALLATION REQUIREMENTS

A. Draft fire hydrants must be painted red (using oil base paint) with reflective tape, to protect PVC pipe from the adverse effects of sunlight and to assist in the rapid location and identification by the Fire Department.
B. All draft fire hydrants must be protected from damage by snowplows, motor vehicles, etc., by the installation of three steel pipes buried three feet into the ground with four feet extending above the grade level of the roadway. The entire pipe must be filled with concrete. The protective pipes must be located in a triangle configuration approximately three feet away from the draft hydrant. Steel pipes must also be painted with red oil base paint and reflective tape.
C. All draft hydrants must have a sign stating “draft hydrant” displayed in a location acceptable to the Fire Department having jurisdiction.

The above policy is subject to change or modification by the Fire Department having jurisdiction.

MAXIMUM LIFT CONSIDERATIONS

Definition: Lift is determined by measuring from the lowest level of the water surface to the truck intake, which is 36” above grade.

Maximum vertical lift recommendations:

Elevation	Do Not Exceed
4,000 ft	13 ft
5,000 ft.	12 ft.
6,000 ft.	11 ft.
7,000 ft.	10 ft.
8,000 ft.	9 ft.
9,000 ft.	8 ft.
10,000 ft.	7 ft.

APPENDIX F

MONO COUNTY CWPP COLLABORATIVE EFFORT

THE NEED FOR A CWPP

In response to the Healthy Forest Restoration Act (HFRA), and in an effort to create incentives, Congress directed interface communities to prepare a Community Wildfire Protection Plan (CWPP). Once completed, a CWPP provides statutory incentives for the federal agencies to consider the priorities of local communities as they develop, and implement forest management and hazardous fuel reduction projects.

CWPPs can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, structure protection, or all of the above.

The minimum requirements for a CWPP are:

- Collaboration between local and state government representatives, in consultation with federal agencies and other interested parties.
- Addressed in this appendix
- Prioritized fuel reduction in identified areas, as well as recommendations for the type and methods of treatments
- Addressed in Main CWPP report (see recommendations sections)
- Recommendations and treatment measures for homeowners and communities to reduce the ignitability of those structures in the project area.
- Addressed in Appendix B of this CWPP

INTER-AGENCY COLLABORATION

Roles and Responsibilities

To be successful, wildfire mitigation in the interface must be a community-based, collaborative effort. Stakeholders and, primarily, Mono County and the local Fire Safe Councils, will have the greatest responsibility for implementing the recommended mitigation projects. Cal Fire and the USFS/BLM will be valuable participants in addressing cross-boundary projects throughout the area.

Nearly all of the recommendations from this report affect private land or access roads to private land. There are also mitigation recommendations for individual structures, which are the responsibility of the homeowner. Homeowners will, however, need a point of contact to help them implement these recommendations. The best defensible space will be created with oversight and expert advice from the fire department and/or government forestry personnel. One-on-one dialog will continue to build the relationship with community members. This level of involvement will allow agencies to keep track of the progress and update this plan to reflect the latest modifications at the community level.

THE COLLABORATIVE PROCESS

"The initial step in developing a CWPP should be the formation of an operating group with representation from local government, local fire authorities, and the state agency responsible for forest management. (…) Once convened, members of the core team should engage local representatives… to begin sharing perspectives, priorities, and other information relevant to the planning process."[1]

Numerous federal, State, local, and private agencies (stakeholders) participated in this CWPP. These stakeholders included:

- Mono County stakeholders:
  - Debra Hein, BLM
  - Bob Rooks, Mammoth Lakes, FD
  - Dale Schmidt, LADWP/Wheeler VFD
- Mono County communities including:
  - Lake Mary Area
  - Twin Lakes
  - June Lake
  - Swauger Creek/Devils Gate
  - North Mammoth Lakes
  - Mono City
  - Lee Vining
- Mammoth Lakes Fire Protection District
- Mono County Supervisors
- California Department of Fire (CalFire)
- Bureau of Land Management
- United States Forest Service
- Anchor Point Group

The true collaborative process was initiated through a stakeholder meeting held in June, 2005. The purpose of the meetings was to bring all past, current, and future efforts and needs to the table. The primary focus was on the identification and delineation of communities, areas of concern, and values at risk. Best practices and anticipated "roadblocks" were identified.

A second round of stakeholder meetings was held in January of 2009 to present the results and discuss any issues or concerns with the draft report.

In addition public meetings were held to get input and feedback from residents. There was support for the projects and interest in convening community meetings to start the process. Comments were incorporated into the final document.

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[1] A handbook for Wildland-Urban Interface Communities March 2004,

http://www.safnet.org/policyandpress/cwpphandbook.pdf

There are many sources of funds available for implementing the recommendations within the CWPP. Some available grants and websites where more information can be found are provided below.

- **Agency: Homeland Security, Office for Domestic Preparedness**
  - Purpose: to assist local, state, regional, or national organizations in addressing fire prevention and safety. The emphasis for these grants is the prevention of fire-related injuries to children.
  - More information: http://www.firegrantsupport.com/
- **Agency: Federal Emergency Management Agency (FEMA)**
  - Purpose: to improve firefighting operations, purchase firefighting vehicles, equipment, and personal protective equipment, fund fire prevention programs, and establish wellness and fitness programs.
  - More information: http://usfa.fema.gov/dhtml/inside-usfa/grants.cfm
- **Agency: National Volunteer Fire Council**
  - Purpose: to support volunteer fire departments
  - More information: http://www.nvfc.org/federalfunding.html
- **Agency: Community Facilities Grant Program**
  - Purpose: to help rural communities. Funding is provided for fire stations
  - More information: www.rurdev.usda.gov/rhs/
- **Agency: Firehouse.com**
  - Purpose: emergency services grants
  - More information: www.firehouse.com/funding/grants.html
- **Agency: Cooperative Forestry Assistance**
  - Purpose: to assist in the advancement of forest resources management, the control of insects and diseases affecting trees and forests, the improvement and maintenance of fish and wildlife habitat, and the planning and conduct of urban and community forestry programs
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/cfda10664.html
- **Agency: Forest Service, Economic Action Programs**
  - Purpose: Economic Action Programs that work with local communities to identify, develop, and expand economic opportunities related to traditionally underutilized wood products and to expand the utilization of wood removed through hazardous fuel reduction treatments.
  - More information: www.fireplan.gov/community_assist.cfm
- **Agency: FEMA**
  - Purpose: Assistance to Firefighters Grant Program
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/apply.cfm and www.nvfc.org/federalfunding.html

Appendix G:
FHSZ Model Primer

FACT SHEET:

Fire Hazard Severity Zone Model A Non-technical Primer

California Department of Forestry and Fire Protection Office of the State Fire Marshal

Most of the highest wildfire losses take place during hot, windy days or nights when flames spread so fast that many buildings catch fire and overwhelm available firefighting forces. Many buildings ignite when burning embers land on wood roofs, blow in through vents, pile up in cracks, or become lodged under boards. By constructing buildings in a way that reduces the ability of embers to intrude, a major cause of structure ignition is reduced.

Recently adopted building codes reduce the risk of burning embers igniting buildings. Standards are already in effect for roofs and attic vents. Application of roofing standards depends on the Fire Hazard Severity Zone of a property. New building codes for California, will require siding, exterior doors, decking, windows, eaves, wall vents and enclosed overhanging decks, to meet new test standards. These standards apply throughout areas where the State has financial responsibility for wildland fire protection and for local responsibility areas zoned as very high fire hazard severity.

While all of California is subject to some degree of fire hazard, there are specific features that make some areas more hazardous. California law requires CAL FIRE to identify the severity of fire hazard statewide. These fire zones, called Fire Hazard Severity Zones are based on factors such as fuel, slope of the land and fire weather. There are three zones, based on increasing fire hazard: medium, high and very high.

Model Behind Fire Hazard Severity Zone Mapping

The zone designation for each specific parcel is initially assigned by a computer model. The model is based both on existing fire behavior modeling techniques used by fire scientists throughout the United States and on new methodologies and data developed by the Fire Center at the University of California in Berkeley.

The model evaluates land area using characteristics that affect the probability that the area will burn and the potential fire behavior that is expected should the area burn in a wildfire. Many factors are considered such as fire history, existing and potential fuel, flame length, blowing embers, terrain, and typical weather for the area.

Hazard Versus Risk

As required by law, the model evaluates “hazard” not “risk.” *Hazard* refers to physical conditions that cause damage. “Hazard” as calculated in the model is based on the physical conditions that give a likelihood that an area will burn in the future, the heat produced when it does burn, and a prediction of the embers that spread the fire. It is based on the potential vegetation that will grow in the area over the next 30 – 50 years.

Risk, on the other hand, is the potential damage a fire can do to values at risk in the area under existing and future conditions. Risk does consider modifications that affect susceptibility of property to damage, such as defensible space, irrigation and sprinklers, and building construction that reduces the risk of burning embers igniting buildings. Hazard does not equal risk, but is an important factor in determining risk.

Zones and Parcels

Mapping an area as large as California requires the creation of spatial units called zones. Zones are areas that form the spatial building blocks for constructing a map. They are akin to the pieces in a jig-saw puzzle.

Zones are created by computer from areas of similar terrain, vegetation, and fuel types. They are areas that have relatively similar burn probabilities and fire behavior characteristics. The zone size varies from 20 acres and larger in urbanized areas to 200 acres and larger in wildland areas. Urban areas are treated differently in mapping due to the significant changes in both fuel conditions and burn probability that happen as areas become urbanized.

Wildland zones are areas of similar terrain and fuel conditions created by using computer techniques to build the boundaries. Areas dominated by brush lands on steep slopes will generally occur in different zones than flat grassland areas.

Urban zones are delineated based on minimum area and average parcel size. They must be at least 20 acres in size, and contain average parcel sizes that are less than two acres per parcel. In most counties, urban zones were developed using parcel data. Where such data was not available parcel density was interpreted using 2000 census data and statewide vegetation map data. In practice, the majority of areas mapped as urban zones have parcel sizes less than one acre, with highly developed infrastructure and ornamental vegetation.

Fundamental to understanding the map is that hazard zones do not exist at scales smaller than those used to create the zones. Thus when looking at the map, one needs to know how information is averaged across the zone to derive the final hazard ranking. The zones will have smaller areas within them of different hazard characteristics. This detail is lost when scores are averaged over the entire area of the zone to obtain a zone-wide description of hazard

Focus on Characterizing Fire Behavior and Fire Hazard to Buildings

Since new building standards seek to reduce the chance that buildings will ignite in a wildfire, the model focuses on those descriptions of fire behavior that influence structure ignition. The model uses fire behavior characteristics that describe the intensity of both radiation and convection from nearby flame sources (using flame length as a measure) and mass transport of firebrands due to convection lifting and wind).

Intrinsic to hazard, consequently, is the estimation of probability, or chance. Further, the conditions that give rise to hazard for an area are not solely a function of conditions in that particular area. Firebrands landing in an area may be produced some distance away, and hence the hazard for an area is influenced by hazards off-site

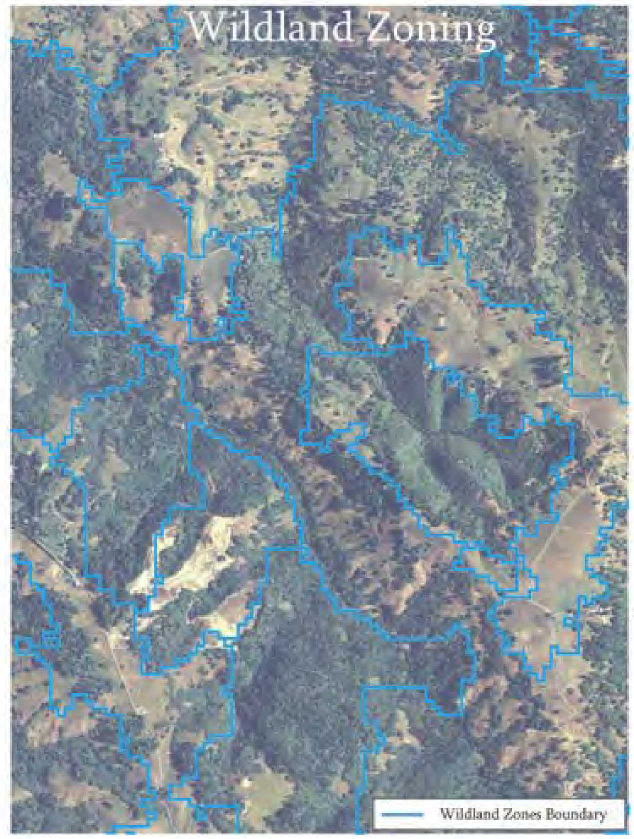
Terms Used

Fire Hazard Severity has two key components: probability of burning and expected fire behavior. The factors considered in determining hazard are: 1) how often an area will burn; and 2) when it does burn, what characteristics might lead to buildings being ignited?

Fire behavior refers to the physical characteristics of the fire – examples include rate of spread, length of flames, and the ability to produce firebrands or embers.

Burn probability describes the average chance of a fire burning an area in any given year. It is based on the fire records spanning the last 55 years. Some areas of the state have much higher chances of burning, and this is reflected in the hazard zones.

Zoning and Scoring



The model uses building blocks to derive FHSZ classes based on a two-step process: Zoning and Scoring (See Figure 1). Urban areas are treated differently from wildlands due to the significant changes in both fuel conditions and burn probability that happen as areas become urbanized

Each wildland zone gets scores that tie together the burn probability with the expected flame sizes predicted by fuels, slope, and expected fire weather. Since it describes potential hazard to buildings, the model characterizes the fuel potential of the area over a 30-50 year period and the maximum expected hazard value is used.

While some areas may have recently been treated and currently have only moderate hazard, buildings in that area will be exposed to increasing hazards as these vegetation fuels develop, hence the use of "climax" or fuel potential in the model. As with the chance of fire, expected flame size varies significantly from one fuel type to the next.

Areas also receive a score for the amount of firebrands (burning embers transported by the wind) that are expected to land on an area. In the model, firebrands are produced based on fuel types and a model describing the distribution of firebrands transported from the source area. The firebrand score is a function of the number of brands that are expected to land on a given area, and are consequently influenced by areas around them where the embers are produced.

Each wildland zone gets an area-averaged classification for flaming and firebrands, which together determine the final hazard ranking for the zone: moderate, high or very high.

Urban zones are scored based on their proximity to wildland zones and the flame score for that wildland zone, the number of firebrands being produced in the wildlands and received in the urban area, and the amount of vegetation fuels present in the urban zone. Urban areas immediately next to wildland zones typically have the highest hazard, and areas more removed from the wildlands have lower hazards.

The influence of wildland fire hazard into urban areas can range from only about 200 feet in low hazard conditions, to nearly a mile in very high hazard areas. The nature and depth of the zones are a function of both how likely a flame front will penetrate, and how many firebrands are expected to land in the urbanized areas.

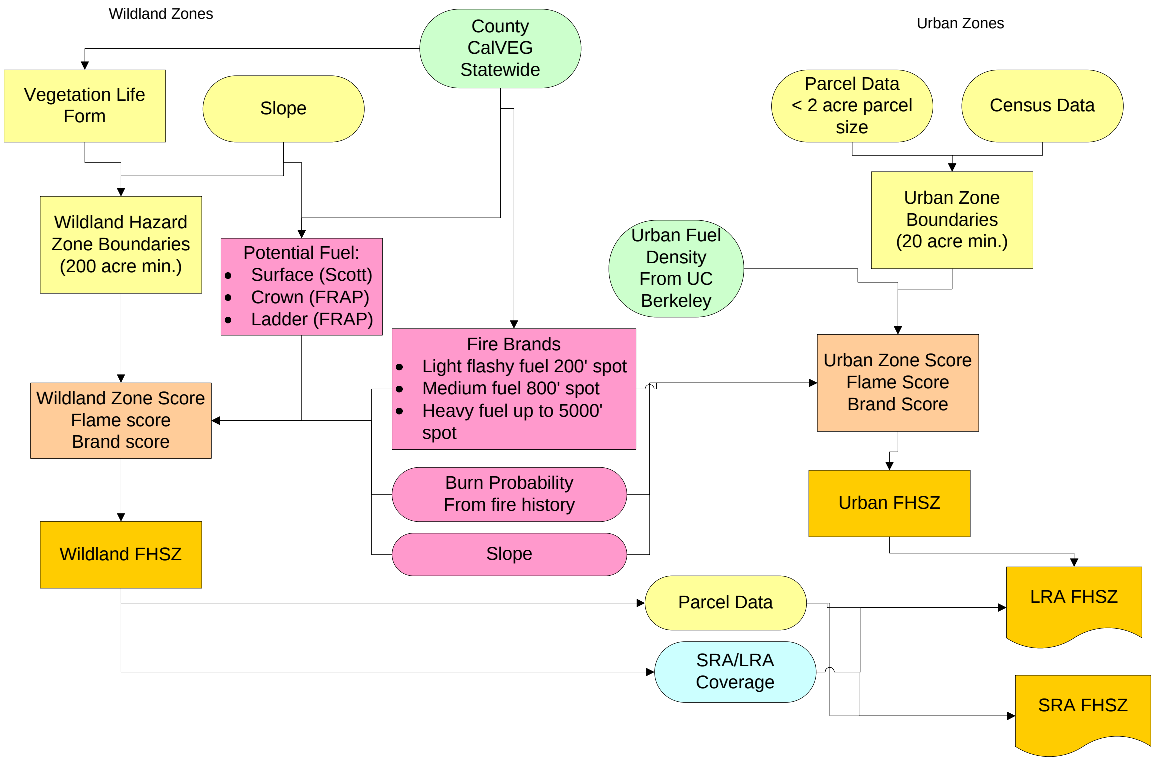
Results of the Model

Results of the model lead to revised maps of fire hazard severity. To summarize, classification of a zone as moderate, high or very high fire hazard is based on the severity of fire behavior that leads to building ignition. Each area of the map gets a score for flame length, embers, and the likelihood of the area burning. Scores are averaged over the zone areas. Final FHSZ class (moderate, high and very high) is determined based on the averaged scores for the zone.

Model results were tested and validated in four counties with very different conditions: Butte, Calaveras, Sonoma, and San Diego. Further, draft maps have been reviewed by the 21 CAL FIRE units and six contract counties; their recommendations for changes were evaluated and incorporated when appropriate.

Updated information and support documents for FHSZ are available on CAL FIRE's Fire and Resource Assessment Program's website at http://frap.cdf.ca.gov/fhsz/review.html.

Figure 1: FIRE HAZARD SEVERITY ZONING MODEL STRUCTURE



Appendix H: Historic Fire List

Year	Cause	Acres Burned	Community Planning Area
1943	Unknown/Unidentified	633	Antelope Valley
1946	Unknown/Unidentified	227	Antelope Valley (Near)
1947	Unknown/Unidentified	146	Antelope Valley (Near)
1947	Unknown/Unidentified	537	Sonora Junction (Near)
1948	Unknown/Unidentified	515	Bodie Hills
1951	Unknown/Unidentified	165	Antelope Valley
1951	Unknown/Unidentified	115	Antelope Valley (Near)
1953	Unknown/Unidentified	122	Bodie Hills (Near)
1955	Smoking	207	Antelope Valley
1955	Lightning	71	Bodie Hills
1956	Smoking	122	Antelope Valley
1956	Lightning	243	Antelope Valley (Near)
1958	Unknown/Unidentified	351	Wheeler Crest (Near)
1959	Lightning	101	Bodie Hills (Near)
1960	Unknown/Unidentified	611	Bodie Hills
1961	Lightning	324	Bodie Hills
1961	Lightning	44	Sonora Junction
1962	Lightning	70	Antelope Valley (Near)
1964	Smoking	368	Antelope Valley
1964	Debris	682	Antelope Valley (Near)
1964	Campfire	100	Bridgeport
1964	Miscellaneous	362	Bridgeport (Near)
1964	Smoking	27	Sonora Junction
1966	Lightning	19	Bodie Hills (Near)
1966	Miscellaneous	327	Mammoth Vicinity
1970	Lightning	63	Antelope Valley (Near)
1970	Debris	4	Bodie Hills (Near)
1970	Playing with Fire	36	Mono Basin
1972	Miscellaneous	156	Antelope Valley
1972	Lightning	150	June Lake (Near)
1972	Playing with Fire	1,458	June Lake (Near)
1972	Miscellaneous	120	Long Valley
1972	Lightning	698	Long Valley
1972	Miscellaneous	36	Long Valley
1972	Equipment Use	153	Mammoth Vicinity
1972	Campfire	16	Oasis (Near)
1973	Lightning	213	Antelope Valley
1973	Unknown/Unidentified	376	Antelope Valley (Near)
1973	Miscellaneous	189	Bridgeport
1974	Smoking	2,112	Antelope Valley
1974	Lightning	9	Antelope Valley (Near)
1974	Lightning	662	Antelope Valley (Near)
1974	Equipment Use	22	Sonora Junction
1974	Lightning	108	Sonora Junction
1974	Miscellaneous	667	Wheeler Crest
1977	Lightning	74	Benton Hot Springs (Near)
1977	Lightning	102	Benton Hot Springs (Near)
1977	Lightning	352	Bridgeport (Near)

1977	Debris	277	Sonora Junction
1978	Lightning	349	Mono Basin
1979	Arson	25	Sonora Junction
1980	Lightning	15	Antelope Valley (Near)
1981	Miscellaneous	3,159	Wheeler Crest
1983	Equipment Use	24	Antelope Valley (Near)
1983	Miscellaneous	266	Wheeler Crest (Near)
1984	Miscellaneous	27	Long Valley (Near)
1984	Unknown/Unidentified	3,087	Mono Basin
1985	Smoking	212	Benton
1985	Lightning	117	Bodie Hills
1985	Lightning	16	Bridgeport (Near)
1985	Unknown/Unidentified	798	June Lake (Near)
1985	Playing with Fire	88	Sonora Junction
1985	Miscellaneous	3,061	Upper Owens
1985	Miscellaneous	277	Wheeler Crest (Near)
1986	Lightning	11	Bodie Hills
1986	Miscellaneous	21	Mammoth Vicinity
1986	Lightning	538	Mono Basin
1986	Lightning	40	Upper Owens (Near)
1987	Lightning	76	June Lake
1987	Unknown/Unidentified	640	Mammoth Vicinity
1987	Miscellaneous	436	Mammoth Vicinity
1987	Arson	1,018	Mammoth Vicinity
1987	Lightning	179	Upper Owens (Near)
1988	Lightning	57	Sonora Junction (Near)
1989	Lightning	44	Bodie Hills
1989	Lightning	77	Upper Owens (Near)
1990	Lightning	382	Sonora Junction
1990	Lightning	56	Upper Owens (Near)
1993	Lightning	545	Upper Owens (Near)
1994	Lightning	67	Sonora Junction
1995	Arson	81	Antelope Valley
1996	Vehicle	2,581	Antelope Valley
1996	Unknown/Unidentified	49	Antelope Valley
1996	Lightning	857	Bridgeport
1996	Lightning	14	Mono Basin
1997	Lightning	42	Mono Basin
1999	Debris	11	Mono Basin
1999	Smoking	246	Sonora Junction
2000	Lightning	1,528	Antelope Valley
2000	Campfire	700	Mono Basin
2001	Lightning	5,590	Mono Basin
2001	Lightning	2,714	Upper Owens
2002	Campfire	26,684	Antelope Valley
2002	Miscellaneous	392	Chalfant Valley (Near)
2002	Lightning	2,549	Wheeler Crest
2003	Miscellaneous	50	June Lake
2003	Lightning	8	Mammoth Vicinity

2003	Unknown/Unidentified	740	Mono Basin
2003	Lightning	2,460	Upper Owens (Near)
2004	Vehicle	8,905	Antelope Valley
2004	Lightning	3,161	Antelope Valley
2004	Lightning	190	June Lake (Near)
2004	Lightning	27	Mono Basin
2005	Arson	19	June Lake
2005	Miscellaneous	12	Long Valley (Near)
2005	Lightning	45	Mono Basin
2005	Arson	34	Upper Owens (Near)
2006	Lightning	83	Benton Hot Springs (Near)
2006	Debris	7,437	Benton Hot Springs (Near)
2006	Miscellaneous	18	Mammoth Vicinity
2007	Lightning	1,076	Antelope Valley
2007	Lightning	89	Bodie Hills (Near)
2007	Lightning	680	June Lake
2007	Lightning	12	Upper Owens (Near)
2007	Lightning	597	Upper Owens (Near)
2008	Lightning	355	Mammoth Vicinity
2008	Miscellaneous	22	Mono Basin
2009	Lightning	91	Benton Hot Springs (Near)
2010	Lightning	98	Benton Hot Springs
2010	Lightning	632	Bodie Hills
2010	Lightning	1,205	Mono Basin
2011	Lightning	1,046	Bridgeport
2012	Lightning	20	Bodie Hills
2012	Lightning	31	Mono Basin
2012	Lightning	12,575	Mono Basin
2012	Lightning	12	Upper Owens (Near)
2013	Lightning	14,267	Bodie Hills
2014	Lightning	93	Bodie Hills
2014	Equipment Use	45	June Lake
2014	Vehicle	46	Mono Basin
2015	Unknown/Unidentified	512	Bridgeport
2015	Vehicle	27	Bridgeport (Near)
2015	Miscellaneous	3,816	Mono Basin/June Lake
2015	Miscellaneous	6,538	Wheeler Crest
2016	Miscellaneous	16	Mono Basin
2016	Miscellaneous	641	Mono Basin
2016	Miscellaneous	5,461	Upper Owens
2016	Lightning	2,822	Upper Owens (Near)
2016	Equipment Use	123	Wheeler Crest
2017	Lightning	8,925	Antelope Valley